
# ENERGY AUDIT – FINAL REPORT

## GLOUCESTER CITY
## GLOUCESTER HEIGHTS FIRE COMPANY
### 232 NICHOLSON ROAD
### GLOUCESTER CITY, NJ 08030
### ATTN: MR. JACK LIPSETT

**CEG PROPOSAL NO. 9C08131**

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# I. EXECUTIVE SUMMARY

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

Gloucester City
Gloucester Heights Fire Company
232 Nicholson Road
Gloucester City, NJ 08030

Municipal Contact Person: Jack Lipsett
Facility Contact Person: Jim "Bowie" Johnson

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

The annual energy costs at this facility are as follows:

| | |
|---|---|
| Electricity | $ 14,830 |
| Natural Gas | $ 10,448 |
| Total | $ 25,278 |

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

**Table 1**
**Energy Conservation Measures (ECM's)**

| ECM NO. | DESCRIPTION | COST | ANNUAL SAVINGS | SIMPLE PAYBACK (YEARS) | SIMPLE RETURN ON INVESTMENT |
|---|---|---|---|---|---|
| 1 | Lighting Upgrade | $12,516 | $1,472 | 8.5 | 12.9% |
| 2 | Lighting Controls | $660 | $114 | 5.8 | 17.3% |
| 3 | Programmable Thermostat Replacement | $360 | $432 | 0.7 | 122.3% |
| 4 | Rear Double-Door Resealing | $20 | $32.56 | 0.6 | 165.1% |

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

**Table 2**
**Estimated Energy Savings**

| ECM NO. | DESCRIPTION | ANNUAL UTILITY REDUCTION | | |
|---|---|---|---|---|
| | | ELECT DEMAND (KW) | ELECT CONSUMPTION (KWH) | NAT GAS (THERMS) |
| 1 | Lighting Upgrade | 8.8 | 7,929 | - |
| 2 | Lighting Controls | - | 989 | - |
| 3 | Programmable Thermostat Replacement | - | 884 | 157 |
| 4 | Rear Double-Door Resealing | - | 87.6 | 9.5 |



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

- **ECM #2:** Lighting Controls
- **ECM #3:** Programmable Thermostat Replacement
- **ECM #4:** Rear Double-Door Resealing

In addition to the above recommendations, CEG also recommends the installation of **ECM #1:** Lighting Upgrade. Even though this ECM has a payback greater than the seven (7) year threshold, CEG believes it can be a valuable upgrade to the facility. If the facility operating hours are ever increased the payback will be realized faster than currently calculated.

# II. INTRODUCTION

This comprehensive energy audit covers the 9,996 square feet Gloucester Heights Fire Company. The Gloucester Heights Fire Company is utilized as a mixed-use facility. The front of the building functions as the Fire Company and the rear of the building as a Senior Center. The facility was constructed in 1970 and recently renovated in 2008.

The first task was to collect and review one year's worth of utility energy data for electricity and natural gas. This information was used to analyze operational characteristics, calculate energy benchmarks for comparison to industry averages, estimate savings potential, and establish a baseline to monitor the effectiveness of implemented measures. A computer spreadsheet was used to enter, sum, and calculate benchmarks and to graph utility information (see Appendix A).

The Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/$ft^2$/yr) and can be 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 annual consumption of all fuels to BTU's then dividing by the area (gross square footage) of the building. EUI is a good indicator of the relative potential for energy savings. A comparatively low EUI indicates less potential for large energy savings. Blueprints (where available) were obtained from the municipal and were utilized to calculate/verify the gross area of the facility.

After gathering the utility data and calculating the EUI, the next step in the audit process is obtaining Architectural and Engineering drawings (where available). By reviewing the Architectural and Engineering drawings, questions regarding the building envelope, lighting systems/controls, HVAC equipment and controls are noted. These questions are then compared to the energy usage profiles developed during the utility data gathering step. Furthermore, 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. After this information is gathered the next step in the process is the site visit.

The site visit was spent inspecting the actual systems and answering specific questions from the preliminary review. The building manager provided occupancy schedules, O & M practices, the building energy management program, and other information that has an impact on energy consumption.

The post-site work includes evaluation of the information gathered during the site visit, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on mechanical, lighting and building envelope improvements.

# III. METHOD OF ANALYSIS

CEG completed the preliminary audit tasks noted in Section II preparing for the site survey. The site survey is a critical input in deciphering where energy opportunities exist within a facility. The auditor walks the entire site to inventory the building envelope (roof, windows, etc.), the heating, ventilation, and air conditioning equipment (HVAC), the lighting equipment, other facility-specific equipment, and to gain an understanding of how each facility is used.

The collected data is then processed using energy engineering calculations to calculate the anticipated energy usage for the proposed energy conservation measures (ECMs). The actual energy usage is entered directly from the utility bills provided by the Owner. The anticipated energy usage is compared to the actual usage to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not duplicative. The savings for each recommendation may actually be higher if the individual recommendations were installed instead of the entire project. For example, the lighting module calculates the change in wattage and multiplies it by the new operating hours instead of the existing operating hours (if there was a change in the hours at all). The lighting controls module calculates the change in hours and multiplies it by the new system wattage instead of the existing wattage. Therefore, if you chose to install the recommended lighting system but not the lighting controls, the savings achieved with the new lighting system would actually be higher because there would have been no reduction in the hours of use.

The same principal follows for heating, cooling, and temperature recommendations – even with fuel switching. If there are recommendations to change the temperature settings to reduce fuel use, then the savings for the heating/cooling equipment recommendations are reduced, as well.

Our thermal module calculates the savings for temperature reductions utilizing automated engineering calculations within Microsoft Excel™ spreadsheets. The savings are calculated in "output" values – meaning energy, not fuel savings. To show fuel savings we multiply the energy values times the fuel conversion factor (these factors are different for electricity, natural gas, fuel oil, etc.) and also take into account the heating/cooling equipment efficiency. The temperature recommendation savings are lower when the heating/cooling equipment is more efficient or is using a cheaper fuel.

Thermal recommendations (insulation, windows, etc.) are evaluated by taking the difference in the thermal load due to reduced heat transfer. Again, the "thermal load" is the thermal load after the other recommendations have been accounted for.

Lastly, installation costs, refer to Appendix B, are then applied to each recommendation and simple paybacks are calculated. Costs are derived from Means Cost Data, other industry publications, and local contractors and suppliers. The NJ SmartStart Building® program incentives (refer to Appendix C) are calculated for the appropriate ECM's and subtracted from the installed cost prior to calculation of the simple payback. In addition, where applicable, maintenance cost savings are estimated and applied to the net savings. Simple return on

investment is calculated using the standard formula of the difference of gains minus investments, divided by the investments. Included within the gains are the annual energy savings, utility incentives and maintenance savings as a total sum. The calculation is completed assuming the project is 100% direct purchased by the Owner with an energy cost escalation of 2.4% for natural gas and 2.2% for electricity.

# IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Electric

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from January-08 to December-08. Public Service Electric and Gas Company (PSE&G) provides electricity to the facility under the GLP rate. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the most current rate structure available.

Natural Gas

Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from January-08 to December-08. The natural gas for the facility is serviced by two companies, PSE&G and Woodruff Energy, respectively. PSE&G delivers the natural gas to the facility under the GSG rate. Woodruff Energy is a Third Party Supplier and provides the commodity services for the natural gas account.

Below is the average unit cost for the utilities at this facility.

| Description | Average |
|---|---|
| Electricity | 19¢ / kWh |
| Natural Gas | $1.68 / Therm |

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

| MONTH OF USE | CONSUMPTION (KWH) | DEMAND (KW) | TOTAL BILL |
|---|---|---|---|
| 1/08 | 6,080 | 23 | $839 |
| 2/08 | 5,720 | 24 | $822 |
| 3/08 | 6,080 | 31 | $874 |
| 4/08 | 6,320 | 38 | $913 |
| 5/08 | 3,360 | 27 | $758 |
| 6/08 | 10,600 | 45 | $2,216 |
| 7/08 | 13,200 | 33 | $3,059 |
| 8/08 | 4,080 | 23 | $1,095 |
| 9/08 | 3,240 | 23 | $949 |
| 10/08 | 3,160 | 16 | $660 |
| 11/08 | 5,520 | 18 | $927 |
| 12/08 | 10,080 | 16 | $1,716 |
| **Totals** | **77,440** | **45 Max** | **$14,830** |



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

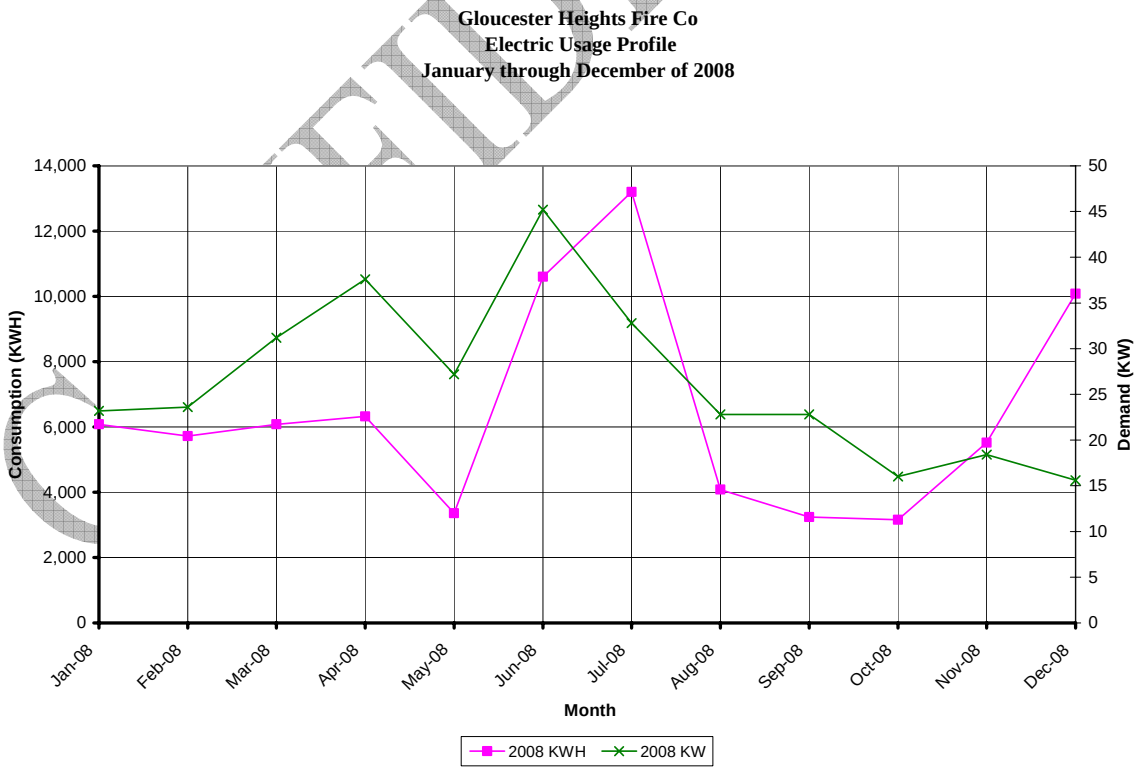
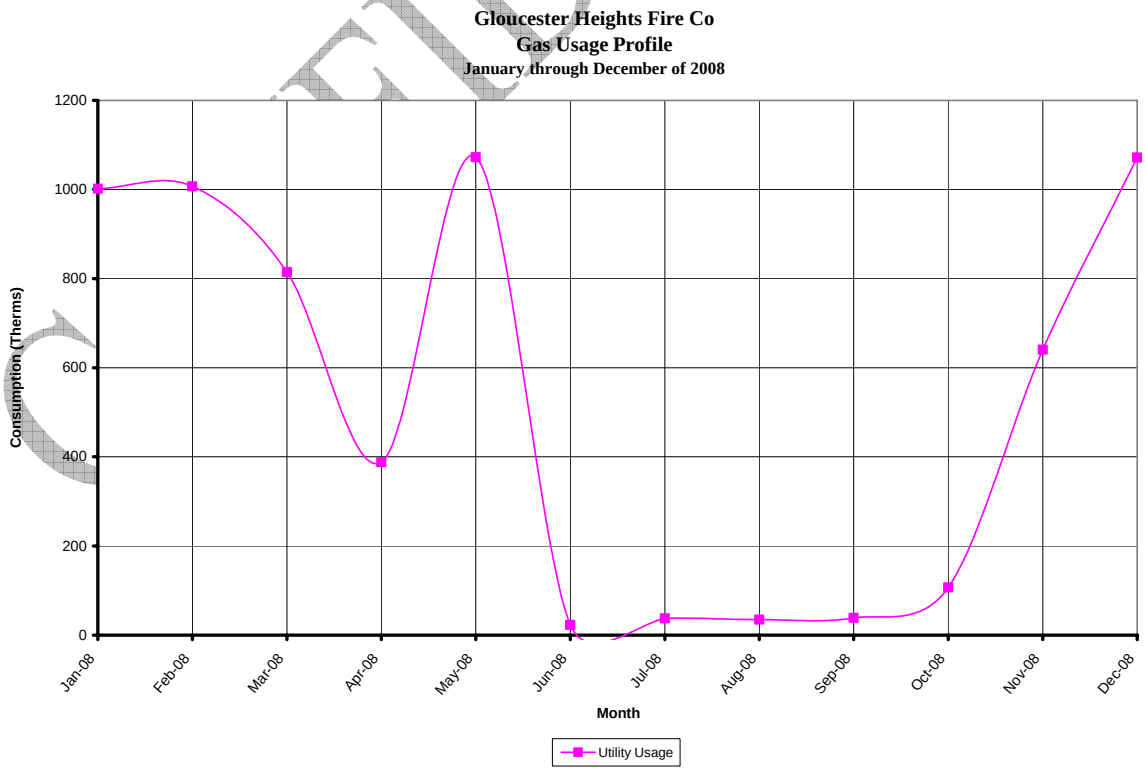


**Table 4**
**Natural Gas Billing Data**

| MONTH OF USE | CONSUMPTION (THERMS) | TOTAL BILL |
|---|---|---|
| 1/08 | 1,001.6 | $1,604 |
| 2/08 | 1,006.9 | $1,612 |
| 3/08 | 814.9 | $1,305 |
| 4/08 | 388.1 | $593 |
| 5/08 | 1,072.6 | $1,620 |
| 6/08 | 22.9 | $52 |
| 7/08 | 37.6 | $85 |
| 8/08 | 34.6 | $66 |
| 9/08 | 38.7 | $68 |
| 10/08 | 106.6 | $159 |
| 11/08 | 640.4 | $903 |
| 12/08 | 1071.5 | $2,381 |
| **Totals** | **6,236.6** | **$10,448** |



**Figure 2**
**Natural Gas Usage Profile**



B. Energy Use Index (EUI)

The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. Their website allows the user to determine how well the client's building energy use intensity (EUI) compares with similar facilities throughout the U.S. and in your specific region or state.

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

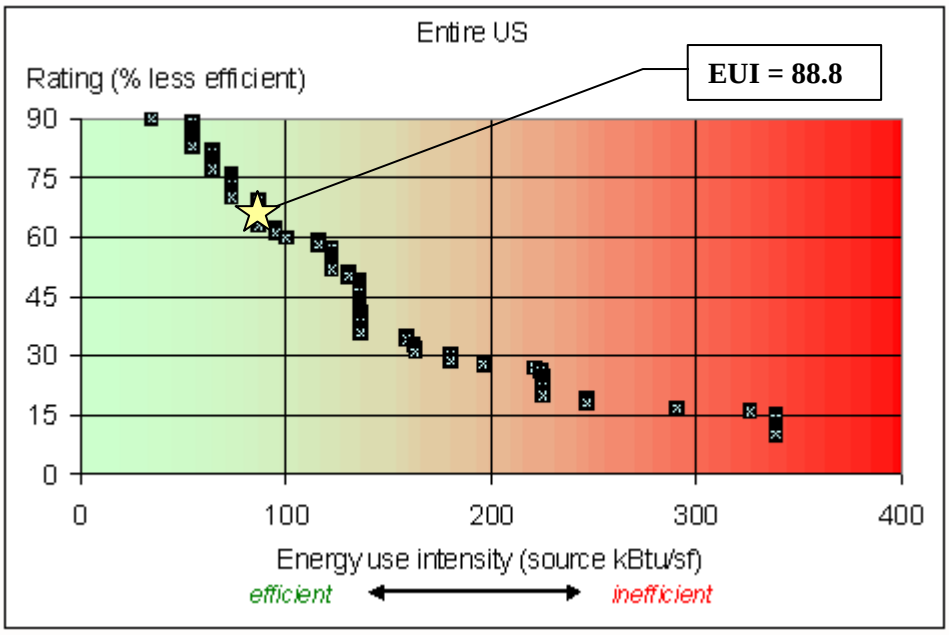
Electric = ((77,440 kWh) * (1000 W/kW) * (3.414 Btu/h / 1 W))/ (1000 Btu/h / 1 kBtu/h)
= 264,380 kBtu/h

Gas = ((6,236.6 therms) * (100,000 Btu/h / 1 Therm)) / (1000 Btu/h / 1 kBtu/h) = 623,660 kBtu/h

$$Building\ \ EUI = \frac{(264{,}380\ kBtu/h + 623{,}660\ kBtu/h)}{9{,}996\ SF} = \frac{888{,}040\ kBtu/h}{9{,}996\ SF}$$

Gloucester Heights Fire Company EUI = 88.8 kBtu/SF

**Figure 3**
**Energy Use Intensity Distributions: Police and Fire 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 you to track and assess energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and more emphasis is being placed throughout multiple arenas on carbon reduction, greenhouse gas emissions and other environmental impacts.

In accordance with the Local Government Energy Audit Program, CEG has created an Energy Start account for the municipal in order to allow the municipal access to monitoring their yearly energy usage as it compares to facilities of similar type. The account can be accessed at the following address, the username and password are also listed below:

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

Username: Gloucestercity
Password: lgeaceg2009

Specific building types are detailed on the ENERGY STAR website. Non-typical buildings are covered by an "Other" category. The Gloucester City Fire Houses fall under this "Other" category. The "Other" category is used if your building type or a section of the building is not represented by one of the specific categories. An Energy Performance Rating cannot be calculated if more than 10% of a building is classified as "Other." The majority of the Public Works Garage would be classified as "Other" and therefore cannot be given an Energy Performance Rating. Despite this Portfolio Manager calculates the building EUI. The EUI is an important tool that can be used to track the energy efficiency if the building. Baselines for improvement can be set that the municipality can strive to meet. CEG strongly urges Gloucester City to keep their Portfolio Manager account up to date in order to monitor the performance of the building.

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

# V. FACILITY DESCRIPTION

Gloucester City's Gloucester Heights Fire Hall consists of engine bays, a hall, kitchen, bar and members lounge; totaling approximately 9,996 SF. The Gloucester Heights Fire Hall is a one story (the fire hall) structure with the front section (the fire House) being two stories. Building construction is typical of block construction. The first section of the facility was built in 1970 with an addition in 2008. The few windows in the facility are new double pane windows. Typically, the Fire House will be occupied by one or two people for a few hours a day during the week. Gloucester Heights is a volunteer fire company that only fully operates when an emergency occurs in their response area. Additionally, there is a hall portion that is used as a Senior Center one day a week, along with occasional hall rentals.

Heating System

The hall is heated via a traditional rooftop forced air heating system. The fire hall is served by five (5) York Roof Top units. The units are controlled via antiquated, basic Honeywell programmable thermostats that are in need of replacement.

The engine bay is served by a single gas-fired furnace hung from the ceiling structure. The unit is controlled by a standard non-programmable wall mounted thermostat.

The Fire house (front, two story structure) is served by two (2) Goodman condensing furnaces with sealed combustion. The owner operates this equipment either on or off based on occupancy. The units are controlled by a standard programmable thermostat

Domestic Hot Water

Domestic hot water for the fire house is provided by a 40 gallon electric hot water heater manufactured by General Electric. The Kitchen and restrooms of the fire hall are provided hot water by a Bradford White 50 gallon gas fired hot water heater.

Cooling System

The cooling system for the hall is typical of a traditional rooftop forced air cooling system. Cooling operates in the same manner as the heating described above. All packaged rooftop equipment on the roof of the facility contains standard DX cooling coil, compressor and condenser section. Cooling temperature set-points are controlled in the same manner as the heating controls are operated.

Cooling for the Fire house is provided by the two (2) Goodman Furnaces and their associated evaporator coils and remote condensing units.

Controls System

There are wall mounted thermostats located throughout the facility that control the various heating and air conditioning units. Controls in the facility are standard programmable thermostats. The Hall thermostats are in need of replacement due to age and declined calibration.

Lighting

T-12 fluorescent lighting is prevalent throughout the facility. The Fire house is lit by 4-foot wrap around fixtures containing two (2) or four (4) 34 watt T12 lamps. The Hall contains 2'x4' 4-lamp T12 fixtures. All lights are controlled via standard wall switching; no lighting controls are present at the facility. During our site survey it was noted that several areas were illuminated within the facility in areas that were not in use.

In addition to the fluorescent lighting the front entrance and the bar contain many high-hats with incandescent flood lamps. The lamps were typically 65 watts but varied from fixture to fixture. This style of lamp uses a large amount of electricity for the amount of light emitted, generating a lot of heat in the process. The recessed lights are controlled via standard wall switching.

# VI. MAJOR EQUIPMENT LIST

Following the completion of the field survey a detailed equipment list was created. The equipment within this list is considered major energy consuming equipment whose replacement could yield substantial energy savings. In addition, the list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

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

# VII. ENERGY CONSERVATION MEASURES

## ECM #1: Lighting Upgrade

**Description:**

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

CEG recommends a replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the Owner on electrical costs due to the better performance of the electronic ballasts. In addition to functional cost savings, the fixture replacement will also provide operational cost savings. The operational cost savings will be realized through the lesser number of lamps that will be required to be replaced per year. The expected lamp life of a T8 lamp, approximately 30,000 burn-hours, in comparison to the existing T12 lamps, approximately 20,000 burn-hours, will provide the Owner with fewer lamps to replace per year. Based on the operating hours of this facility, approximately 1460 hours per year, the Owner will be changing approximately 33% less lamps per year.

This ECM replaces all T12 fixtures with energy efficient T8 fixtures. Also, included is the replacement of all incandescent lamps with compact fluorescent lamps.

**Energy Savings Calculations:**

A detailed Investment Grade Lighting Audit can be found in Appendix F that outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

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

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

$$\text{Smart Start®}\ Incentive = (36 \times \$25) + (102 \times\ \$\ 30) = \$3{,}960$$

Maintenance Savings are calculated as follows:

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

$$Maintenance\ Savings = (470 \times 33\%\ reduction \times \$\ 2.00) = \$313$$

**Energy Savings Summary:**

| **ECM #1 - ENERGY SAVINGS SUMMARY** | |
|---|---|
| **Installation Cost ($):** | $16,789 |
| **NJ Smart Start Equipment Incentive ($):** | ($3,960) |
| **Maintenance Savings ($):** | ($313) |
| **Net Installation Cost ($):** | *$12,516* |
| **Total Energy Savings ($ / yr):** | *$1,472* |
| **Simple Payback (yrs):** | *8.5* |
| **Simple Return on Investment:** | *12.9%* |

## ECM #2: Lighting Controls

**Description:**

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

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

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G of the referenced standard, states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all areas of the facility excluding the hall; approximately 4,996 SF.

**Energy Savings Calculations:**

From Appendix F of this report, we calculated the lighting power density (Watts/ft$^2$) of the existing offices, locker rooms, storage rooms, small shops, etc. to be 1.98 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

Savings = 10% x 1.2 Watts/SF x 4,996 SF x 1000 hrs/yr. = 600 kWh x $0.19/kWh

Savings = $114 / yr

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $75/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $55/unit. Total number of rooms to be retrofitted is 12. Total cost to install sensors is $55/unit x 12 units = $660.

**Energy Savings Summary:**

| ECM #2 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $900 |
| **NJ Smart Start Equipment Incentive ($):** | ($240) |
| **Maintenance Savings ($):** | - |
| **Net Installation Cost ($):** | *$660* |
| **Total Energy Savings ($ / yr):** | *$114* |
| **Simple Payback (yrs):** | *5.8* |
| **Simple Return on Investment:** | *17.3%* |

## ECM #3: Programmable Thermostat Replacement

**Description:**

Throughout the building there are standard, manual wall thermostats for various HVAC units that provide local control with adjustable settings for the conditioning equipment. These aged, indoor temperature controls are inaccurate due to temperature drift, age, and not having been re-calibrated. These units also do not have unoccupied setback features.

New programmable thermostats are available that utilize programming schedules for occupied and unoccupied times and can be set to vary space temperature at these respective times. In addition, the programmable thermostats can be used in conjunction with a motion sensor. When the space is not occupied the equipment can operate at the unoccupied set point. Once the space becomes occupied the motion sensor sends a signal to the thermostat to raise the temperature of the space to the occupied set point. This control system approach is ideal for facilities with low occupancy levels such as a volunteer fire house and hall.

This energy conservation measure would replace the various HVAC unit thermostats with programmable 7-day thermostats with night time setback control. The recommended thermostat set points for heating/cooling are as follows:

| | |
|---|---|
| Occupied Heating = | 70° F |
| Unoccupied Heating = | 65° F |
| Occupied Cooling = | 75° F |
| Unoccupied Cooling = | 80° F |

CEG recommends replacement of the two (2) existing remote thermostats that control the York rooftop units serving the Hall with Honeywell RTH7500D 7-day programmable thermostat or equivalent.

**Energy Savings Calculations:**

The energy savings of a 7-day programmable thermostat was calculated by using Energy Star Life Cycle Cost Estimate software for qualified programmable thermostats. The referenced calculator can be found at www.energystar.gov. Refer to Appendix G for the detailed calculation.

Calculated energy savings for heating = $132/Unit x 2 units = $264

Calculated energy savings for cooling = $84/Unit x 2 units = $168

Cost of a 7-day programmable thermostat (installed) = $180/unit x 2 units = $360

Simple Payback = $360/($264 + $268) = 0.7 Years

A detailed energy savings calculation can be found in Appendix G that outlines the savings from the use of programmable thermostats.

**Energy Savings Summary:**

| **ECM #5 - ENERGY SAVINGS SUMMARY** | |
|---|---|
| **Installation Cost ($):** | $360 |
| **NJ Smart Start Equipment Incentive ($):** | - |
| **Maintenance Savings ($):** | - |
| **Net Installation Cost ($):** | *$360* |
| **Total Energy Savings ($ / yr):** | *$432* |
| **Simple Payback (yrs):** | *0.7* |
| **Simple Return on Investment:** | *122.3%* |

## ECM #4: Rear Double-Door Resealing

**Description:**

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

During CEG survey of the facility it was a potential savings was observed through the proper weather sealing of the rear double door. CEG witnessed a large gap between the two double doors, this gap allows outside air to infiltrate into the facility.

This ECM installs weather stripping on the rear double door of the facility. The following calculation represents the potential savings from the installation of weather stripping. Frost king weather stripping was used for the basis of design or equivalent product.

**Energy Savings Calculations:**

Heating Degree Days (HDD) = 4,793°F – day/yr.

Cooling Degree Days (CDD) = 1,532°F – day/yr.

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

Area of Gap in Doors = 84 $in^2$ = 0.583 $ft^2$

Average Wind Speed = 7 mph

Effectiveness of Opening = 0.5 for perpendicular opening

Unit Conversion factor = 88.0

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

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

Airflow Rate = (88.0) x (0.5) x (0.583 $ft^2$) x (7 mph) = 180 cfm

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

$$\text{Heating energy savings} = \frac{(180 \text{ x } 1.085 \text{ x } 4{,}793)}{100{,}000 \text{ btu/1therm nat. gas}} = 9.5 \, therms \times \$1.68 / therm = \$15.96$$

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

$$\text{Cooling energy savings} = \frac{(180 \text{ x } 1.085 \text{ x } 1{,}532)}{3{,}414 \text{ btu/1 kWh}} = 87.6\ kWh \times \$0.19 / kWh = \$16.60$$

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

Total Energy Savings = ($15.96 + $16.60) = $32.56

Door Seal Cost = $20

**Energy Savings Summary:**

| **ECM #4 - ENERGY SAVINGS SUMMARY** | |
|---|---|
| **Installation Cost ($):** | $20 |
| **NJ Smart Start Equipment Incentive ($):** | - |
| **Maintenance Savings ($):** | - |
| **Net Installation Cost ($):** | *$20* |
| **Total Energy Savings ($ / yr):** | *$32.56* |
| **Simple Payback (yrs):** | *0.6* |
| **Simple Return on Investment:** | *165.1%* |

# VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

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

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

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 1,460 S.F. can be utilized for a PV system on the Fire Hall. A depiction of the area utilized is shown in Appendix F. Using this square footage it was determined that a system size of 23 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 35,893 KWh annually, reducing the overall utility bill by 46% percent. A detailed financial analysis can be found in Appendix F. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

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

| PAYMENT TYPE | SIMPLE PAYBACK | INTERNAL RATE OF RETURN |
|---|---|---|
| Self-Finance | 10.7 Years | 18.8% |
| Direct Purchase | 10.7 Years | 8.7% |

Wind energy production is another option available through the Renewable Energy Incentive Program. Small wind turbines can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG has reviewed the applicability of wind energy for Gloucester Heights Fire Hall and has determined it is not a viable option. There is not enough free land available on the site to accommodate the installation of a wind turbine.

# IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

**Load Profile:**

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to Section IV, Figures 1 and 2 included within this report to reference the electricity usage load profile for January 2008 through December 2008.

Electricity:

Section IV, Figure 1 demonstrates a typical cooling profile, (May –August), complimenting the heating load. It is evident that there is a significant reduction in the Peak Load from August 2008 to October 2008 and a substantial increase from May 2008 to July 2008. The electrical loading during the other months is typical, with the exception being December 2008. The kW demand profile is typical.

Natural Gas:

Section IV, Figure 2 demonstrates a fairly typical heating load (November –March), and complimentary cooling load (April –October). Consequently there is a clear separation between summer and winter loads consistent with Wholesale Energy Pricing. Heating loads carry a much higher average cost because of the higher demand for natural gas during the winter. There is some concern in the April – June timeframe. April going into May should follow a downward slope but May has a very large spike in consumption according to the data provided. CEG recommends this May spike be further investigated. Imbalances can occur when utilizing Third Party Suppliers.

**Tariff Analysis:**

Electricity:

Gloucester City receives electrical service through Public Service Electric and Gas Company (PSE&G) on a GLP (General Lighting and Power) rate. This utility tariff is for delivery service for general purposes at secondary distribution voltages. The rate schedule has a Delivery Charge, Societal Benefits Charge, Non-utility Generation Charge, Securitization Charge, System Control Charge, Customer Account Services Charge, Standby Fee, Base Rate Distribution Adjustment Charge, Solar Pilot Recovery Charge and RGGI Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS).

Natural Gas:

Gloucester City receives natural gas service through Public Service Electric and Gas Company (PSE&G) on a GSG utility rate class for delivery and received commodity by a Third Party

Supplier (TPS); Woodruff Energy. The GSG utility tariff is for delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. It is pertinent to note, since Gloucester City has elected to utilize a TPS, if the TPS should not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

**Recommendations:**

CEG's recommendation pertains to Gloucester City's electric costs (mainly because Gloucester City does not have a large Natural Gas Critical Mass). CEG recognized the electric cost is competitive with current market prices for a single facility. However, there are opportunities available by aggregation of all facilities and procuring energy from third party suppliers.

CEG advises Gloucester City take a global approach that will be consistent for all facilities within the municipality. Gloucester City's "weighted average price" per kWh (kilowatt hour) for all buildings is approximately $0.1225 per kWh (kWh is the common unit of electric measure). The weighted average price per dekatherm for natural gas is $11.37/dth (Dth is the common unit of measure). Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Gloucester City could realize savings if it were to take advantage of these current market prices quickly, before energy increases. Based on last year's historical consumption (January through December 2008) and current electric rates, Gloucester City would see savings of over $10,000 per year (Note: Savings were calculated using Gloucester City's Average Annual Consumption of 490,135 kWh and a variance of $.02258 /kWh utilizing a fixed one-year commodity contract). Gloucester City should aggregate its entire electric load to gain the most optimal energy costs. CEG recommends advisory services for alternative sourcing and supply of energy on a "managed approach."

Lastly, CEG recommends that Gloucester City schedule a meeting with their current utility provider to review their utility charges and current tariff structure for electricity. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), Gloucester City will learn more about the competitive supply process. Gloucester City can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu, and should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the data to manage ongoing demand-side management projects. Furthermore, CEG recommends special attention to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with their utility representative. In addition, Gloucester City should also ask the utility representative about alternative billing options. Some utilities allow for consolidated billing options when utilizing the service of a Third Party Supplier.

# X. INSTALLATION FUNDING OPTIONS

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

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

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

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

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

# XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

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

C. Maintain all weather stripping on windows and doors.

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

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

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

G. Recalibrate existing temperature sensors within the facility.

H. Clean all light fixtures to maximize light output.

I. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling.

# Electric Cost Summary

**PSE&G - Electric Rate- GLP**

**Gloucester Heights Fire Co** **2008**

**Account # 61 848 149 07**

**Meter # 1683437**

| Month | Jan-08 | Feb-08 | Mar-08 | Apr-08 | May-08 | Jun-08 | Jul-08 | Aug-08 | Sep-08 | Oct-08 | Nov-08 | Dec-08 | **Total** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Billing Days | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | | |
| KWH | 6,080 | 5,720 | 6,080 | 6,320 | 3,360 | 10,600 | 13,200 | 4,080 | 3,240 | 3,160 | 5,520 | 10,080 | 77,440 | |
| KW | 23 | 24 | 31 | 38 | 27 | 45 | 33 | 23 | 23 | 16 | 18 | 16 | 45 | Max |
| Monthly Load Factor | 35% | 36% | 26% | 23% | 17% | 33% | 54% | 24% | 20% | 27% | 42% | 87% | 35% | |
| Electric Delivery, $ | $235 | $228 | $266 | $297 | $298 | $815 | $1,121 | $376 | $352 | $140 | $207 | $376 | $4,711 | |
| Delivery $/kwh | $0.039 | $0.040 | $0.044 | $0.047 | $0.089 | $0.077 | $0.085 | $0.092 | $0.109 | $0.044 | $0.037 | $0.037 | $0.061 | |
| Electric Supply, $ | $604 | $594 | $608 | $617 | $460 | $1,401 | $1,938 | $719 | $598 | $521 | $720 | $1,340 | $10,119 | |
| Supply $/kwh | $0.099 | $0.104 | $0.100 | $0.098 | $0.137 | $0.132 | $0.147 | $0.176 | $0.184 | $0.165 | $0.130 | $0.133 | $0.131 | |
| Total Cost, $ | $839 | $822 | $874 | $913 | $758 | $2,216 | $3,059 | $1,095 | $949 | $660 | $927 | $1,716 | $14,830 | |
| $/KWH | $0.138 | $0.144 | $0.144 | $0.145 | $0.226 | $0.209 | $0.232 | $0.268 | $0.293 | $0.209 | $0.168 | $0.170 | **$0.192** | |

# Natural Gas Cost Summary

**PSE&G - Natural Gas Delivery - Rate - GSG**

**Third Party Supplier - Woodruff Energy**

## Gloucester Heights Fire Co

**Account# 507-553 - Woodruff** **2008**

**Account# 61 848 149 0 7- PSE&G**

**Meter# Combined 2301301 & 2521945**

| Month | Jan-08 | Feb-08 | Mar-08 | Apr-08 | May-08 | Jun-08 | Jul-08 | Aug-08 | Sep-08 | Oct-08 | Nov-08 | Dec-08 | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Billing Days | | | | | | | | | | | | | |
| Therms (Burner Tip) | 1001.6 | 1006.9 | 814.9 | 388.1 | 1072.6 | 22.9 | 37.6 | 34.6 | 38.7 | 106.6 | 640.4 | 1071.5 | 6236.6 |
| Total Distribution Cost | $401 | $403 | $327 | $126 | $332 | $17 | $21 | $20 | $22 | $42 | $264 | $440 | 2,414 |
| Cost per Therm | $0.400 | $0.400 | $37.340 | $0.326 | $0.309 | $0.000 | $0.000 | $0.587 | $0.557 | $37.340 | $0.412 | $0.410 | $0.387 |
| Total Commodity Cost | $1,203 | $1,209 | $979 | $466 | $1,288 | $35 | $64 | $45 | $47 | $117 | $639 | $1,941 | 8,034 |
| Cost per Therm | $1.20 | $1.20 | $1.20 | $1.20 | $1.20 | $0.00 | $0.00 | $1.31 | $1.20 | $1.10 | $1.00 | $1.81 | $1.29 |
| Total Cost | $1,604 | $1,612 | $1,305 | $593 | $1,620 | $52 | $85 | $66 | $68 | $159 | $903 | $2,381 | $10,448 |
| Cost per Therm | $1.601 | $1.601 | $1.602 | $1.527 | $1.510 | $0.000 | $0.000 | $1.894 | $1.758 | $1.492 | $1.410 | $2.222 | **$1.675** |

# DETAILED COST BREAKDOWN PER ECM

CONCORD ENGINEERING GROUP

## Gloucester Heights Fire Hall

**ECM 1 Lighting Upgrade**

| | Qty | Unit Cost $ | Material $ | Labor $ | Total $ |
|---|---|---|---|---|---|
| Lighting Retrofit | LS | $16,789 | $0 | $0 | $16,789 |
| Total Cost | | | $0 | $0 | $16,789 |
| Utility Incentive - NJ Smart Start ($25 per 1-2 lamp fixture & $30 per 3-4 lamp fixture) | | | | | ($3,960) |
| Total Cost Less Incentive | | | | | $12,829 |

**ECM 2 Lighting Controls**

| | Qty | Unit Cost $ | Material $ | Labor $ | Total $ |
|---|---|---|---|---|---|
| Dual - Technology Sensor | 12 | $75 | $360 | $630 | $900 |
| Total Cost | | | $360 | $630 | $900 |
| Utility Incentive - NJ Smart Start ($20 per Sensor) | | | | | ($240) |
| Total Cost Less Incentive | | | | | $660 |

**ECM 3 Programmable Thermostat Replacement**

| | Qty | Unit Cost $ | Material $ | Labor $ | Total $ |
|---|---|---|---|---|---|
| New Programmable Thermostat | 2 | $180 | $240 | $120 | $360 |
| Total Cost | | | $240 | $120 | $360 |
| Utility Incentive - N/A | | | | | $0 |
| Total Cost Less Incentive | | | | | $360 |

**ECM 4 Rear Double-Door Resealing**

| | Qty | Unit Cost $ | Material $ | Labor $ | Total $ |
|---|---|---|---|---|---|
| New Door Seal | LS | $20 | $0 | $0 | $20 |
| Total Cost | | | $0 | $0 | $20 |
| Utility Incentive - NJ Smart Start | | | | | $0 |
| Total Cost Less Incentive | | | | | $20 |

# Concord Engineering Group, Inc.

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


## SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

### Electric Chillers

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

### Gas Cooling

| | |
|---|---|
| Gas Absorption Chillers | $185 - $400 per ton |
| Gas Engine-Driven Chillers | Calculated through custom measure path) |

### Desiccant Systems

| | |
|---|---|
| | $1.00 per cfm – gas or electric |

### Electric Unitary HVAC

| | |
|---|---|
| Unitary AC and Split Systems | $73 - $93 per ton |
| Air-to-Air Heat Pumps | $73 - $92 per ton |
| Water-Source Heat Pumps | $81 per ton |
| Packaged Terminal AC & HP | $65 per ton |
| Central DX AC Systems | $40- $72 per ton |
| Dual Enthalpy Economizer Controls | $250 |

### Ground Source Heat Pumps

| | |
|---|---|
| Closed Loop & Open Loop | $370 per ton |

### Gas Heating

| | |
|---|---|
| Gas Fired Boilers < 300 MBH | $300 per unit |
| Gas Fired Boilers ≥ 300 - 1500 MBH | $1.75 per MBH |
| Gas Fired Boilers ≥1500 - ≤ 4000 MBH | $1.00 per MBH |
| Gas Fired Boilers > 4000 MBH | (Calculated through Custom Measure Path) |
| Gas Furnaces | $300 - $400 per unit |

## Variable Frequency Drives

| | |
|---|---|
| Variable Air Volume | $65 - $155 per hp |
| Chilled-Water Pumps | $60 per hp |
| Compressors | $5,250 to $12,500 per drive |

## Natural Gas Water Heating

| | |
|---|---|
| Gas Water Heaters ≤ 50 gallons | $50 per unit |
| Gas-Fired Water Heaters >50 gallons | $1.00 - $2.00 per MBH |
| Gas-Fired Booster Water Heaters | $17 - $35 per MBH |

## Premium Motors

| | |
|---|---|
| Three-Phase Motors | $45 - $700 per motor |

## Prescriptive Lighting

| | |
|---|---|
| T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities | $10 - $30 per fixture, (depending on quantity) |
| Hard-Wired Compact Fluorescent | $25 - $30 per fixture |
| Metal Halide w/Pulse Start | $25 per fixture |
| LED Exit Signs | $10 - $20 per fixture |
| T-5 and T-8 High Bay Fixtures | $16 - $284 per fixture |

## Lighting Controls – Occupancy Sensors

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

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

| | |
|---|---|
| Occupancy hi-low | $75 per fixture controlled |
| Daylight Dimming | $75 per fixture controlled |

## Other Equipment Incentives

| | |
|---|---|
| Performance Lighting | $1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation |
| Custom Electric and Gas Equipment Incentives | not prescriptive |

# STATEMENT OF ENERGY PERFORMANCE
# Gloucester Heights Fire Hall

**Building ID:** 1773135
**For 12-month Period Ending:** December 31, 2008[1]
**Date SEP becomes ineligible:** N/A

**Date SEP Generated:** July 08, 2009

**Facility**
Gloucester Heights Fire Hall
232 Nicholson Rd.
Gloucester City, NJ 08030

**Facility Owner**
Gloucester City
512 Monmouth St.
Gloucester City, NJ 08030

**Primary Contact for this Facility**
Jack Lipsett
512 Monmouth St.
Gloucester City, NJ 08030

**Year Built:** 1970
**Gross Floor Area (ft²):** 9,996

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

**Site Energy Use Summary**[3]

| | |
|---|---|
| Electricity (kBtu) | 264,225 |
| Natural Gas (kBtu)[4] | 623,640 |
| Total Energy (kBtu) | 887,865 |

**Energy Intensity**[5]

| | |
|---|---|
| Site (kBtu/ft²/yr) | 89 |
| Source (kBtu/ft²/yr) | 154 |

**Emissions** (based on site energy use)

| | |
|---|---|
| Greenhouse Gas Emissions ($MtCO_2e$/year) | 73 |

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

**National Average Comparison**

| | |
|---|---|
| National Average Site EUI | 78 |
| National Average Source EUI | 157 |
| % Difference from National Average Source EUI | -2% |
| 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**
Raymond Johnson
520 South Burnt Mill Rd.
Voorhees, NJ 08043

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

# ENERGY STAR® Data Checklist for Commercial Buildings

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

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

| CRITERION | VALUE AS ENTERED IN PORTFOLIO MANAGER | VERIFICATION QUESTIONS | NOTES | ☑ |
|---|---|---|---|---|
| **Building Name** | Gloucester Heights Fire Hall | 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** | 232 Nicholson Rd., Gloucester City, NJ 08030 | 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 House (Other)

| CRITERION | VALUE AS ENTERED IN PORTFOLIO MANAGER | VERIFICATION QUESTIONS | NOTES | ☑ |
|---|---|---|---|---|
| **Gross Floor Area** | 9,996 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** | 1 (Optional) | Is this the number of personal computers in the space? | | ☐ |
| **Weekly operating hours** | 12 Hours(Optional) | Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed. | | ☐ |
| **Workers on Main Shift** | N/A(Optional) | Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. | | ☐ |

# ENERGY STAR® Data Checklist for Commercial Buildings

## *Energy Consumption*

***Power Generation Plant or Distribution Utility:*** PSE&G - Public Service Elec & Gas Co

| **Fuel Type: Electricity** | | |
|---|---|---|
| **Meter: Electric Meter - 1683437 (kWh)**<br>**Space(s):** Entire Facility | | |
| **Start Date** | **End Date** | **Energy Use (kWh)** |
| 12/01/2008 | 12/31/2008 | 10,080.00 |
| 11/01/2008 | 11/30/2008 | 5,520.00 |
| 10/01/2008 | 10/31/2008 | 3,160.00 |
| 09/01/2008 | 09/30/2008 | 3,240.00 |
| 08/01/2008 | 08/31/2008 | 4,080.00 |
| 07/01/2008 | 07/31/2008 | 13,200.00 |
| 06/01/2008 | 06/30/2008 | 10,600.00 |
| 05/01/2008 | 05/31/2008 | 3,360.00 |
| 04/01/2008 | 04/30/2008 | 6,320.00 |
| 03/01/2008 | 03/31/2008 | 6,080.00 |
| 02/01/2008 | 02/29/2008 | 5,720.00 |
| 01/01/2008 | 01/31/2008 | 6,080.00 |
| **Electric Meter - 1683437 Consumption (kWh)** | | **77,440.00** |
| **Electric Meter - 1683437 Consumption (kBtu)** | | **264,225.28** |
| **Total Electricity Consumption (kBtu)** | | **264,225.28** |
| **Is this the total Electricity consumption at this building including all Electricity meters?** | | ☐ |

| **Fuel Type: Natural Gas** | | |
|---|---|---|
| **Meter: Natural Gas (therms)**<br>**Space(s):** Entire Facility | | |
| **Start Date** | **End Date** | **Energy Use (therms)** |
| 12/01/2008 | 12/31/2008 | 1,071.50 |
| 11/01/2008 | 11/30/2008 | 640.40 |
| 10/01/2008 | 10/31/2008 | 106.60 |
| 09/01/2008 | 09/30/2008 | 38.70 |
| 08/01/2008 | 08/31/2008 | 34.60 |
| 07/01/2008 | 07/31/2008 | 37.60 |
| 06/01/2008 | 06/30/2008 | 22.90 |
| 05/01/2008 | 05/31/2008 | 1,072.60 |
| 04/01/2008 | 04/30/2008 | 388.10 |

| | | |
|---|---|---|
| 03/01/2008 | 03/31/2008 | 814.90 |
| 02/01/2008 | 02/29/2008 | 1,006.90 |
| 01/01/2008 | 01/31/2008 | 1,001.60 |
| **Natural Gas Consumption (therms)** | | **6,236.40** |
| **Natural Gas Consumption (kBtu)** | | **623,640.00** |
| **Total Natural Gas Consumption (kBtu)** | | **623,640.00** |
| **Is this the total Natural Gas consumption at this building including all Natural Gas meters?** | | ☐ |

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

## Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

# FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

**Facility**
Gloucester Heights Fire Hall
232 Nicholson Rd.
Gloucester City, NJ 08030

**Facility Owner**
Gloucester City
512 Monmouth St.
Gloucester City, NJ 08030

**Primary Contact for this Facility**
Jack Lipsett
512 Monmouth St.
Gloucester City, NJ 08030

## General Information

| Gloucester Heights Fire Hall | |
|---|---|
| Gross Floor Area Excluding Parking: ($ft^2$) | 9,996 |
| Year Built | 1970 |
| For 12-month Evaluation Period Ending Date: | December 31, 2008 |

## Facility Space Use Summary

| Fire House | |
|---|---|
| Space Type | Other - Fire Station/Police Station |
| Gross Floor Area($ft^2$) | 9,996 |
| Number of PCs[o] | 1 |
| Weekly operating hours[o] | 12 |
| Workers on Main Shift[o] | N/A |

## Energy Performance Comparison

| | Evaluation Periods | | Comparisons | | |
|---|---|---|---|---|---|
| **Performance Metrics** | **Current** (Ending Date 12/31/2008) | **Baseline** (Ending Date 12/31/2008) | **Rating of 75** | **Target** | **National Average** |
| Energy Performance Rating | N/A | N/A | 75 | N/A | N/A |
| Energy Intensity | | | | | |
| *Site (kBtu/ft²)* | 89 | 89 | 0 | N/A | 78 |
| *Source (kBtu/ft²)* | 154 | 154 | 0 | N/A | 157 |
| Energy Cost | | | | | |
| *$/year* | $ 25,276.00 | $ 25,276.00 | N/A | N/A | $ 22,196.89 |
| *$/ft²/year* | $ 2.53 | $ 2.53 | N/A | N/A | $ 2.22 |
| Greenhouse Gas Emissions | | | | | |
| $MtCO_2e$/year | 73 | 73 | 0 | N/A | 64 |
| $kgCO_2e/ft^2$/year | 7 | 7 | 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

**"Gloucester Heights Fire Company"**

### Domestic Hot Water Heater

| Location | Area Served | Manufacturer | Qty | Model # | Serial # | Input (MBh) | Recovery (gal/h) | Capacity (gal) | Efficiency | Fuel | Approx. Age | ASHRAE Service Life | Remaining Life |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Storage Closet | Senior Center | Bradford White | 1 | MI5036FBN | DC8869106 | 40 | 42 | 50 | 85% | Nat. Gas | 2 | 12 | 10 |
| Furnace Room | Fire Co. | General Electric | 1 | PE40M09AAH | GE0608B25330 | 4500 W | 53 | 40 | 92% | Electric | 1 | 12 | 11 |

### Air Handling Units

| Location | Area Served | Manufacturer | Qty | Model # | Serial # | Cooling Coil | Cooling Eff. (EER) | Cooling Capacity | Heating Type | Input (MBh) | Output (MBh) | Heating Eff. (%) | Fuel | Volts | Phase | Hz | Approx. Age | ASHRAE Service Life | Remaining Life |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Roof | Senior Center | York | 1 | DJ060N10N2AAA3E | N0N8514616 | DX -R22 | 11.2 | 5 Ton | Gas Furnace | 125 | 100 | 80% | Nat. Gas | 208-203 | 3 | 60 | 1 | 15 | 14 |
| Roof | Senior Center | York | 2 | D4CG060N10325B | NCCM095649<br>NCCM071031 | DX -R22 | 11.2 | 5 Ton | Gas Furnace | 125 | 103 | 82% | Nat. Gas | 208-230 | 3 | 60 | 15 | 15 | 0 |
| Roof | Senior Center | York | 1 | DJ060N08N2AAA3E | N0A9529622 | DX -R22 | 11.2 | 5 Ton | Gas Furnace | 100 | 80 | 80% | Nat. Gas | 208-203 | 3 | 60 | 1 | 15 | 14 |
| Roof | Senior Center | York | 1 | D3CG470 | - | DX -R22 | 11.2 | | Gas Furnace | 204 | 161.5 | 80% | Nat. Gas | 208-203 | 3 | 60 | 12 | 15 | 3 |

### AC Condensers

| Location | Area Served | Manufacturer | Qty. | Model # | Serial # | Cooling Capacity | Eff. (SEER) | Refrigerant | Volts | Phase | Approx. Age | ASHRAE Service Life | Remaining Life |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Roof | Fire Co. 2nd Flr | Goodman | 1 | GSC13036 | - | 3 Ton | 13 | R-22 | 208-230 | 3 | 1 | 20 | 19 |
| Roof | Fire Co. 1st Flr | Goodman | 1 | GSC13030 | - | 2.5 Ton | 13 | R-22 | 208-230 | 3 | 1 | 20 | 19 |

### Unit Heaters and Cabinet Unit Heaters

| Location | Area Served | Manufacturer | Qty. | Model # | Serial # | Heating Type | Heating Capacity (MBH) | CFM | RPM / HP | Approx. Age | ASHRAE Service Life | Remaining Life |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engine Bay | Engine Bay | Reznor | 1 | X | - | Gas Furnace | 100 | - | - | 1 | 13 | 12 |

### Furnace - Condensing sealed Combustion

| Location | Area Served | Manufacturer | Qty | Model # | Serial # | Cooling Coil | Cooling Eff. (SEER) | Cooling Capacity | Heating Type | Input (MBh) | Output (MBh) | Heating Eff. (%) | Fuel | Volts | Phase | Hz | Approx. Age | ASHRAE Service Life | Remaining Life |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Co. 2nd Flr | Fire Co. 2nd Flr | Goodman | 1 | GCH909004CXAB | 805612090 | DX - R22 | 13 | 3 Ton | Gas Furnace | 92 | 87.5 | 95% | Nat. Gas | 120 | 1 | 60 | 1 | 18 | 17 |
| Fire Co. 2nd Flr | Fire Co. 1st Flr | Goodman | 1 | GCH90703BXAB | 803149208 | DX - R22 | 13 | 2.5 Ton | Gas Furnace | 69 | 65 | 94% | Nat. Gas | 120 | 1 | 60 | 1 | 18 | 17 |

**Units include matching evaporator coil.

# INVESTMENT GRADE LIGHTING AUDIT

## CONCORD ENERGY SERVICES

**CEG Job #:** 9C08131
**Project:** Gloucester Energy Audits
**Address:** 829 Jersey Ave.
**City:** Gloucester City
**Building SF:** 9,996

**"Gloucester Heights Fire Company"**

**DATE:** 7/15/2009
**KWH COST:** $0.190

| EXISTING LIGHTING | | | | | | | | | | PROPOSED LIGHTING | | | | | | | | SAVINGS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Line No. | | Fixture Location | No. eFixts | Fixture eType | Yearly Usage | Watts Used | Total kW | kWh/Yr Fixtures | Yearly $ Cost | No. rFixts | Retro-Unit rDescription | Watts Used | Total kW | kWh/Yr Fixtures | Yearly $ Cost | Unit Cost (INSTALLED) | Total Cost | kW Savings | kWh/Yr Savings | Yearly $ Savings | Yearly Payback |
| 1 | | Front Entrance | 11 | High Hat Fixture Incandescent Lamp | 624 | 65 | 0.72 | 446.16 | $84.77 | 11 | 15 W Compact Fluorescent Lamp | 15 | 0.17 | 102.96 | $19.56 | $2.92 | $32.12 | 0.55 | 343.2 | $65.21 | 0.49 |
| 2 | | 1st Flr Office | 1 | 4' 4-Lamp T12 Prism Reflector Electronic Ballast. Mounted Below Ceiling | 624 | 146 | 0.15 | 91.104 | $17.31 | 1 | 4' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 91 | 0.09 | 56.784 | $10.79 | $140.00 | $140.00 | 0.06 | 34.32 | $6.52 | 21.47 |
| 3 | | 1st Flr Corridor | 1 | 2' 2-Lamp T12 Prism Reflector Electronic Ballast. Mounted Below Ceiling | 624 | 37 | 0.04 | 23.088 | $4.39 | 1 | 2' 2-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 30 | 0.03 | 18.72 | $3.56 | $50.00 | $50.00 | 0.01 | 4.368 | $0.83 | 60.25 |
| 4 | | 1st Flr Rest Room | 1 | 2' 2-Lamp T12 Prism Reflector Electronic Ballast. Mounted Below Ceiling | 624 | 37 | 0.04 | 23.088 | $4.39 | 1 | 2' 2-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 30 | 0.03 | 18.72 | $3.56 | $50.00 | $50.00 | 0.01 | 4.368 | $0.83 | 60.25 |
| 5 | | Stair | 2 | 2' 2-Lamp T12 Prism Reflector Electronic Ballast. Mounted Below Ceiling | 624 | 37 | 0.07 | 46.176 | $8.77 | 2 | 2' 2-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 30 | 0.06 | 37.44 | $7.11 | $50.00 | $100.00 | 0.01 | 8.736 | $1.66 | 60.25 |
| 6 | | Boat Bay | 1 | 2' 2-Lamp T12 Prism Reflector Electronic Ballast. Mounted Below Ceiling | 624 | 37 | 0.04 | 23.088 | $4.39 | 1 | 2' 2-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 30 | 0.03 | 18.72 | $3.56 | $50.00 | $50.00 | 0.01 | 4.368 | $0.83 | 60.25 |
| 7 | | Boat Bay | 2 | 4' 2-Lamp T12 Prism Reflector Electronic Ballast. Mounted Below Ceiling | 624 | 73 | 0.15 | 91.104 | $17.31 | 2 | 4' 2-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 61 | 0.12 | 76.128 | $14.46 | $80.00 | $160.00 | 0.02 | 14.976 | $2.85 | 56.23 |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | | 2nd Flr Rest Room | 1 | 2' 2-Lamp T12 Prism Reflector Electronic Ballast. Mounted Below Ceiling | 624 | 37 | 0.04 | 23.088 | $4.39 | 1 | 2' 2-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 30 | 0.03 | 18.72 | $3.56 | $50.00 | $50.00 | 0.01 | 4.368 | $0.83 | 60.25 |
| 9 | | Engine Bay | 9 | 8' 2-Lamp T12 Prism Reflector Electronic Magnetic Ballast. Mounted Below Ceiling | 624 | 200 | 1.80 | 1123.2 | $213.41 | 18 | 4' 2-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 61 | 1.10 | 685.152 | $130.18 | $80.00 | $1,440.00 | 0.70 | 438.048 | $83.23 | 17.30 |
| 10 | | 2nd Flr Lounge | 12 | 2'x4' 4-Lamp T12 Prism Lens Electronic Ballast | 624 | 146 | 1.75 | 1093.248 | $207.72 | 12 | 2'x4' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 91 | 1.09 | 681.408 | $129.47 | $140.00 | $1,680.00 | 0.66 | 411.84 | $78.25 | 21.47 |
| 11 | | Front of Hall | 42 | 2'x4' 4-Lamp T12 Prism Lens Magnetic Ballast | 1000 | 154 | 6.47 | 6468 | $1,228.92 | 42 | 2'x4' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 91 | 3.82 | 3822 | $726.18 | $140.00 | $5,880.00 | 2.65 | 2646 | $502.74 | 11.70 |
| 12 | | | 1 | 2'x2' 2-lamp T12 U-Tube Prism reflector, magnetic Ballast | 1000 | 78 | 0.08 | 78 | $14.82 | 1 | 2'x2' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 44 | 0.04 | 44 | $8.36 | $80.00 | $80.00 | 0.03 | 34 | $6.46 | 12.38 |
| 13 | | Front Kitchen | 6 | 2'x4' 4-Lamp T12 Prism Lens Magnetic Ballast | 1000 | 154 | 0.92 | 924 | $175.56 | 6 | 2'x4' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 91 | 0.55 | 546 | $103.74 | $140.00 | $840.00 | 0.38 | 378 | $71.82 | 11.70 |
| 14 | | Rear of Hall (Senior Center) | 29 | 2'x4' 4-Lamp T12 Prism Lens Magnetic Ballast | 1000 | 154 | 4.47 | 4466 | $848.54 | 29 | 2'x4' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 91 | 2.64 | 2639 | $501.41 | $140.00 | $4,060.00 | 1.83 | 1827 | $347.13 | 11.70 |
| 15 | | Rear Kitchen | 2 | 2'x4' 4-Lamp T12 Prism Lens Magnetic Ballast | 1000 | 154 | 0.31 | 308 | $58.52 | 2 | 2'x4' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 91 | 0.18 | 182 | $34.58 | $140.00 | $280.00 | 0.13 | 126 | $23.94 | 11.70 |
| 16 | | | 2 | 2'x2' 2-lamp T12 U-Tube Prism reflector, magnetic Ballast | 1000 | 78 | 0.16 | 156 | $29.64 | 2 | 2'x2' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 44 | 0.09 | 88 | $16.72 | $80.00 | $160.00 | 0.07 | 68 | $12.92 | 12.38 |
| 17 | | Restroom and Storage | 3 | 2'x4' 4-Lamp T12 Prism Lens Magnetic Ballast | 1000 | 154 | 0.46 | 462 | $87.78 | 3 | 2'x4' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 91 | 0.27 | 273 | $51.87 | $140.00 | $420.00 | 0.19 | 189 | $35.91 | 11.70 |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | | Rear Restroom | 3 | 2'x4' 4-Lamp T12 Prism Lens Magnetic Ballast | 1000 | 154 | 0.46 | 462 | $87.78 | 3 | 2'x4' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 91 | 0.27 | 273 | $51.87 | $140.00 | $420.00 | 0.19 | 189 | $35.91 | 11.70 |
| 19 | | | 1 | 2'x2' 2-lamp T12 U-Tube Prism reflector, magnetic Ballast | 1000 | 78 | 0.08 | 78 | $14.82 | 1 | 2'x2' 3-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 44 | 0.04 | 44 | $8.36 | $80.00 | $80.00 | 0.03 | 34 | $6.46 | 12.38 |
| 20 | | Electric Service Closet | 1 | 8' 2-Lamp T12 Prism Reflector Electronic Magnetic Ballast. Mounted Below Ceiling | 250 | 200 | 0.20 | 50 | $9.50 | 2 | 4' 2-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 61 | 0.12 | 30.5 | $5.80 | $80.00 | $160.00 | 0.08 | 19.5 | $3.71 | 43.18 |
| 21 | | | 1 | 8' 1-Lamp T12 Prism Reflector Electronic Magnetic Ballast. Mounted Below Ceiling | 250 | 100 | 0.10 | 25 | $4.75 | 2 | 4' 1-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 30 | 0.06 | 15 | $2.85 | $80.00 | $160.00 | 0.04 | 10 | $1.90 | 84.21 |
| 22 | | Hall Storage | 1 | 8' 2-Lamp T12 Prism Reflector Electronic Magnetic Ballast. Mounted Below Ceiling | 1000 | 200 | 0.20 | 200 | $38.00 | 2 | 4' 2-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 61 | 0.12 | 122 | $23.18 | $80.00 | $160.00 | 0.08 | 78 | $14.82 | 10.80 |
| 23 | | | 3 | 8' 1-Lamp T12 Prism Reflector Electronic Magnetic Ballast. Mounted Below Ceiling | 1000 | 100 | 0.30 | 300 | $57.00 | 2 | 4' 1-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 30 | 0.06 | 60 | $11.40 | $80.00 | $160.00 | 0.24 | 240 | $45.60 | 3.51 |
| 24 | | Bar Storage | 2 | 8' 1-Lamp T12 Prism Reflector Electronic Magnetic Ballast. Mounted Below Ceiling | 1000 | 200 | 0.40 | 400 | $76.00 | 2 | 4' 1-Lamp T8 Cooper Lighting Metalux Fixture with prism reflector and Electronic Ballast | 30 | 0.06 | 60 | $11.40 | $80.00 | $160.00 | 0.34 | 340 | $64.60 | 2.48 |
| 25 | | Bar | 6 | High Hat Fixture Incandescent Lamp | 1000 | 65 | 0.39 | 390 | $74.10 | 6 | 15 W Compact Fluorescent Lamp | 15 | 0.09 | 90 | $17.10 | $2.92 | $17.52 | 0.30 | 300 | $57.00 | 0.31 |
| | | | | | | | | | | | | | | | | | | | | | |
| | | **Totals** | 144 | | | | 19.77 | 17750.34 | $3,372.57 | 155 | | | 11.17 | 10003.25 | $1,900.62 | | $16,789.64 | 8.60 | 7747.092 | $1,471.95 | 11.41 |

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) | $180 |
| Initial Cost per Conventional Unit (retail price) | $73 |
| Unit Fuel Cost (Cooling) ($/kWh) | $0.190 |
| Unit Fuel Cost (Heating) ($/Therm) | $1.68 |

**24 Hour Typical Usage Patterns***

| | Weekday | Weekend |
|---|---|---|
| Nighttime Set-Back/Set-Up Hours | 20 | 20 |
| Daytime Set-Back/Set-Up Hours | 4 | 4 |
| Hours without Set-Back/Set-Up | 0 | 0 |

Choose your city from the drop-down menu → **City**: PA-Philadelphia

**Heating Season***

| | |
|---|---|
| Typical Indoor Temperature w/o Set-Back | 70 |
| Nighttime Set-Back Temperature (Average) | 65 |
| Daytime Set-Back Temperature (Average) | 70 |
| Heating System Type | Gas Furnace |

**Cooling Season***

| | |
|---|---|
| Typical Indoor Temperature w/o Set-Up | 75 |
| Nighttime Set-Up Temperature (Average) | 80 |
| 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 | $925 | $1,057 | $132 |
| *Heating Energy Consumption (MBTU)* | *55* | *63* | *8* |
| Cooling Energy Cost | $312 | $396 | $84 |
| *Cooling Energy Consumption (MBTU)* | *5.6* | *7.1* | *2* |
| **Total** | **$1,237** | **$1,453** | **$216** |
| **Life Cycle Costs** | | | |
| Energy Costs | $13,749 | $16,150 | $2,401 |
| Heating Energy Costs | *$10,279* | *$11,748* | *$1,468* |
| *Heating Energy Consumption (MBTU)* | 825 | 943 | 118 |
| Cooling Energy Costs | $3,469 | $4,402 | $933 |
| *Cooling Energy Consumption (MBTU)* | 84 | 106 | 23 |
| Purchase Price for 1 Unit(s) | *$180* | *$73* | *-$107* |
| **Total** | **$13,929** | **$16,223** | **$2,294** |
| | | Simple payback of initial cost (years) | **0.5** |

## Summary of Benefits for 1 Programmable Thermostat(s)

| | |
|---|---|
| Initial cost difference | **$107** |
| Life cycle savings | **$2,401** |
| Net life cycle savings (life cycle savings - additional cost) | **$2,294** |
| Life cycle energy saved (MBTU)-includes both Heating and Cooling | **140** |
| Simple payback of additional cost (years) | **0.5** |
| Life cycle air pollution reduction (lbs of $CO_2$) | **20,420** |
| Air pollution reduction equivalence (number of cars removed from the road for a year) | **2** |
| Air pollution reduction equivalence (acres of forest) | **2** |
| Savings as a percent of retail price | **1274%** |

## Assumptions for Programmable Thermostats

| Category | Value | | Data Source |
|---|---|---|---|
| **Heating/Cooling System Efficiencies** | | | |
| Gas Furnace | 84.0 | | LBNL 2004, Average of ENERGY STAR and Conventional |
| Gas Boiler | 82.5 | | LBNL 2004, Average of ENERGY STAR and Conventional |
| Oil Furnace | 84.0 | | LBNL 2004, Average of ENERGY STAR and Conventional |
| Oil Boiler | 82.5 | | LBNL 2004, Average of ENERGY STAR and Conventional |
| **Baseline Energy Consumption (MBTU)** | | | |
| Gas Furnace | 54.1 | | DOE 2001 |
| Gas Boiler | 56.1 | | DOE 2001 |
| Oil Furnace | 68.7 | | DOE 2001 |
| Oil Boiler | 71.2 | | DOE 2001 |
| Central Air Conditioner | 9.5 | | DOE 2001 |
| **Reference Degree Days (Heating/Cooling)** | | | |
| Gas Furnace | 4,255 | | DOE 2001 |
| Gas Boiler | 4,255 | | DOE 2001 |
| Oil Furnace | 5,339 | | DOE 2001 |
| Oil Boiler | 5,339 | | DOE 2001 |
| Central Air Conditioner | | 1701 | DOE 2001 |
| Typical Indoor Temperature (Heating Season) | 70 | | ENERGY STAR Programmable Thermostat Eligibility Criteria. Pre-programmed settings for heating include a morning and evening temperature ≤70°F and an adjustment of at least 8 °F (≤62°F) during daytime and nighttime. |
| Typical Indoor Temperature (Cooling Season) | 78 | | ENERGY STAR Programmable Thermostat Eligibility Criteria. Pre-programmed settings for cooling include a morning and evening temperature ≥78°F and an adjustment of at least 7 °F (≥85°F) during daytime and an adjustment of at least 4°F (≥82°F) at nighttime. |
| **Energy Prices** | | | |
| Natural Gas ($/Therm) | $1.2700 | $/Therm | EIA 2008 |
| Fuel Oil ($/Gallon) | $2.6800 | $/gal | EIA 2008 |
| Electric Price (Residential) | $0.1059 | $/kWh | EIA 2008 |
| **Usage** | | | |
| Nighttime Hours | 8 | | Default shipped setting, ENERGY STAR specification |
| Daytime Hours | 10 | | Default shipped setting, ENERGY STAR specification |
| **Carbon Dioxide Emissions Factors** | | | |
| Oil Carbon Emission Factor | 161.27 | lbs $CO_2$/MBtu | EPA 2007 |
| Gas Carbon Emission Factor | 116.97 | lbs $CO_2$/MBtu | EPA 2007 |
| Electricity Carbon Emission Factor | 1.54 | lbs $CO_2$/kWh | EPA 2008 |
| **Thermostat Savings** | | | |
| Savings per Degree of Setback (Heating Season) | 3% | | Industry Data 2004 |
| Savings per Degree of Setback (Cooling Season) | 6% | | Industry Data 2004 |
| **Thermostat Lifetime** | 15 | years | LBNL 2007 |
| **Initial Cost** | | | |
| ENERGY STAR Programmable Thermostat | $92 | | Industry Data 2008 |
| Conventional Thermostat | $73 | | Industry Data 2008 |
| **$CO_2$ Equivalents** | | | |
| Annual $CO_2$ sequestration per forested acre | 9,700 | lbs $CO_2$/acre-yr | EPA 2007 |
| Annual $CO_2$ emissions for "average" passenger car | 12,037 | lbs $CO_2$/acre-yr | EPA 2007 |
| **Discount Rate** | | | |
| Commercial and Residential Discount Rate (real) | 4% | | A real discount rate of 4 percent is assumed, which is roughly equivalent to the nominal discount rate of 7 percent (4 percent real discount rate + 3 percent inflation rate). |

**Project Name:** LGEA Solar PV Project - Gloucester Heights Fire Hall
**Location:** Gloucester City, NJ
**Description:** Photovoltaic System 95% Financing - 25 year

**Simple Payback Analysis**

| | Photovoltaic System 95% Financing - 25 year |
|---|---|
| Total Construction Cost | $207,000 |
| Annual kWh Production | 35,893 |
| Annual Energy Cost Reduction | $6,820 |
| Annual SREC Revenue | $12,562 |
| First Cost Premium | **$207,000** |
| Simple Payback: | **10.68** Years |

**Life Cycle Cost Analysis**

| | | | |
|---|---|---|---|
| Analysis Period (years): | 25 | Financing %: | 95% |
| Financing Term (mths): | 240 | Maintenance Escalation Rate: | 3.0% |
| Average Energy Cost ($/kWh) | **$0.190** | Energy Cost Escalation Rate: | 3.0% |
| Financing Rate: | 7.00% | SREC Value ($/kWh) | $0.350 |

| Period | Additional Cash Outlay | Energy kWh Production | Energy Cost Savings | Additional Maint Costs | SREC Revenue | Interest Expense | Loan Principal | Net Cash Flow | Cumulative Cash Flow |
|---|---|---|---|---|---|---|---|---|---|
| 0 | $10,350 | 0 | 0 | 0 | $0 | 0 | 0 | (10,350) | 0 |
| 1 | $0 | 35,893 | $6,820 | $0 | $12,562 | $13,617 | $4,678 | $1,086 | ($9,264) |
| 2 | $0 | 35,713 | $7,024 | $0 | $12,500 | $13,279 | $5,016 | $1,228 | ($8,035) |
| 3 | $0 | 35,535 | $7,235 | $0 | $12,437 | $12,916 | $5,379 | $1,376 | ($6,659) |
| 4 | $0 | 35,357 | $7,452 | $0 | $12,375 | $12,528 | $5,768 | $1,531 | ($5,127) |
| 5 | $0 | 35,180 | $7,676 | $362 | $12,313 | $12,111 | $6,185 | $1,331 | ($3,797) |
| 6 | $0 | 35,004 | $7,906 | $361 | $12,251 | $11,664 | $6,632 | $1,501 | ($2,296) |
| 7 | $0 | 34,829 | $8,143 | $359 | $12,190 | $11,184 | $7,111 | $1,679 | ($617) |
| 8 | $0 | 34,655 | $8,387 | $357 | $12,129 | $10,670 | $7,625 | $1,864 | $1,247 |
| 9 | $0 | 34,482 | $8,639 | $355 | $12,069 | $10,119 | $8,177 | $2,057 | $3,304 |
| 10 | $0 | 34,309 | $8,898 | $353 | $12,008 | $9,528 | $8,768 | $2,257 | $5,562 |
| 11 | $0 | 34,138 | $9,165 | $352 | $11,948 | $8,894 | $9,402 | $2,466 | $8,028 |
| 12 | $0 | 33,967 | $9,440 | $350 | $11,888 | $8,214 | $10,081 | $2,683 | $10,711 |
| 13 | $0 | 33,797 | $9,723 | $348 | $11,829 | $7,485 | $10,810 | $2,909 | $13,619 |
| 14 | $0 | 33,628 | $10,015 | $346 | $11,770 | $6,704 | $11,591 | $3,143 | $16,762 |
| 15 | $0 | 33,460 | $10,315 | $345 | $11,711 | $5,866 | $12,429 | $3,386 | $20,148 |
| 16 | $0 | 33,293 | $10,625 | $343 | $11,652 | $4,968 | $13,328 | $3,639 | $23,787 |
| 17 | $0 | 33,126 | $10,943 | $341 | $11,594 | $4,004 | $14,291 | $3,901 | $27,688 |
| 18 | $0 | 32,961 | $11,272 | $339 | $11,536 | $2,971 | $15,325 | $4,173 | $31,861 |
| 19 | $0 | 32,796 | $11,610 | $338 | $11,479 | $1,863 | $16,432 | $4,455 | $36,316 |
| 20 | $0 | 32,632 | $11,958 | $336 | $11,421 | $675 | $17,620 | $4,748 | $41,064 |
| 21 | $0 | 32,469 | $12,317 | $334 | $11,364 | $572 | $16,198 | $6,576 | $47,639 |
| 22 | $0 | 32,306 | $12,686 | $333 | $11,307 | $392 | $13,330 | $9,939 | $57,579 |
| 23 | $0 | 32,145 | $13,067 | $331 | $11,251 | $0 | $0 | $23,987 | $81,565 |
| 24 | $0 | 31,984 | $13,459 | $329 | $11,194 | $0 | $0 | $24,324 | $105,889 |
| 25 | $0 | 31,824 | $13,863 | $328 | $11,138 | $0 | $0 | $24,674 | $130,563 |
| | **Totals:** | 684,755 | $183,245 | $5,585 | $239,664 | $169,260 | $196,650 | $226,178 | $627,537 |
| | | | | **Net Present Value (NPV)** | | | **$26,913** | | |
| | | | | **Internal Rate of Return (IRR)** | | | **18.8%** | | |

**Project Name:** LGEA Solar PV Project - Gloucester Heights Fire Hall
**Location:** Gloucester City, NJ
**Description:** Photovoltaic System

**Simple Payback Analysis**

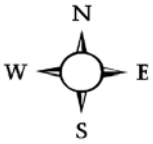
| | Photovoltaic System |
|---|---|
| Total Construction Cost | $207,000 |
| Annual kWh Production | 35,893 |
| Annual Energy Cost Reduction | $6,820 |
| Annual SREC Revenue | $12,562 |
| First Cost Premium | **$207,000** |
| Simple Payback: | **10.68** **Years** |

**Life Cycle Cost Analysis**

| | | | |
|---|---|---|---|
| Analysis Period (years): | 25 | Financing %: | 0% |
| Financing Term (mths): | 0 | Maintenance Escalation Rate: | 3.0% |
| Average Energy Cost ($/kWh) | **$0.190** | Energy Cost Escalation Rate: | 3.0% |
| Financing Rate: | 0.00% | SREC Value ($/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 | $207,000 | 0 | 0 | 0 | $0 | (207,000) | 0 |
| 1 | $0 | 35,893 | $6,820 | $0 | $12,562 | $19,382 | ($187,618) |
| 2 | $0 | 35,713 | $7,024 | $0 | $12,500 | $19,524 | ($168,094) |
| 3 | $0 | 35,535 | $7,235 | $0 | $12,437 | $19,672 | ($148,422) |
| 4 | $0 | 35,357 | $7,452 | $0 | $12,375 | $19,827 | ($128,595) |
| 5 | $0 | 35,180 | $7,676 | $362 | $12,313 | $19,626 | ($108,969) |
| 6 | $0 | 35,004 | $7,906 | $361 | $12,251 | $19,797 | ($89,173) |
| 7 | $0 | 34,829 | $8,143 | $359 | $12,190 | $19,974 | ($69,198) |
| 8 | $0 | 34,655 | $8,387 | $357 | $12,129 | $20,160 | ($49,039) |
| 9 | $0 | 34,482 | $8,639 | $355 | $12,069 | $20,352 | ($28,686) |
| 10 | $0 | 34,309 | $8,898 | $353 | $12,008 | $20,553 | ($8,133) |
| 11 | $0 | 34,138 | $9,165 | $352 | $11,948 | $20,762 | $12,628 |
| 12 | $0 | 33,967 | $9,440 | $350 | $11,888 | $20,979 | $33,607 |
| 13 | $0 | 33,797 | $9,723 | $348 | $11,829 | $21,204 | $54,811 |
| 14 | $0 | 33,628 | $10,015 | $346 | $11,770 | $21,438 | $76,249 |
| 15 | $0 | 33,460 | $10,315 | $345 | $11,711 | $21,682 | $97,931 |
| 16 | $0 | 33,293 | $10,625 | $343 | $11,652 | $21,934 | $119,865 |
| 17 | $0 | 33,126 | $10,943 | $341 | $11,594 | $22,196 | $142,061 |
| 18 | $0 | 32,961 | $11,272 | $339 | $11,536 | $22,468 | $164,530 |
| 19 | $0 | 32,796 | $11,610 | $338 | $11,479 | $22,751 | $187,280 |
| 20 | $0 | 32,632 | $11,958 | $336 | $11,421 | $23,043 | $210,324 |
| 21 | $1 | 32,469 | $12,317 | $334 | $11,364 | $23,347 | $233,670 |
| 22 | $2 | 32,306 | $12,686 | $333 | $11,307 | $23,661 | $257,331 |
| 23 | $3 | 32,145 | $13,067 | $331 | $11,251 | $23,987 | $281,318 |
| 24 | $4 | 31,984 | $13,459 | $329 | $11,194 | $24,324 | $305,642 |
| 25 | $5 | 31,824 | $13,863 | $328 | $11,138 | $24,674 | $330,316 |
| | **Totals:** | 684,755 | $183,245 | $5,585 | $239,664 | $537,316 | $417,324 |
| | | | | **Net Present Value (NPV)** | | **$330,341** | |
| | | | | **Internal Rate of Return (IRR)** | | **8.7%** | |

| Building | Roof Area (sq ft) | Panel | Qty | Panel Sq Ft | Panel Total Sq Ft | Total KW | Total Annual kWh | Panel Weight (33 lbs) | W/SQFT |
|---|---|---|---|---|---|---|---|---|---|
| Gloucester Heights Fire Hall | 1460 | Sunpower SPR230 | 100 | 14.7 | 1,470 | 23.00 | 35,893 | 3,300 | 15.64 |


.= Proposed PV Layout

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