
# LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

**PREPARED FOR:**

**GOOD WILL FIRE CO. #1 OF PEMBERTON**
**200 HANOVER STREET**
**PEMBERTON, NJ 08068**
**ATTN: MR. JEFFREY WILSON**
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# I. EXECUTIVE SUMMARY

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

Good Will Fire Company of Pemberton
200 Hanover Street
Pemberton, NJ 08068

Contact Person: Jeffrey W. Wilson

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program for the Good Will Fire Company of Pemberton. The purpose of this analysis is to provide the owner insight into the energy savings potential that exists within the facility at Good Will Fire Company. Energy Efficiency changes and upgrades requires support from the building occupants, operations personnel and the administrators of the building in order to maximize the savings and overall benefit. The efficiency improvement of public buildings provides a benefit for the environment and the residence of New Jersey. Through this report it has been demonstrated that there is a great potential for energy savings and infrastructure improvements at Good Will Fire Company.

The Energy Conservation Measures (ECMs) identified within the report represent the potential annual savings at the facility. It is recommended to consider all ECMs as part of the Owner's initiative to save energy, reduce emissions, and lower operating costs. 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 annual energy costs at this facility are as follows:

| | |
|---|---|
| Electricity | $ 1,285 |
| Natural Gas | $ 4,911 |
| Total | $ 6,196 |

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 #1A | Garage Lighting T5HO Retrofit | $1,900 | $111 | 17.1 | -12.4% |
| ECM #1B | Garage Lighting T-8 Retrofit | $575 | $100 | 5.8 | 160.9% |
| ECM #2 | HVAC System Replacement | $9,980 | $419 | 23.8 | -37.0% |
| ECM #3 | Unit Heater Replacement | $18,900 | $428 | 44.2 | -70.6% |
| ECM #4 | Vending Miser Controls | $179 | $598 | 0.3 | 4907.1% |

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

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

| ENERGY CONSERVATION MEASURES (ECM's) | | | | |
|---|---|---|---|---|
| **ECM NO.** | **DESCRIPTION** | **ANNUAL UTILITY REDUCTION** | | |
| | | **ELECTRIC DEMAND (KW)** | **ELECTRIC CONSUMPTION (KWH)** | **NATURAL GAS (THERMS)** |
| ECM #1A | Garage Lighting T5HO Retrofit | 0.70 | 474.00 | 0.00 |
| ECM #1B | Garage Lighting T-8 Retrofit | 0.60 | 428.00 | 0.00 |
| ECM #2 | HVAC System Replacement | 0.00 | 1212.00 | 129.00 |
| ECM #3 | Unit Heater Replacement | 0.00 | 0.00 | 382.00 |
| ECM #4 | Vending Miser Controls | 0.00 | 2553.00 | 0.00 |

**Renewable Energy Conservation Measures:**

The Good Will Fire Company has a total estimated solar system potential of 4.7 kW DC that could generate 5,097 kilowatt-hours annually offsetting 92.7% of the total energy purchased from the grid. Solar is an economically viable option for the Owner to pursue, using either existing financing methods or alternative routes, such as a Power Purchase. Given the small system size it is recommended the Fire Company strongly consider self purchase of the system, however contacting local solar contractors may provide additional options for obtaining a system as many residential/light commercial solar contractors offer power purchase agreements for a system of this size.

**Energy Procurement Recommendations:**

CEG recommends that the Good Will Fire Company seek to join a purchasing cooperative with Burlington County which utilizes the advisement of 3rd party unbiased Energy Consulting Firm experienced in the procurement of retail natural gas commodity and negotiation of contract terms and conditions.

**Maintenance and Operational Recommendations:**

In addition to the ECMs and REMs, 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 and further recommendations for the building are provided in the building reports:

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 windows and 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.
5. Verify all thermostats are utilizing setback and scheduling capabilities.
6. Fire Company personnel are currently very attentive to turning lights off when leaving the building as well as setting back thermostats, however it is recommended they reinforce the importance of savings energy at its facility by regularly mentioning it in its newsletter to volunteers and placing labels on light switches and thermostats as reminder tools.

**Implementation Strategy Moving Forward:**

It is recommended the Owner strongly consider all projects with a simple payback of ten years and under for implementation. However consideration should be taken on projects over ten years as they may be necessary capital improvements. The Owner should also consider pursuing any and all additional NJ Clean Energy Programs in order to receive the maximum incentives available.

Some of the conservation measures within the list, such as vending miser controls, can be implemented with little to no cost and yield quick paybacks. Investigating the lighting options within the garage, Concord Engineering was able to suggest two strategies in which the Fire Company can choose progress. The lighting replacement with T-8 fixtures is currently being implemented within the garage in fixtures which have failed and need replacing. With the low cost of T-8 lamps and almost identical savings to that of the more expensive T5HO fixtures, the continuing replacement with T-8 lamps may be more beneficial. Additionally, the realization that the garage lighting is operating on average at an estimated 800 hours a year, does not warrant the longer payback of T5HO fixtures.

The HVAC system replacement ECM can be considered as a near future investment for the Fire Company. With the HVAC equipment within the facility nearing the ASHRAE useful service life of 15 years, a project to replace the units and re-evaluate the zone control scheme and placement for thermostats can be considered for an upcoming project.

**Overall Assessment:**

Overall, the Good Will Fire Company of Pemberton is reasonably maintained and operating fairly efficiently. Through the implementation of measures outlined in this study and improving the overall operational efficiency it is likely the Owner has potential to further reduce its total energy cost of $6,196 by approximately 18%.

**Additional Comments:**

The ECM's outlined within this report were based upon billing data gathered from Pemberton Electric Company. Currently, the Pemberton Fire Company consumes 5,500 kWh per year, in comparison with similar fire house audits performed by Concord the Pemberton Facility has significantly less electric consumption to these facilities. These observations and data were taken into account while calculating ECM's. The current consumption for equipment electric usage was base lined as close to the billing consumption as possible. With this in mind, efficiency upgrades for equipment with minimal energy consumption will result in a limited reduction.

## II. INTRODUCTION

The comprehensive energy audit covers the 6,800 square foot Good Will Fire Company of Pemberton, which includes the following spaces: Offices, garage bay, kitchen, restrooms, sleeping quarters, meeting room, and lounge.

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

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

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

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

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

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

## III. METHOD OF ANALYSIS

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

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

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

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment 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:

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

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

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

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

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

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

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

# IV. HISTORIC ENERGY CONSUMPTION/COST

## A. Energy Usage / Tariffs

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

The electric usage profile represents the actual electrical usage for the facility. Pemberton Borough Electric provides electricity to the facility. A Third Part Supplier (TPS) has not been contracted. 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 gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Basic General Supply Service (GSG) rate structure. A Third Part Supplier (TPS) has not been contracted. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

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 | 23.4¢ / kWh |
| Natural Gas | $1.12 / Therm |

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

**ELECTRIC USAGE SUMMARY**

Utility Provider: Pemberton Borough Electric Department
Rate: N/A
Meter No: N/A
Account # 20690402
Third Party Utility N/A
TPS Meter / Acct No: N/A

| MONTH OF USE | CONSUMPTION KWH | DEMAND KW | TOTAL BILL |
|---|---|---|---|
| Apr-11 | 320 | 0.15 | $80 |
| Mar-11 | 320 | 0.09 | $75 |
| Feb-11 | 320 | 0.09 | $75 |
| Jan-11 | 330 | 0.19 | $87 |
| Dec-10 | 390 | 0.10 | $89 |
| Nov-10 | 300 | 0.09 | $71 |
| Oct-10 | 290 | 0.09 | $69 |
| Sep-10 | 590 | 0.18 | $137 |
| Aug-10 | 670 | 0.18 | $153 |
| Jul-10 | 770 | 0.18 | $173 |
| Jun-10 | 650 | 0.15 | $146 |
| May-10 | 550 | 0.19 | $130 |
| **Totals** | **5,500** | **0.19 Max** | **$1,285** |

**AVERAGE DEMAND** **0.14 KW average**
**AVERAGE RATE** **$0.234** **$/kWh**

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

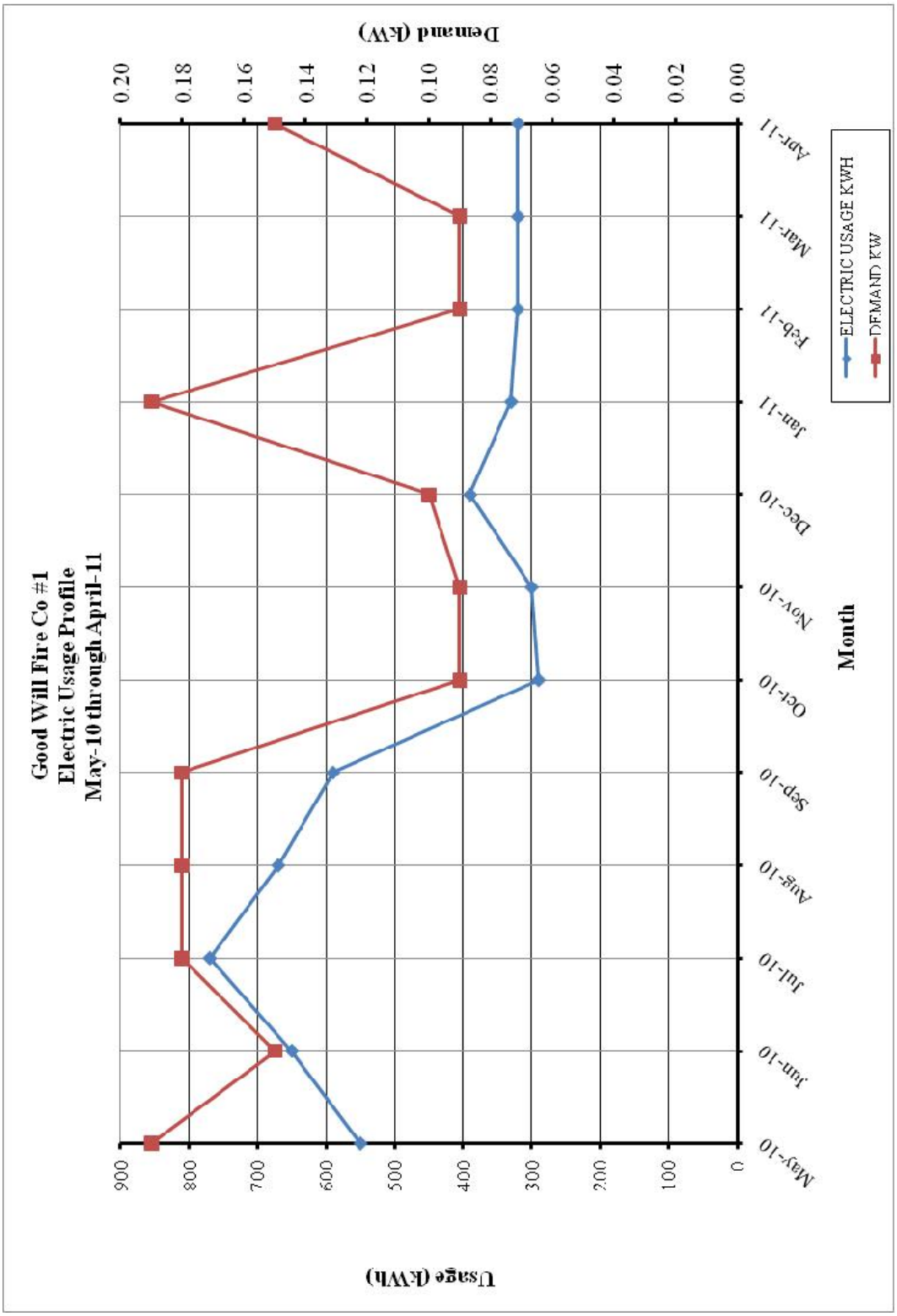
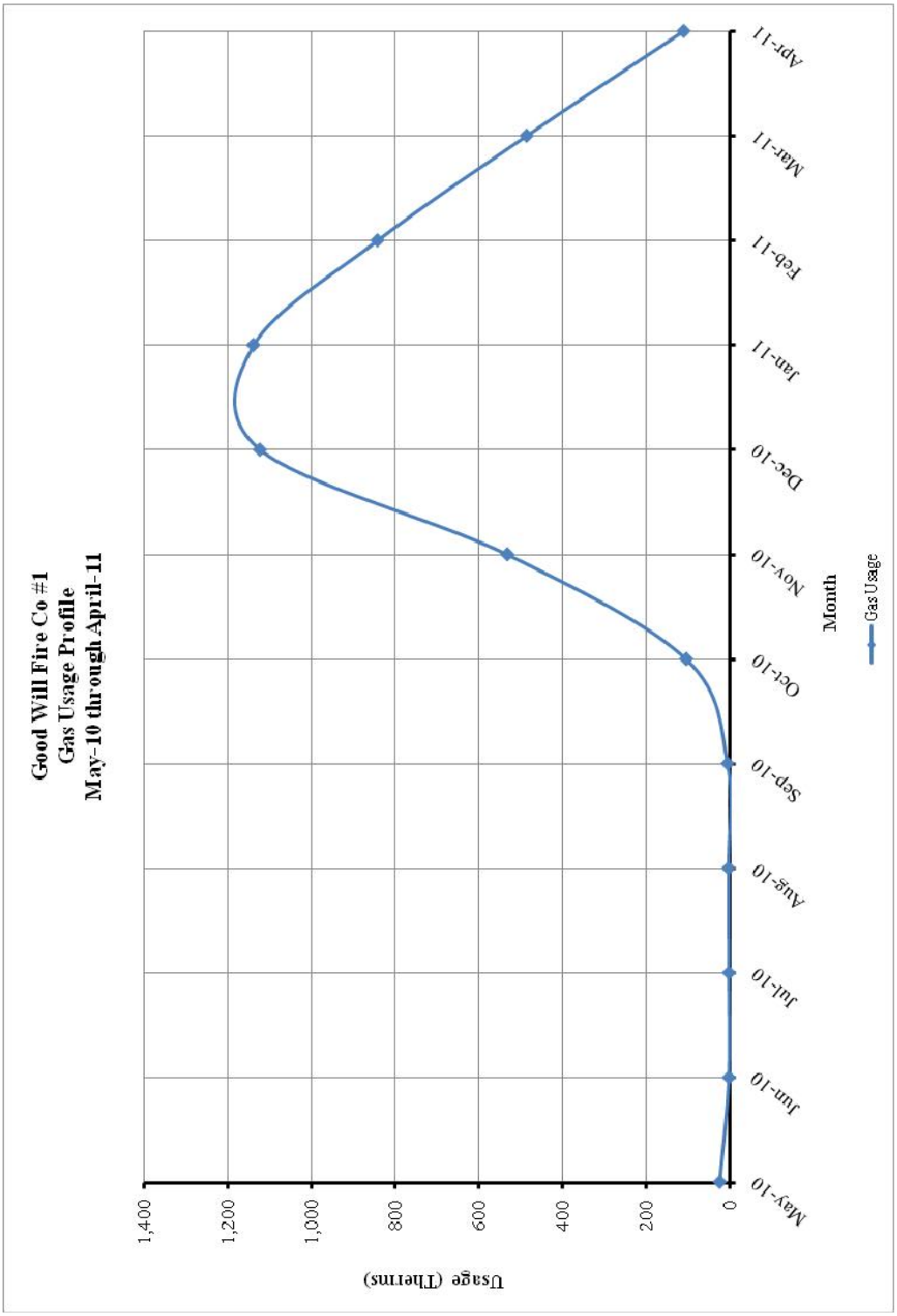


**Table 4**
**Natural Gas Billing Data**

| NATURAL GAS USAGE SUMMARY | | |
|---|---|---|
| Utility Provider: PSE&G | | |
| Rate: GSG | | |
| Meter No: 3026393 | | |
| Point of Delivery ID: PG000011554566728377 | | |
| Third Party Utility Provider: N/A | | |
| TPS Meter No: N/A | | |
| **MONTH OF USE** | **CONSUMPTION (THERMS)** | **TOTAL BILL** |
| Apr-11 | 111.09 | $121.27 |
| Mar-11 | 486.02 | $489.75 |
| Feb-11 | 842.28 | $964.93 |
| Jan-11 | 1,138.73 | $1,295.51 |
| Dec-10 | 1,123.15 | $1,273.80 |
| Nov-10 | 532.13 | $551.70 |
| Oct-10 | 104.87 | $120.80 |
| Sep-10 | 6.23 | $16.43 |
| Aug-10 | 4.15 | $14.97 |
| Jul-10 | 3.11 | $13.77 |
| Jun-10 | 3.09 | $13.32 |
| May-10 | 24.87 | $34.92 |
| **TOTALS** | **4,379.72** | **$4,911.17** |
| **AVERAGE RATE:** | **$1.12** | **$/THERM** |

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



**B. Energy Use Index (EUI)**

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

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

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

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

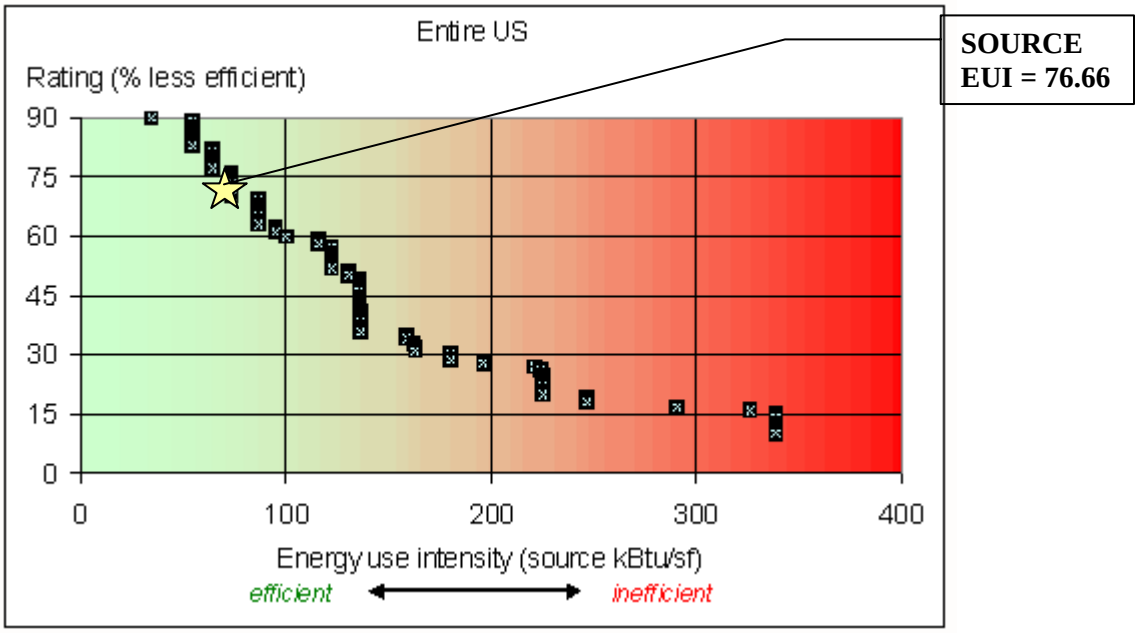
$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ X\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ X\ SS\ Ratio)}{Building\ Square\ Footage}$$

**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 | 5,500.0 | | | 18,777 | 3.340 | 62,715 |
| NATURAL GAS | | 4,379.7 | | 437,972 | 1.047 | 458,557 |
| TOTAL | | | | 456,749 | | 521,272 |
| *Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007. | | | | | | |
| **BUILDING AREA** | | 6,800 | SQUARE FEET | | | |
| **BUILDING SITE EUI** | | *67.17* | kBtu/SF/YR | | | |
| **BUILDING SOURCE EUI** | | *76.66* | kBtu/SF/YR | | | |

Figure 1 below depicts a national EUI grading for the source energy use of a Fire/Police building type.

**Figure 1**
**Source Energy Use Intensity Distributions: Fire/Police Building**



## C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government entities 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

[redacted]

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** | **NATIONAL AVERAGE** |
| Good Will Fire Company | N/A | 50 |

An Energy Performance score of "N/A" represents a facility that cannot receive a rating. See Energy Star website for details.

## V. FACILITY DESCRIPTION

The 6,800 SF Good Will Fire Company Building is a two story facility comprised of offices, meeting room, garage bay, sleeping quarter and lounge. The Fire House is a volunteer facility but the typical hours of operation are between 8:00 am and 5:00 pm. Exterior walls are 12 inch block CMU construction with only an epoxy wall and surface coating. 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. Blinds are utilized throughout the indoor office areas of the facility per occupant comfort. The blinds are valuable because they help to reduce heat loss in the winter and reduce solar heat in the summer. The roof is a truss system that is comprised of asphalt shingles over plywood sheathing. The insulation between the attic area and second floor spaces contains R-19 batt insulation. The building was built in 2001 with no additions since the original construction.

HVAC Systems

The indoor areas of the first and second floor are conditioned by Carrier split system furnaces that have 5 ton condensing units to satisfy the cooling load. One furnace is located in the mechanical room and serves the first floor offices and kitchen while the second furnace is located in the attic and serves the second floor offices, lounge and meeting room. It was noted during the survey that the attic furnace has a tendency to freeze up.

The garage area of the fire house is heated by Sterling gas fired tubular propeller unit heaters. These units have a thermal efficiency of approximately 81%.

Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters. The toilet room exhaust fans are controlled by the on/off light switches in the room.

HVAC System Controls

The gas fired furnace units are controlled via local thermostats, one located in the kitchen for control over the entire 1st floor and one located in the lounge for control over the entire 2nd floor. The thermostats are standard non-programmable and set to 72°F. The gas fired Sterling unit heaters in the garage are controlled with local thermostats set to approximately 60°F. The unit heater thermostats are also non-programmable.

Domestic Hot Water

Domestic hot water for the restrooms and kitchen is provided by a 75 gallon Bradford White gas fired hot water heater, capacity of 75,000 Btu/h. The domestic hot water is circulated throughout the building by a hot water re-circ pump. The domestic hot water piping insulation appeared to be in good condition.

Lighting

Typical lighting throughout building is fluorescent tube surface mounted fixtures with T-8 lamps and electronic ballasts. The lounge area has recessed high hat fixtures with par-30 lamps. The garage bay area has T-12 surface mounted fixtures with magnetic ballasts but while conducting the survey it was noted that some fixtures are being replaced with T-8 lamps and electronic ballasts. Outdoor lighting is provided by wall mounted fluorescents and 70 watt metal halide wall packs.

## 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 #1A: Install T-5 Lighting System in Garage

**Description:**

The Garage is currently lit via ten, 8 foot, 75 Watt T-12 fluorescent fixtures that are mounted approximately 26'-0" above the finished floor. The lighting system is antiquated and the space would be better served with a more efficient, fluorescent lighting system. Currently, the facility is replacing broken fixtures with 8 foot, 59 Watt, T-8 fluorescent fixtures but has not done a full retrofit of the complete T-12 system.

CEG recommends upgrading the lighting within the Garage to an energy-efficient T-5 lighting system that includes new lighting fixtures with high efficiency, electronic ballasts and T-5 high output (HO) lamps. The T-5 HO lamps are rated for 20,000 hours versus the 12,000 hours for the F96T12 fluorescents so there would be a savings in replacement cost and labor. In addition to the standard lighting features of the T-5 fixtures; a day-lighting option could be selected for the outside rows of light to take advantage of the natural daylight that provides light to the room during the day via the clerestory.

This measure replaces all the remaining T-12, 75 Watt fixtures in the Garage with a well-designed T-5 lighting system. Approximately seven, 3-lamp T5HO high bay fixtures with reflectors and high-efficiency, electronic ballasts will be required for the replacement.

**Energy Savings Calculations:**

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix – ECM#1A** that outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: $25 per fixture.

**Energy Savings Summary:**

| ECM #1A - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $2,075 |
| **NJ Smart Start Equipment Incentive ($):** | $175 |
| **Net Installation Cost ($):** | $1,900 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $111 |
| **Total Yearly Savings ($/Yr):** | $111 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 17.1 |
| **Simple Lifetime ROI** | -12.4% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $1,665 |
| **Internal Rate of Return (IRR)** | -2% |
| **Net Present Value (NPV)** | ($574.89) |

## ECM #1B: Install T-8 Lighting System in Garage

**Description:**

The Garage is currently lit via ten, 8 foot, 75 Watt T-12 fluorescent fixtures that are mounted approximately 26'-0" above the finished floor. The lighting system is antiquated and the space would be better served with a more efficient, fluorescent lighting system. Currently, the facility is replacing broken fixtures with 8 foot, 59 Watt, T-8 fluorescent fixtures but has not done a full retrofit of the complete T-12 system.

Alternately, CEG recommends upgrading the lighting within the Garage to an energy-efficient T-8 lighting system that includes new lighting fixtures with high efficiency, electronic ballasts and T-8 59 watt lamps. The T-8 lamps are rated for 15,000 hours versus the 10,000 hours for the F96T12 fluorescents so there would be a savings in replacement cost and labor.

This measure replaces all the remaining T-12, 75 Watt fixtures in the Garage with a well-designed T-8 lighting system. Approximately seven, 3-lamp 96T8 slimline fixtures with reflectors and high-efficiency, electronic ballasts will be required for the replacement.

**Energy Savings Calculations:**

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix – ECM#1B** that outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: $25 per fixture.

**Energy Savings Summary:**

| ECM #1B - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $750 |
| **NJ Smart Start Equipment Incentive ($):** | $175 |
| **Net Installation Cost ($):** | $575 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $100 |
| **Total Yearly Savings ($/Yr):** | $100 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 5.8 |
| **Simple Lifetime ROI** | 160.9% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $1,500 |
| **Internal Rate of Return (IRR)** | 15% |
| **Net Present Value (NPV)** | $618.79 |

## ECM #2: HVAC System Replacement

**Description:**

The Fire House HVAC system is currently ten years old, more than Halfway through its useful life expectancy and could be replaced with a newer much more efficient system. The system currently utilizes two gas fired furnaces coupled with two outdoor condensing units that serve the building. The units are controlled via centrally located thermostats on each floor.

This ECM proposes replacing the system with a newer and more efficient gas furnace system. System specifications are based on the installation of Lennox SLP98V gas fired furnace units as well as new Lennox XC21 high efficiency condensing units.

**Energy Savings Calculations:**

Cooling savings were calculated based equivalent full load hours for a standard cooling system compared with that of a heat pump unit utilizing the following equation.

$$Electric\ Usage = \frac{Cooling\,(Tons) \times 12{,}000\left(\frac{Btu}{Ton\ hr}\right)}{1000\left(\frac{W}{kW}\right)} \times \left(\frac{1}{SEER}\right) \times Equivalent\ Full\ Load\ Hrs.$$

Heating savings were calculated based on the existing heating requirements of the building utilizing the previous year's gas bills and removing the portion of the bill associated with domestic hot water heating and garage bay unit heaters. The following equations were utilized in calculation these savings.

$$Heating\ Usage\ Stage\ One = \frac{\%HDD(65\,F) \times Heating\ Load\ (kBtu)}{1000\left(\frac{Btu}{kBtu}\right)} \times \left(\frac{1}{HSPF}\right) \times \left(\frac{1}{1000\frac{Wh}{kWh}}\right)$$

| HVAC SYSTEM FURNACE UPGRADE | | | |
|---|---|---|---|
| **ECM INPUTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| *HEATING SAVINGS CALCULATION* | | | |
| **Annual Fuel Usage (kBtu)** | 70,383 | 70,383 | |
| **Existing Heating System Efficiency** | 80% | | |
| **Building Heat Load (kBtu)** | 56,306 | 56,306 | |
| **Heating Degree Days (65 F)** | 5,205 | 5,205 | |
| **Heating Stage [Gas Furnace] (kBtu)** | N/A | 56,306 | |
| **Natural Gas Usage (Therms)** | 704 | 575 | |
| *COOLING SAVINGS CALCULATION* | | | |
| **Cooling Equivalent Full Load Hours** | 200 | 200 | |
| **Electric Usage (kWh)** | 2,667 | 1,455 | |
| **Electric Cost ($/kWh)** | 0.23 | 0.23 | |
| **Natural Gas Cost ($/Therm)** | 1.12 | 1.12 | |
| **ENERGY SAVINGS CALCULATIONS** | | | |
| **ECM RESULTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **Electric Usage (kWh)** | 2,667 | 1,455 | 1,212 |
| **Natural Gas Usage (Therms)** | 704 | 575 | 129 |
| **Energy Cost ($)** | $1,412 | $984 | $428 |
| **COMMENTS:** | HP Operation Above 45 F for Heating, Below 45 F Gas Furnace; HDD(45F) 1033 | | |

**Further Considerations:**

It was noted during the site survey that there are only single zone thermostats for each furnace which caused certain zones in the building to be improperly satisfied. CEG recommends that multiple programmable thermostats be installed in several zones throughout the building for better zone comfort. These thermostats should be programmed to either handle an average temperature between zones or have an override temperature when certain rooms are being utilized. The installation of multiple thermostats will allow the building to condition several zones with an agreeable comfort level throughout. With the implementation of multiple thermostats, more spaces can be controlled per occupant comfort, therefore an estimated additional savings of 5% could be seen.

**Energy Savings Summary:**

| ECM #2 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $11,500 |
| **NJ Smart Start Equipment Incentive ($):** | $1,520 |
| **Net Installation Cost ($):** | $9,980 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $419 |
| **Total Yearly Savings ($/Yr):** | $419 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 23.8 |
| **Simple Lifetime ROI** | -37.0% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $6,285 |
| **Internal Rate of Return (IRR)** | -5% |
| **Net Present Value (NPV)** | ($4,978.01) |

## ECM #3: Infra-Red Radiant Unit Heater in Garage

**Description:**

The Good Will Fire Company #1 of Pemberton (6,800 SF) has a single garage containing four (4) gas fired unit heaters in total, mounted from the ceiling steel structure. These unit heaters are approaching their ASHRAE service life and are rated at approximately 150,000 Btuh output each. These units are used to keep the garages at 60°F in the wintertime.

This ECM would upgrade the public works garage by installing more efficient gas-fired, infrared tube heaters rated at 90% thermal efficiency. When compared to convective heating systems, Infrared heaters provide more efficient heating in large areas and warehouses because they only heat people and objects (not air).The installation will require venting and unit combustion air piping. Basis of design for replacement of the existing unit heaters with infrared tube heating is the Sterling SL150 infrared heater or equivalent.

**Energy Savings Calculations:**

| INFRA-RED RADIANT UNIT HEATER CALCULATIONS | | | |
|---|---|---|---|
| **ECM INPUTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **ECM INPUTS** | Existing Unit Heaters | New Radiant Heating System | - |
| **Existing Nat Gas (Therms)** | 3,440 | - | - |
| **Efficiency (%)** | 80% | 90% | 10% |
| **Nat Gas Heat Value (BTU/Therm)** | 100,000 | 100,000 | - |
| **Equivalent Building Heat Usage (MMBTUs)** | 275 | 275 | - |
| **Ave. Gas Cost ($/Therm)** | 1.12 | 1.12 | - |
| **ENERGY SAVINGS CALCULATIONS** | | | |
| **ECM RESULTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **Natural Gas Usage (Therms)** | 3,440 | 3,058 | 382 |
| **Energy Cost ($)** | $3,853 | $3,425 | $428 |
| **COMMENTS:** | | | |

NJ Smart Start® Program Incentives are not currently available for this ECM.

**Energy Savings Summary:**

| ECM #3 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $18,900 |
| **NJ Smart Start Equipment Incentive ($):** | $0 |
| **Net Installation Cost ($):** | $18,900 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $428 |
| **Total Yearly Savings ($/Yr):** | $428 |
| **Estimated ECM Lifetime (Yr):** | 13 |
| **Simple Payback** | 44.2 |
| **Simple Lifetime ROI** | -70.6% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $5,564 |
| **Internal Rate of Return (IRR)** | -14% |
| **Net Present Value (NPV)** | ($14,348.24) |

## ECM #4: Vending Miser Controls

**Description:**

The Good Will Fire Company #1 in Pemberton currently utilizes a vending machine in the garage area of the building. Vending machines are common within meeting areas which can be in use for a limited time during the day. The installation of the Vending Miser system will help reduce the operating hours of vending machines.

Cold beverage machines regularly operate inefficiently trying to maintain a constant cool temperature within the machine. The VendingMiser® system incorporates innovative energy-saving technology into a small plug-and-play device that in conjunction with a passive infrared sensor regulate the operation of the cold beverage machines based on occupancy and room temperature. This ECM approximates the installation of one of these control systems for the cold beverage machine.

**Energy Savings Calculations:**

See **Vending Miser Appendix** for calculation methods and analysis.

**Energy Savings Summary:**

| ECM #4 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $179 |
| **NJ Smart Start Equipment Incentive ($):** | $0 |
| **Net Installation Cost ($):** | $179 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $598 |
| **Total Yearly Savings ($/Yr):** | $598 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 0.3 |
| **Simple Lifetime ROI** | 4907.1% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $8,963 |
| **Internal Rate of Return (IRR)** | 334% |
| **Net Present Value (NPV)** | $6,954.04 |

## 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 fire department utilizing renewable technologies and concluded that there is potential for solar energy generation.

Solar Generation

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which are 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). Parking lots can also be utilized for the installation of a solar array. A truss system can be installed that is high enough to park vehicles under the array and no parking lot area is lost.

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 credit value used in our financial calculations varies over the fifteen year outlook from an initial value of $550 per MWH down to $200 per MWH at year fifteen. This equates to an average value of $383 per MWH, or $0.383 per kWh generated.

CE has reviewed Good Will Fire Company of Pemberton for the purposes of determining the potential for roof mounted and ground mounted photovoltaic system. It was determined that a total roof area of 388 S.F. can be utilized for a roof mounted PV systems.

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 4.7 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 5,097 KWh annually, reducing the overall utility bill by approximately 92.6% 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 15 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 Sharp NU-U235F2 panel. This panel has a "DC" rated full load output of 235 watts, and has a total panel conversion efficiency of 14.4%. Although panels rated at higher wattages are available through

Sharp 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 based on available roof space area available at the existing facility. Estimated solar array generation is 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 for the facility 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**
**Renewable Financial Summary**

| FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM | | |
|---|---|---|
| **PAYMENT TYPE** | **SIMPLE PAYBACK, Yrs.** | **NET PRESENT VALUE** |
| Finance 100% - 15 yr | 9.08 | $5,467 |

Given the small system size it is recommended the Fire Company strongly consider self purchase of the system, however contacting local solar contractors may provide additional options for obtaining a system as many residential/light commercial solar contractors offer power purchase agreements for a system of this size.

Wind Generation

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 of 4.6 m/s is not adequate enough to make wind an economically viable option for the fire department to pursue.

# IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

**Load Profile:**

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

Electricity:

The Electric Usage Profile is a fairly steady year-long electric load with an above average load profile. The facility is currently receiving electric delivery and supply service directly from a municipal utility, Pemberton Borough Electric.

Unfortunately, there is not an opportunity to take advantage of more competitive energy prices as Pemberton Borough Electric is a municipal electric utility.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile. A base-load shaping (flat) will secure more competitive energy prices when procuring through an alternative energy source.

This load profile may yield more favorable natural gas pricing when shopping for alternative suppliers. Nymex commodity pricing is generally higher in the winter months of November – March and lower in the summer months of April – October. Obtaining a flat load profile, (usage is similar each month), will yield optimum natural gas pricing when shopping for alternative suppliers. Third Party Supplier (TPS) natural gas commodity contracts that offer a firm, fixed price for 100% of the facilities natural gas requirements are recommended.

**Tariff Analysis:**

Electricity:

The facility receives electric distribution service through Pemberton Borough Electric. For the electric supply (generation) service only, the client does not have the option to utilize or contract with a Third Party Supplier (TPS) to supply electric.

Each year since 2002, the four New Jersey Electric Distribution Companies (EDCs) - Public Service Gas & Electric Company (PSE&G), Atlantic City Electric Company (ACE), Jersey Central Power & Light Company (JCP&L), and Rockland Electric Company (RECO) - have

procured several billion dollars of electric supply to serve their Basic Generation Service (BGS) customers through a statewide auction process held in February.

BGS refers to the service of customers who are not served by a third party supplier or competitive retailer. This service is sometimes known as Standard Offer Service, Default Service, or Provider of Last Resort Service.

The Auction Process has consisted of two auctions that are held concurrently, one for larger customers on an hourly price plan (BGS-CIEP) and one for smaller commercial and residential customers on a fixed-price plan (BGS-FP). This facility's rate structure is based on the fixed-price plan (BGS-FP).

Natural Gas:

The facility currently receives natural gas distribution service through Public Service Electric and Gas (PSE&G) on rate schedule GSG (General Service Gas). The facility is also receiving natural gas commodity supply from the utility, PSE&G on the Basic Gas Supply Service (BGSS).

PSE&G provides basic gas supply service (BGSS) to customers who choose not to shop from a Third Party Supplier (TPS) for natural gas commodity. The option is essential to protect the reliability of service to consumers as well as protecting consumers if a third party supplier defaults or fails to provide commodity service. Please refer to the link below for a recap of natural gas BGSS charges from PSE&G for rate schedule GSG. http://www.pseg.com/companies/pseandg/schedules/pdf/commodity.pdf

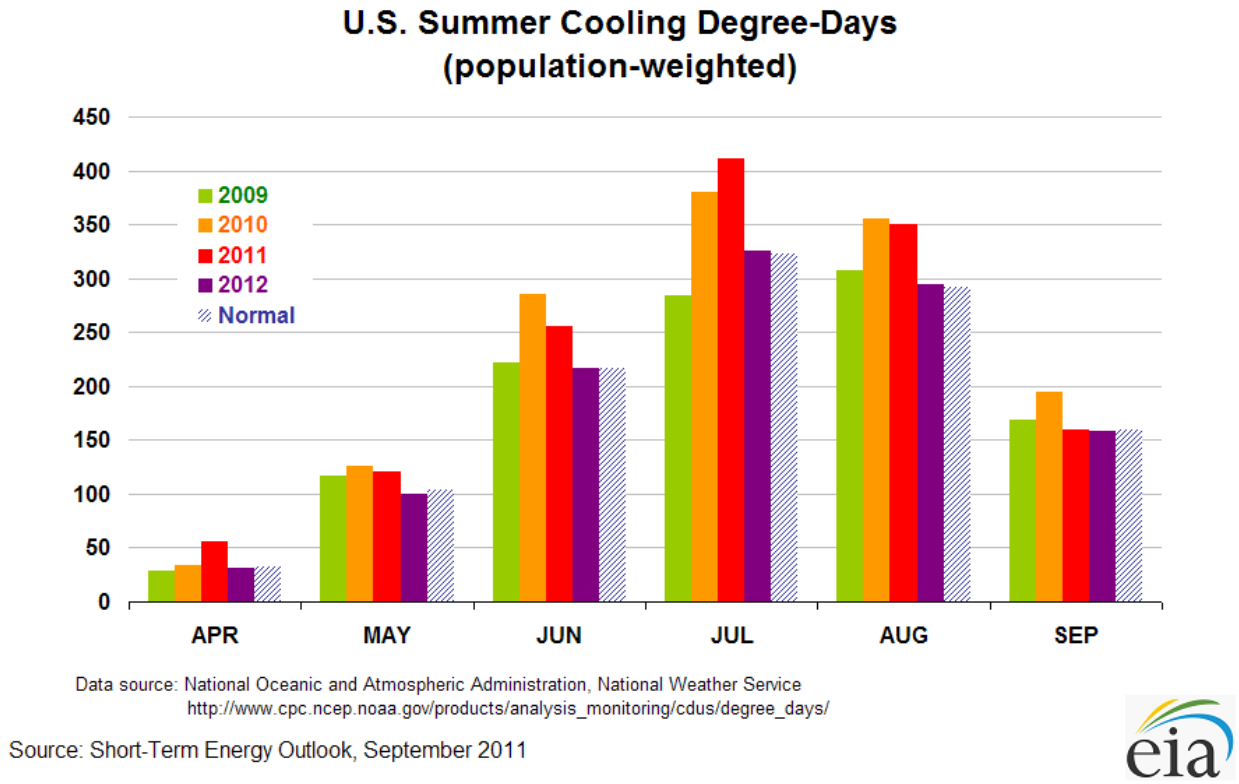
The utility, PSE&G is responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. PSE&G's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge, & Societal Benefits Charge (SBC).

**Electric and Fossil Fuel Commodities Market Overview:**

*Current electricity and natural gas market pricing has remained relatively stable over the last year. Commodity pricing in 2008 marked historical highs in both natural gas and electricity commodity. Commodity pricing commencing spring of 2009 continuing through 2011, has decreased dramatically over 2008 historic highs and continues to be favorable for locking in long term (2-5 year) contracts with 3rd Party Supplier's for both natural gas and electricity supply requirements.*

It is important to note that both natural gas and electric commodity market prices are moved by supply and demand, political conditions, market technicals and trader sentiment. This market is continuously changing Energy commodity pricing is also correlated to weather forecasts.

Because weather forecasts are dependable only in the short-term, prolonged temperature extremes can really cause extreme price swings.




***Short Term Energy Outlook - US Energy Information Administration (9/07/2011):***

***U.S. Natural Gas Prices.*** *Natural gas working inventories ended August 2011 at 3.0 trillion cubic feet (Tcf), about 5 percent, or 144 billion cubic feet (Bcf), below the 2010 end-of-August level. EIA expects that working natural gas inventories will approach last year's high levels by the end of this year's injection season. The projected Henry Hub natural gas spot price averages $4.20 per million British thermal units (MMBtu) in 2011, $0.18 per MMBtu lower than the 2010 average. EIA expects the natural gas market to tighten moderately in 2012, with the Henry Hub spot price increasing to an average of $4.30 per MMBtu.*

*Uncertainty about natural gas prices is lower this year compared with last year at this time. Natural gas futures for November 2011 delivery (for the 5-day period ending September 1, 2011) averaged $4.07 per MMBtu, and the average implied volatility was 34 percent. The lower and upper bounds for the 95-percent confidence interval for November 2011 contracts are $3.16 per MMBtu and $5.26 per MMBtu. At this time last year, the November 2010 natural gas futures contract averaged $4.07 per MMBtu and implied volatility averaged 48 percent. The corresponding lower and upper limits of the 95-percent confidence interval were $2.84 per MMBtu and $5.83 per MMBtu.*

***U.S. Electricity Retail Prices.*** *Retail prices of electricity to the residential sector during the first six months of this year were generally higher than the same period in 2010. Growth in residential electricity prices should moderate during the second half. EIA expects average U.S. residential electricity prices to increase by 2.3 percent in 2011 and by 0.6 percent in 2012.*

**Recommendations:**

1. CEG recommends exploring TPS commodity supply procurement pricing and strategies for natural gas supply service. Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Good Will Fire Company could realize up to a 10% reduction in natural gas supply costs, if it were to take advantage of these current market prices quickly, before energy increases.

   Overall, after review of the utility consumption, billing, and current commodity pricing outlook, CEG recommends that the Good Will Fire Company seek to join a purchasing cooperative with Burlington County which utilize the advisement of 3rd party unbiased Energy Consulting Firm experienced in the procurement of retail natural gas commodity and negotiation of contract terms and conditions.

2. CEG recommends that Good Will Fire Company consider utilizing a third party utility billing-auditing service to further analyze historical utility invoices such as water, sewer, electric and natural gas for incorrect billings and rate tariff optimization services. This service could provide refunds on potential over billings experienced by Good Will Fire Company.

*The recommendations presented by CEG are based on current information provided by the client for its utility usage, any savings presented with these recommendations are estimates only based on that information as well as current commodities marketplace. It is recommended that further analysis and review of more recent utility data be performed prior to performing any of the presented recommendations.*

# 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:

## A. Incentive Programs:

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 100 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. The following measures are potential candidates for Direct Install:

Smart Start Program

*Prescriptive Measures* - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include unit pricing incentives for installation of energy efficient equipment and controls. Proposed equipment and controls must meet the minimum efficiency requirements as well as other application requirements. The Smart Start prescriptive incentives applicable for new construction, renovations, remodeling and equipment replacements, for a wide range of equipment including:

- Electric Chillers
- Gas Cooling
- Electric Unitary HVAC
- Ground Source Heat Pumps
- Gas Heating
- Variable Frequency Drives
- Gas Water Heating
- Premium Motors
- Prescriptive Lighting
- Lighting Controls
- Technical Studies

*Custom Measures* - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include all measures not identified in the prescriptive measures category or measures that must have savings verified through additional analysis such as energy model simulations. Custom measures are intended to include savings as a result of unique

energy efficiency measures, which are typically facility specific such as waste heat recovery. Custom incentives are provided based on the amount of energy saved and minimum internal rate of return in order to be eligible.

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.

**B. Financing Options:**

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.

Power Purchase Agreement

Public Law 2008, Chapter 3 authorizes contracts of up to fifteen (15) years for energy purchase 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.

Energy Savings Improvement Program (ESIP):

Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources. This program provides public entities to make valuable facility infrastructure improvements that are associated with energy savings. All energy savings projects are eligible as long as the financing period does not extend beyond 15 years. The financing can be utilized for all aspects of energy efficiency project implementation including, energy savings plan development, engineering, construction management, construction management, commissioning, and measurement and verification.

This program provides the much needed financing for energy efficiency projects without the burden of increased debt. The program allows for procurement of financing without voter

approval or extending existing debt. The program requires evaluation to ensure a positive cash-flow through the entire 15 year financing period. The first phase of implementing an ESIP is the development of an Energy Savings Plan (ESP) to verify the energy savings, construction costs, and overall financial model.

The underlining program requirement is the limitation of the project term to 15 years. The ESIP project size is open for multiple buildings to be included within one project. In addition all applicable incentive programs can also be utilized to help reduce the overall construction cost.

## 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.

E. Verify all thermostats are utilizing setback and scheduling capabilities.

F. Fire Company personnel are currently very attentive to turning lights off when leaving the building as well as setting back thermostats, however it is recommended they reinforce the importance of savings energy at its facility by regularly mentioning it in its newsletter to volunteers and placing labels on light switches and thermostats as reminder tools.

In addition to the recommendations above, implementing Retro-Commissioning would be beneficial for this facility. Retro-Commissioning is a means to verify your current equipment is operating at its designed efficiency, capacity, airflow, and overall performance. Retro-Commissioning provides valuable insight into systems or components not performing correctly or efficiently. The commissioning process defines the original system design parameters and recommends revisions to the current system operating characteristics.

## XII. ENERGY AUDIT ASSUMPTIONS

The assumptions utilized in this energy audit include but are not limited to following:

A. Cost Estimates noted within this report are based on industry accepted costing data such as RS Means™ Cost Data, contractor pricing and engineering estimates. All cost estimates for this level of auditing are +/- 20%. Prevailing wage rates for the specified region has been utilized to calculate installation costs. The cost estimates indicated within this audit should be utilized by the owner for prioritizing further project development post the energy audit. Project development would include investment grade auditing and detailed engineering.
B. Energy savings noted within this audit are calculated utilizing industry standard procedures and accepted engineering assumptions. For this level of auditing, energy savings are not guaranteed.
C. Information gathering for each facility is strongly based on interviews with operations personnel. Information dependent on verbal feedback is used for calculation assumptions including but not limited to the following:
    a. operating hours
    b. equipment type
    c. control strategies
    d. scheduling
D. Information contained within the major equipment list is based on the existing owner documentation where available (drawings, O&M manuals, etc.). If existing owner documentation is not available, catalog information is utilized to populate the required information.
E. Equipment incentives and energy credits are based on current pricing and status of rebate programs. Rebate availability is dependent on the individual program funding and applicability.
F. Equipment (HVAC, Plumbing, Electrical, & Lighting) noted within an ECM recommendation is strictly noted as a **basis for calculation** of energy savings. The owner should use this equipment information as a benchmark when pursuing further investment grade project development and detailed engineering for specific energy conservation measures.

Utility bill annual averages are utilized for calculation of all energy costs unless otherwise noted. Accuracy of the utility energy usage and costs are based on the information provided. Utility information including usage and costs is estimated where incomplete data is provided.

# ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

**Good Will Fire Company #1**

**ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY**

| ECM NO. | DESCRIPTION | INSTALLATION COST | | | | YEARLY SAVINGS | | | ECM LIFETIME | LIFETIME ENERGY SAVINGS | LIFETIME MAINTENANCE SAVINGS | LIFETIME ROI | SIMPLE PAYBACK | INTERNAL RATE OF RETURN (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 #1A | Garage Lighting T5HO Retrofit | $2,075 | $0 | $175 | $1,900 | $111 | $0 | $111 | 15 | $1,665 | $0 | -12.4% | 17.1 | -1.61% | ($574.89) |
| ECM #1B | Garage Lighting T-8 Retrofit | $750 | $0 | $175 | $575 | $100 | $0 | $100 | 15 | $1,500 | $0 | 160.9% | 5.8 | 15.35% | $618.79 |
| ECM #2 | HVAC System Replacement | $5,500 | $6,000 | $1,520 | $9,980 | $419 | $0 | $419 | 15 | $6,285 | $0 | -37.0% | 23.8 | -5.29% | ($4,978.01) |
| ECM #3 | Unit Heater Replacement | $12,600 | $6,300 | $0 | $18,900 | $428 | $0 | $428 | 13 | $5,564 | $0 | -70.6% | 44.2 | -14.12% | ($14,348.24) |
| ECM #4 | Vending Miser Controls | $179 | $0 | $0 | $179 | $598 | $0 | $598 | 15 | $8,963 | $0 | 4907.1% | 0.3 | 333.80% | $6,954.04 |

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

# Concord Engineering Group, Inc.

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

## SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of 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<br>$600 per ton, EER ≥ 18<br>$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 |

## Prescriptive Lighting

| | |
|---|---|
| Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities | $10 per fixture (1-4 lamps) |
| Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities | $25 per fixture (1-2 lamps)<br>$30 per fixture (3-4 lamps) |
| Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb | $7 per bulb |
| 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<br>$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 |

## Premium Motors

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

## 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% |

# MAJOR EQUIPMENT LIST

## Concord Engineering Group

### Good Will Fire Company of Pemberton

## AC Units

| Tag | | | |
|---|---|---|---|
| **Unit Type** | Condensing Unit | Condensing Unit | |
| **Qty** | 1 | 1 | |
| **Location** | Outside | Outside | |
| **Area Served** | 1st Floor Furnace | Attic Furnace | |
| **Manufacturer** | Carrier | Carrier | |
| **Model #** | 38TKB060330 | 38TKB060330 | |
| **Serial #** | 0302E09901 | - | |
| **Cooling Type** | DX, R-22 | DX, R-22 | |
| **Cooling Capacity (Tons)** | 5 Tons | 5 Tons | |
| **Cooling Efficiency (SEER/EER)** | 11.5 SEER | 11.5 SEER | |
| **Heating Type** | Gas Fired Furnace | Gas Fired Furnace | |
| **Heating Input (MBH)** | 58 MBH | 58 MBH | |
| **Efficiency** | 80% | 80% | |
| **Fuel** | Nat Gas | Nat Gas | |
| **Approx Age** | 10 | 10 | |
| **ASHRAE Service Life** | 15 | 15 | |
| **Remaining Life** | 5 | 5 | |
| **Comments** | | | |

**Note:**
"N/A" = Not Applicable.
"-" = Info Not Available

# MAJOR EQUIPMENT LIST

## Concord Engineering Group

### Good Will Fire Company of Pemberton

## AHUs

| Tag | | | |
|---|---|---|---|
| **Unit Type** | Gas Fired Furnace | Gas Fired Furnace | |
| **Qty** | 1 | 1 | |
| **Location** | Attic | Mechanical Room | |
| **Area Served** | 2nd Floor | 1st Floor | |
| **Manufacturer** | Carrier | Carrier | |
| **Model #** | 8000VS - 58UHV | 8000VS - 58UXV | |
| **Serial #** | - | - | |
| **Cooling Type** | DX, R-22 | DX, R-22 | |
| **Cooling Capacity (Tons)** | 5 Tons | 5 Tons | |
| **Cooling Efficiency (SEER/EER)** | 11.5 SEER | 11.5 SEER | |
| **Heating Type** | Gas Fired Furnace | Gas Fired Furnace | |
| **Heating Input (MBH)** | 58 MBH | 58 MBH | |
| **Efficiency** | 80% | 80% | |
| **Fuel** | Nat Gas | Nat Gas | |
| **Approx Age** | 10 | 10 | |
| **ASHRAE Service Life** | 15 | 15 | |
| **Remaining Life** | 5 | 5 | |
| **Comments** | | | |

**Note:**
"N/A" = Not Applicable.
"-" = Info Not Available

# MAJOR EQUIPMENT LIST

## Concord Engineering Group

### Good Will Fire Company of Pemberton

## Domestic Water Heaters

| | | | |
|---|---|---|---|
| **Tag** | | | |
| **Unit Type** | Gas Fired Domestic Hot Water | | |
| **Qty** | 1 | | |
| **Location** | Mechanical Room | | |
| **Area Served** | Fire House | | |
| **Manufacturer** | Bradford White | | |
| **Model #** | MIITW75T6EN12 | | |
| **Serial #** | VC1055850 | | |
| **Size (Gallons)** | 75 Gallons | | |
| **Input Capacity (MBH/KW)** | 75 MBH | | |
| **Recovery (Gal/Hr)** | 73.7 Gal/Hr | | |
| **Efficiency %** | 80% | | |
| **Fuel** | Nat Gas | | |
| **Approx Age** | 10 | | |
| **ASHRAE Service Life** | 12 | | |
| **Remaining Life** | 2 | | |
| **Comments** | | | |

**Note:**
"N/A" = Not Applicable.
"-" = Info Not Available

# MAJOR EQUIPMENT LIST

## Concord Engineering Group

### Good Will Fire Company of Pemberton

## Unit Heaters

| Tag | | | |
|---|---|---|---|
| **Unit Type** | Tubular Gas Fired Unit Heaters | | |
| **Qty** | 4 | | |
| **Location** | Garage Bay | | |
| **Area Served** | Garage Bay | | |
| **Manufacturer** | Sterling | | |
| **Model #** | TF150 | | |
| **Serial #** | - | | |
| **Heating Type** | Tubular Gas Fired Propeller | | |
| **Input Capacity (MBH/KW)** | 150 MBH | | |
| **CFM** | 2400 CFM | | |
| **RPM/HP** | 1/4 HP | | |
| **GPM** | - | | |
| **Approx Age** | 10 | | |
| **ASHRAE Service Life** | 13 | | |
| **Remaining Life** | 3 | | |
| **Comments** | | | |

**Note:**
"N/A" = Not Applicable.
"-" = Info Not Available

# Investment Grade Lighting Audit

**CEG Job #:** 9C11028

**Project:** Good Will Fire Co. #1 LGEA
200 Hanover Street
Pemberton, NJ 08068

**Bldg. Sq. Ft.** 6,800

Good Will Fire Co #1

**KWH COST:** $0.234

## ECM #1A: 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 |
| 232.21 | Mechanical Room | 50 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 4.3 | $1.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 128.14 | Garage | 800 | 3 | 3 | 8' Channel, 3 Lamp, 59w T8, electronic. Ballast, Surface Mnt., No Lens | 165 | 0.50 | 396.0 | $92.66 | 3 | 2 | 2 Lamp , 54w T5HO, Elect. Ballast, Specular Reflector; fixture | 118 | 0.35 | 283.2 | $66.27 | $150.00 | $450.00 | 0.14 | 112.8 | $26.40 | 17.05 |
| 128.11 | | 800 | 7 | 3 | 8' Channel, 3 Lamp, 75w T12, Mag. Ballast, Surface Mnt., No Lens | 210 | 1.47 | 1,176.0 | $275.18 | 7 | 3 | 3 Lamp , 54w T5HO, Elect. Ballast, Specular Reflector; fixture | 177 | 1.24 | 991.2 | $231.94 | $215.00 | $1,505.00 | 0.23 | 184.8 | $43.24 | 34.80 |
| 622 | Front Room | 100 | 4 | 1 | Double Head Flood, (2) 250w PAR Lamps | 500 | 2.00 | 200.0 | $46.80 | 4 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 227.211 | 1st Floor Hallway | 600 | 3 | 2 | 2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 34 | 0.10 | 61.2 | $14.32 | 3 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Front Computer Room | 600 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 51.6 | $12.07 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 1st Floor Mens Room | 600 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 51.6 | $12.07 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 200 | | 600 | 1 | 2 | 1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 34 | 0.03 | 20.4 | $4.77 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 227.211 | Shower | 300 | 1 | 2 | 2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 34 | 0.03 | 10.2 | $2.39 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 1st Floor Womens Room | 100 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 8.6 | $2.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 200 | | 100 | 1 | 2 | 1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 34 | 0.03 | 3.4 | $0.80 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Officers Room | 600 | 2 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.17 | 103.2 | $24.15 | 2 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Kitchen | 600 | 4 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.34 | 206.4 | $48.30 | 4 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Bunk Room | 300 | 2 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.17 | 51.6 | $12.07 | 2 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Stairwell | 600 | 3 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.26 | 154.8 | $36.22 | 3 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |

# Investment Grade Lighting Audit

## ECM #1A: 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 |
| 227.211 | 2nd Floor Hallway | 600 | 3 | 2 | 2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 34 | 0.10 | 61.2 | $14.32 | 3 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Meeting Room | 600 | 8 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.69 | 412.8 | $96.60 | 8 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 2nd Floor Bathroom | 100 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 8.6 | $2.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 2nd Floor Office | 300 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 25.8 | $6.04 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 2nd Floor Office 2 | 300 | 2 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.17 | 51.6 | $12.07 | 2 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 621 | Lounge | 600 | 6 | 1 | Recessed Light, 75w A Lamp | 75 | 0.45 | 270.0 | $63.18 | 6 | 1 | (1) 26w CFL Lamp | 26 | 0.16 | 93.6 | $21.90 | $20.00 | $120.00 | 0.29 | 176.4 | $41.28 | 2.91 |
| 232.21 | Engineer Room | 100 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 8.6 | $2.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Janitor Closet | 50 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 4.3 | $1.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| | **Totals** | | 58 | 60 | | | | 3,342 | $782 | 58 | 6 | | | 1.7 | 1,368 | $320 | | $2,075 | 0.7 | 474 | $111 | 18.71 |

# Investment Grade Lighting Audit

**CEG Job #:** 9C11028

**Project:** Good Will Fire Co. #1 LGEA
200 Hanover Street
Pemberton, NJ 08068

**Bldg. Sq. Ft.** 6,800

**Good Will Fire Co #1**

**KWH COST:** $0.234

## ECM #1B: 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 |
| 232.21 | Mechanical Room | 50 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 4.3 | $1.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 128.14 | Garage | 800 | 3 | 3 | 8' Channel, 2 Lamp, 59w T8, electronic. Ballast, Surface Mnt., No Lens | 165 | 0.50 | 396.0 | $92.66 | 3 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 128.34 | | 800 | 7 | 3 | 8' Channel, 3 Lamp, 75w T12, Mag. Ballast, Surface Mnt., No Lens | 210 | 1.47 | 1,176.0 | $275.18 | 7 | 3 | 8' Channel,3 Lamp, 59w T8, electronic. Ballast, Surface Mnt., No Lens | 165 | 1.16 | 924 | $216.22 | $90.00 | $630.00 | 0.32 | 252 | $58.97 | 10.68 |
| 622 | Front Room | 100 | 4 | 1 | Double Head Flood, (2) 250w PAR Lamps | 500 | 2.00 | 200.0 | $46.80 | 4 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 227.211 | 1st Floor Hallway | 600 | 3 | 2 | 2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 34 | 0.10 | 61.2 | $14.32 | 3 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Front Computer Room | 600 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 51.6 | $12.07 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 1st Floor Mens Room | 600 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 51.6 | $12.07 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 200 | | 600 | 1 | 2 | 1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 34 | 0.03 | 20.4 | $4.77 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 227.211 | Shower | 300 | 1 | 2 | 2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 34 | 0.03 | 10.2 | $2.39 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 1st Floor Womens Room | 100 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 8.6 | $2.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 200 | | 100 | 1 | 2 | 1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 34 | 0.03 | 3.4 | $0.80 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Officers Room | 600 | 2 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.17 | 103.2 | $24.15 | 2 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Kitchen | 600 | 4 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.34 | 206.4 | $48.30 | 4 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Bunk Room | 300 | 2 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.17 | 51.6 | $12.07 | 2 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Stairwell | 600 | 3 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.26 | 154.8 | $36.22 | 3 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |

# Investment Grade Lighting Audit

## ECM #1B: 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 |
| 227.211 | 2nd Floor Hallway | 600 | 3 | 2 | 2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 34 | 0.10 | 61.2 | $14.32 | 3 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Meeting Room | 600 | 8 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.69 | 412.8 | $96.60 | 8 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 2nd Floor Bathroom | 100 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 8.6 | $2.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 2nd Floor Office | 300 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 25.8 | $6.04 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | 2nd Floor Office 2 | 300 | 2 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.17 | 51.6 | $12.07 | 2 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 621 | Lounge | 600 | 6 | 1 | Recessed Light, 75w A Lamp | 75 | 0.45 | 270.0 | $63.18 | 6 | 1 | (1) 26w CFL Lamp | 26 | 0.16 | 93.6 | $21.90 | $20.00 | $120.00 | 0.29 | 176.4 | $41.28 | 2.91 |
| 232.21 | Engineer Room | 100 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 8.6 | $2.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| 232.21 | Janitor Closet | 50 | 1 | 3 | 2x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens | 86 | 0.09 | 4.3 | $1.01 | 1 | 0 | No Change | 0 | 0.00 | 0 | $0.00 | $0.00 | $0.00 | 0.00 | 0 | $0.00 | 0.00 |
| | **Totals** | | 58 | 60 | | | | 3,342 | $782 | 58 | 4 | | | 1.3 | 1,018 | $238 | | $750 | 0.6 | 428 | $100 | 7.48 |

| Location Description | Area (Sq FT) | Panel | Qty | Panel Sq Ft | Panel Total Sq Ft | Total $KW_{DC}$ | Total Annual kWh | Total $KW_{AC}$ | Panel Weight (41.9 lbs) | W/SQFT |
|---|---|---|---|---|---|---|---|---|---|---|
| Good Will Fire Co | 388 | SHARP NU-U235F2 | 20 | 17.5 | 351 | 4.70 | 5,097 | 3.8 | 838 | 13.40 |


.= Proposed PV Layout

Notes:

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

PVWatts AC Energy & Cost Savings Cautions for Interpreting the Results

(Type comments here to appear on printout; maximum 1 row of 80 characters.)

| Station Identification | |
|---|---|
| City: | Atlantic_City |
| State: | New_Jersey |
| Latitude: | 39.45° N |
| Longitude: | 74.57° W |
| Elevation: | 20 m |
| **PV System Specifications** | |
| DC Rating: | 4.7 kW |
| DC to AC Derate Factor: | 0.810 |
| AC Rating: | 3.8 kW |
| Array Type: | Fixed Tilt |
| Array Tilt: | 20.0° |
| Array Azimuth: | 270.0° |
| **Energy Specifications** | |
| Cost of Electricity: | 0.2 ¢/kWh |

| Results | | | |
|---|---|---|---|
| Month | Solar Radiation (kWh/m$^2$/day) | AC Energy (kWh) | Energy Value ($) |
| 1 | 2.05 | 228 | 0.53 |
| 2 | 2.81 | 297 | 0.69 |
| 3 | 3.84 | 445 | 1.04 |
| 4 | 4.84 | 531 | 1.24 |
| 5 | 5.62 | 626 | 1.46 |
| 6 | 5.89 | 609 | 1.43 |
| 7 | 5.81 | 616 | 1.44 |
| 8 | 5.15 | 548 | 1.28 |
| 9 | 4.34 | 453 | 1.06 |
| 10 | 3.16 | 340 | 0.80 |
| 11 | 2.11 | 219 | 0.51 |
| 12 | 1.75 | 185 | 0.43 |
| Year | 3.95 | 5097 | 11.93 |

**Project Name:** **LGEA Solar PV Project - 9C11028**
**Location:** **Pemberton, NJ**
**Description:** **Photovoltaic System 100% Financing - 15 year**

**Simple Payback Analysis**

| | Photovoltaic System 100% Financing - 15 year |
|---|---|
| Total Construction Cost | $28,687 |
| Annual kWh Production | 5,097 |
| Annual Energy Cost Reduction | $1,193 |
| Average Annual SREC Revenue | $1,965 |

Simple Payback: **9.08** Years

**Life Cycle Cost Analysis**

| | | | |
|---|---|---|---|
| Analysis Period (years): | 15 | Financing %: | 100% |
| Discount Rate: | 3% | Maintenance Escalation Rate: | 3.0% |
| Average Energy Cost ($/kWh) | **$0.234** | Energy Cost Escalation Rate: | 3.0% |
| Financing Rate: | 6.00% | Average SREC Value ($/kWh) | $0.386 |

| 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 | $0 | 0 | 0 | 0 | $0 | 0 | 0 | 0 | 0 |
| 1 | $0 | 5,097 | $1,193 | $0 | $2,803 | $1,688 | $1,217 | $1,091 | $1,091 |
| 2 | $0 | 5,072 | $1,228 | $0 | $2,789 | $1,613 | $1,292 | $1,113 | $2,204 |
| 3 | $0 | 5,046 | $1,265 | $0 | $2,523 | $1,533 | $1,372 | $883 | $3,087 |
| 4 | $0 | 5,021 | $1,303 | $0 | $2,259 | $1,449 | $1,456 | $658 | $3,745 |
| 5 | $0 | 4,996 | $1,342 | $51 | $2,248 | $1,359 | $1,546 | $634 | $4,379 |
| 6 | $0 | 4,971 | $1,383 | $51 | $2,237 | $1,264 | $1,641 | $663 | $5,043 |
| 7 | $0 | 4,946 | $1,424 | $51 | $1,978 | $1,162 | $1,743 | $447 | $5,489 |
| 8 | $0 | 4,921 | $1,467 | $51 | $1,969 | $1,055 | $1,850 | $480 | $5,969 |
| 9 | $0 | 4,897 | $1,511 | $50 | $1,714 | $941 | $1,964 | $269 | $6,239 |
| 10 | $0 | 4,872 | $1,556 | $50 | $1,705 | $820 | $2,085 | $306 | $6,545 |
| 11 | $0 | 4,848 | $1,603 | $50 | $1,454 | $691 | $2,214 | $102 | $6,647 |
| 12 | $0 | 4,824 | $1,651 | $50 | $1,447 | $555 | $2,350 | $143 | $6,791 |
| 13 | $0 | 4,799 | $1,701 | $49 | $1,200 | $410 | $2,495 | ($54) | $6,737 |
| 14 | $0 | 4,775 | $1,752 | $49 | $1,194 | $256 | $2,649 | ($9) | $6,728 |
| 15 | $0 | 4,752 | $1,804 | $49 | $950 | $92 | $2,813 | ($199) | $6,529 |
| **Totals:** | | 73,836 | $22,183 | $552 | $28,472 | $14,887 | $28,687 | $6,529 | $77,224 |

**Net Present Value (NPV)** **$5,467**