ENERGY AUDIT – FINAL REPORT

LOPATCONG
Fire Company No. 1

112 Park Avenue
Phillipsburg, NJ 08865
ATTN: Betty Dobes

CEG PROPOSAL NO. 9C09058

CONCORD ENGINEERING GROUP

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Table of Contents

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I. EXECUTIVE SUMMARY

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

Lopatcong Township
Fire Company Engine #1
112 Park Avenue
Phillipsburg, NJ 08865

Facility Contact Person: Betty Dobes

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

The annual energy costs at this facility are as follows:

Electricity	$5,480
Natural Gas	$5,277
Total	$10,757

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

Table 1
Energy Conservation Measures (ECM's)

ECM NO.	DESCRIPTION	COST[A]	ANNUAL SAVINGS[B]	SIMPLE PAYBACK (YEARS)	SIMPLE LIFETIME ROI
1	Lighting Upgrades	$4,033	$2,789	1.5	68.5%
2	Lighting Controls	$385	$216	1.8	55.5%
3	Shop Replacement: Infrared Heaters	$9,225	$502	18.4	5.4%
4	Replace Domestic Hot Water Boiler	$4,150	$63	65	1.5%
5	43.93 KW PV Solar System	$169,740	$5,592	10.68	8.7%

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

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

Table 2
Estimated Energy Savings

ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECT DEMAND (KW)	ELECT CONSUMPTION (KWH)	NAT GAS (THERMS)
1	Lighting Upgrades	6.97	14,487	-
2	Lighting Controls	-	1,139	-
3	Shop Replacement: Infrared Heaters	-	-	374
4	Replace Domestic Hot Water Boiler	-	-	46
5	43.93 KW PV Solar System	18.86	29,432	-

Recommendation:

Concord Engineering Group strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under seven (7) years. The potential energy and cost savings from these ECM's are too great to pass upon. The following Energy Conservation Measures are recommended for Lopatcong Fire Company #1:

- **ECM #1: Lighting Upgrades**
- **ECM #2: Lighting Controls**

In addition to the above recommendations, CEG also recommends the installation of **ECM #4:** Replace Domestic Hot Water Boiler. Even though this ECM has a payback greater than the seven (7) year threshold, CEG believes it can be a valuable upgrade to the facility. The life of this unit is beyond its recommended time and should definitely be considered for replacement.

II. INTRODUCTION

This comprehensive energy audit covers the 3,700 square foot Lopatcong Firehouse, Engine #1 and the 1,000 square foot garage addition. The firehouse itself includes offices, lounge, bunk room, kitchen, restrooms, boiler room and small engine bays.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

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

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

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

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ 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:

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Electric

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from January-08 to December-08. This facility currently has two (2) meters, one for the main building and another for the Jersey Central Power and Light Company (JCP&L) provides electricity to the facility under the General Service Secondary rate. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the most current rate structure available.

Natural Gas

Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from January-08 to December-08. Elizabethtown Gas Company supplies the natural gas commodity. Elizabethtown Gas charges a rate per therm for delivery of the natural gas via their pipelines to the burners under their Small General Service Heat rate.

Description	Average
Electricity	19¢ /kWh
Natural Gas	$1.34 /Therm

Table 3
Electricity Billing Data

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
1/08	3,780	19	$649
2/08	3,658	19	$625
3/08	2,960	19	$527
4/08	2,889	19	$498
5/08	2,356	19	$426
6/08	1,816	17	$395
7/08	3,273	17	$652
8/08	3,405	17	$680
9/08	2,765	14	$571
10/08	3,430	15	$607
11/08	2,575	15	$502
12/08	2,495[A]	19[A]	$453[A]
Totals	**35,402**	**19 Max**	**$6,587**

Notes: A. Utility information for 12/08 is estimated; utility bill was not provided by Owner for this month.

Figure 1
Electricity Usage Profile

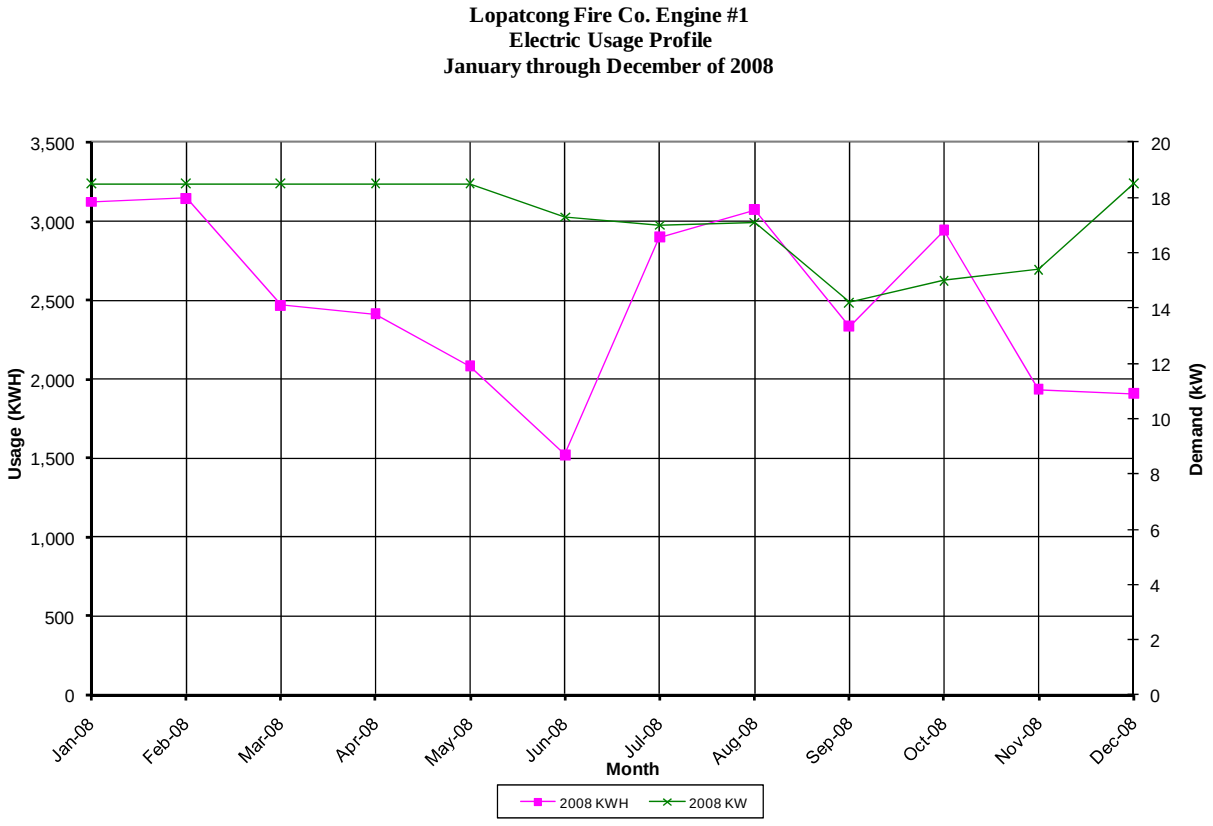
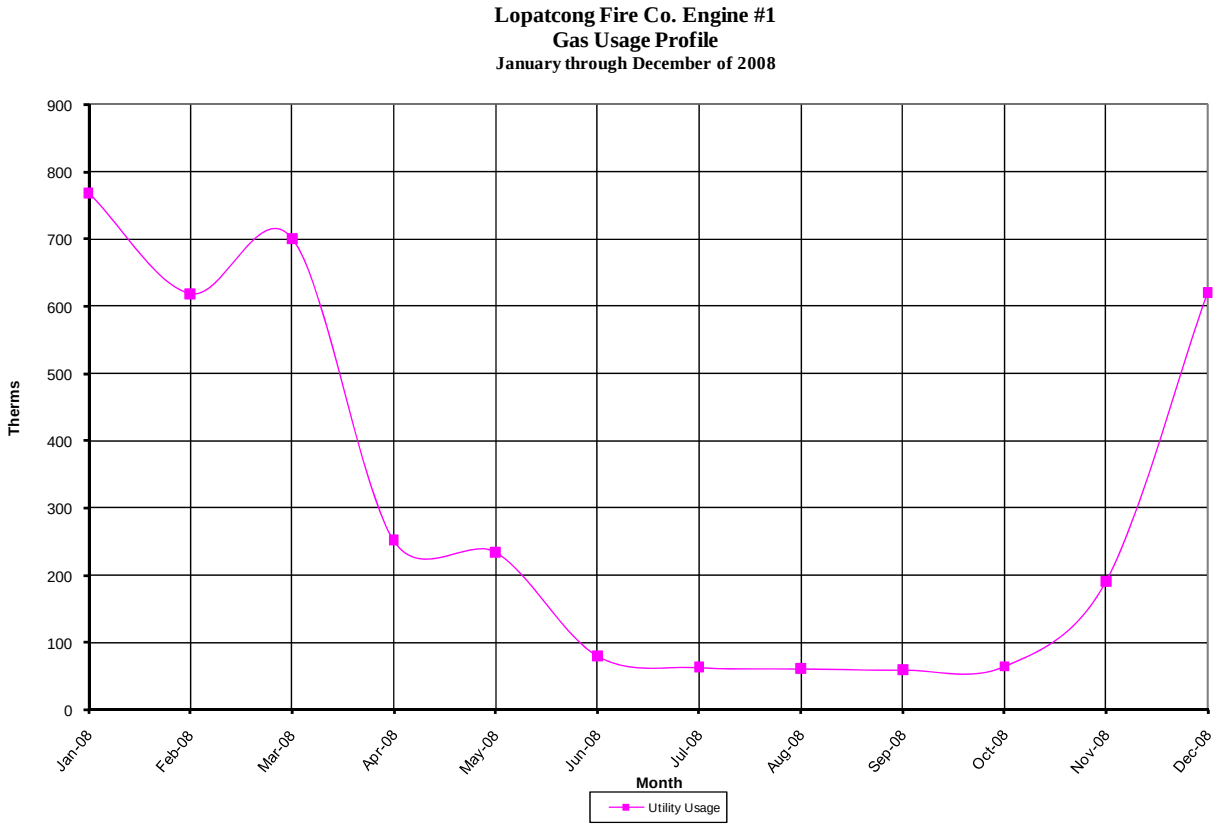


Table 4
Natural Gas Billing Data

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
1/08	768.8	$1,081
2/08	618.6	$655
3/08	700.9	$987
4/08	252.1	$365
5/08	234.8	$341
6/08	80.8	$128
7/08	63.3	$104
8/08	61.5[A]	$101[A]
9/08	59.7	$98
10/08	64.8	$111
11/08	191.1	$247
12/08	620.5	$740
Totals	**3716.9**	**$4,971**

Notes: A. Utility information for 08/08 is estimated; utility bill was not provided by Owner for this month.

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

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

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

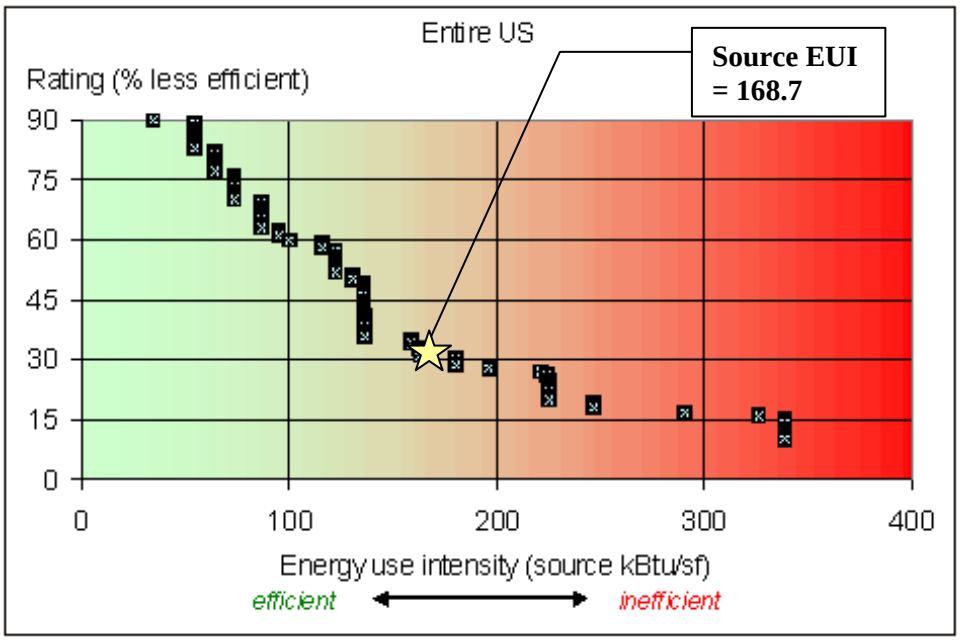
Electric = ((35,402 kWh) * (1000 W/kW) * (3.414 Btu/h / 1 W))/ (1000 Btu/h / 1 kBtu/h)
= 120,862 kBtu

Gas = ((3,717 therms) * (100,000 Btu/h / 1 Therm)) / (1000 Btu/h / 1 kBtu/h) = 371,700 kBtu

$$Building\ \ EUI = \frac{(120{,}862\ kBtu + 371{,}700\ kBtu)}{4{,}700\ SF} = \frac{492{,}562\ kBtu}{4{,}700\ SF}$$

Lopatcong Fire Company #1 EUI = 104.8 kBtu/SF (Site Energy); 168.7 kBtu/SF (Source Energy)

Figure 3
Source Energy Use Intensity Distributions: Fire and Police Stations



C. EPA Energy Benchmarking System

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

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

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

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

Username: Lopatcongtwp
Password: lgeaceg2009

Specific building types are detailed on the ENERGY STAR website. Non-typical buildings are covered by an “Other” category. The “Other” category is used if your building type or a section of the building is not represented by one of the specific categories. An Energy Performance Rating cannot be calculated if more than 10% of a building is classified as “Other.” Lopatcong Firehouse, Engine #1 would be classified as “Other” and therefore cannot be given an Energy Performance Rating. However, Portfolio Manager can still be used to track the buildings energy use index.

Refer to Appendix D for the “Statement of Energy Performance” Report.

V. FACILITY DESCRIPTION

The City of Lopatcong's Fire Company Engine #1 consists of offices, lounges, engine bays, storage rooms, etc.; totaling approximately 3,700 SF. Fire Co. Engine #1 was originally constructed in 1910. In 2008, a separate building was constructed which greatly increased the square footage of the facility by adding a 1,000 square foot engine bay. The main house is block construction with partial vinyl siding. The new engine bay is block construction with aluminum siding all around. The roof of the main house is shingled while the roof of the new engine bay is rubber. The inoperable glass block windows are located throughout the facility. Since this fire house is a volunteer facility it is only occupied for approximately 40 hours a week.

Heating System

The original Engine bay is heated by two (2) Modine gas fired heat exchangers. The Modine units have input capacities of 75 MBH and 105 MBH and their thermal efficiency is approximately 80%. These units are controlled via standard non-programmable thermostats. The new engine bay is being served by two (2) Reznor gas fired furnaces. These Reznor units both have an input capacity of 131 MBH with 93% thermal efficiency. These units are controlled via programmable thermostats that were manually overridden to be in the off position.

The remaining areas of the main house are heated via two (2) Lennox condensing furnaces. These Lennox units have a 4 ton condensing section accompanied by direct vent condensing furnaces which provide 80 MBH of heating. The efficiencies of the furnaces were approximately 94% when they were first installed in January of 1991.

In addition, the basement area is heated via electric baseboard heating only. The baseboard heating is installed in 12 foot sections along the side walls.

Domestic Hot Water

Domestic hot water for the restrooms is provided by an A.O. Smith gas-fired hot water heater, with a 50 gallon capacity, an input of 40 MBH, and a recovery rate of 40.4 gallons per hour.

Cooling System

The offices and lounge are cooled with the same two (3) Lennox split systems. These units are 4 ton nominal tonnage and had an EER of 94.1 when they were installed in 1991. Additionally, there is one (1) Comfort Aire window air conditioning unit which provides 9,000 Btu's of cooling to the basement bar area. Any other information regarding this unit was unable to be attained during the time of the survey.

Controls System

The Reznor gas fired furnaces in the new garage and the split system furnaces in the old house are all controlled via programmable thermostats but the thermostats for the Reznor units in the new garage are manually overridden and turned off. The Modine unit heaters in the old garage are controlled via standard non-programmable thermostats.

Lighting

The office areas, lounge, kitchen, hallways and bathrooms are lit mostly via 2-foot by 4-foot lay in T12 fixtures with prismatic lens' and magnetic ballasts. The basement consists of 1 foot by 4 foot T12 fixtures along with some Par high hat fixtures. The fire house uses 60 watt incandescent to light most of the area outside the building as well as several metal halides and assorted flood lights. Standard switching is utilized and there are no other types of lighting controls present.

The old engine bay consists of 4 foot and 8 foot T12 fixtures with no lens and magnetic ballasts. The new garage makes use of the only 2 foot by 4 foot T8 industrial fixtures found throughout the facility. The lights are switched via standard wall switching. No other lighting controls were being used.

VI. MAJOR EQUIPMENT LIST

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

Refer to Appendix E for the Major Equipment List.

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VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrades

Description:

New fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple change from the old to the new can provide substantial savings. A typical drop-ceiling lay in fixture with four, 4-foot lamps (40 Watt lamps) has a total wattage of about 154 Watts. By retrofitting with new lamps, reflector and electronic ballasts the total wattage would be reduced to 91 Watts per fixture and the space light levels and light quality would increase by about 15% and 35%, respectively.

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

This ECM replaces all T12 lighting fixtures with energy efficient T8 lighting, Cooper Metalux or equivalent fixture.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives are calculated as follows:

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

$$\text{Smart Start®}\ Incentive = (\#\ of\ 1-2\ lamp\ \ fixtures \times\ \$\ 25) + (\#\ of\ 3-4\ lamp\ \ fixtures \times\ \$\ 30)$$
$$\text{Smart Start®}\ Incentive = (22 \times\ \$\ 25) + (\ 20 \times\ \$\ 30) = \$1{,}150$$

Maintenance Savings are calculated as follows:

$$Maintenance\ Savings = (\#\ of\ \ lamps \times \%\ reduction \times \$\ \ per\ lamp)$$
$$Maintenance\ Savings = (\ 54 \times 33\%\ reduction \times \$\ 2.00) = \$36$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,219
NJ Smart Start Equipment Incentive ($):	($1,150)
Net Installation Cost ($):	$4,069
Maintenance Savings ($ / yr):	*$36*
Energy Savings ($ / yr):	*$2,753*
Total Yearly Savings ($ / yr):	*$2,789*
Simple Payback (yrs):	*1.46*
Simple Lifetime ROI (%):	*1613.6%*
Estimated ECM Lifetime (yr):	*25*
Simple Lifetime Savings ($):	*$69,725*

ECM #2: Lighting Controls

Description:

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

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

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G of the referenced standard, states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all areas of the facility except the engine bays (2,350 SF).

Energy Savings Calculations:

From Appendix F of this report, we calculated the lighting power density (Watts/ft^2) of the existing offices, locker rooms, storage rooms, etc. to be 2.33 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

Savings = 10% x 2.33 Watts/SF x 2,350 SF x 2080 hrs/yr. = 1,139 kWh x $0.19/kWh

Savings = $216 / yr

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $75/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $55/unit. Total number of rooms to be retrofitted is 7. Total cost to install sensors is $55/unit x 7 units = $330.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$525
NJ Smart Start Equipment Incentive ($):	($140)
Net Installation Cost ($):	*$385*
Maintenance Savings ($ / yr):	*$0*
Energy Savings ($ / yr):	*$216*
Total Yearly Savings ($ / yr):	*$216*
Simple Payback (yrs):	*1.8*
Simple Lifetime ROI (%):	*741.6%*
Estimated ECM Lifetime (yr):	*15*
Simple Lifetime Savings ($):	*$3,240*

ECM #3: Shop Replacement - Infrared Heaters

Description:

The Garage Bay Areas are heated via two (2) Modine gas-fired, heating and ventilating air-handling units located below the ceiling in each of the garages. This unit provides forced hot air to the garage space. The air-handling unit appears to be approximately twenty-nine (29) years of age. Heating a large space like the Garage Bay Area with a forced hot air system is not the most efficient means of heating a space of this type. The workers did not complain of inadequate working conditions during the winter time, however, CEG believes there could be efficiency and cost savings in utilizing a low intensity infrared (IR) tube heating system in-lieu of the forced air heating system.

Our team recommends replacing the existing gas-fired unit heaters with a low intensity infrared (IR) tube heating system. When compared to convective heating systems, IR heaters provide more efficient heating in large areas and warehouses for two reasons: they only heat people and objects (not air) and they can be conveniently located and directed to provide heat to only a smaller section occupied by workers.

This ECM recommends the installation of IR heaters by Sterling Model SLR or equivalent in place of the air handling units currently utilized. The Owner can choose to abandon the existing air-handling units in place or remove the heater. CEG believes that abandoning the heaters in place is the best option because the demolition will be very costly.

Energy Savings Calculations:

Garage Heat Loss Calculations:

Based on the size of the existing gas-fired heating unit and the use of engineering calculations, the heat loss for the Garage has been calculated to be approximately 56,000 Btu/h (40 Btu/h per SF, 1,400 SF). The Base Building Heat Loss calculation is based on maintaining a 60 º F delta in temperature between indoor and outdoor ambient, respectively.

The heat loss that the warm-air system needs to overcome is actually greater than the base heat loss because infrared systems provides a higher mean radiant temperature (MRT) through warm floors, equipment, etc., and because stratification is lower than forced-air systems. Traditionally, warm air systems in industrial and commercial applications will usually require approximately 10 º F higher average air temperatures to provide equivalent comfort as provided by an infrared system. Due to this fact, the following is the calculation of the heat loss the warm air system will be required to meet:

$$\text{Heat Loss}_{WA} = (\text{Base Building Heat Loss} \times \text{Revised } \Delta T\ (70\ ^\circ F)) / \text{Standard } \Delta T\ (60\ ^\circ F)$$
$$= (56{,}000\ \text{Btu/h} \times 70\ ^\circ F) / (60\ ^\circ F)$$
$$= 65{,}333\ \text{Btu/h}$$

Estimated Fan Energy Savings:

The gas-fired air-handling unit has a large supply fan (approx. .5 HP) that runs each time the unit calls for heating. Assuming that this motor is 80% efficient and the total run hours is 2,600 hours per year, this equates to an electrical savings of:

Fan Energy Savings = {0.746 kW/HP x Motor HP x Load Factor (0.75) x Hours of Operation x Cost of Electricity ($0.19)] ÷ Motor Efficiency

Total Fan energy Savings = $173

Natural Gas Energy Savings:

To estimate the amount of energy consumed by the existing unit heaters or the infrared heaters throughout the heating season, the Degree Day method of energy estimating is being utilized. The equation is as follows:

$$EnergyUsed = \frac{H_L \times HDD \times Hrs}{\Delta t \times Eff \times V}$$

Where:

H_L = Building Heat Loss, BTU/Hr. (Warm Air = 65,333 Btu/h, Infrared = 56,000 Btu/h)

HDD = number of Heating Degree Days as Specified Base Temperature
(Warm Air $DD_{70^\circ F}$ = 6,280; Infrared $DD_{60^\circ F}$ = 3,878for Newark, NJ)

Hrs = Hours per Day

Δt = Design temperature difference, º F (Warm Air = 70 º F, Infrared = 60 º F)

Eff = Efficiency of Energy Utilization (Existing NG Heater = 0.60, Vented Infrared Heater = 0.84)

V = Heating value of fuel, BTU/Therm (Natural Gas = 100,000 Btu = 1 Therm)

Estimated Energy Consumption – Gas Fired Air Handling Unit:

$$EnergyUsed = \frac{(65{,}333 Btu/h) \times (6{,}280^\circ F) \times 12h}{70^\circ F \times 60\% \times 100{,}000 Btu/Therm}$$

Energy Used = 1172 Therms/Year

Estimated Energy Consumption – Infrared Heaters:

$$EnergyUsed = \frac{(56{,}000Btu/h)\times(3{,}878°F)\times 12h}{60°F\times 84\%\times 100{,}000Btu/Therm}$$

Energy Used = 517 Therms/Year

Energy Savings = 1,172 – 517 = 655 Therms per year

Cost Savings = 655 Therms/yr x $1.337/Therm = $876 per year

Total Energy Savings = Fan Energy Savings + Natural Gas Savings
= $173 + $876 = $1,049 per year

Also, incentives for the installation of the infrared heating system are not currently available and maintenance savings could not be adequately calculated because information was not available to baseline the savings.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$9,225
NJ Smart Start Equipment Incentive ($):	($0)[A]
Net Installation Cost ($):	$9,225
Maintenance Savings ($ / yr):	*$0*
Energy Savings ($ / yr):	*$1,049*
Total Yearly Savings ($ / yr):	*$1,049*
Simple Payback (yrs):	*8.8*
Simple Lifetime ROI (%):	*47.8%*
Estimated ECM Lifetime (yr):	*13*
Simple Lifetime Savings ($):	*$13,637*

Note: A. CEG believes that a NJ Smart Start® Custom Measure incentive could be applied for in order to offset the installation cost. However, further study is required.

ECM #4: Replace Domestic Hot Water Heater

Description:

The domestic hot water heater located in the basement was installed in 1988. The unit is an A.O. Smith Energy Saver with 40 MBH input, 40.4 gallon per hour recovery rate and 50-gallon storage capacity. Based on the site survey and manufacturer's performance data, the efficiency of this unit is approximately 70%. Based on the fact that the hot water heater is approximately twenty one (21) years old which means that this unit is approximately nine (9) years overdue for replacement making this heater a good candidate for replacement.

This energy conservation measure will replace the existing gas-fired, 50-gallon capacity domestic hot water heater with a 90% thermal efficient A.O. Smith Cyclone HE; BTX-80 domestic hot water heater with 50-gallon storage capacity or equivalent.

Energy Savings Calculations:

Existing Natural Gas-Fired DHW Heater

Rated Capacity = 40 MBH input; 50 gallons storage

Thermal Efficiency = 75%
Radiation Losses = 5%
Net Efficiency = 70%

Proposed Natural Gas-Fired, High-Efficiency DHW Heater

Rated Capacity = 76 MBH input; 50 gallons storage

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

Operating Data for DHW Heater

Estimated Daily DHW Load = 50 gal/h

DHW Boiler Operating Hrs/Yr. = 1,040 Hrs.

Old Natural Gas Heating Consumption = 211 Therms = $284/year

New Natural Gas Heating Consumption = 165 Therms = $221/year

Yearly Savings = $284/year - $221/year = $63/year

Average cost of natural gas = $1.34/Therm

Installed Cost of A.O. Smith Cyclone HE DHW Heater = $4,200

Simple Payback = $4,200 / $63 = 65 years

The SmartStart Buildings® incentive is $50 per unit for domestic hot water heaters less than 50 gallon storage.

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

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$4,200
NJ Smart Start Equipment Incentive ($):	($50)
Net Installation Cost ($):	*$4,150*
Maintenance Savings ($ / yr):	*$0*
Energy Savings ($ / yr):	*$63*
Total Yearly Savings ($ / yr):	*$63*
Simple Payback (yrs):	*65*
Simple Lifetime ROI (%):	*-81.7%*
Estimated ECM Lifetime (yr):	*12*
Simple Lifetime Savings ($):	*$756*

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

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

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

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 1,200 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in Renewable / Distributed Energy Measures Calculation appendix. Using this square footage it was determined that a system size of 18.86 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 29,432 KWh annually, reducing the overall utility bill by approximately 16% percent. A detailed financial analysis can be found in the Renewable / Distributed Energy Measures Calculation appendix. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The solar panel system analysis is based on Sun Power SPR-230 panels. The panel efficiency is 18% with an inverter efficiency of 95%. This region allows for a typical range of sunlight between 4.5 and 4.9 hours per day. The calculations are based on an average 4.68 hours per day. The operating hours are calculated based on 351 days per year accounting for two weeks per year of service down time. The calculations are also based on a solar PV system which utilizes the New Jersey guidelines for net metering. Net metering allows excess energy generated at production peaks to flow onto the grid. The excess energy is metered and subtracted from the facility's total energy usage on an annual basis. Due to this allowance the system design excludes the use of inefficient battery storage.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with

95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

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

The above information is concluded as ECM #5 showing installation costs, energy savings and other pertinent summarized information in section I of this report.

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

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

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

Section IV, Figure 1 demonstrates a flat (base-load) electric profile. The summer (June-September) is a typical load caused by air conditioning with some increased consumption. The balance of the year is very flat. There is a drop-off in electric use beginning January and falling to its lowest point in April. There is a peak again in October probably due to the electric base–board heaters. This base-load shaping is important because a flat consumption profile will yield more competitive energy prices when procuring energy.

Natural Gas:

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

Tariff Analysis:

Electricity:

The Engine Co. #1 receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This is a single or three phase service at secondary voltages. For electric supply (generation), the customer will use the utilities Basic Generation Service (BGS) or a Third Party Supplier (TPS). If they use the utility BGS then they will pay according to the BGS default service. The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI

Natural Gas:

Engine Co. #1 receives natural gas service through Elizabethtown Gas Company (Etown) on a SGS, (Small General Service) utility rate when not receiving commodity by a Third Party Supplier. The utility tariff rate SGS is available to those customers whose annual weather annualized usage as determined by the utility is less than 3,000 therms per year and where Gas Company's facilities are suitable and the quantity of gas is available for the service desired. In August of each year the Gas Company shall re-determine each customers eligibility based on their annual normalized usage.

This is a Continuous service with the following monthly charges: Service Charge, Distribution Charge and Commodity Charge as determined by Rider "A", and Monthly Service Charge .

Imbalances occur when Third Party Suppliers are used to supply natural gas, full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used. Otherwise, imbalances can occur, jeopardizing economics and scheduling.

From review of the information provided, it appears that Lopatcong can improve its natural gas costs by about 20% as per current market rates.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the Township. CEG's primary observation is seen in the electric costs. The average price per kWh (kilowatt hour) for all buildings based on 1-year historical average price is $.145/kWh (kWh is the common unit of electric measure). The average price per decatherm for natural gas is $ 10.5 / dth (dth, is the common unit of measure). Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The Township could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy increases. Based on annual historical consumption (January through December 2008) and current electric rates, the Township could see an improvement in its electric costs of up to 25% annually. (Note: Savings were calculated using Lopatcong's Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's secondary recommendation coincides with Lopatcong's natural gas costs. Based on the current market, Lopatcong could improve its natural gas costs up to 25% annually. CEG recommends further advisement on these prices. The Township should also consider procuring energy (natural gas) through alternative supply sources. CEG recommends energy advisory services.

CEG also recommends that the city schedule a meeting with their current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This

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

Finally, if Lopatcong changes or plans on changing its supplier for energy (natural gas), it needs to closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

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

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

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

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

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

XI. ADDITIONAL RECOMMENDATIONS

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

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

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

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

F. Recalibrate existing temperature sensors within the facility.

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

H. Clean all light fixtures to maximize light output.

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

Electric Cost Summary

JCP&L

Locatcong TWP Engine Co #1

2008

Account # 10000480355

Meter #

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	**Total**	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31		
KWH	3,122	3,144	2,468	2,413	2,083	1,520	2,899	3,073	2,336	2,943	1,934	1,910	29,845	
KW	19	19	19	19	19	17	17	17	14	15	15	19	19	Max
Monthly Load Factor	23%	25%	18%	18%	15%	12%	23%	24%	23%	26%	17%	14%	20%	
Total Cost, $	$524	$526	$436	$410	$368	$328	$568	$605	$487	$512	$377	$341	$5,480	
$/KWH	$0.168	$0.167	$0.176	$0.170	$0.177	$0.216	$0.196	$0.197	$0.209	$0.174	$0.195	$0.178	**$0.184**	

Yellow Area Indicates Estimation Due to Missing Information

Account # 100069811279

Meter #

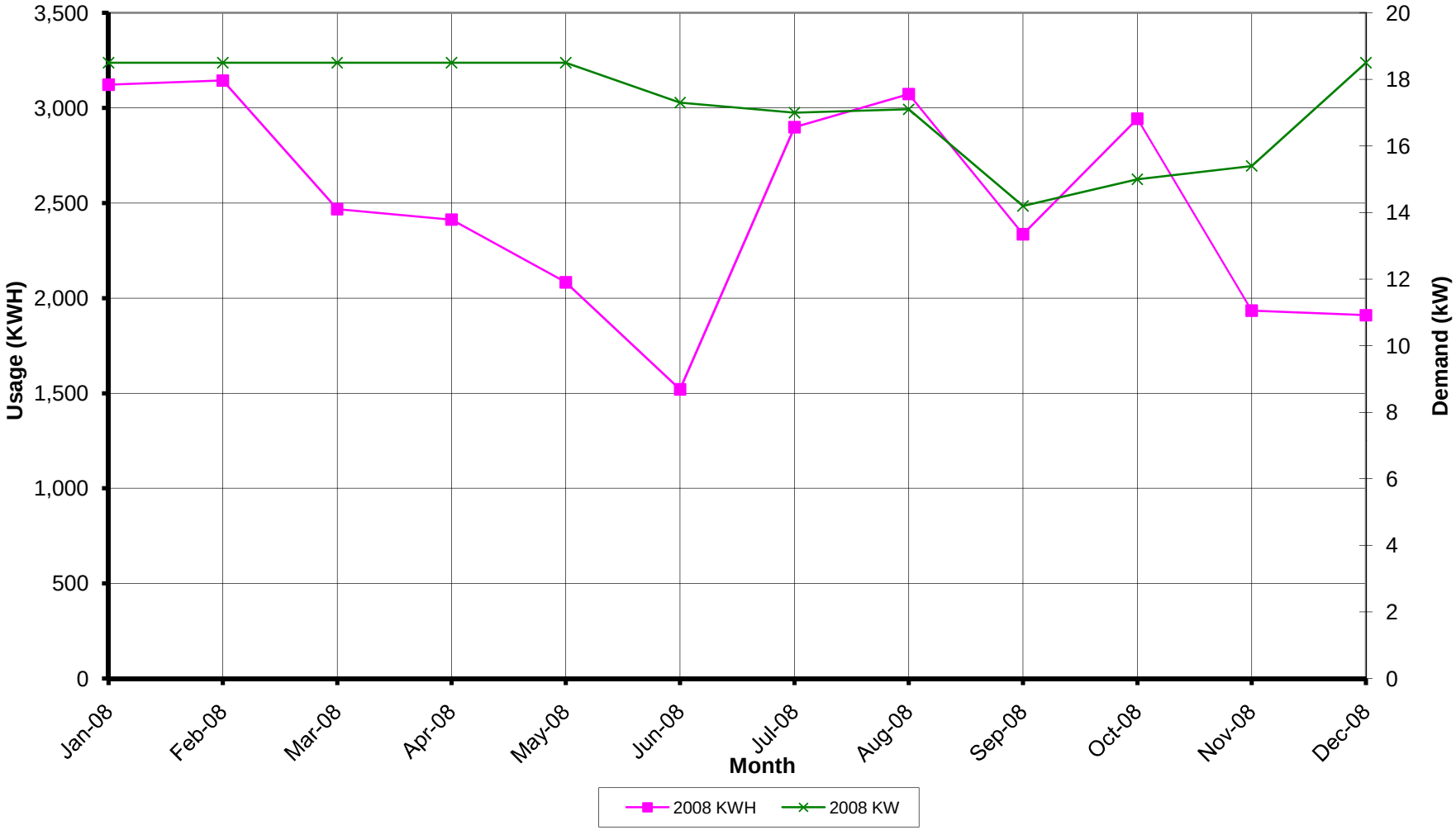
Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	**Total**
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	
KWH	658	514	492	476	273	296	374	332	429	487	641	585	5,557
Total Cost, $	$126	$99	$91	$88	$59	$67	$84	$75	$84	$95	$125	$112	$1,106
$/KWH	$0.191	$0.192	$0.185	$0.185	$0.215	$0.227	$0.226	$0.227	$0.196	$0.195	$0.195	$0.192	**$0.199**

Yellow Area Indicates Estimation Due to Missing Information

TOTAL for both accounts

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	**Total**
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	
KWH	3,780	3,658	2,960	2,889	2,356	1,816	3,273	3,405	2,765	3,430	2,575	2,495	35,402
KW													
Monthly Load Factor													
Total Cost, $	$649	$625	$527	$498	$426	$395	$652	$680	$571	$607	$502	$453	$6,587
$/KWH	$0.359	$0.360	$0.362	$0.355	$0.392	$0.443	$0.422	$0.424	$0.405	$0.369	$0.390	$0.370	$0.19

Lopatcong Fire Co. Engine #1
Electric Usage Profile
January through December of 2008



Summary of Natural Gas Cost

Elizabethtown Gas

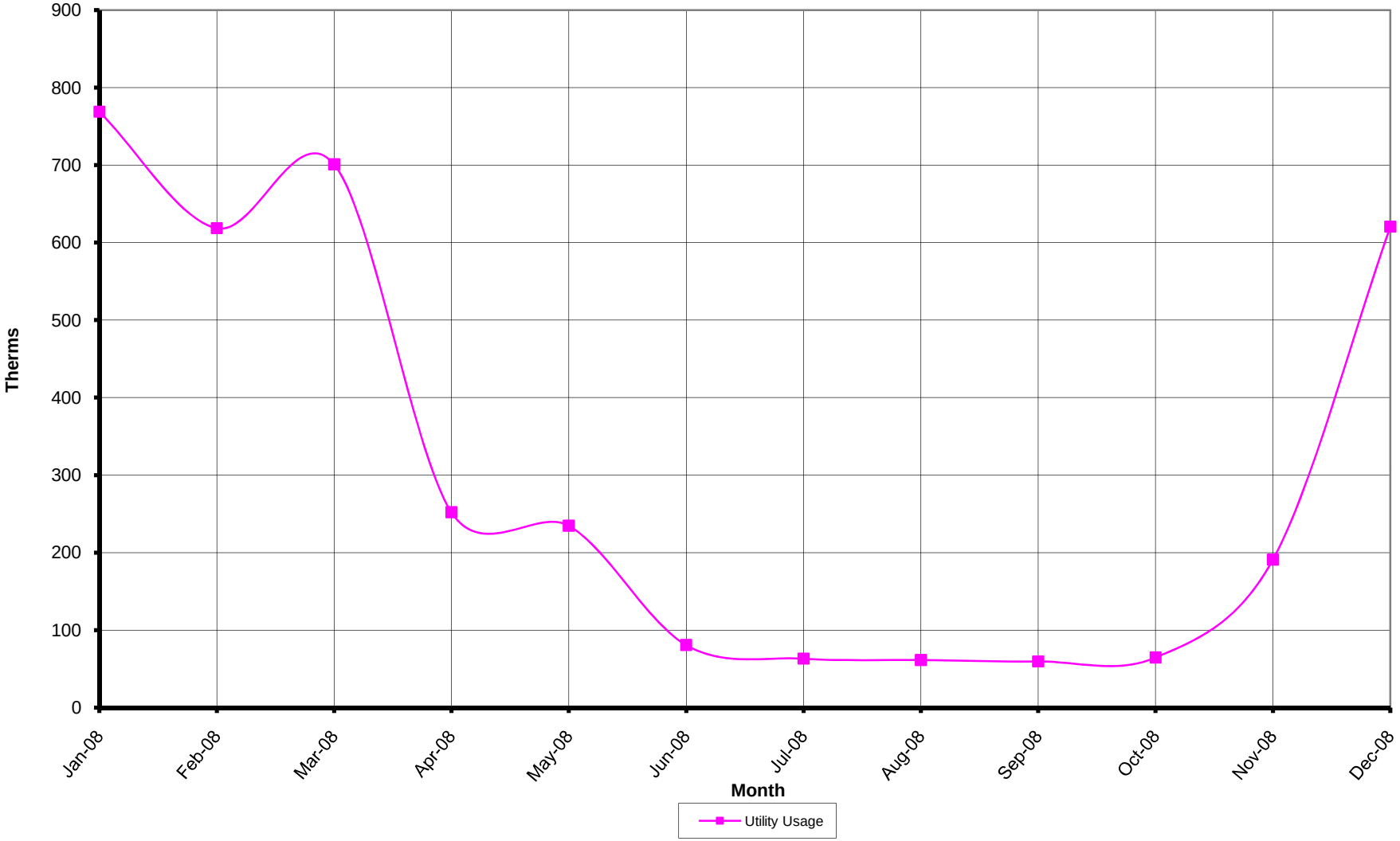
Delaware Park Fire Co. #1
112 Park Ave
Phillipsburg, NJ 08865
Account# 0264537411
Meter # 06463332

2008-2009

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	**Total**
Billing Days	31	30	31	30	31	31	30	31	30	31	31	28	
Therms (Burner Tip)	768.8	618.6	700.9	252.1	234.8	80.8	63.3	61.5	59.7	64.8	191.1	620.5	3716.9
Total Distribution Cost	$286	$172	$262	$105	$99	$45	$38	$38	$37	$38	$64	$172	1,355
Cost per Therm	$0.372	$0.278	$0.374	$0.415	$0.420	$0.551	$0.607	$0.610	$0.613	$0.590	$0.334	$0.278	$0.365
Total Commodity Cost	$795	$494	$725	$261	$243	$84	$65	$64	$62	$73	$184	$568	3,616
Cost per Therm	$1.03	$0.80	$1.03	$1.03	$1.03	$1.03	$1.03	$1.03	$1.03	$1.13	$0.96	$0.92	$0.97
Total Cost	$1,081	$665	$987	$365	$341	$128	$104	$101	$98	$111	$247	$740	$4,971
Cost per Therm	$1.406	$1.076	$1.408	$1.449	$1.454	$1.585	$1.641	$1.642	$1.647	$1.716	$1.295	$1.193	**$1.337**

Yellow Area Indicates Estimation Due to Missing Information

Lopatcong Fire Co. Engine #1
Gas Usage Profile
January through December of 2008



ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu	RATIO	kBtu
ELECTRIC	35,402			120,862	3.340	403,681
NATURAL GAS		3,716.90		371,690	1.047	389,159
FUEL OIL			0.00	0	1.010	0
PROPANE			0.00	0	1.010	0
TOTAL				492,552		792,840
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		4,700		SQUARE FEET		
BUILDING SITE EUI		104.80		kBtu/SF/YR		
BUILDING SOURCE EUI		**168.69**		**kBtu/SF/YR**		

DETAILED COST BREAKDOWN PER ECM

CONCORD ENGINEERING GROUP

Lopatcong Fire Co. Engine #1

ECM 1 Interior Lighting Upgrade

	Qty	Unit Cost $	Material $	Labor $	Total $
Lighting Retrofit	LS	$5,148	$0	$0	$5,148
Total Cost			$0	$0	$5,148
Utility Incentive - NJ Smart Start (1-2 lamp fixture $25, 3-4 lamp fixture $30)					($1,186)
Total Cost Less Incentive					$3,962

ECM 1 Compact Flourescent Lighting

	Qty	Unit Cost $	Material $	Labor $	Total $
Lighting Retrofit	LS	$71	$0	$0	$71
Total Cost			$0	$0	$71

ECM 2 Interior Lighting Controls

	Qty	Unit Cost $	Material $	Labor $	Total $
Dual - Technology Sensor	7	$75	$210	$315	$525
Total Cost			$210	$315	$525
Utility Incentive - NJ Smart Start ($20 per Sensor)					($140)
Total Cost Less Incentive					$385

ECM 3 Shop Replacement: Infrared Heaters

	Qty	Unit Cost $	Material $	Labor $	Total $
Vantage II Infrared Heaters	2	$4,613	$0	$0	$9,225
Total Cost			$0	$0	$9,225
Smart Start® Incentive ($0/MBH)	0				$0
Utility Incentive - N/A					$0
Total Cost Less Incentive					$9,225

ECM 4 Domestic Water Heater Replacement

	Qty	Unit Cost $	Material $	Labor $	Total $
A.O. Smith Cyclone HE BTX-80	1	$4,200	$0	$0	$4,200
Total Cost			$0	$0	$4,200
Smart Start® Incentive ($50/unit)	1				$50
Utility Incentive - N/A					$0
Total Cost Less Incentive					$4,150

ECM 5 18.86 KW PV Solar System

	Qty	Unit Cost $	Material $	Labor $	Total $
Conergy Photovoltaic Modules	82	$2,070	$0	$0	$169,740
Total Cost					$169,740

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

Electric Chillers

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

Gas Cooling

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

Desiccant Systems

	$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

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

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Fire Co. Engine #1

Building ID: 1797658
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: August 18, 2009

Facility
Fire Co. Engine #1
1112 Park Avenue
Phillipsburg, NJ 08865

Facility Owner
Lopatcong Township
232 South Third Street
Phillipsburg, NJ 08865

Primary Contact for this Facility
Ray Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

Year Built: 1910
Gross Floor Area (ft²): 4,700

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

Site Energy Use Summary[3]

Natural Gas (kBtu)[4]	371,690
Electricity (kBtu)	120,792
Total Energy (kBtu)	492,482

Energy Intensity[5]

Site (kBtu/ft²/yr)	105
Source (kBtu/ft²/yr)	169

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	38

Electric Distribution Utility
Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	7%
Building Type	Fire Station/Police Station

Stamp of Certifying Professional

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

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

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

Certifying Professional
Ray Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

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

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Fire Co. Engine #1	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Fire Station/Police Station	Is this an accurate description of the space in question?		☐
Location	1112 Park Avenue, Phillipsburg, NJ 08865	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Fire Co. Engine #1 (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	4,700 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	1 (Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	40 Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	6 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Lt Co

Fuel Type: Electricity		
Meter: Electric Fire Co 1 (kWh (thousand Watt-hours)) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
12/01/2008	12/31/2008	1,910.00
11/01/2008	11/30/2008	1,934.00
10/01/2008	10/31/2008	2,943.00
09/01/2008	09/30/2008	2,336.00
08/01/2008	08/31/2008	3,073.00
07/01/2008	07/31/2008	2,899.00
06/01/2008	06/30/2008	1,520.00
05/01/2008	05/31/2008	2,083.00
04/01/2008	04/30/2008	2,413.00
03/01/2008	03/31/2008	2,468.00
02/01/2008	02/29/2008	3,144.00
01/01/2008	01/31/2008	3,122.00
Electric Fire Co 1 Consumption (kWh (thousand Watt-hours))		**29,845.00**
Electric Fire Co 1 Consumption (kBtu)		**101,831.14**
Meter: Electric 2 Fire Co. Engine 1 (kWh (thousand Watt-hours)) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
12/01/2008	12/31/2008	585.00
11/01/2008	11/30/2008	641.00
10/01/2008	10/31/2008	487.00
09/01/2008	09/30/2008	429.00
08/01/2008	08/31/2008	332.00
07/01/2008	07/31/2008	374.00
06/01/2008	06/30/2008	296.00
05/01/2008	05/31/2008	273.00
04/01/2008	04/30/2008	476.00
03/01/2008	03/31/2008	492.00
02/01/2008	02/29/2008	514.00
01/01/2008	01/31/2008	658.00
Electric 2 Fire Co. Engine 1 Consumption (kWh (thousand Watt-hours))		**5,557.00**
Electric 2 Fire Co. Engine 1 Consumption (kBtu)		**18,960.48**

Total Electricity Consumption (kBtu)	**120,791.62**
Is this the total Electricity consumption at this building including all Electricity meters?	☐

Fuel Type: Natural Gas		
Meter: Gas Fire Co. Engine 1 (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
12/01/2008	12/31/2008	620.50
11/01/2008	11/30/2008	191.10
10/01/2008	10/31/2008	64.80
09/01/2008	09/30/2008	59.70
08/01/2008	08/31/2008	61.50
07/01/2008	07/31/2008	63.30
06/01/2008	06/30/2008	80.80
05/01/2008	05/31/2008	234.80
04/01/2008	04/30/2008	252.10
03/01/2008	03/31/2008	700.90
02/01/2008	02/29/2008	618.60
01/01/2008	01/31/2008	768.80
Gas Fire Co. Engine 1 Consumption (therms)		**3,716.90**
Gas Fire Co. Engine 1 Consumption (kBtu)		**371,690.00**
Total Natural Gas Consumption (kBtu)		**371,690.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
Fire Co. Engine #1
1112 Park Avenue
Phillipsburg, NJ 08865

Facility Owner
Lopatcong Township
232 South Third Street
Phillipsburg, NJ 08865

Primary Contact for this Facility
Ray Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

General Information

Fire Co. Engine #1	
Gross Floor Area Excluding Parking: (ft^2)	4,700
Year Built	1910
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Fire Co. Engine #1	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft^2)	4,700
Number of PCs[o]	1
Weekly operating hours[o]	40
Workers on Main Shift[o]	6

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2008)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	105	105	0	N/A	78
Source (kBtu/ft^2)	169	169	0	N/A	157
Energy Cost					
$/year	$ 11,555.00	$ 11,555.00	N/A	N/A	$ 8,601.74
$/$ft^2$/year	$ 2.46	$ 2.46	N/A	N/A	$ 1.83
Greenhouse Gas Emissions					
$MtCO_2e$/year	38	38	0	N/A	28
$kgCO_2e/ft^2$/year	8	8	0	N/A	6

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

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Lopatcong Fire Company Engine #1"

Domestic Hot Water Heater

Location	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	A.O. Smith	1	FSG 50 210	MF90-0049457-H43	40	40.4	50	-	Nat Gas	21	12	-9	

Air Handling Units

Location	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Attic	Lennox Pulse	1	GSR21Q4/5-80-1	5892A09735	DX	-	4 Ton	Condensing Furnace	80	72	90%	Nat Gas	120	1	60	18	18	0	
Attic	Lennox Pulse	1	GSR21Q4/5-80-1	-	DX	-	4 Ton	Condensing Furnace	80	72	90%	Nat Gas	120	1	60	18	18	0	

AC Condensers

Location	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Side Roof	Lennox	1	HS19-511V-3P	5191403038	4 Ton	-	R-22	208	1	18	20	2	
Side Roof	Lennox	1	HS19-511V-3P	519403045	4 Ton	-	R-22	208	1	18	20	2	

Unit Heaters and Cabinet Unit Heaters

Location	Manufacturer	Qty.	Model #	Serial #	Heating Type	Heating Capacity (MBH)	CFM	RPM / HP	GPM	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Old Truck Engine Bay	Modine	1	PA75AB	30011010380	Nat Gas	75 MBH	-	-	-	29	13	-16	
Old Truck Engine Bay	Modine	1	PA105A	18011010180	Nat Gas	105 MBH	-	-	-	29	13	-16	
New Garage	Reznor	2	V3Tcore	-	Nat Gas	131 MBH	2256	1050 RPM --1/4 HP	-	1	13	12	

PTAC - Units

Location	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity - DX	Heating Capacity - HW	Fan HP	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basement Bar	Comfort Aire	1	-	-	9000 Btu	-	-	-	-	-	89	10	-79	

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09059
Project: Lopatcong Township Energy Audit
Address: 1112 Park Avenue
City: Phillipsburg, NJ
Building SF: 4,700

"Lopatcong Fire Company Engine #1"

DATE: 10/8/2009
KWH COST: $0.190

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Front Halls	16	2'x4' 4L T12 Lay In/ Magnetic Ballast/ Prism Lens	2080	136	2.18	4526.08	$859.96	16	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	1.46	3028.48	$575.41	$140.00	$2,240.00	0.72	1497.6	$284.54	7.87
			7	60W Incandescent Wall	2080	60	0.42	873.6	$165.98	7	18 W CFL Lamp	18	0.13	262.08	$49.80	$5.75	$40.25	0.29	611.52	$116.19	0.35
3		Mens Room	1	2'x4' 4L T12 Lay In/ Magnetic Ballast/ Prism Lens	2080	136	0.14	282.88	$53.75	1	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.09	189.28	$35.96	$140.00	$140.00	0.05	93.6	$17.78	7.87
4		Womens Room	1	2'x4' 4L T12 Lay In/ Magnetic Ballast/ Prism Lens	2080	136	0.14	282.88	$53.75	1	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.09	189.28	$35.96	$140.00	$140.00	0.05	93.6	$17.78	7.87
5		Mens Room Closet	1	60W Incandescent High Hat	2080	60	0.06	124.8	$23.71	1	18 W CFL Lamp	18	0.02	37.44	$7.11	$5.75	$5.75	0.04	87.36	$16.60	0.35
6		Kitchen	2	2'x4' 4L T12 Lay In/ Magnetic Ballast/ Prism Lens	2080	136	0.27	565.76	$107.49	2	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	378.56	$71.93	$140.00	$280.00	0.09	187.2	$35.57	7.87
7		Bay Office	1	8' 2L T12 No Lens/ Magnetic Ballast/ 96W per lamp	2080	222	0.22	461.76	$87.73	2	4' 2 Lamp T-8, no lens, Electronic Balast Cooper Metalux DIM248	44	0.09	183.04	$34.78	$160.00	$320.00	0.13	278.72	$52.96	6.04

8		2 Truck Engine Bay	7	8' 2L T12 No Lens/ Magnetic Ballast/ 96W per lamp	2080	222	1.55	3232.32	$614.14	2	4' 2 Lamp T-8, no lens, Electronic Balast Cooper Metalux DIM248	44	0.09	183.04	$34.78	$160.00	$320.00	1.47	3049.28	$579.36	0.55
			2	4' 2L T12 No Lens/ Magnetic Ballast	2080	84	0.17	349.44	$66.39	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	73	0.15	303.68	$57.70	$160.00	$320.00	0.02	45.76	$8.69	36.81
10		Upper Truck Bay	3	8' 2L T12 No Lens/ Magnetic Ballast/ 96W per lamp	2080	222	0.67	1385.28	$263.20	6	4' 2 Lamp T-8, no lens, Electronic Balast Cooper Metalux DIM248	44	0.26	549.12	$104.33	$160.00	$960.00	0.40	836.16	$158.87	6.04
			1	4' 2L T12 No Lens/ Magnetic Ballast	2080	84	0.08	174.72	$33.20	1	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	73	0.07	151.84	$28.85	$160.00	$160.00	0.01	22.88	$4.35	36.81
12		Outside	2	2 Lamp Flood Light	2080	200	0.40	832	$158.08	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.40	832	$158.08	0.00
			2	1 Lamp Flood Light	2080	100	0.20	416	$79.04	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.20	416	$79.04	0.00
			2	60W Incandescent	2080	60	0.12	249.6	$47.42	2	18 W CFL Lamp	18	0.04	74.88	$14.23	$5.75	$11.50	0.08	174.72	$33.20	0.35
			2	Metal Halide Wall Peak	2080	100	0.20	416	$79.04	2	28 W CFL Lamp	28	0.06	116.48	$22.13	$6.88	$13.76	0.14	299.52	$56.91	0.24
		Dedication Plaques	2	13W CFL	2080	13	0.03	54.08	$10.28	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.03	54.08	$10.28	0.00
		New Garage	30	2'x4' 2L 32W T8 Industrial with Reflector	2080	58	1.74	3619.2	$687.65	30	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	1.74	3619.2	$687.65	0.00
			5	RAB 70W Metal Halide with photo cell	2080	74	0.37	769.6	$146.22	5	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.37	769.6	$146.22	0.00
		Basement Bar	8	1'x3' Recessed, Prism 2L 25W T-12	2080	70	0.56	1164.8	$221.31	8	1'x3' Recessed, Prism 2L 25W T8	40	0.32	665.6	$126.46	$32.00	$256.00	0.24	499.2	$94.85	2.70
			1	1'x4' Surface, Prism 2L T-12 34W	2080	80	0.08	166.4	$31.62	1	1'x4' Surface, Prism 2L T8 32 Watt 800 Series Lamps	58	0.06	120.64	$22.92	$12.00	$12.00	0.02	45.76	$8.69	1.38
			6	70W Par Flood High Hat	2080	78	0.47	973.44	$184.95	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.47	973.44	$184.95	0.00
		Totals	102				10.06	20920.64	$3,974.92	101			3.09	6433.44	$1,222.35		$5,219.26	6.97	14487.2	$2,752.57	1.90

Project Name: LGEA Solar PV Project - Lopactong Fire Co. Engine #1
Location: Phillipsburg, NJ
Description: Photovoltaic System 95% Financing - 20 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 20 year
Total Construction Cost	$169,740
Annual kWh Production	29,432
Annual Energy Cost Reduction	$5,592
Annual SREC Revenue	$10,301
First Cost Premium	**$169,740**
Simple Payback:	**10.68** Years

Life Cycle Cost Analysis

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

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$8,487	0	0	0	$0	0	0	(8,487)	0
1	$0	29,432	$5,592	$0	$10,301	$11,166	$3,836	$891	($7,596)
2	$0	29,285	$5,760	$0	$10,250	$10,889	$4,113	$1,007	($6,589)
3	$0	29,138	$5,933	$0	$10,198	$10,592	$4,411	$1,129	($5,460)
4	$0	28,993	$6,111	$0	$10,147	$10,273	$4,730	$1,256	($4,205)
5	$0	28,848	$6,294	$297	$10,097	$9,931	$5,072	$1,091	($3,113)
6	$0	28,703	$6,483	$296	$10,046	$9,564	$5,438	$1,231	($1,882)
7	$0	28,560	$6,677	$294	$9,996	$9,171	$5,831	$1,377	($506)
8	$0	28,417	$6,878	$293	$9,946	$8,749	$6,253	$1,529	$1,023
9	$0	28,275	$7,084	$291	$9,896	$8,297	$6,705	$1,687	$2,709
10	$0	28,134	$7,296	$290	$9,847	$7,813	$7,190	$1,851	$4,560
11	$0	27,993	$7,515	$288	$9,798	$7,293	$7,709	$2,022	$6,583
12	$0	27,853	$7,741	$287	$9,749	$6,736	$8,267	$2,200	$8,783
13	$0	27,714	$7,973	$285	$9,700	$6,138	$8,864	$2,385	$11,168
14	$0	27,575	$8,212	$284	$9,651	$5,497	$9,505	$2,577	$13,745
15	$0	27,437	$8,458	$283	$9,603	$4,810	$10,192	$2,777	$16,521
16	$0	27,300	$8,712	$281	$9,555	$4,073	$10,929	$2,984	$19,505
17	$0	27,164	$8,974	$280	$9,507	$3,283	$11,719	$3,199	$22,704
18	$0	27,028	$9,243	$278	$9,460	$2,436	$12,566	$3,422	$26,126
19	$0	26,893	$9,520	$277	$9,412	$1,528	$13,475	$3,653	$29,779
20	$0	26,758	$9,806	$276	$9,365	$554	$14,449	$3,893	$33,672
21	$0	26,624	$10,100	$274	$9,319	$469	$13,283	$5,392	$39,064
22	$0	26,491	$10,403	$273	$9,272	$321	$10,930	$8,150	$47,215
23	$0	26,359	$10,715	$271	$9,226	$0	$0	$19,669	$66,884
24	$0	26,227	$11,036	$270	$9,179	$0	$0	$19,946	$86,829
25	$0	26,096	$11,368	$269	$9,134	$0	$0	$20,232	$107,062
	Totals:	561,499	$150,261	$4,580	$196,525	$138,793	$161,253	$185,466	$514,580
					Net Present Value (NPV)		**$22,073**		
					Internal Rate of Return (IRR)		**18.8%**		

Project Name: LGEA Solar PV Project - Lopactong Fire Co. Engine #1
Location: Phillipsburg, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$169,740
Annual kWh Production	29,432
Annual Energy Cost Reduction	$5,592
Annual SREC Revenue	$10,301
First Cost Premium	**$169,740**
Simple Payback:	**10.68** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.190**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$169,740	0	0	0	$0	(169,740)	0
1	$0	29,432	$5,592	$0	$10,301	$15,893	($153,847)
2	$0	29,285	$5,760	$0	$10,250	$16,009	($137,837)
3	$0	29,138	$5,933	$0	$10,198	$16,131	($121,706)
4	$0	28,993	$6,111	$0	$10,147	$16,258	($105,448)
5	$0	28,848	$6,294	$297	$10,097	$16,093	($89,355)
6	$0	28,703	$6,483	$296	$10,046	$16,233	($73,122)
7	$0	28,560	$6,677	$294	$9,996	$16,379	($56,742)
8	$0	28,417	$6,878	$293	$9,946	$16,531	($40,212)
9	$0	28,275	$7,084	$291	$9,896	$16,689	($23,523)
10	$0	28,134	$7,296	$290	$9,847	$16,853	($6,669)
11	$0	27,993	$7,515	$288	$9,798	$17,024	$10,355
12	$0	27,853	$7,741	$287	$9,749	$17,202	$27,557
13	$0	27,714	$7,973	$285	$9,700	$17,387	$44,945
14	$0	27,575	$8,212	$284	$9,651	$17,579	$62,524
15	$0	27,437	$8,458	$283	$9,603	$17,779	$80,303
16	$0	27,300	$8,712	$281	$9,555	$17,986	$98,289
17	$0	27,164	$8,974	$280	$9,507	$18,201	$116,490
18	$0	27,028	$9,243	$278	$9,460	$18,424	$134,914
19	$0	26,893	$9,520	$277	$9,412	$18,656	$153,570
20	$0	26,758	$9,806	$276	$9,365	$18,895	$172,465
21	$1	26,624	$10,100	$274	$9,319	$19,144	$191,610
22	$2	26,491	$10,403	$273	$9,272	$19,402	$211,012
23	$3	26,359	$10,715	$271	$9,226	$19,669	$230,681
24	$4	26,227	$11,036	$270	$9,179	$19,946	$250,626
25	$5	26,096	$11,368	$269	$9,134	$20,232	$270,859
Totals:		561,499	$150,261	$4,580	$196,525	$440,599	$342,205
				Net Present Value (NPV)		**$270,884**	
				Internal Rate of Return (IRR)		**8.7%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Lopatcong Fire Co. Engine #1	1200	Sunpower SPR230	82	14.7	1,206	18.86	29,432	2,706	15.64

.= Proposed PV Layout

Notes:

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

OLD DOMESTIC HOT WATER HEATER

Domestic Hot Water Calculator

About

Water Heater Characteristics

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

Energy Use

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

Gas vs. Electric Water Heating

Gas

.7	? Overall Efficiency
0.7484	? Conversion Efficiency
2420 BTU/hr	? Power Into Water Heater

Cost

$ 1.34 /Therm	? Utility Rates
$ 284.0692800	? Yearly Water Heating Cost

NEW REPLACEMENT HOT WATER HEATER

Domestic Hot Water Calculator

About

Water Heater Characteristics

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

Energy Use

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

Gas vs. Electric Water Heating

Gas	
0.9	? Overall Efficiency
0.9623	? Conversion Efficiency
1882 BTU/hr	? Power Into Water Heater

Cost

$ 1.34 /Therm	? Utility Rates
$ 220.9166880(	? Yearly Water Heating Cost