



ENERGY AUDIT – FINAL REPORT

MILLVILLE BOARD OF EDUCATION MAINTENANCE BUILDING

625 NORTH 7TH STREET

MILLVILLE, NJ 08332

ATTN: TONI BASICH

ASSISTANT SCHOOL BOARD

SECRETARY/PURCHASING

CEG PROJECT No. 9C09072

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I. EXECUTIVE SUMMARY

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

Millville Board of Education
Maintenance Building
625 North 7th Street
Millville, NJ 08332

Municipal Contact Person: Toni Basich
Facility Contact Person: Esteban Garcia

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

The annual energy costs at this facility are as follows:

Electricity	\$ 8,110
Natural Gas	\$ 9,586
Total	\$ 17,696

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. Be aware that the ECM's and REM' are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is $\pm 20\%$. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

**Table 1
Financial Summary Table**

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST^A	ANNUAL SAVINGS^B	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
ECM #1	Lighting Upgrade - General	\$13,355	\$1,916	7.0	115.2%
ECM #2	Lighting Controls	\$1,960	\$351	5.6	168.6%
ECM #3	Unit Heater Replacement - Infrared	\$9,079	\$5,623	1.6	829.0%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST	ANNUAL SAVINGS	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
REM #1	14.26 KW PV System	\$128,340	\$9,694	13.2	88.8%

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

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

**Table 2
Estimated Energy Savings Summary Table**

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Upgrade - General	3.6	9906.0	0.0
ECM #2	Lighting Controls	0.0	2116.0	0.0
ECM #3	Unit Heater Replacement - Infrared	0.0	0.0	584.0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	14.26 KW PV System	0.0	18787.0	0.0

Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for the facility:

- **ECM #1:** Lighting Upgrade - General
- **ECM #2:** Lighting Controls
- **ECM #3:** Unit Heater Replacement - Infrared

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

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

II. INTRODUCTION

The comprehensive energy audit covers the 9,550 square foot Maintenance Building, which includes the following spaces: wood shop, truck bay, storage, and offices.

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

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft²/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

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

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

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

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

III. METHOD OF ANALYSIS

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

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

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

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment costs to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

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

$$\text{Simple Lifetime Savings} = (\text{Yearly Savings} \times \text{ECM Lifetime})$$

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

$$\text{Lifetime Maintenance Savings} = (\text{Yearly Maintenance Savings} \times \text{ECM Lifetime})$$

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

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

The electric usage profile represents the actual electrical usage for the facility. Atlantic City Electric provides electricity to the facility under their Basic Generation Service (BGS) rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. South Jersey Gas provides natural gas to the facility under the Basic Gas Supply Service (BGSS) rate structure. PEPCO Energy Services, Inc. is the third party supplier. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

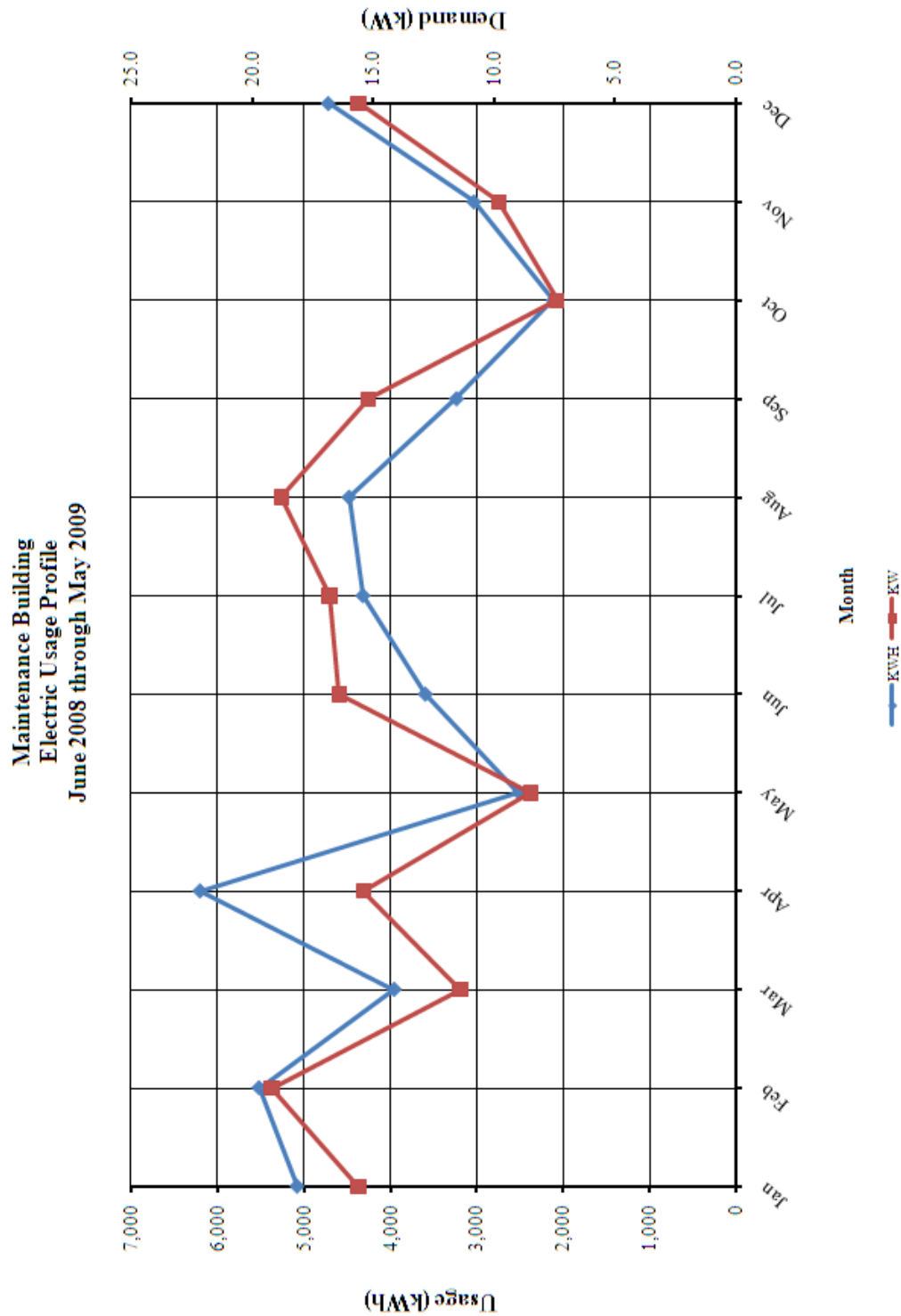
The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provided, the average cost for utilities at this facility is as follows:

<u>Description</u>	<u>Average</u>
Electricity	16.6¢ / kWh
Natural Gas	\$1.85 / Therm

**Table 3
Electricity Billing Data**

ELECTRIC USAGE SUMMARY			
Utility Provider: Atlantic City Electric Rate: Annual General Service (AGS) Meter No: 24376047 Customer ID No: - Third Party Utility - TPS Meter / Acct No: -			
MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-09	5,080	15.6	\$763
Feb-09	5,520	19.2	\$861
Mar-09	3,960	11.4	\$610
Apr-09	6,200	15.4	\$977
May-09	2,520	8.5	\$458
Jun-08	3,600	16.4	\$668
Jul-08	4,320	16.8	\$813
Aug-08	4,480	18.8	\$831
Sep-08	3,240	15.2	\$579
Oct-08	2,120	7.4	\$339
Nov-08	3,040	9.8	\$485
Dec-08	4,720	15.6	\$727
Totals	48,800	19.2 Max	\$8,110
AVERAGE DEMAND		14.2 KW average	
AVERAGE RATE		\$0.166 \$/kWh	

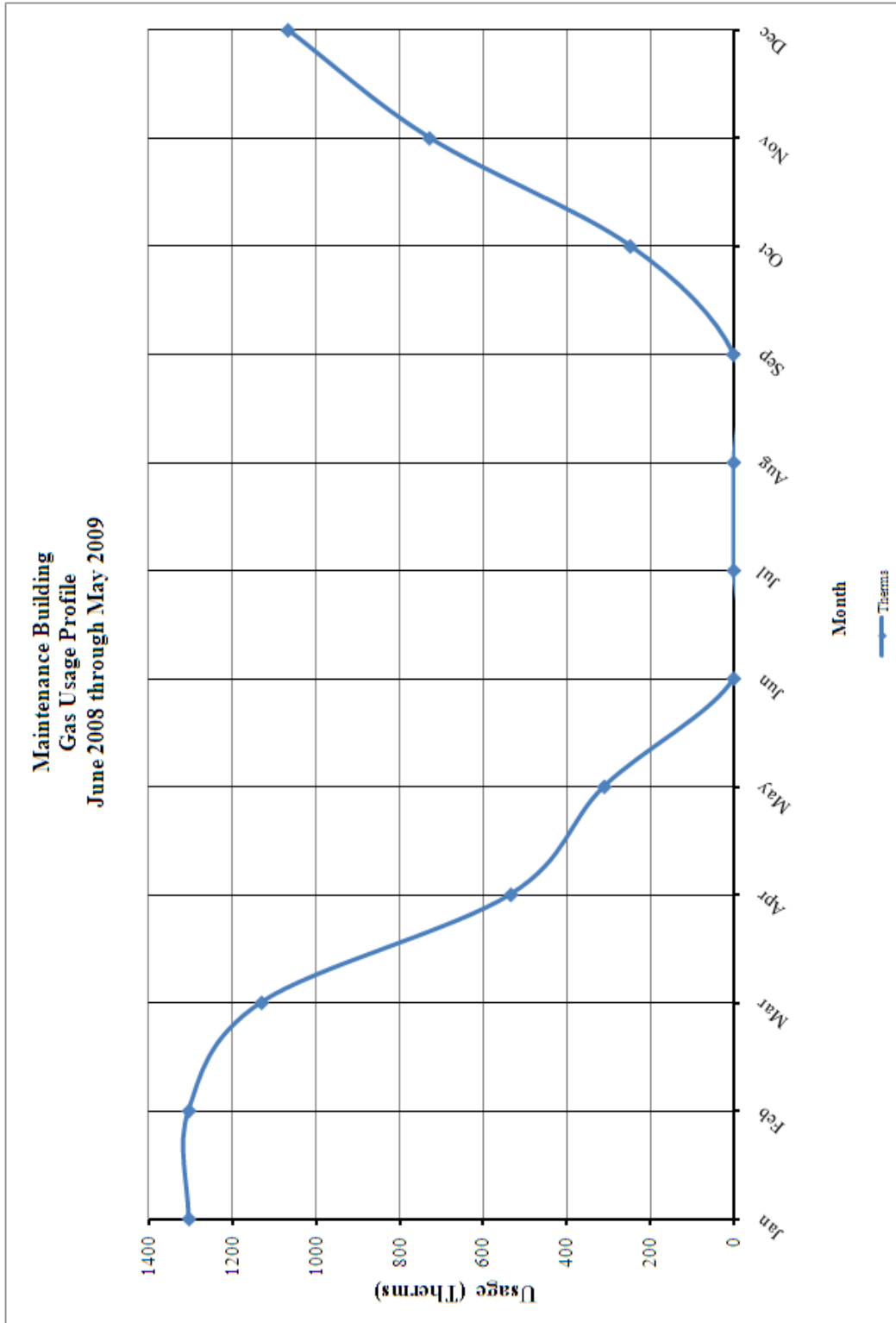
**Figure 1
Electricity Usage Profile**



**Table 4
Natural Gas Billing Data**

NATURAL GAS USAGE SUMMARY		
Utility Provider: South Jersey Gas		
Rate: BGSS		
Meter No: 430998		
Point of Delivery ID: -		
Third Party Utility Provider: PEPCO Energy Services Inc.		
TPS Meter No: -		
MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Jan-09	1,305.00	\$1,958.85
Feb-09	1,305.00	\$1,888.83
Mar-09	1,131.00	\$1,488.62
Apr-09	534.00	\$744.04
May-09	310.00	\$368.30
Jun-08	0.00	\$19.97
Jul-08	0.00	\$18.73
Aug-08	0.00	\$18.10
Sep-08	1.00	\$20.92
Oct-08	248.00	\$363.94
Nov-08	729.00	\$1,096.06
Dec-08	1,068.00	\$1,599.82
TOTALS	6,631.00	\$9,586.18
AVERAGE RATE:	\$1.45	\$/THERM

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

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

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

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

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

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

**Table 5
Facility Energy Use Index (EUI) Calculation**

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	48800.0			166,603	3.340	556,455
NATURAL GAS		5188.9		518,894	1.047	543,282
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				685,497		1,099,737
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	9,550 SQUARE FEET					
BUILDING SITE EUI	71.78 kBtu/SF/YR					
BUILDING SOURCE EUI	115.16 kBtu/SF/YR					

As a comparison, data has been gathered by the US Department of Energy (DOE) for various facilities cataloguing the standard site and source energy utilization. This data has been published in the 2003 Commercial Building Energy Consumption Survey and is noted as follows for facilities of this type:

- Service (Vehicle Repair):
77 kBtu/SF Site Energy, 150 kBtu/SF Source Energy.

Based on the information compiled for the studied facility, as compared to the national average the energy usage is approximately 23% lower than the baseline data.

C. EPA Energy Benchmarking System

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

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

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

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

User Name: millvilleboe
 Password: lgeaceg2009

 Security Question: What city were you born in?
 Security Answer: “millville”

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

**Table 6
 ENERGY STAR Performance Rating**

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Maintenance Building	N/A	N/A

The Maintenance Building falls under an “other” category which is not applicable for Energy Performance Rating. See the **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 9,550 SF Maintenance Building is a one story facility comprised of an office, lunchroom, vehicle maintenance/storage area, wood shop, drawing storage and material storage. The typical hours of operation for this facility are between 5:00 am and 4:00 pm. Exterior walls are of basic block construction with no insulation typical of this style of building. The windows throughout the facility are in fair condition and appear to be original to the structure. Typical windows throughout the facility are single pane, 1/4" clear glass with a mix of vinyl and aluminum frames. The roof was recently replaced and is of typical roll rubber construction with no aggregate covering. The facility was built in 1929 with no major additions since the original construction.

HVAC Systems

Heating is provided to the vehicle storage area, wood shop and general storage area via ten (10) Modine gas fired furnaces. Units vary in size and airflow, a detailed list of equipment capacities and efficiencies can be found in the **Major Equipment List Appendix** of this report.

The drawing storage area and associated spaces are heated and cooled via an over head air distribution system. An Arcoaire furnace and remote condensing unit satisfy the space. The natural gas fired furnace has a heating capacity of 100 MBH and is located in an attic area above the space. The Condensing unit has a 3-Ton cooling capacity, located on the roof of the building.

Air conditioning in the office and lunchroom is provided by window air conditioning units. Each unit is approximately 1-Ton, unit nameplate was not available.

HVAC System Controls

The heating and air conditioning systems, with exception to the window A/C units, throughout the building are controlled by individual Honeywell programmable thermostats. Occupied hours (5:00 am to 4:00 pm) have been set to 60°F and the unoccupied mode (4:00 pm to 5:00 am) has been set to 45°F. Integral window air conditioning controls located on individual units are used to control this style of system.

Domestic Hot Water

Three (3) electric hot water heaters provide hot water to the restrooms and kitchen area of the facility. The first a 40 gallon Bradford White unit with capacity of 4.5 kW, this unit serves and is located in the facilities main bathroom. The second unit is a 9 gallon Bradford White with a capacity of 1.5 kW, serving and located in the single bathroom. The third unit is a 2 gallon Bradford White with a capacity of 1.5 kW serving and located in the break room kitchen. All are point of use units and require no circulation system.

Lighting

Typical lighting throughout the building is fluorescent pendant mount fixtures with T-12 lamps and magnetic ballasts. Storage rooms and closets are lit with a mixture of incandescent lamps

and compact fluorescent lamps. A detailed list containing all building light fixtures can be found in the **Investment Grade Lighting Audit Appendix** of this report.

VI. MAJOR EQUIPMENT LIST

The equipment list is considered major energy consuming equipment and through energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade - General

Description:

The lighting in the Maintenance Building is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts, T-8 lamps with electronic ballasts.

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

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix – ECM#1** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start[®] Program Incentives are calculated as follows:

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

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

$$\text{Smart Start}^{\circledR} \text{ Incentive} = (45 \times \$ 25) + (29 \times \$ 30) = \underline{\$1,995}$$

Maintenance Savings are calculated as follows:

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

$$\text{Maintenance Savings} = (206 \times 33\% \text{ reduction} \times \$ 4.00) = \underline{\$272}$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$15,350
NJ Smart Start Equipment Incentive (\$):	\$1,995
Net Installation Cost (\$):	\$13,355
Maintenance Savings (\$/Yr):	\$272
Energy Savings (\$/Yr):	\$1,644
Total Yearly Savings (\$/Yr):	\$1,916
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.0
Simple Lifetime ROI	115.2%
Simple Lifetime Maintenance Savings	\$4,080
Simple Lifetime Savings	\$28,740
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	\$9,518.08

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.

ASHRAE Standard 90.1-2004, Appendix G is a reference standard for modeling building efficiency. The standard estimates that lighting controls provide a 10% reduction in lighting power usage for daytime occupancies in buildings over 5,000 SF, and 15% reduction in buildings under 5,000 SF. This ECM implements dual technology occupancy sensors in administration areas including offices, and storage areas.

The ECM includes replacement of standard wall switches with sensors wall switches for individual rooms, ceiling mount sensors for large areas or restrooms. Sensors shall be manufactured by SensorSwitch, Watt Stopper or equivalent.

The **Investment Grade Lighting Audit Appendix** of this indicates which areas of the facility would benefit from lighting control. The calculations adjust the lighting power usage by 10% for all areas that include occupancy sensor lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = 10\% \times \text{Occupancy Sensored Light Energy (kWh/Yr)}$$

$$\text{Energy Savings} = 10\% \times 21,159 \text{ (kWh)} = 2,116 \text{ (kWh)}$$

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

$$\text{Savings} = 2,116 \text{ (kWh)} \times 0.166 \left(\frac{\$}{\text{kWh}} \right) = \$351$$

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

$$\text{Installation Cost} = (\# \text{ of sensors} \times \$ \text{ per sensor}) = (14 \times \$160) = \underline{\$ 2,240}$$

NJ Smart Start[®] Program Incentives are calculated as follows:

From the **NJ Smart Start Incentive Appendix**, the incentive for installing a lighting control is \$20 per controller.

$$\text{Smart Start}^{\text{®}} \text{ Incentive} = (\# \text{ of controller} \times \$ 20) = (14 \times \$ 20) = \underline{\$280}$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$2,240
NJ Smart Start Equipment Incentive (\$):	\$280
Net Installation Cost (\$):	\$1,960
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$351
Total Yearly Savings (\$/Yr):	\$351
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.6
Simple Lifetime ROI	168.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$5,265
Internal Rate of Return (IRR)	16%
Net Present Value (NPV)	\$2,230.22

ECM #3: Shop Replacement - Infrared Heaters

Description:

The truck bay of the Maintenance Building is heated by six (6) Modine gas-fired units. These units are controlled by standard programmable thermostats. These units do not provide adequate heating because of the high ceilings and losses through garage doors when open.

Our team recommends replacing the existing unit heaters with low intensity infrared (IR) tube heaters. 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); they can be conveniently located and directed to provide heat to only a smaller section occupied by workers.

Energy Savings Calculations:

Based on the existing unit heater data, thermostat settings and natural gas bills, the total energy consumed by these heating units is approximately 2,919 Therms/Year. The total rated heat capacity of the IR tubes is 80% of the current load or 0.8 x 2,919 Therms = 2,335 Therms/Year. The total amount of IR heaters and their size can be estimated based on the current heat load and building layout. In general, a building 200 feet wide or less will require two rows of tubes. Heat output of each 20-foot section is approximately 60,000 Btu/hr.

Natural Gas Equipment List - Estimated Annual Usage per unit						
Concord Engineering Group						
Maintenance Building						
Manufacturer	Qty.	Model #	Serial #	Input (MBh)	% of Total Input	Estimated Annual Therms
Arcoaire		GUI100A020I	R910500154	100	6.25%	324.31
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Modine	1	PA150AF	15012021090	150	9.38%	486.46
Total Input MBH				1,600	1.00	5,188.94
Total Input Therms				16.0		
Total Gas Consumption Therms / yr.				5188.94		

Estimated Fan Energy Savings:

Each of the Modine gas-fired unit heaters have a 1/4 HP fan that runs each time the unit calls for heating. Assuming that these motors are 80% efficient and the total run hours is 1,280, this equates to an electrical savings of

Existing 1/4 HP Motor Operating Cost =

{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity} ÷ Motor Efficiency

$$= [0.746 \times 0.25 \times 0.75 \times 1,280 \times 0.166] \div 0.80 = \$37.15 / \text{Year}$$

Based on three (6) existing units, this equates to $6 \times \$34.91 = \$223/\text{Year Savings}$

Natural Gas Energy Savings:

$$20\% \text{ savings} \times 2919 \text{ Therms/Yr} \times \$1.85/\text{Therm} = \$5,400/\text{Year}$$

Total Energy Savings = Fan Energy Savings + Natural Gas Savings

$$= \$223 + \$5,400 = \underline{\$5,623} \text{ per year}$$

The total implementation cost including material and labor is estimated at approximately \$9,079. It is pertinent to note, the labor cost includes installation of the infra-red heaters and required modifications of the existing natural gas piping.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$9,079
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$9,079
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$5,623
Total Yearly Savings (\$/Yr):	\$5,623
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.6
Simple Lifetime ROI	829.0%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$84,345
Internal Rate of Return (IRR)	62%
Net Present Value (NPV)	\$58,048.01

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 the Millville Board of Education, to evaluate if there is any potential for solar or wind energy generation.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which can 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). Parking lots can also be utilized for the installation of a solar array. A truss system can be installed that is high enough to park a vehicle under the array, this way no parking lot area is lost. The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The 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 facility and believes a roof mounted system is best suited. A depiction of the proposed area layouts is shown in **Renewable / Distributed Energy Measures Calculation, Appendix**. Based on measurements of the roof it was determined that a system size of 14.26 kilowatts could be installed. The total system has an estimated kilowatt hour production of 18,787 KWh annually, reducing the overall electric consumption by approximately 38.4%. A detailed financial analysis can be found in **Renewable / Distributed Energy Measures Calculation, Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an

appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the Renewable/Distributed Energy Measures Calculation appendix.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today’s energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

Direct purchase involves the BOE paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following is the payback period:

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM				
PAYMENT TYPE	SIMPLE PAYBACK	SIMPLE ROI	NET PRESENT VALUE	INTERNAL RATE OF RETURN
Direct Purchase	13.24 Years	88.8%	\$136,489	6.3 %

*The solar energy measure is shown for reference in the executive summary REM table as REM#1.

Given the large amount of capital required by the BOE to invest in a solar system through a Direct Purchase CEG does not recommend the BOE pursue this route. It would be more advantageous for the BOE to solicit Power Purchase Agreement (PPA) Providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA Provider would sell all of the electric generated by Solar Arrays to the BOE at a reduced rate compared to their existing electric rate.

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG's review of the applicability of wind energy for the facility found; the low average wind speed and proximity to residential neighborhoods make facility a poor candidate for wind energy production.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

The 9,550 SF Maintenance Building is a one story facility comprised of an office, lunchroom, vehicle maintenance/storage area, wood shop, drawing storage and material storage. The typical hours of operation for this facility are between 5:00 am and 4:00 pm. The facility was built in 1929 with no major additions since the original construction.

The Electric Usage Profile demonstrates a fragmented load profile, but one that may be consistent for this type of facility. There is a sharp peak observed in April and a slight peak from May through September. Again a sharp escalation is seen in October continuing through February. These are all periods that coincide with increased maintenance functions, such as spring, summer and winter.

The drawing storage area and associated spaces are heated and cooled via an over head air distribution system. An Arcoaire furnace and remote condensing unit satisfy the space. The natural gas fired furnace has a heating capacity of 100 MBH and is located in an attic area above the space. The Condensing unit has a 3-Ton cooling capacity, located on the roof of the building.

Air conditioning in the office and lunchroom is provided by window air conditioning units. Each unit is approximately 1-Ton, unit nameplate was not available.

Three (3) electric hot water heaters provide hot water to the restrooms and kitchen of the facility. The first a 40 gallon Bradford White unit with capacity of 4.5 kW, the unit serves and is located in the facilities main bathroom. The second unit is a 9 gallon Bradford White with a capacity of 1.5 kW, serving and located in the single bathroom. The third unit is a 2 gallon Bradford White with a capacity of 1.5 kW serving and located in the break room kitchen. All are point of use units and require no circulation system.

This facility receives its electric delivery service via Atlantic City Electric (ACE) on a MGS rate schedule. This facility receives its electric commodity service from South Jersey Energy Company through the ACES agreement. A flat (base-load) shaping is important because it will yield more competitive pricing when shopping for alternative energy supply.

Natural Gas:

The Natural Gas Usage Profile demonstrates a typical heating load profile, with increasing consumption in the winter months (October – March) and a dramatic drop in consumption in the summer months (May – September). Heating is the obvious reason for the winter consumption. Heating is provided to the vehicle storage area, wood shop and general storage area via ten (10) Modine gas fired furnaces. The drawing storage area and associated spaces are heated and cooled via an over head air distribution system. An Arcoaire furnace and remote condensing unit satisfy the space. The natural gas fired furnace has a heating capacity of 100 MBH and is located in an attic area above the space.

Natural gas delivery service in this facility is provided by South Jersey Gas Company on a GSG rate schedule. The natural gas Commodity service is provided by PEPCO Energy Services through the ACES agreement. A flat load profile will always allow for the most competitive price available when shopping for alternative energy supplies.

Tariff Analysis:

Electricity:

This facility receives electrical Delivery Service from Atlantic City Electric on a MGS (Monthly General Service) utility rate.

The MGS rate is available at any point of The Utility's system where facilities of adequate character and capacity exist for the entire electric service requirements of any customer delivered at one point and metered at or compensated to the voltage of delivery. This schedule is not available to residential customers. This service includes the following charges: Delivery Service Charges, Distribution Demand Charges, Reactive Demand Charges, Non-Utility Generation Charges, Societal Benefits Charges, Regulatory Assets Recovery Charges, Transition Bond Charges, Market Transition Charge Tax, Transmission Demand Charge, Regional Greenhouse Gas Initiative Recovery Charge, and Infrastructure Investment Surcharge.

This facility receives electrical supply service through the ACES agreement (Alliance for Competitive Energy Services). ACES, is an alliance composed of the NJSBA and the NJASBO and is administered by Gable Associates. CEG believes that if the BOE wants to procure alternative energy, they must through the ACES agreement. CEG will make a recommendation that is counter to this agreement. The term of the ACES agreement is the first meter read date on or after April 30, 2009 until the last meter read date, May, 2011.

The ACES agreement provides for NJSBA to adopt a resolution for renewal for no more than a (5) consecutive year term. CEG will recommend against such a renewal and believes that a 5 – year term may not be allowed under local government law.

Natural Gas:

This facility is serviced by South Jersey Gas Company (SJG) on its firm delivery rate, General Service Gas (GSG) from the utility and BGSS (Basic Generation Supply Service) when not being served by a Third Party Supplier (TPS). Currently The BOE is procuring natural gas from a Third Party Supplier (TPS), PEPCO Energy Services. This Delivery Rate has the following charges: Customer Charge, Delivery Charge, BSC Volume Charge and Commodity Charge under this rate structure. The BGSS Supply rates are designed to recover SJG's cost of gas applicable to customers who purchase gas from SJG. The company earns no profit from BGSS. BGSS consists of two (2) pricing mechanisms: Residential and Commercial customers that use less than 5,000 therms annually and Commercial and Industrial customers that consume at least 5,000 therms annually.

Imbalances occur when Third Party Suppliers (TPS) are used to supply natural gas and full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. Note: It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used, otherwise, imbalances can occur, jeopardizing economics and scheduling. If the supplier does not deliver they can be placed on a very costly rate. A customer can automatically be put on an alternative supply rate by the utility.

A "firm account" refers to the type of interstate pipeline service that the utility has subscribed for and delivered on behalf of the customer. Much like the telecom industry, the pipeline space (capacity) has been deregulated. The pipeline capacity is broken down into reliability of service. "Firm service" is the highest level of reliability and is the last, in pecking order, for interruption.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the scope of this project. Therefore, CEG recommends aggregating all energy loads. CEG's observations are seen in both the electric and natural gas costs. The average "price to compare" per kWh (kilowatt hour) for all buildings is \$.1058/ kWh (kWh is the common unit of electric measure). The average "price to compare" per decatherm for natural gas is \$10.90 /dth (dth is the common unit of measure). These Weighted Average Prices are as supplied via Third Party Suppliers (TPS) for electricity (South Jersey Energy Company) and for natural gas (PEPCO Energy services), as administered through the ACES (Alliance for Competitive Energy Services) and the lead agency, The New Jersey School Boards Association, with administration from Gable Associates.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The BOE 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 2009) and current electric rates, the BOE could see an improvement of up to 15 % or up to \$150,000 in its electric costs annually. (Note: Savings were calculated using an Average Annual Consumption of 9,776,921 kWh and an Average fixed one-year commodity contract). CEG recommends aggregating the entire electric load to gain the

most optimal energy costs. CEG recommends that the BOE seek an energy advisor to maximize energy savings and to apply a “managed approach” to procuring energy.

CEG’s secondary recommendation coincides with the BOE’s natural gas costs. Based on the current market, (which is very competitive), the BOE could see a savings of over 20% or up to \$90,000 annually in its natural gas expenditures. Again, CEG recommends the use of any energy advisor to review alternative energy sourcing strategies and to install a “managed approach” to energy procurement.

CEG also recommends that The BOE not renew its energy supply contract with the ACES aggregation and PEPCO Energy Services, and the ACES agreement with South Jersey Energy and its fixed price contract. The fixed priced contract does not accomplish the needs of the BOE. The BOE needs budget protection and CEG has shown that these energy prices are not competitive to the market. The ACES agreement has demonstrated that the price is much above market and the BOE has no way of adjusting the price should prices fall.

CEG further recommends that the BOE create an energy program through a “managed approach.” The “managed approach” will take into account creating an “energy budget” that is in line with the BOE’s budget year and risk tolerance. Risk tolerance is the appetite that a customer has for risk. Based on the reduced state and local government budgets and the general aversion for risk, the local government is required to manage this risk.

CEG recommends the BOE 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), they will learn more about the competitive supply process. They 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, the BOE 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 the BOE frequently changes its supplier for energy, CEG recommends it closely monitor balancing, particularly when the contract is close to termination.

X. INSTALLATION FUNDING OPTIONS

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

- i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. The “Energy Savings Improvement Program (ESIP)” law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.
- 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. Clean all light fixtures to maximize light output.
- D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Millsville Board of Education - Maintenance Building

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY

ECM NO.	DESCRIPTION	INSTALLATION COST			YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS (Yearly Saving * ECM Lifetime)	LIFETIME MAINTENANCE SAVINGS (Yearly Maint Saving * ECM Lifetime)	LIFETIME ROI (Lifetime Savings - Net Cost / Net Cost)	SIMPLE PAYBACK (Net cost / Yearly Savings)	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT./SREC							
ECM #1	Lighting Upgrade - General	\$15,350	\$0	\$1,995	\$13,355	\$1,644	\$272	\$1,916	\$28,740	\$4,080	115.2%	7.0	11.57%	\$9,518.08
ECM #2	Lighting Controls	\$2,240	\$0	\$280	\$1,960	\$351	\$0	\$351	\$5,295	\$0	168.6%	5.6	15.97%	\$2,230.22
ECM #3	Unit Heater Replacement - Infrared	\$9,079	\$0	\$0	\$9,079	\$5,623	\$0	\$5,623	\$84,345	\$0	829.0%	1.6	61.89%	\$58,048.01
RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY														
REM #1	14.26 KW PV System	\$128,340	\$0	\$0	\$128,340	\$3,119	\$6,575	\$9,694	\$242,350	\$164,375	88.8%	13.2	5.63%	\$40,463.05

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



Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

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

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Other Equipment Incentives

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



STATEMENT OF ENERGY PERFORMANCE

Maintenance Building

Building ID: 1874964
For 12-month Period Ending: May 31, 2009¹
Date SEP becomes ineligible: N/A

Date SEP Generated: October 12, 2009

Facility

Maintenance Building
 625 N. 7th St.
 Millville, NJ 08332

Facility Owner

Millville Board of Education
 110 N. Third Street
 Millville, NJ 08332

Primary Contact for this Facility

Toni Basich
 110 N. Third Street
 Millville, NJ 08332

Year Built: 1929

Gross Floor Area (ft²): 9,550

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	166,506
Natural Gas (kBtu) ⁴	663,100
Total Energy (kBtu)	829,606

Energy Intensity⁵

Site (kBtu/ft ² /yr)	87
Source (kBtu/ft ² /yr)	131

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	61
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Electric Distribution Utility

Atlantic City Electric Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	150
% Difference from National Average Source EUI	-13%
Building Type	Service (Vehicle Repair/Service, Postal Service)

Meets Industry Standards⁶ for Indoor Environmental Conditions:

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

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.

Certifying Professional

Raymond Johnson
 520 South Burnt Mill Rd.
 Voorhees, NJ 08332

Notes:

- 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.
- 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.
- Values represent energy consumption, annualized to a 12-month period.
- 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.
- Values represent energy intensity, annualized to a 12-month period.
- 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	<input checked="" type="checkbox"/>
Building Name	Maintenance Building	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		<input type="checkbox"/>
Type	Service (Vehicle Repair/Service, Postal Service)	Is this an accurate description of the space in question?		<input type="checkbox"/>
Location	625 N. 7th St., Millville, NJ 08332	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		<input type="checkbox"/>
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		<input type="checkbox"/>
Maintenance Building (Other)				
CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Gross Floor Area	9,550 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.		<input type="checkbox"/>
Number of PCs	1 (Optional)	Is this the number of personal computers in the space?		<input type="checkbox"/>
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.		<input type="checkbox"/>
Workers on Main Shift	10 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		<input type="checkbox"/>

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Atlantic City Electric Co

Fuel Type: Electricity		
Meter: Electric Meter (kWh (thousand Watt-hours))		
Space(s): Entire Facility		
Generation Method: Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
05/01/2009	05/31/2009	2,520.00
04/01/2009	04/30/2009	6,200.00
03/01/2009	03/31/2009	3,960.00
02/01/2009	02/28/2009	5,520.00
01/01/2009	01/31/2009	5,080.00
12/01/2008	12/31/2008	4,720.00
11/01/2008	11/30/2008	3,040.00
10/01/2008	10/31/2008	2,120.00
09/01/2008	09/30/2008	3,240.00
08/01/2008	08/31/2008	4,480.00
07/01/2008	07/31/2008	4,320.00
06/01/2008	06/30/2008	3,600.00
Electric Meter Consumption (kWh (thousand Watt-hours))		48,800.00
Electric Meter Consumption (kBtu (thousand Btu))		166,505.60
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		166,505.60
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		<input type="checkbox"/>
Fuel Type: Natural Gas		
Meter: Natural Gas Meter (therms)		
Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
05/01/2009	05/31/2009	310.00
04/01/2009	04/30/2009	534.00
03/01/2009	03/31/2009	1,131.00
02/01/2009	02/28/2009	1,305.00
01/01/2009	01/31/2009	1,305.00
12/01/2008	12/31/2008	1,068.00
11/01/2008	11/30/2008	729.00
10/01/2008	10/31/2008	248.00
09/01/2008	09/30/2008	1.00
08/01/2008	08/31/2008	0.00

07/01/2008	07/31/2008	0.00
06/01/2008	06/30/2008	0.00
Natural Gas Meter Consumption (therms)		6,631.00
Natural Gas Meter Consumption (kBtu (thousand Btu))		663,100.00
Total Natural Gas Consumption (kBtu (thousand Btu))		663,100.00
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		<input type="checkbox"/>

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.	<input type="checkbox"/>

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

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
Maintenance Building
625 N. 7th St.
Millville, NJ 08332

Facility Owner
Millville Board of Education
110 N. Third Street
Millville, NJ 08332

Primary Contact for this Facility
Toni Basich
110 N. Third Street
Millville, NJ 08332

General Information

Maintenance Building	
Gross Floor Area Excluding Parking: (ft ²)	9,550
Year Built	1929
For 12-month Evaluation Period Ending Date:	May 31, 2009

Facility Space Use Summary

Maintenance Building	
Space Type	Other - Service (Vehicle Repair/Service, Postal Service)
Gross Floor Area(ft ²)	9,550
Number of PCs ^o	1
Weekly operating hours ^o	40
Workers on Main Shift ^o	10

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 05/31/2009)	Baseline (Ending Date 05/31/2009)	Rating of 75	Target	National Average
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft ²)	87	87	0	N/A	77
Source (kBtu/ft ²)	131	131	0	N/A	150
Energy Cost					
\$/year	N/A	N/A	N/A	N/A	N/A
\$/ft ² /year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
MtCO ₂ e/year	61	61	0	N/A	54
kgCO ₂ e/ft ² /year	6	6	0	N/A	5

More than 50% of your building is defined as Service (Vehicle Repair/Service, Postal Service). This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Service (Vehicle Repair/Service, Postal Service). This building uses X% less energy per square foot than the CBECS national average for Service (Vehicle Repair/Service, Postal Service).

Notes:

o - This attribute is optional.

d - A default value has been supplied by Portfolio Manager.

MAJOR EQUIPMENT LIST

Concord Engineering Group
"Millville B.O.E. - Maintenance Building"

Furnace

Location	Area Served	Manufacturer	Qty.	Equipment Tag	Model #	Serial #	Input (MBH)	Output (MBH)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Truck Bay Mezz	Dwg Storage Office Area	Atcoaire	1	-	GU1106A20IN	E91090154	100	79	79%	Nat. Gas	18	18	0

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty.	Equipment Tag	Model #	Serial #	Input Capacity	Recovery (gal/hr)	Capacity (gal)	Efficiency (%)	Fuel	Phase	Hz	Approx. Age	ASHRAE Service Life	Remaining Life
Single Bathroom	Single Bathroom	Bradford White	1	-	WPN22-1	ZF453580	1.5 kW	-	9	-	Electric	1	60	1	12	6
Gang Toilet	Gang Toilet	Bradford White	1	-	M-L4059DS-12	GBS08356	4.5 kW	-	40	-	Electric	1	60	1	12	8
Break Room Kitchen	Break Room Kitchen	Bradford White	1	-	MI-24655-TINAL	EC10271394	1.5 kW	-	2	-	Electric	1	60	1	12	11

AC Condensers

Location	Area Served	Manufacturer	Qty.	Equipment Tag	Model #	Serial #	Cooling Capacity	EER	Refrigerant	Volts	Phase	Hz	Approx. Age	ASHRAE Service Life	Remaining Life
Roof	Dwg Storage Office Area	Tempstar	1	-	ACS036ACX1	L9725 70630	3 Ton	13 SEER	R-22	208-230	1	60	12	20	8
Window AC	Dir. Of Maint. Office	Carrier	1	-	-	-	6-9,000 Btu	-	R-23	115	1	60	6	10	-
Window AC	Break room	-	1	-	-	-	12,000 Btu	-	R-24	115	1	60	6	10	4

Unit Heaters

Location	Area Served	Manufacturer	Qty.	Equipment Tag	Model #	Serial #	Heating Type	Input (MBH)	Output (MBH)	CFM	RPM/HP	Fuel	Phase	Hz	Approx. Age	ASHRAE Service Life	Remaining Life
Truck Bay	Truck Bay	Moline	6	-	PA150AF	15012021090	Gas HX	150	135	-	-	Nat. Gas	1	60	8	13	5
Wood Shop	Wood Shop	Moline	4	-	PA150AF	15012021090	Gas HX	150	135	-	-	Nat. Gas	1	60	8	13	5

INVESTMENT GRADE LIGHTING AUDIT

1	Storage A/Woodshop	2750	32	2	8' Industrial, 2-Lamp, T12 60W, Magnetic Ballast, Pendant Mount	126	4.03	11,088.0	\$1,840.61	64	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	58	3.71	10208	\$1,694.53	\$125.00	\$8,000.00	0.32	880	\$146.08	54.76
2	Storage A/Woodshop	2750	2	2	4' Industrial, 2-Lamp, T12 40W, Magnetic Ballast, Pendant Mount	94	0.19	517.0	\$85.82	2	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	58	0.12	319	\$52.95	\$125.00	\$250.00	0.07	198	\$32.87	7.61
3	Storage A/Woodshop	2750	6	2	4' Industrial, 2-Lamp, T8 40W, Electronic Ballast, Pendant Mount	94	0.56	1,551.0	\$257.47	0	0	No Change Required (NCR)	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
4	Storage A/Woodshop	2750	4	4	1' x 4', 4-Lamp, T8 32W, Electronic Ballast, Pendant Mount, Prismatic Lens	109	0.44	1,195.0	\$199.03	0	0	NCR	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
5	Storage A Pesticide	2750	2	2	4' Vaportight, 2-Lamp, T12 40W, Magnetic Ballast, Surface Mount, Prismatic Lens	94	0.19	517.0	\$85.82	0	0	NCR	1	0.00	0	\$0.00	\$1.00	\$0.00	0.00	0	\$0.00	0.00
6	Storage A Bathroom	2750	1	2	4' Industrial, 2-Lamp, T8 32W, Electronic Ballast, Pendant Mount	58	0.06	159.5	\$26.48	0	0	NCR	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
7	Trade Bay	2750	22	4	8' Industrial, 4-Lamp, T12 60W, Magnetic Ballast, Pendant Mount	240	5.28	14,520.0	\$2,410.32	44	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	58	2.55	7018	\$1,164.99	\$125.00	\$5,500.00	2.73	7502	\$1,245.33	4.42
8	Trade Bay Bathroom	2750	1	2	8' Strip, 2-Lamp, T12 60W, Magnetic Ballast, Surface Mount	126	0.13	346.5	\$57.52	2	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	58	0.12	319	\$52.95	\$125.00	\$250.00	0.01	27.5	\$4.57	54.76
9	Office #1	2750	2	2	2' x 4', 2-Lamp, T12 40W, Magnetic Ballast, Recessed Mount, Prismatic Lens	94	0.19	517.0	\$85.82	2	2	2'x4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	58	0.12	319	\$52.95	\$140.00	\$280.00	0.07	198	\$32.87	8.52
10	Office #1	2750	1	2	2' x 2', U Tube, 2-Lamp, T12, Magnetic Ballast, Recessed Mount, Prismatic Lens	70	0.07	192.5	\$31.96	1	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217	34	0.03	93.5	\$15.52	\$200.00	\$200.00	0.04	99	\$16.43	12.17
11	Upstairs Furnace Room	2750	1	2	8' Strip, 2-Lamp, T12 60W, Magnetic Ballast, Surface Mount	126	0.13	346.5	\$57.52	2	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	58	0.12	319	\$52.95	\$125.00	\$250.00	0.01	27.5	\$4.57	54.76
12	Corridor	2750	1	2	2' x 2', U Tube, 2-Lamp, T12, Magnetic Ballast, Recessed Mount, Prismatic Lens	70	0.07	192.5	\$31.96	1	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217	34	0.03	93.5	\$15.52	\$200.00	\$200.00	0.04	99	\$16.43	12.17
13	Men's Bathroom	2750	2	4	2' x 4', 4-Lamp, T12 40W, Magnetic Ballast, Recessed Mount, Prismatic Lens	188	0.38	1,034.0	\$171.64	2	3	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	82	0.16	451	\$74.87	\$140.00	\$280.00	0.21	583	\$96.78	2.89
14	Electrical Storage	2750	4	4	2' x 4', 4-Lamp, T8 32W, Electronic Ballast, Recessed Mount, Prismatic Lens	109	0.44	1,195.0	\$199.03	0	0	NCR	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
15	Kitchen	2750	1	4	1' x 4', 4-Lamp, T12 40W, Magnetic Ballast, Surface Mount, Prismatic Lens	188	0.19	517.0	\$85.82	1		2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	82	0.08	225.5	\$37.43	\$140.00	\$140.00	0.11	291.5	\$48.39	2.89

INVESTMENT GRADE LIGHTING AUDIT

16	Dining Room	2750	4	4	2750	4	109	0.44	1,199.0	\$199.03	0	0	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
17	Dining Room	2750	2	4	2750	2	109	0.22	599.5	\$99.52	0	0	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
18	Small Garage	2750	1	2	2750	1	126	0.13	346.5	\$57.52	2	2	58	0.12	319	\$52.95	\$125.00	\$250.00	0.01	27.5	\$4.57	54.76
19	Director of Maintenance Office	2750	2	4	2750	2	188	0.38	1,034.0	\$171.64	2	3	82	0.16	451	\$74.87	\$140.00	\$280.00	0.21	583	\$96.78	2.89
20	Break room	2750	2	4	2750	2	188	0.38	1,034.0	\$171.64	2	3	82	0.16	451	\$74.87	\$140.00	\$280.00	0.21	583	\$96.78	2.89
21	Break room Kitchen	2750	4	2	2750	4	70	0.28	770.0	\$127.82	4	2	34	0.14	374	\$62.08	\$200.00	\$800.00	0.14	396	\$65.74	12.17
Totals			88	48		88		12.98	35,695.0	\$5,925.37	121	19		7.042	19365.5	\$3,214.67		\$15,350.00	3.60	9905.5	\$1,644.31	9.34


Project Name: Millville BOE - Maintenance							
Location: Millville, NJ 08332							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
	Photovoltaic System - Direct Purchase						
Total Construction Cost	\$128,340						
Annual kWh Production	18,787						
Annual Energy Cost Reduction	\$3,119						
Annual SREC Revenue	\$6,575						
First Cost Premium	\$128,340						
Simple Payback:	13.24						Years
Life Cycle Cost Analysis							
Analysis Period (years):	25			Financing %:	0%		
Financing Term (mths):	0			Maintenance Escalation Rate:	3.0%		
Average Energy Cost (\$/kWh)	\$0.166			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	\$128,340	0	0	0	\$0	(128,340)	0
1	\$0	18,787	\$3,119	\$0	\$6,575	\$9,694	(\$118,646)
2	\$0	18,693	\$3,212	\$0	\$6,543	\$9,755	(\$108,891)
3	\$0	18,600	\$3,309	\$0	\$6,510	\$9,818	(\$99,073)
4	\$0	18,507	\$3,408	\$0	\$6,477	\$9,885	(\$89,188)
5	\$0	18,414	\$3,510	\$190	\$6,445	\$9,765	(\$79,422)
6	\$0	18,322	\$3,615	\$189	\$6,413	\$9,839	(\$69,583)
7	\$0	18,230	\$3,724	\$188	\$6,381	\$9,917	(\$59,666)
8	\$0	18,139	\$3,836	\$187	\$6,349	\$9,997	(\$49,669)
9	\$0	18,049	\$3,951	\$186	\$6,317	\$10,082	(\$39,587)
10	\$0	17,958	\$4,069	\$185	\$6,285	\$10,170	(\$29,418)
11	\$0	17,869	\$4,191	\$184	\$6,254	\$10,261	(\$19,156)
12	\$0	17,779	\$4,317	\$183	\$6,223	\$10,357	(\$8,800)
13	\$0	17,690	\$4,446	\$182	\$6,192	\$10,456	\$1,656
14	\$0	17,602	\$4,580	\$181	\$6,161	\$10,559	\$12,215
15	\$0	17,514	\$4,717	\$180	\$6,130	\$10,667	\$22,882
16	\$0	17,426	\$4,859	\$179	\$6,099	\$10,778	\$33,660
17	\$0	17,339	\$5,005	\$179	\$6,069	\$10,895	\$44,555
18	\$0	17,252	\$5,155	\$178	\$6,038	\$11,015	\$55,570
19	\$0	17,166	\$5,309	\$177	\$6,008	\$11,141	\$66,711
20	\$0	17,080	\$5,469	\$176	\$5,978	\$11,271	\$77,981
21	\$1	16,995	\$5,633	\$175	\$5,948	\$11,406	\$89,387
22	\$2	16,910	\$5,802	\$174	\$5,918	\$11,546	\$100,933
23	\$3	16,825	\$5,976	\$173	\$5,889	\$11,691	\$112,624
24	\$4	16,741	\$6,155	\$172	\$5,859	\$11,842	\$124,466
25	\$5	16,658	\$6,340	\$172	\$5,830	\$11,998	\$136,464
Totals:		358,417	\$83,799	\$2,923	\$125,446	\$264,804	\$206,321
Net Present Value (NPV)						\$136,489	
Internal Rate of Return (IRR)						6.3%	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW _{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Maintenance Building	1000	Sunpower SPR230	62	14.7	912	14.26	18,787	2,046	15.64



Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	14.3 kW
DC to AC Derate Factor:	0.810
AC Rating:	11.6 kW
Array Type:	Fixed Tilt
Array Tilt:	39.5°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	16.6 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	3.61	1344	223.10
2	4.20	1399	232.23
3	4.78	1688	280.21
4	5.23	1734	287.84
5	5.44	1820	302.12
6	5.48	1704	282.86
7	5.55	1761	292.33
8	5.41	1736	288.18
9	5.23	1661	275.73
10	4.60	1553	257.80
11	3.59	1234	204.84
12	3.17	1152	191.23
Year	4.69	18787	3118.64

 := Proposed PV Layout

Notes:

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