ENERGY AUDIT – FINAL REPORT

BUENA VISTA PUBLIC WORKS BUILDING

430 UNION ROAD
BUENA VISTA, NJ 08310
ATTN: MR. RONALD P. TREBING
Administrator / CMFO

CEG PROJECT NO. 9C08150

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I. EXECUTIVE SUMMARY

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

Buena Vista Township
Public Works Facility
430 Union Road
Buena Vista Twp, NJ 08310

Municipal Contact Person: Ronald P. Trebing

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	$ 3,292
Diesel Fuel Oil	$ 2,430
Total	$ 5,722

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

Table 1
Energy Conservation Measures (ECM's)

ECM NO.	DESCRIPTION	COST	ANNUAL SAVINGS	SIMPLE PAYBACK (YEARS)	SIMPLE RETURN ON INVESTMENT
1	Lighting Upgrade - Fluorescent Lighting	$5,010	$707	7.1	24.8 %
2	Lighting Upgrade – Compact Fluorescent	$92	$75	1.2	93.5 %
3	Lighting Upgrade – Lighting Controls	$220	$53	4.2	25.2 %
4	Forced Hot-Air Furnace Upgrade (Oil)	$10,000	$1,262	7.9	11.5 %
5	Domestic Hot Water Heater Replacement	$2,800	$701	4.0	26.4 %
6	Air Conditioning Upgrade – Split System	$4,850	$329	14.7	2.3 %
7	Install Double-Pane Insulating Windows	$1,500	$444	3.4	31.3 %
8	11.5 KW PV Solar Panel System	$103,500	$9,152	11.3	7.9 %

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)	FUEL OIL (Gallons)
1	Lighting Upgrade - Fluorescent Lighting	-	4,422	-
2	Lighting Upgrade – Compact Fluorescent	-	472	-
3	Lighting Upgrade – Lighting Controls	-	330	-
4	Forced Hot-Air Furnace Upgrade (Oil)	-	-	411
5	Domestic Hot Water Heater Replacement	-	4,383	-
6	Air Conditioning Upgrade – Split System	-	2,057	-
7	Install Double-Pane Insulating Windows	-	532	-
8	11.5 KW PV Solar Panel System	11.5	17,946	-

Recommendations:

Concord Engineering Group 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 economically justifiable. The following Energy Conservation Measures are recommended for the Buena Vista Public Works Building:

- **ECM #1:** Interior T-8 Fluorescent Lighting Upgrades
- **ECM #2:** Install Compact Fluorescent Lamps
- **ECM #3:** Interior Lighting Controls – Occupancy Sensors
- **ECM #4:** Forced Hot-Air Furnace Upgrade (Oil)
- **ECM #5:** Domestic Hot Water Heater Replacement
- **ECM #7:** Install Double-Pane Insulating Windows

II. INTRODUCTION

This comprehensive energy audit covers the 9,000 square foot Public Works Facility that includes a vehicle and equipment storage garage, administrative office, sign shop, restroom, a vehicle repair building with office, locker room, shower, and utility room.

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

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

After gathering the utility data and calculating the EUI, the next step in the audit process is obtaining Architectural and Engineering drawings (where available). By reviewing the Architectural and Engineering drawings, questions regarding the building envelope, lighting systems/controls, HVAC equipment and controls are noted. These questions are then compared to the energy usage profiles developed during the utility data gathering step. Furthermore, through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc. After this information is gathered the next step in the process is the site visit.

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

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

III. METHOD OF ANALYSIS

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

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

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

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

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

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from January-08 to December-08. Atlantic City Electric provides electricity to the facility under the MGS / Monthly General Service Rate Schedule. 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.

The Public Works does not utilize natural gas service. Table 4 and Figure 2 show the Diesel Fuel Oil energy usage for the surveyed Public Works Facility from January-08 to December-08. Pedroni Fuel Co. supplies the Dyed Diesel Fuel Oil to the storage tank at the facility. Below is the average unit cost for the utilities at this facility.

Description	Average
Electricity	16¢/kWh
Diesel Fuel Oil	$3.07/Gallon

Table 3
Electricity Billing Data

Public Works Facility

Provider	Month	Start Date	End Date	Account	Utility Type	Billing Days	Peak Demand	Units	Load Factor (%)	Total Consumption	Units	Supply Charge	Delivery Charge	Total $
Atlantic City Electric	January	12/10/2007	1/10/2008	0239 8099 9975	Electric	31	10.55	kw	38.5	3022	kwh	$ 174.43	$ 278.45	$ 452.88
Atlantic City Electric	February	1/10/2008	2/8/2008	0239 8099 9975	Electric	29	8.9	kw	40.45	2506	kwh	$ 142.83	$ 229.73	$ 372.56
Atlantic City Electric	March	2/8/2008	3/11/2008	0239 8099 9975	Electric	32	11.27	kw	32.02	2772	kwh	$ 167.60	$ 258.53	$ 426.13
Atlantic City Electric	April	3/11/2008	4/10/2008	0239 8099 9975	Electric	30	10.34	kw	35.99	2680	kwh	$ 156.90	$ 256.94	$ 413.84
Atlantic City Electric	May	4/10/2008	5/9/2008	0239 8099 9975	Electric	29	7.66	kw	20.1	1072	kwh	$ 79.95	$ 94.04	$ 173.99
Atlantic City Electric	June	5/9/2008	6/10/2008	0239 8099 9975	Electric	32	7.74	kw	13.18	784	kwh	$ 56.13	$ 79.20	$ 135.33
Atlantic City Electric	July	6/10/2008	7/10/2008	0239 8099 9975	Electric	30	5.27	kw	19.34	734	kwh	$ 44.17	$ 95.66	$ 139.83
Atlantic City Electric	August	7/10/2008	8/8/2008	0239 8099 9975	Electric	29	4.06	kw	20.34	575	kwh	$ 33.02	$ 78.67	$ 111.69
Atlantic City Electric	September	8/8/2008	9/9/2008	0239 8099 9975	Electric	32	3.42	kw	22.08	580	kwh	$ 31.20	$ 77.09	$ 108.29
Atlantic City Electric	October	9/9/2008	10/9/2008	0239 8099 9975	Electric	30	4.4	kw	38.88	1232	kwh	$ 54.24	$ 155.39	$ 209.63
Atlantic City Electric	November	10/9/2008	11/7/2008	0239 8099 9975	Electric	29	8.57	kw	28.18	1681	kwh	$ 77.62	$ 190.90	$ 268.52
Atlantic City Electric	December	11/7/2008	12/9/2008	0239 8099 9975	Electric	32	11.34	kw	35.49	3091	kwh	$ 131.58	$ 347.57	$ 479.15
						Max Peak:	11.34	kw	Total:	20729	kwh		Total:	$ 3,291.84
													Avg. Cost per kwh:	$ 0.16

Figure 1
Electricity Usage Profile

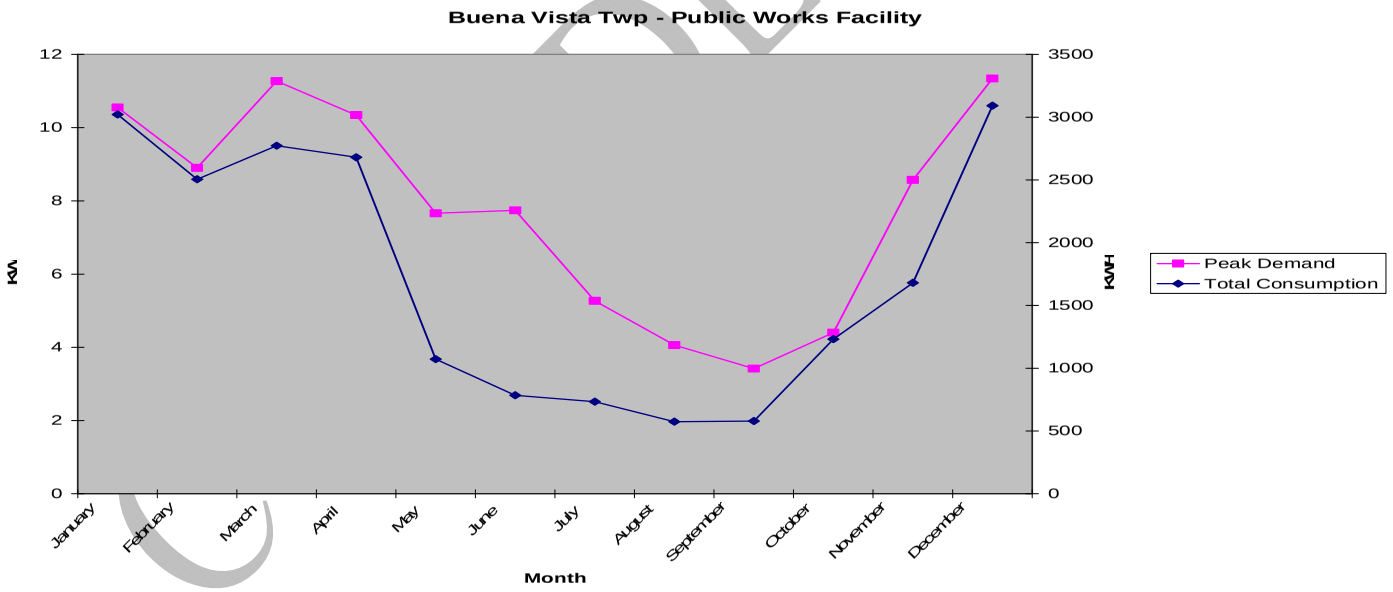
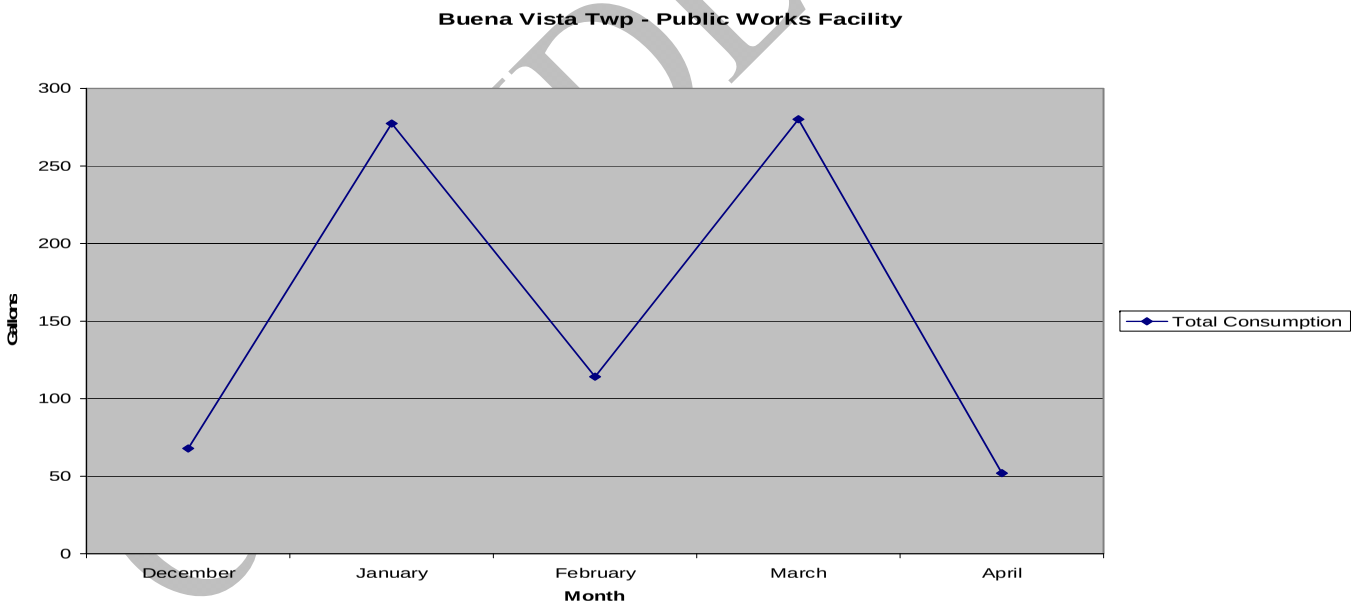


Table 4
Diesel Fuel Oil Billing Data

Public Works Facility

Provider	Month	Start Date	End Date	Account	Utility Type	Billing Days	Consumption	Units	Total $
Pedroni	December	12/27/2007	1/25/2008	9924C	Oil	29	67.9	gallons	$ 196.91
Pedroni	January	1/25/2008	2/11/2008	9924C	Oil	17	277.4	gallons	$ 760.21
Pedroni	February	2/11/2008	3/18/2008	9924C	Oil	31	114.2	gallons	$ 320.45
Pedroni	March	3/18/2008	4/22/2008	9924C	Oil	34	280.2	gallons	$ 966.55
Pedroni	April	4/22/2008	12/1/2008	9924C	Oil	240	52	gallons	$ 186.13
						12 Month Total:	791.7	gallons	$ 2,430.25
						Average Cost per gallon:	$ 3.07		

Figure 2
Diesel Fuel Oil Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's energy utilization per square foot of building. This calculation is completed by converting all utility usage (gas, electric, oil) consumed by a building over a specified time period, typically 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 among buildings of similar type. The EUI for this facility is calculated as follows:

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

Electric = ((20,729 kWh) * (1000 W/kW) * (3.414 Btu/h / 1 W))/ (1000 Btu/h / 1 kBtu/h)
= 70,769 kBtu/h

Diesel Fuel Oil = ((792 Gallons) * (139,000 Btu/h / 1 Gal)) / (1000 Btu/h / 1 kBtu/h)
= 110,088 kBtu/h

$$\text{Building EUI} = \frac{\text{(70,769 kBTU / h + 110,088 kBtu / h)}}{\text{9,000 SF}} = \frac{\text{180,857 kBtu / h}}{\text{9,000 SF}} = \text{20.1 kBtu/SF}$$

Public Works Facility EUI = 20.1 kBtu/SF

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 priorites and goals. Saving energy will in-turn save the environment.

Specific building types are detailed on the ENERGY STAR website. Non-typical buildings are covered by an "Other" category. The Public Works Facility falls under this "Other" category. The "Other" category is used if your building type or a section of the building is not represented by one of the specific categories. An Energy Performance Rating cannot be calculated if more then 10% of a building is classified as "Other." The majority of the Public Works Facility would be classified as "Other" and therefore cannot be given an Energy Performance Rating.

V. FACILITY DESCRIPTION

The Public Works Facility is approximately 9,000 square feet. The facility consists of two buildings that are connected by an enclosed passageway. The larger building is a pre-fabricated, insulated metal building which is the storage garage for large vehicles such as sump trucks, loaders, back-hoes, etc. This building is approximately 6,300 square feet and, in addition to vehicle storage, the building includes the Director's office and a sign shop.

The second building on site is a vehicle repair garage and is approximately 2,700 square feet. The function of this building is primarily for vehicle repair however it also includes an office, locker room and shower, and utility room. The building has slab-on-grade floor and 12" thick concrete block walls. Windows are clear, single-pane, non-insulting.

Heating System

The vehicle storage building is essentially unheated; only the office in this building is heated. Heat in the office is produced by a through-wall, packaged terminal air conditioner with electric resistance heat.

The vehicle repair building utilizes an oil fired furnace to provide heating and ventilation throughout the building. Rigid ductwork installed provides distribution of warm air to all rooms. The furnace is an Armstrong model LG14-350/450B60-24 which burns number 2 fuel oil at a rate of four (4) gallons per hour (GPH). An above ground storage tank, located above ground behind the building, holds approximately 550 gallons of fuel oil, and provides fuel for the furnace.

Domestic Hot Water

An electric hot water heater resides in the vehicle repair building where the only plumbing fixtures for the facility exist. The water heater is a Bradford White M280R6DS-INCWN, 80 gallon, 240 volt with two (2) 3,500 watt heating elements.

Cooling System

The vehicle storage building has a large wall mounted propeller fan mounted in the high-bay area. In the warm climates, the fan is stared manually and overhead garage doors are open to allow for cross-ventilation. No means of mechanical air conditioning, other than ventilation, existing in the storage area.

The office in each building has a through-wall packaged terminal air conditioner installed to provide air conditioning. In the vehicle storage building, a unit manufactured by GE is installed and provides approximately 9,500 BTUH of cooling although the actual capacity and EER are unknown. The vehicle repair building office has a Frigidaire unit installed. Model FAL104J1A1 provides 10,000 BTUH of cooling with an EER of 9.5.

Lighting System

The offices are lit by 4-foot surface mounted fixtures containing T12 lamps and magnetic ballasts.

The storage garage is lit by pendant mounted metal halide fixtures.

The maintenance garage is lit by 4-foot and 8-foot T12 lamps and magnetic ballasts.

The toilet room and locker room are lit using a mixture of 4-foot surface mounted fixtures containing T12 lamps and magnetic ballasts, and incandescent "A-lamp" fixtures.

The corridors are lit by incandescent "A-lamp" fixtures.

Storage and utility closets are lit by incandescent "A-lamp" fixtures.

Standard switching is utilized throughout the facility.

The exterior lighting is mounted on the building and includes an assortment of wall packs.

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

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 savings. In addition, the list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment if a manufacturers 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.

Equipment denoted by an asterisk indicates an estimate of the equipment ratings due to equipment inaccessibility, worn nameplates, lack of nameplates, etc.

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

VII. ENERGY CONSERVATION MEASURES (ECM)

ECM #1: Lighting Upgrade - Upgrade the Fluorescent Lighting

Description:

Improved fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple retrofit of the existing fixture can provide substantial savings. An industrial fixture with four, 8-foot lamps (75 Watt lamps with a magnetic ballast) has a total wattage of 320 Watts per fixture. By using the improved lamps and ballasts, the total wattage would be reduced to 204 Watts. The light levels would increase by about 15% and the light quality would increase by 35%.

CEG recommends replacement of the existing T12 lamps and magnetic ballasts with the latest technology T8 lamps and high efficiency electronic ballasts. The new energy efficient, T8 lamps 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 the latest high efficiency T8 lamps is approximately 30,000 burn-hours, requiring fewer lamps to replace per year. Based on the operating hours of this portion of the facility, approximately 2210 hours per year, the Owner will be changing approximately 33% less lamps per year.

In addition, a single electronic ballast can operate one, two, three, or four lamps in a fixture. The existing magnetic ballasts can only operate up to two lamps. The electronic ballasts could reduce the amount of ballasts in the facility by half. This can be taken advantage of with "tandem wiring" of ballasts. Instead of using one electronic ballast for every one fixture it is sometimes feasible to use one electronic ballast for every two or more fixtures. The electrician wires a single ballast to operate the lamps in adjacent light fixtures which further reduces the amount of ballasts needed.

Energy Savings Calculations:

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

Maintenance Savings are calculated as follows:

Maintenance Savings = (# *of lamps* x % *reduction* x $ *per lamp*) + *Installation Labor*

Maintenance Savings = (90 x 33% *reduction* x $2.00) + ($20 x 30) = $659

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	**$6119**
NJ Smart Start Equipment Incentive ($):	**($450)**
Maintenance Savings ($):	**($659)**
Net Installation Cost ($):	**$5010**
Total Energy Savings ($ / yr):	**$707**
Simple Payback (yrs):	**7.1**
Simple Return on Investment:	**24.8 %**

ECM #2: Lighting Upgrade – Install Compact Fluorescent Lighting

Description:

Compact fluorescent lamps (CFL's) were created to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light.

The CFL is available in a myriad of shapes and sizes depending on the specific application. Typical replacements are: a 13-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 25-Watt CFL for a 100-Watt incandescent lamp.

The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. CFL's are also available in 3000K, 3500K, and 4100K. The 4100K would be the "brightest" or "coolest" output.

A CFL can be chosen to screw right into existing fixtures, or hardwired into existing fixtures.

Energy Savings Calculations:

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

Maintenance Savings are calculated as follows:

Maintenance Savings = (*# of lamps* x % *reduction* x $ *per lamp*) + *Installation Labor*
Maintenance Savings = (10 x 75% *reduction* x $.50) + ($15 x 7.5) = $116

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	**$208**
NJ Smart Start Equipment Incentive ($):	**($0)**
Annual Maintenance Savings ($):	**($116)**
Net Installation Cost ($):	**$92**
Total Energy Savings ($ / yr):	**$75**
Simple Payback (yrs):	**1.2**
Simple Return on Investment:	**93.5 %**

ECM #3: Lighting Upgrade – Install Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. There has been a belief 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 determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs.

Lighting controls are available in many forms. Lighting controls can be as simplistic as an additional switch. Time-clocks are often used which allows the user to set an on/off schedule. Time-clocks range from a dial clock with on/off indicators to a small box the size of a thermostat with user programs for on/off schedule in a digital format. 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 E 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 offices, mechanical rooms, storage rooms, etc.

CEG would recommend wall switches for individual rooms, ceiling mount sensors for large office areas or restrooms, and fixture mount box sensors for some applications as manufactured by Sensorswitch, Watt Stopper, etc.

Energy Savings Calculations:

From Appendix E of this report, we calculated the lighting power density (Watts/ft^2) of the existing facility to be .83 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

Savings = 10% x .83 Watts/SF x 1,800 SF x 2,210 hrs/yr.

= 330 kWh/yr. x $0.16/kWh

Annual Savings = $52.80 / yr

Installation cost per dual-technology sensor is $75/unit.

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 4 (1,800 SF).

Total cost to install sensors is $55 x 4 units = $220.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	**$300**
NJ Smart Start Equipment Incentive ($):	**($80)**
Maintenance Savings ($):	**($0)**
Net Installation Cost ($):	**$220**
Total Energy Savings ($ / yr):	**$52.80**
Simple Payback (yrs):	**4.2**
Simple Return on Investment:	**25.2 %**

ECM #4: Forced Hot-Air Furnace Upgrade

Description:

Heating and ventilating for the Supervisor's office, locker room, and repair garage is provided by an oil-fired furnace. The existing unit was installed when the building was constructed and is at least 25 years old at this time. The exact date of construction is unknown. The estimated service life for the furnace is 18 years as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook..

For heating, this section of the building utilizes an Armstrong oil-fired furnace to provide forced hot air through a duct system. Due to the age of the unit, it is estimated that it is firing at a combustion efficiency of 55-60% at best. When new, the combustion efficiency of the furnace was 80%. The firing rate of the furnace is just below 4 gallons per hour of No. 2 fuel oil. No. 2 oil has a heating value of 140,000 BTU/gallon. The input for the furnace is 450,000 BTU/Hr. and the output is estimated at 270,000 BTU/Hr.

This energy conservation measure would replace the existing furnace with a more efficient, oil-fired unit that is down-sized to match the heat loss of the spaces served. The combustion efficiency for the new furnace will be 80%. The energy efficiency of the new unit is based on a Thermo Pride OL33-200 oil furnace

Heating Energy Savings Calculations:

To estimate the amount of energy necessary to heat the building throughout the heating season, the Degree Day method of energy estimating is used.

$$EnergyUsed = \frac{H_L \times D \times 24}{\Delta t \times k \times V} \times (C_D)$$

where:

H_L = Building Heat Loss, BTU/Hr.

D = number of 65 F Heating Degree Days

Δt = Design temperature difference, deg. F

k = a correction factor that includes the effects of rated full load efficiency, part load performance, oversizing and energy conservation devices.

V = Heating value of fuel, BTU/gallon

C_D = empirical correction factor for heating effect vs. 65 F degree days

$$EnergyUsed = \frac{(185{,}000)\times(4539)\times 24}{70\times .6\times 140{,}000}\times(.6)$$

Energy Used = 2056 gallons/Year

The existing furnace is oversized and should be replaced with a smaller one. Calculations indicate a furnace with an input of 250,000 BTU/Hr. should be adequate.

The combustion efficiency of the proposed furnace is 20% higher than the existing furnace and therefore should achieve the same heating effect using 20% less fuel.

Energy Savings = Energy Used$_{Ex.\ Furn.}$ *– Energy Used*$_{New\ Furn.}$

Energy Savings = 2056 x (1-.80) = 411.2 gallons/Year

Cost Savings = $3.07/gallon x 411.2 gallons/Year = $1262/Year

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	**$10,000**
NJ Smart Start Equipment Incentive ($):	**($0)**
Maintenance Savings ($):	**($0)**
Net Installation Cost ($):	**$10,000**
Total Energy Savings ($ / yr):	**$1262**
Simple Payback (yrs):	**7.9**
Simple Return on Investment:	**11.5 %**

ECM #5: Domestic Hot Water Heater Replacement

Description:

The electric domestic hot water heater for the building was installed during original construction of the building. It was stated that the building is at least 25 years old.

This energy conservation measure will replace the existing electric, 4,500 Watt, 80-gallon capacity domestic hot water heater with a new, tankless water heater. Tankless water heaters heat water directly without the use of a storage tank. Therefore, they avoid the standby heat losses associated with storage water heaters and provide a constant supply of hot water. Consequently, there is no recovery period as is typical with storage-type hot water heaters.

Energy Savings Calculations:

Proposed Electric Tankless Water Heater

Rated Capacity = 5 gallons per minute (50ºF Rise)

Existing Electric DHW Heater

Rated Capacity = 4,500 Watts Energy Factor (EF) = 0.90
80 gallons storage

Stand-by Heat Loss of Existing Electric DHW Heater:

Surface Area of Existing Water Heater = 37.7 $Ft.^2$

Temperature Difference = 110 ºF water temp. – 70 ºF ambient temp. = 40 ºF

Water Heater Jacket Coefficient of Thermal Transmission = 0.13 BTU/Hr.- $Ft.^2$-ºF

Stand-by Heat Loss = (.13) x (37.7) x (40) = 196 BTU/Hr. = 0.669 kW

Water Heater Stand-by Hours = 18 hr./day x 7 days/wk. x 52 wk./yr. = 6552 hours/year

Energy Savings

Energy Savings = (0.669) x 6552 = 4383 kWh/Year

Cost Savings = 16 ¢/kWh x 4,383 kWh = $701/Year

Installed cost of 5 GPM tankless water heater = $2,800

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	**$2,800**
NJ Smart Start Equipment Incentive ($):	**($0)**
Maintenance Savings ($):	**($0)**
Net Installation Cost ($):	**$2,800**
Total Energy Savings ($ / yr):	**$701**
Simple Payback (yrs):	**4.0**
Simple Return on Investment:	**26.4 %**

ECM #6: Air Conditioning Upgrade – Split System Units

Description:

Air-conditioning is provided within the Director's and Supervisor's Office via residential-style window air-conditioning units. The existing window air-conditioning units are inefficient with an estimated seasonal energy efficiency ratio (SEER) of 9.0. The NJ State Energy Code (ASHRAE 90.1-2004) mandates a minimum energy efficiency of 10.6 SEER for units of this type. The existing window air-conditioning unit in the Supervisors Office is aged and is past its service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. The estimated service life for a window air-conditioning unit is 10 years.

This energy conservation measure would replace the window-air conditioning units serving the office; total two (2) window air-conditioning units. The existing units will be replaced with high energy efficient, ductless split system air-conditioning units with cooling capacities typical of the existing units. The average SEER of the new equipment will be upwards of 18 SEER.

Energy Savings Calculations:

$$EnergySavings = \frac{[CoolingTons \times 12{,}000\,Btu/ton \div 1000W/kW]}{[(EER_{NEW} - EER_{OLD})]} \times Avg.\,Load\ Factor \times Hrs.\,of\ Cooling \times \#\,of\ Units$$

Existing Air Conditioning Units

Rated Capacity = .75 Tons (x 2 Units)

Condenser Unit Efficiency = 9.0 EER

Cooling Season Hrs. of Operation = 1,800 hrs/yr. (x 1 unit), 200 hrs/yr. (x 1 unit)

Average Cost of Electricity - $0.16/kWh

Proposed High-Efficiency Air Conditioning Unit

Rated Capacity =.75 Tons (x2 Units)

New Condenser Unit Efficiency = 16 EER

$$EnergySavings = \frac{[CoolingTons \times 12{,}000\,Btu/ton \div 1000W/kW]}{[(EER_{NEW} - EER_{OLD})]} \times Avg.LoadFactor \times Hrs.ofCooling$$

$$EnergySavings = \frac{[.75\,CoolingTons \times 12{,}000\,Btu/ton \div 1000W/kW]}{[(16EER_{NEW} - 9EER_{OLD})]} \times 0.80 \times 1800$$

$$= 1851 kWh/yr.$$

$$EnergySavings = \frac{[.75\,CoolingTons \times 12{,}000\,Btu/ton \div 1000W/kW]}{[(16EER_{NEW} - 9EER_{OLD})]} \times 0.80 \times 200$$

$$= 206 kWh/yr.$$

Total Cost Savings = (1851 kWh + 206 kWh) * $0.16/kWh = $329 / Yr.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	**$5000**
NJ Smart Start Equipment Incentive ($):	**($150)**
Maintenance Savings ($):	**($0)**
Net Installation Cost ($):	**$4,850**
Total Energy Savings ($ / yr):	**$329**
Simple Payback (yrs):	**14.7**
Simple Return on Investment:	**2.3 %**

ECM #7: Install Double-Pane Insulating Windows

Description:

The older section of the Public Works building has single-pane windows which allow substantial heat losses and gains resulting in cooler interior surfaces during the heating season and warmer interior surfaces during the cooling season. In addition, these windows are a source of cold air leakage into the building. Finally, single-pane glass may result in condensation-related problems when warm interior air contacts cold surfaces.

High-performance windows can provide many benefits including:

- Improved comfort by reducing radiant heat exchange
- Improved indoor air quality by reducing air leakage that can bring dirt, dust, and other impurities into the building
- Lower utility bills since these windows are better insulated and more air-tight
- Fewer condensation problems since these windows stay warmer in the heating season resulting in drier windows

This energy conservation measure would replace all of the single-pane windows with double-pane, insulating windows.

Energy savings calculations:

Heating Degree Days = 5,169°F – day/yr.

Cooling Degree Days = 3198°F – day/yr.

Total window area to be retrofitted = 21 SF
U exist. = 1.13 Btu/hr – ft^2 - °F

U new = 0.55 Btu/hr – ft^2 - °F

Annual Energy Savings (Heating) =

=24 hrs * Window Areas * (U exist - U new) * HD Days

= 24 * 21 * (1.13-0.55) * 5,169 = 16,419.3 MMBtu/Year = 117 gallons/year

Energy Savings = 117 gallons x $3.07 = $359/year

Annual Energy Savings (Cooling) =

=4 hrs * Window Areas * (U exist - U new) * HD Days

= 4 * 21 * (1.13-0.55) * 3,198 = 155,800 Btu/Year = 532 kWh/year

Energy Savings = 532 kWh/year x $0.16 = $85/year

Upgraded Window Cost = $1500

Total Annual Savings = $359 + $85 = $444/Year

Simple Payback for Upgraded Windows = 3.4Years

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	**$1500**
NJ Smart Start Equipment Incentive ($):	**($0)**
Maintenance Savings ($):	**($0)**
Net Installation Cost ($):	**$1,500**
Total Energy Savings ($ / yr):	**$ 444**
Simple Payback (yrs):	**3.4**
Simple Return on Investment:	**31.3 %**

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES (ECM #8)

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 Buena Vista Township, 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 approximately 2700 S.F. is available and can be utilized for a PV system on the smaller building adjacent to the main Public Works building. A depiction of the area utilized is shown in Appendix F following the financial calculations. Using this square footage it was determined that a system size of 11.5 kilowatts could be installed to match the maximum peak monthly demand. The required square footage for a system of this size is 735 S.F. and has an estimated kilowatt hour production of 17,946 KWh annually, reducing the overall electric consumption by approximately 86%. A detailed financial analysis can be found in Appendix F. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

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

PAYMENT TYPE	SIMPLE PAYBACK	INTERNAL RATE OF RETURN
Self-Finance	11.3 Years	11.9 %
Direct Purchase	11.3 Years	7.9 %

Wind energy production is another option available through the Renewable Energy Incentive Program. Small wind turbines can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG has reviewed the applicability of wind energy for Buena Vista Township and has determined it is not a viable option. Low average wind speeds for the area are not adequate for wind turbine generation. Typical wind turbines start producing energy at 8 mph wind speeds. Buena Vista Township averages 4 mph wind speeds making this application impractical.

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 diesel fuel oil usage load profile for January 2007 through December 2008.

Electricity:

Section IV, Figure 1 demonstrates a typical electric heating load profile, (November-March) with possible summertime air conditioning consumption. It is evident that there is a significant reduction in the On Peak Load from April through October 2008 and an increase from November through March 2008. The Off Peak load is typical, with some expected increased consumption in the June-September period. The base-load shaping is important because a flat consumption profiles will yield more competitive pricing. The township might look into why the Demand (kW) has extreme peaks in July and September. This can be investigated with the Local Utility Company, Atlantic City Electric.

Natural Gas:

Per the data provided, the Public Works Garage does not utilize Natural Gas service.

Diesel / Fuel Oil:

From the data provided The Public Works Garage uses dyed diesel fuel oil. Diesel Fuel Oil is dyed to indicate that the Township is exempt from sales tax. The average price per gallon ($3.07) is competitive. However the Township might ask their supplier (Pedroni), or other suppliers for a fixed rate. The price per gallon does increase by 30% from January to April. Fixing the rate would allow for better cash flow and a fixed steady rate.

Tariff Analysis:

Electricity:

The Public Works Garage receives electrical service through Atlantic City Electric on a BGS (Basic Generation Service) rate. Since the passing and implementation of the Electricity Discount and Energy Competition Act (EDECA) in 1999, there have been many changes brought about by the deregulation of the electric industry in New Jersey. Since that time, customers in New Jersey have been able to choose their electrical supplier. Customers who do not choose to switch to a Third Party Supplier (TPS), or who leave a TPS to return to their Electric Delivery Company are supplied with Basic Generation Service.

Natural Gas:

The Public Works Garage does not receive natural gas service from the data supplied.

Diesel / Fuel Oil:

Fuel Oil is not subject to a utility tariff. Petroleum products are subject to price changes as dictated by free market trades and as monitored on the NYMEX (New York Mercantile Exchange).

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the scope. CEG's observations are seen in both the electric and natural gas costs. The average price per kWh (kilowatt hour) for all buildings is $0.1335 / kWh (kWh is the common unit of electric measure). The average price per decatherm for natural gas is $15.26 /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. Buena could see significant savings if it were to take advantage of these current market prices quickly, before energy increases. Based on last year's historical consumption (January – December 2008) and current electric rates, a savings of over $7000.00 per year can be realized (Note: Savings were calculated using Buena Vista's Average Annual Consumption of 228,409 kWh and a variance of $3.35/kWh utilizing a fixed 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 Buena Vista's natural gas costs and the Third Party Supplier, Woodruff Energy. CEG recognized a segment of the natural gas cost is not competitive with current market prices. Based on the current market, the Township is paying approximately $7.83 per unit above market in the South Jersey Gas Company service territory. CEG recommends further advisement on these prices. CEG would also recommend Buena procuring energy (natural gas) on its own. CEG recommends alternative sourcing strategies.

CEG recommends that The Buena Vista Township 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), Buena will learn more about the competitive supply process. The town 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 given 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.

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 sensors serving the office spaces

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.

APPENDIX

Electric Cost Summary
Public Works Facility
ATLANTIC CITY ELECTRIC
Acct.No:0239 8099 9975

Appendix A

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
Last Meter Read Date	12/10/2007	1/10/2008	2/8/2008	3/11/2008	4/10/2008	5/9/2008	6/10/2008	7/10/2008	8/8/2008	9/9/2008	10/9/2008	11/7/2008	12/10/2007
Current Meter Read Date	1/10/2008	2/8/2008	3/11/2008	4/10/2008	5/9/2008	6/10/2008	7/10/2008	8/8/2008	9/9/2008	10/9/2008	11/7/2008	12/9/2008	12/9/2008
Billing Days	31	29	32	30	29	32	30	29	32	30	29	32	365
KWH	3,022	2,506	2,772	2,680	1,072	784	734	575	580	1,232	1,681	3,091	20,729
KW	11	9	11	10	8	8	5	4	3	4	9	11	11
Monthly Load Factor	39%	40%	32%	36%	20%	13%	19%	20%	22%	39%	28%	35%	29%
Electric Delivery, $	$278	$230	$259	$257	$94	$79	$96	$79	$77	$155	$191	$348	$2,142
Delivery $/kwh	$0.092	$0.092	$0.093	$0.096	$0.088	$0.101	$0.130	$0.137	$0.133	$0.126	$0.114	$0.112	$0.109
Electric Supply, $	$174	$143	$168	$157	$80	$56	$44	$33	$31	$54	$78	$132	$1,150
Supply $/kwh	$0.058	$0.057	$0.060	$0.059	$0.075	$0.072	$0.060	$0.057	$0.054	$0.044	$0.046	$0.043	$0.057
Total Cost, $	$453	$373	$426	$414	$174	$135	$140	$112	$108	$210	$269	$479	$3,292
$/KWH	$0.1499	$0.1487	$0.1537	$0.1544	$0.1623	$0.1726	$0.1905	$0.1942	$0.1867	$0.1702	$0.1597	$0.1550	$0.1588

PUBLIC WORKS FACILITY

CONSTRUCTION COST AND REBATES					
ECM # 1 - UPGRADE FLUORESCENT LIGHTING	Qty	Unit Cost $	Material $	Labor $	Total $
New T-8 Linear Fluorescent Lamps & Ballasts	1	$3,819	$3,819	$2,300	$6,119
Total Cost					$6,119
Annual Maintenance Savings					-$659
Utility Incentive					-$450
Total Net Cost					**$5,010**
ECM # 2 - INSTALL CFL LIGHTING	Qty	Unit Cost $	Material $	Labor $	Total $
Compact Fluorescent	1	$58	$58	$150	$208
Total Cost					$208
Annual Maintenance Savings					-$116
Total Net Cost					**$92**
ECM # 3 - INSTALL LIGHTING CONTROLS	Qty	Unit Cost $	Material $	Labor $	Total $
Occupancy Sensors	4	$75	$300	$0	$300
Total Cost					$300
Utility Incentive					-$80
Total Net Cost					**$220**
ECM # 4 - HOT AIR FURNACE UPGRADE	Qty	Unit Cost $	Material $	Labor $	Total $
Demo Existing Furnace	1	$0	$0	$1,000	$1,000
Install New Furnace	1	$2,500	$2,500	$5,000	$7,500
Ductwork Modifications	1	$500	$500	$600	$1,100
Piping Modification	1	$100	$100	$300	$400
Total Cost					$10,000
Utility Incentive					$0
Total Net Cost					**$10,000**
ECM # 5 - DOMESTIC HOT WATER HEATER	Qty	Unit Cost $	Material $	Labor $	Total $
Demo Existing Electric Service to HWH	1	$200	$200	$400	$600
Demo Hot Water heater	1	$0	$0	$500	$500
New Hot Water Heater	1	$850	$850	$250	$1,100
Piping Modification & Vent	1	$100	$100	$500	$600
Total Cost					$2,800
Utility Incentive					$0
Total Net Cost					**$2,800**

PUBLIC WORKS FACILITY

ECM # 6 - AC UPGRADE - SPLIT SYSTEM UNITS	Qty	Unit Cost $	Material $	Labor $	Total $
Remove Existing Thru-Wall Units	2	$0	$0	$300	$300
New HVAC Equipment	2	$1,000	$2,000	$1,600	$3,600
Electrical Modifications	2	$200	$400	$700	$1,100
Total Cost					$5,000
Utility Incentive					-$150
Total Net Cost					**$4,850**
ECM # 7 - DOUBLE-PANE INSULATING WINDOWS	Qty	Unit Cost $	Material $	Labor $	Total $
Demo Existing Windows	2	$0	$0	$200	$200
Install New Windows	2	$250	$500	$800	$1,300
Total Cost					$1,500
Utility Incentive					$0
Total Net Cost					**$1,500**
ECM # 8 - PV SOLAR	Qty	Unit Cost $	Material $	Labor $	Total $
PV Solar	50	$2,070	$103,500	Included	$103,500
Total					**$103,500**

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SmartStart Building Incentives

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

BUENA VISTA PUBLIC WORKS FACILITY

TAG	MAKE	MODEL	TYPE	CAPACITY	EFFICIENCY	SERVES	LOCATION	REMAINING USEFUL LIFE	NOTES
PTAC	FRIGIDAIRE	FAL104J1A1	DX/ ELECT HEAT THRU WALL	10,000 BTUH, 1055 watt, 9.5 AMP	9.5 EER	REPAIR BUILDING OFFICE	OFFICE	1 YEAR	PACKAGED THRU-THE-WALL. ELECTRIC COOLING AND HEATING.
PTAC	GE	N/A	DX/ ELECT HEAT THRU WALL	9,500 BTUH	N/A	VEHICLE STORAGE OFFICE	OFFICE	5 YEARS	PACKAGED THRU-THE-WALL. ELECTRIC COOLING AND HEATING.
H-1	ARMSTRONG	LG14-350/450B60-24	OIL FIRED FURNACE	450 MBH INPUT, 350 MBH OUTPUT	77.7%	VEHICLE REPAIR BLDG	UTILITY ROOM	5 YEARS	OIL FIRED FURNACE
DHW-1	BRADFORD WHITE	M280R6DS-INCWN	ELECTRIC HOT WATER HEATER WITH STORAGE	80 GAL, (2) 3500 WATT ELEMENTS	100%	VEHICLE REPAIR BLDG	UTILITY ROOM	10 YEARS	ELECTRIC DOMESTIC HOT WATER HEATER

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Project #: BS09-003
Project Name : Buena Vista Township Energy Audit - Public Works Facility
Address: 430 Union Road
City, State: Buena Vista Twp, NJ 08310
Building SF: 9000

		Existing Fixtures					Proposed Fixtures									Fixtures Retrofitted			Unit Installation Cost						
Existing Lighting Fixture Type	Room Name	Lighting Fixture Description	Lamps per Fixture	Watts	Qty of Fixtures	Total Watts	Existing/Replace	Description	Lamps per Fixture	Watts	Qty of Fixtures	Total Watts	Wattage Reduction	Average Burn Hours	Ave $/kwh	Energy Savings, kWh	Energy Savings, $	Qty	Material Each	Labor Each	Total Each	Total Materials	Total Labor	Total All	Rebate Estimate	Simple Payback
	Director's Office/Storage Garage																									
A	Storage Garage	1L-Metal Halide	1	0	8	0	0	0	0	0	8	0	0	2210	$0.16	0	$0.00	8	0	0	$0.00	$0.00	$0.00	$0.00	$0.00	
B	Director's Office	2L-4' Linear Fluorescent-Surface Mounted T12	2	77	6	462	Relamp, Reballast	Sylvania Lamps FO32/835/XP/ECO Sylvania Ballast QHE 2X32T8/UNV ISL-SC	2	48	6	288	174	2210	$0.16	385	$61.53	6	25.05	60	$85.05	$150.30	$360.00	$510.30	$60.00	7.3
C	Storage Closet	1L-Incand. "A" Lamp-Surface Mounted	1	60	1	60	Relamp	Sylvania CF19EL/MINI/830	1	18	1	18	42	400	$0.16	17	$2.69	1	5.86	15	$20.86	$5.86	$15.00	$20.86	$0.00	7.8
C	Storage Closet	1L-Incand. "A" Lamp-Surface Mounted	1	60	1	60	Relamp	Sylvania CF19EL/MINI/830	1	18	1	18	42	400	$0.16	17	$2.69	1	5.86	15	$20.86	$5.86	$15.00	$20.86	$0.00	7.8
	Director's Office/Storage Garage Summary				**16**	**582**					**16**	**324**	**258**			**418**	**$66.90**	**16**				**$162**	**$390**	**$552**	**$60**	**7.4**
	Maintenance Garage																									
D	Maintenance Garage	2L-8' Linear Fluorescent-Surface Mounted T12	2	160	8	1280	Relamp, Reballast	Sylvania Lamps FO96/835/XP/SS/ECO Sylvania Ballast QHE 2X59T8/UNV ISN-SC	2	102	8	816	464	2210	$0.16	1,025	$164.07	8	137.2	60	$197.20	$1,097.60	$480.00	$1,577.60	$80.00	9.1
E		4L-8' Linear Fluorescent-Surface Mounted T12	4	320	8	2560	Relamp, Reballast	Sylvania Lamps FO96/835/XP/SS/ECO Sylvania Ballasts 2-QHE 2X59T8/UNV ISN-SC	4	204	8	1632	928	2210	$0.16	2,051	$328.14	8	274.35	70	$344.35	$2,194.80	$560.00	$2,754.80	$160.00	7.9
B		2L-4' Linear Fluorescent-Surface Mounted T12	2	77	2	154	Relamp, Reballast	Sylvania Lamps FO32/835/XP/ECO Sylvania Ballast QHE 2X32T8/UNV ISL-SC	2	48	2	96	58	2210	$0.16	128	$20.51	2	25.05	60	$85.05	$50.10	$120.00	$170.10	$20.00	7.3
C	Mechanical Room	1L-Incand. "A" Lamp-Surface Mounted	1	60	2	120	Relamp	Sylvania CF19EL/MINI/830	1	18	2	36	84	400	$0.16	34	$5.38	2	5.86	15	$20.86	$11.72	$30.00	$41.72	$0.00	7.8
C	Corridor	1L-Incand. "A" Lamp-Surface Mounted	1	60	2	120	Relamp	Sylvania CF19EL/MINI/830	1	18	2	36	84	2210	$0.16	186	$29.70	2	5.86	15	$20.86	$11.72	$30.00	$41.72	$0.00	1.4
B	Locker Room	2L-4' Linear Fluorescent-Surface Mounted T12	2	77	2	154	Relamp, Reballast	Sylvania Lamps FO32/835/XP/ECO Sylvania Ballast QHE 2X32T8/UNV ISL-SC	2	48	2	96	58	2210	$0.16	128	$20.51	2	25.05	60	$85.05	$50.10	$120.00	$170.10	$20.00	7.3
B	Toilet Room	2L-4' Linear Fluorescent-Surface Mounted T12	2	77	1	77	Relamp, Reballast	Sylvania Lamps FO32/835/XP/ECO Sylvania Ballast QHE 2X32T8/UNV ISL-SC	2	48	1	48	29	2210	$0.16	64	$10.25	1	25.05	60	$85.05	$25.05	$60.00	$85.05	$10.00	7.3
C		1L-Incand. "A" Lamp-Surface Mounted	1	60	2	120	Relamp	Sylvania CF19EL/MINI/830	1	18	2	36	84	2210	$0.16	186	$29.70	2	5.86	15	$20.86	$11.72	$30.00	$41.72	$0.00	1.4
B	Sign Shop	2L-4' Linear Fluorescent-Surface Mounted T12	2	77	6	462	Relamp, Reballast	Sylvania Lamps FO32/835/XP/ECO Sylvania Ballast QHE 2X32T8/UNV ISL-SC	2	48	6	288	174	2210	$0.16	385	$61.53	6	25.05	60	$85.05	$150.30	$360.00	$510.30	$60.00	7.3
C	Mezzanine	1L-Incand. "A" Lamp-Surface Mounted	1	60	2	120	Relamp	Sylvania CF19EL/MINI/830	1	18	2	36	84	400	$0.16	34	$5.38	2	5.86	15	$20.86	$11.72	$30.00	$41.72	$0.00	7.8
B	Office	2L-4' Linear Fluorescent-Surface Mounted T12	2	77	4	308	Relamp, Reballast	Sylvania Lamps FO32/835/XP/ECO Sylvania Ballast QHE 2X32T8/UNV ISL-SC	2	48	4	192	116	2210	$0.16	256	$41.02	4	25.05	60	$85.05	$100.20	$240.00	$340.20	$40.00	7.3
	Maintenance Garage Summary				**39**	**5475**					**39**	**3312**	**2163**			**4,476**	**$716.18**	**39**				**$3,715**	**$2,060**	**$5,775**	**$390**	**7.5**

Project Name: Buena Vista Public Works
Location: Buena Vista, NJ
Description: Photovoltaic System 95% Financing - 20 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 20 year
Total Construction Cost	$103,500
Annual kWh Production	17,946
Annual Energy Cost Reduction	$2,871
Annual SREC Revenue	$6,281
First Cost Premium	**$103,500**
Simple Payback:	**11.31** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	240	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.160**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$5,175	0	0	0	$0	0	0	(5,175)	0
1	$0	17,946	$2,871	$0	$6,281	$6,809	$2,339	$5	($5,170)
2	$0	17,857	$2,958	$0	$6,250	$6,640	$2,508	$60	($5,111)
3	$0	17,767	$3,046	$0	$6,219	$6,458	$2,690	$117	($4,993)
4	$0	17,678	$3,138	$0	$6,187	$6,264	$2,884	$177	($4,816)
5	$0	17,590	$3,232	$181	$6,157	$6,055	$3,092	$59	($4,757)
6	$0	17,502	$3,329	$180	$6,126	$5,832	$3,316	$126	($4,630)
7	$0	17,415	$3,429	$179	$6,095	$5,592	$3,556	$197	($4,434)
8	$0	17,328	$3,531	$178	$6,065	$5,335	$3,813	$270	($4,164)
9	$0	17,241	$3,637	$178	$6,034	$5,059	$4,088	$346	($3,817)
10	$0	17,155	$3,747	$177	$6,004	$4,764	$4,384	$426	($3,391)
11	$0	17,069	$3,859	$176	$5,974	$4,447	$4,701	$509	($2,882)
12	$0	16,984	$3,975	$175	$5,944	$4,107	$5,041	$596	($2,286)
13	$0	16,899	$4,094	$174	$5,915	$3,743	$5,405	$687	($1,599)
14	$0	16,814	$4,217	$173	$5,885	$3,352	$5,796	$781	($818)
15	$0	16,730	$4,343	$172	$5,856	$2,933	$6,215	$879	$61
16	$0	16,646	$4,474	$171	$5,826	$2,484	$6,664	$981	$1,041
17	$0	16,563	$4,608	$171	$5,797	$2,002	$7,146	$1,087	$2,128
18	$0	16,480	$4,746	$170	$5,768	$1,485	$7,662	$1,197	$3,324
19	$0	16,398	$4,888	$169	$5,739	$932	$8,216	$1,311	$4,635
20	$0	16,316	$5,035	$168	$5,711	$338	$8,810	$1,430	$6,065
21	$0	16,234	$5,186	$167	$5,682	$286	$8,099	$2,315	$8,381
22	$0	16,153	$5,342	$166	$5,654	$196	$6,665	$3,968	$12,349
23	$0	16,072	$5,502	$166	$5,625	$0	$0	$10,962	$23,310
24	$0	15,992	$5,667	$165	$5,597	$0	$0	$11,099	$34,410
25	$0	15,912	$5,837	$164	$5,569	$0	$0	$11,242	$45,652
	Totals:	342,377	$77,156	$2,793	$119,832	$84,630	$98,325	$113,089	$88,488
				Net Present Value (NPV)			**$6,247**		
				Internal Rate of Return (IRR)			**11.9%**		

Project Name: Buena Vista Public Works
Location: Buena Vista, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$103,500
Annual kWh Production	17,946
Annual Energy Cost Reduction	$2,871
Annual SREC Revenue	$6,281
First Cost Premium	**$103,500**
Simple Payback:	**11.31** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.160**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$103,500	0	0	0	$0	(103,500)	0
1	$0	17,946	$2,871	$0	$6,281	$9,153	($94,347)
2	$0	17,857	$2,958	$0	$6,250	$9,207	($85,140)
3	$0	17,767	$3,046	$0	$6,219	$9,265	($75,875)
4	$0	17,678	$3,138	$0	$6,187	$9,325	($66,550)
5	$0	17,590	$3,232	$181	$6,157	$9,207	($57,343)
6	$0	17,502	$3,329	$180	$6,126	$9,274	($48,069)
7	$0	17,415	$3,429	$179	$6,095	$9,344	($38,724)
8	$0	17,328	$3,531	$178	$6,065	$9,418	($29,307)
9	$0	17,241	$3,637	$178	$6,034	$9,494	($19,813)
10	$0	17,155	$3,747	$177	$6,004	$9,574	($10,239)
11	$0	17,069	$3,859	$176	$5,974	$9,657	($582)
12	$0	16,984	$3,975	$175	$5,944	$9,744	$9,162
13	$0	16,899	$4,094	$174	$5,915	$9,834	$18,997
14	$0	16,814	$4,217	$173	$5,885	$9,929	$28,925
15	$0	16,730	$4,343	$172	$5,856	$10,026	$38,952
16	$0	16,646	$4,474	$171	$5,826	$10,128	$49,080
17	$0	16,563	$4,608	$171	$5,797	$10,234	$59,314
18	$0	16,480	$4,746	$170	$5,768	$10,344	$69,659
19	$0	16,398	$4,888	$169	$5,739	$10,459	$80,118
20	$0	16,316	$5,035	$168	$5,711	$10,578	$90,695
21	$1	16,234	$5,186	$167	$5,682	$10,701	$101,396
22	$2	16,153	$5,342	$166	$5,654	$10,829	$112,225
23	$3	16,072	$5,502	$166	$5,625	$10,962	$123,187
24	$4	15,992	$5,667	$165	$5,597	$11,099	$134,286
25	$5	15,912	$5,837	$164	$5,569	$11,242	$145,529
Totals:		342,377	$77,156	$2,793	$119,832	$249,029	$194,195
				Net Present Value (NPV)		**$145,554**	
				Internal Rate of Return (IRR)		**7.9%**	

Building	Usable Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Public Works	2700	Sunpower SPR230	50	14.7	735	11.50	17,946	1,650	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.