ENERGY AUDIT – FINAL

PITMAN BOARD OF EDUCATION
MEMORIAL ELEMENTARY SCHOOL
420 HUDSON AVENUE
PITMAN, NJ 08071

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CEG PROJECT NO. 9C09067

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I. EXECUTIVE SUMMARY

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

Pitman Board of Education
Memorial Elementary School
420 Hudson Ave.
Pitman, NJ 08071

Municipal Contact Person: Thomas F. Schulte
Facility Contact Person: Tom Herms

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	$ 36,023
Natural Gas	$ 26,595
Total	$ 62,618

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 ± 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	Pneumatic Controls Conversion to DDC	$154,312	$9,262	16.7	-10.0%
ECM #2	Air Handling Unit Replacement	$11,632	$355	32.8	-54.2%
ECM #3	Exterior Building Lighting Upgrade	$1,050	$215	4.9	207.1%
ECM #4	Install Compact Flourescent Lamps	$104	$311	0.3	4385.6%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	47.6 KW PV System	$380,880	$28,727	13.3	88.6%

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	Pneumatic Controls Conversion to DDC	0	21,743	2,020
ECM #2	Air Handling Unit Replacement	2.05	2,460	0
ECM #3	Exterior Building Lighting Upgrade	0.40	1,490	0
ECM #4	Install Compact Flourescent Lamps	0.72	2,163	0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION	NATURAL GAS (THERMS)
REM #1	47.6 KW PV System	0.0	58151.0	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 #3:** Exterior Building Lighting Upgrade
- **ECM #4:** Install Compact Fluorescent Lamps

Although ECM #1 does not provide a payback less than 10 years, it is recommended to proceed with the installation of a direct digital control system that replaces the outdated pneumatic controls throughout the facility. This ECM will improve the facilities energy efficiency as well as occupant comfort. More savings may be realized through further study of this ECM.

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.
5. Insulation on the domestic water system was in need of some repair in the area of the heat exchanger.

Renewable Energy Measures (REMs) were also reviewed for implementation at the Memorial Elementary School. CEG utilized a roof mounted solar array to house a substantial PV system. The recommended 47.6 kW PV system will produce approximately 58,151 kWh of electricity annually and will reduce the schools electrical consumption from the grid by 23%. The system's calculated simple payback of 13.3 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options before deciding to not implement this renewable energy measure.

Overall, the Memorial Elementary School appears to be operating at a high efficiency level compared to other schools in the region. With the implementation of the above recommended measures the Pitman BOE will realize further energy savings at the Memorial Elementary School.

II. INTRODUCTION

The comprehensive energy audit covers the 38,578 square foot Pitman Memorial School, which includes the following spaces: classrooms, administration offices and multipurpose cafeteria/auditorium.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

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

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

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

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

ECM Calculation Equations:

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

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

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

$$Lifetime\ Ma\,\mathrm{int}\,enance\ Savings = \left(Yearly\ Ma\,\mathrm{int}\,enance\ Savings \times ECM\ Lifetime \right)$$

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

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

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:

Description	Average
Electricity	14.4¢ / kWh
Natural Gas	$1.55 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Atlantic City Electric
Rate: Annual General Service (AGS)
Meter No: 81777602
Account No: 0067 5289 9994
Third Party Utility N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-09	21,520	69.6	$2,938
Feb-09	20,640	67.2	$2,863
Mar-09	19,280	34.4	$2,627
Apr-09	31,840	64.8	$4,304
May-09	19,200	72.0	$2,734
Jun-09	17,920	52.0	$2,840
Jul-08	16,640	32.0	$2,824
Aug-08	17,920	62.4	$2,941
Sep-08	16,960	36.8	$2,720
Oct-08	24,160	83.2	$3,291
Nov-08	19,280	33.6	$2,662
Dec-08	24,160	67.2	$3,279
Totals	**249,520**	**83.2 Max**	**$36,023**

AVERAGE DEMAND **56.3 KW average**
AVERAGE RATE **$0.144** **$/kWh**

Note: The billing period for April, 2009 was measured from April 2, 2009 to May 20, 2009 this extended metering period accounts for the spike in electrical usage plotted for this month.

Figure 1
Electricity Usage Profile

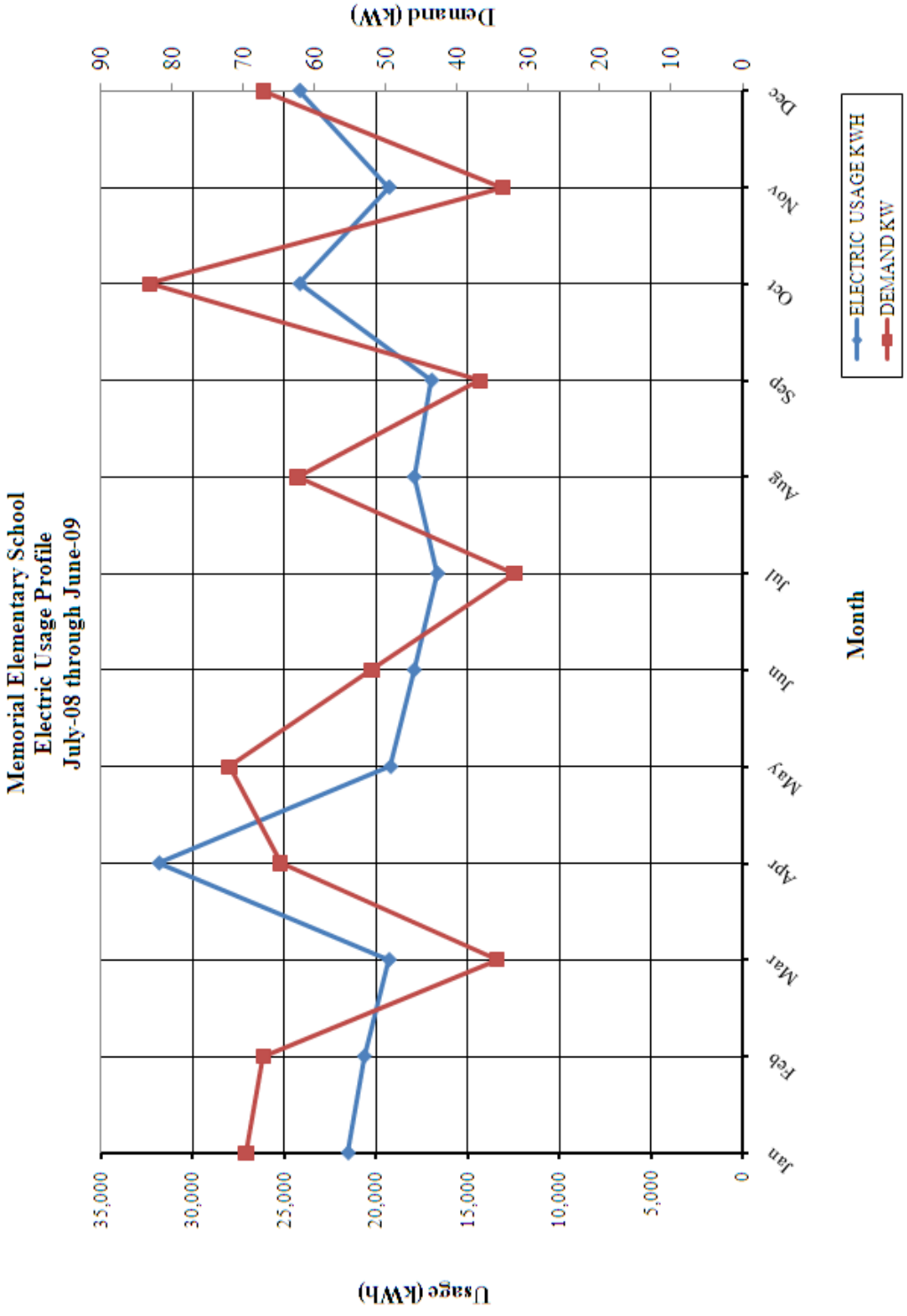
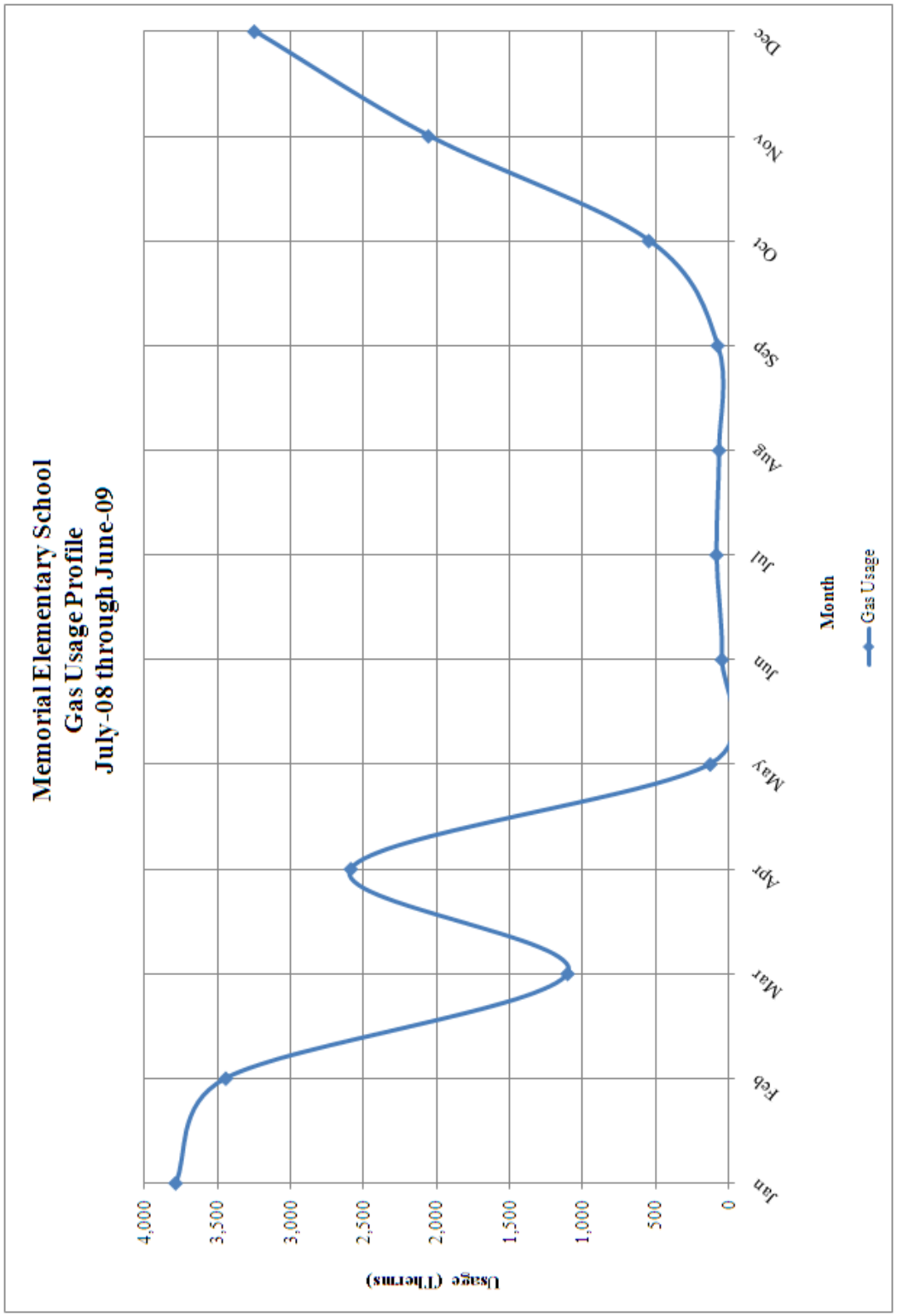


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	South Jersey Gas	
Rate:	Firm Transportation	
Meter No:	362118	
Point of Delivery ID:	N/A	
Third Party Utility Provider:	Pepco Energy Services	
TPS Meter No:	21631001407	
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jan-09	3,787.62	$5,816.58
Feb-09	3,443.78	$5,409.17
Mar-09	1,103.17	$1,744.51
Apr-09	2,587.67	$4,090.32
May-09	126.27	$88.46
Jun-09	46.58	$91.86
Jul-08	83.59	$192.57
Aug-08	65.79	$127.64
Sep-08	75.63	$140.03
Oct-08	546.96	$800.73
Nov-08	2,056.46	$3,144.99
Dec-08	3,248.94	$4,948.00
TOTALS	**17,172.46**	**$26,594.86**
AVERAGE RATE:	**$1.55**	**$/THERM**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

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

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

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

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

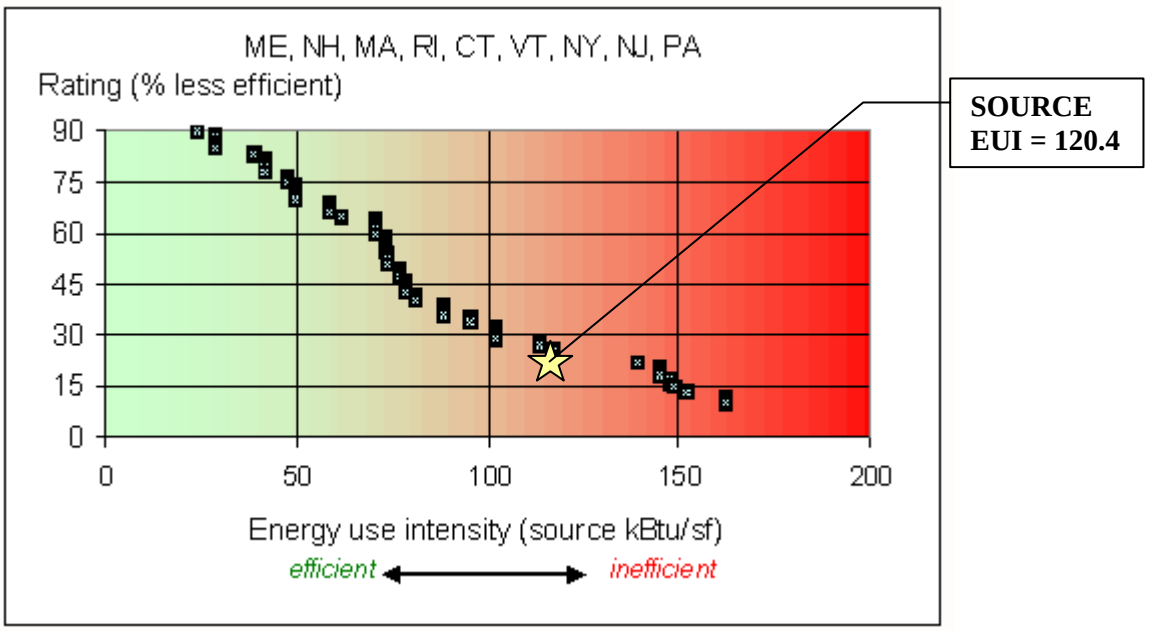
$$Building\ \ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio + Gas\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio)}{Building\ \ Square\ \ Footage}$$

Table 5
Facility Energy Use Index (EUI) Calculation

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	249520.0			851,861	3.340	2,845,217
NATURAL GAS		17172.5		1,717,246	1.047	1,797,957
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				2,569,107		4,643,173
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		38,578	SQUARE FEET			
BUILDING SITE EUI		*66.60*	kBtu/SF/YR			
BUILDING SOURCE EUI		*120.36*	kBtu/SF/YR			

Figure 3 below depicts a national EUI grading for the source use of *Elementary School*.

Figure 3
Source Energy Use Intensity Distributions: Elementary School



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: pitmanboe
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "pitman"

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**
Memorial Elementary School	74	50

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 38,578 SF Elementary School is a single story facility comprised of classrooms, administration offices and multipurpose cafeteria/auditorium. The original building was built in 1962 and a library and computer lab was added on in 1999. The typical school hours are from 7:30 am to 3:00 pm. The building is also utilized for special programs after normal schools hours. The average building use is approximately 60 hours per week. The building construction is CMU block with brick face. It is unknown if the CMU blocks are filled. The windows throughout the facility are in good condition and appeared to be recently replaced. The window type throughout the facility is double, thermopane, with vinyl cladding. The roof is a single ply flat roofing system supported by metal deck. The amount of insulation below the roof membrane is unknown. The roofing does appear to be severely worn in some areas and it was noticed during the survey that there were several areas that had large areas of standing water. The exterior doors were in good condition and also appear that they have recently been replaced. The weather stripping appears to be in good condition. The main entrance does not have a vestibule.

HVAC Systems

The heating system consists of two Aerco Benchmark Hot Water boilers. The boilers provide hot water to the classroom unit ventilators and the heating and ventilation unit for the multipurpose cafeteria/auditorium. The boilers also provide hot water during the heating season to a heat exchanger which produces domestic hot water for the restrooms and kitchen area. The boilers were installed in 2006 and are in good condition and appeared to be well maintained. During the time of the boiler installation both hot water circulating pumps were also replaced and also appear to be in good condition. The hot water circulating pumps are operating in conjunction with variable frequency drives that were installed at the time of the boiler installation. All associated piping was also replaced and is properly insulated and is in good condition. The boiler control system is a standalone Aerco controller which is set to operate on an outdoor air temperature setback and appears to be operating correctly.

Unit ventilators that heat and ventilate the classrooms and administration area were installed in 2004 & 2006 throughout the facility. The unit ventilators are manufactured by AAF and appear to be in good condition and well maintained. It was noted that the air filters were in need of replacement.

The areas that currently have cooling are the guidance offices, administration offices, library, computer lab and the special education area. The guidance offices are cooled utilizing Airedale ceiling cassette units which were installed in 1999 are in good working order. These units have associated condensing units for each corresponding unit. The library, computer lab and special education area also have direct expansion split systems for cooling. This equipment is in good condition and appears to be operating as designed. It was noted that the area around all the condensing units was severely overgrown with vegetation and should be cleared to allow these units to operate properly. The administration area is being cooled by two Lennox rooftop direct expansion units that are cooling only. The units are approximately 15 years old and would be a good candidate for replacement.

Exhaust System

Air is exhausted from the toilet rooms and common areas through typical centrifugal roof exhaust fans. These fans are manually controlled by local disconnect switches at the individual fans. The kitchen hood exhaust fan is also a typical centrifugal roof fan and controlled by a remote switch located in the kitchen area. This fan is only operated as needed. It was noted during the survey that several fans were not operating. It was not determined if they were off due to mechanical failure.

HVAC System Controls

Currently, the HVAC systems are not controlled via a central Pneumatic or DDC control system. All equipment is controlled manually or by stand alone controllers integral to the equipment. The system appears to work overall but during the survey several members of the staff complained of overheating issues during the winter months. A DDC control system should be reviewed for implementation at the Memorial School.

Domestic Hot Water

The domestic hot water system is designed to operate in two fashions. During the winter months the heating water is also diverted through a portion of piping into a shell and tube heat exchanger to provide domestic hot water. The system is only operational during the times the hot water boilers are operated. During the shoulder months and summer recess domestic hot water is produced via an electric water heater. This water heater was installed as part of the 2006 boiler renovation. There is a small domestic hot water circulating pump of fractional horsepower that was operating at the time of the survey. Insulation on the domestic water system was in need of some repair in the area of the heat exchanger. The heat exchanger did not appear to have been serviced recently and should be checked to ensure the tube assemblies are clean. The heat exchanger also appears to be original to the facility.

Lighting

Typical lighting throughout the building is fluorescent tube fixtures with T-8 lamps and electronic ballasts. Lighting is both surface mount and drop in style. Storage rooms and closets are utilizing compact fluorescents. These areas were retrofitted approximately ten years ago. Approximately two years ago all areas that were previously retrofitted received occupancy sensors. Typical exterior lighting is wall-mounted high pressure sodium fixtures. Typical control of the exterior lighting is provided by mechanical timers with photo-cell sensors at the fixtures.

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: Pneumatic Controls Conversion to DDC

Description:

Throughout the building there are pneumatic manual wall thermostats for the various HVAC units and local pneumatic controls with adjustable settings on the heating units. These indoor temperature controls are inaccurate due to temperature drift, age, cost of maintenance of pneumatics and not having been re-calibrated. These units also do not have night time setback features. In addition, the pneumatic controllers don't have the ability to maintain the temperature setpoint under changing load conditions.

This energy conservation measure would replace the existing pneumatic temperature control system with a Direct Digital Control System. The Direct Digital Control System will consist of multiple controllers networked over an Ethernet system that will display data at a standard PC via a web browser to allow the School District remote control and monitoring of the HVAC equipment. The advantages of a DDC system include deleting the air compressor, air dryer, and controls along with the maintenance costs of the pneumatic systems. With a DDC system, it is possible to develop historical records on the operating characteristics of a building; identifying trends which can lead to better performance.

Energy Savings Calculations:

Studies have shown that the installation of a full DDC system could save an estimated 10% of the total energy costs for this facility which is approximately $62,618.

Annual Savings = 10% x $62,618 = $6,262.

Assuming one-half of the total energy savings is natural gas and the other half is electric savings, this equates to 21,743 kWh and 2,020 Therms saved. We have also assumed a maintenance savings of $3,000 per year for the pneumatic devices.

The cost of a full DDC system with new field devices, thermostats, controllers, computer, software, engineering, etc. is approximately $4 per SF based on recent project cost data and a control contractor's budget pricing. For this facility, the estimated cost of a DDC system for the facility is approximately $154,312 (based on 38,578 SF).

There are currently no Smart Start Incentives available for this ECM.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$154,312
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$154,312
Maintenance Savings ($/Yr):	$3,000
Energy Savings ($/Yr):	$6,262
Total Yearly Savings ($/Yr):	$9,262
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.7
Simple Lifetime ROI	-39.1%
Simple Lifetime Maintenance Savings	$45,000
Simple Lifetime Savings	$93,930
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($43,742.85)

ECM #2: Air Handling Unit Replacement

Description:

General cooling for the administration area is provided by two (2) cooling only air-handling units (Lennox M/N CHA16), located on the roof, containing a supply fan and DX cooling coil. The air-handling unit units appear to be approximately 15 years of age and have reached their expected service life. This equipment is antiquated and is in need of replacement. It is estimated that the existing air-cooled condensing unit is operating at an efficiency of 8.0 EER (9.15 SEER) (degradation of the equipment is accounted for in the efficiency).

This energy conservation measure would replace the air-handling units serving the administration area with new, York Cooling only Affinity Series air handling units. The new units will provide cooling capacities typical of the existing equipment. The NJ State Energy Code (ASHRAE 90.1-2004) mandates a minimum energy efficiency of 12.0 SEER for units of this type and this baseline will be utilized in selecting the new equipment. The unit will provide approximately 24 MBH cooling capacity at an efficiency of 15 SEER.

Energy Savings Calculations:

Given Information

Estimated Cooling Load: Nominal 2 Tons, 24 MBH
Full-Load Cooling Hours: 1,200 hours per year (June through September)
Cost of Electricity: $0.144 / kWh

Existing Equipment

Cooling Efficiency: 9.15 SEER (Estimate based on age.)

New Equipment

Cooling Efficiency: 15.0 SEER

Cooling Energy Savings Calculations

$$EnergySavings = \frac{[CoolingTons \times 12{,}000\ Btu/ton]}{[1000\ W/kW]} \times \left(\frac{1}{EER_{OLD}} - \frac{1}{EER_{NEW}} \right) \times Hrs.ofCooling$$

$$EnergySavings = \frac{[2Tons \times 12{,}000\ Btu/ton]}{[1000\ W/kW]} \times \left(\frac{1}{9.15} - \frac{1}{15} \right) \times 1{,}200 \times 2\ units = \underline{2{,}460\ kWh\ per\ year}$$

Energy Cost Savings = 2,460 kWh x $0.144 / kWh = $355 per year

Estimated Demand Savings = kWh Saved / Hrs at Load = 2,460 kWh / 1200 hrs = 2.05 kW

NJ Smart Start® Program Incentives are calculated as follows:

From the **New Jersey Smart Start® Program Incentives Appendix**, the replacement of cooling only air handling unit totaling less than 2.0 cooling tons with efficiency greater than 14 SEER, warrants an incentive of $92 per cooling ton.

Smart Start® Equipment Incentive = (4 Tons x $92 per ton) = $368

Maintenance savings could not be calculated due to the fact that there is not adequate data to baseline the existing expenditures.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$12,000
NJ Smart Start Equipment Incentive ($):	$368
Net Installation Cost ($):	$11,632
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$355
Total Yearly Savings ($/Yr):	$355
Estimated ECM Lifetime (Yr):	15
Simple Payback	32.8
Simple Lifetime ROI	-54.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,325
Internal Rate of Return (IRR)	-8%
Net Present Value (NPV)	($7,394.03)

ECM #3: Exterior Building Lighting Upgrade

Description:

The exterior building lighting fixtures consist of six (6) 150-Watt high pressure sodium (HPS) wall-pack fixtures. Just as an automobile's fuel efficiency is measured in miles per gallon, lamp efficiency is measured in terms of lumens per watt – the amount of light produced for each watt of electricity consumed. Presently the 150-Watt lamps are only producing 60% of their full lumen potential due to lamp depreciations while a Compact Fluorescent Lamp (CFL) will produce almost the same lumen output but with less wattage.

This measure would replace the six (6) existing fixtures with CFL's that consist of one 120-Watt lamp as manufactured by Philips or equal.

Energy Savings Calculations:

It is estimated that the average nighttime hours for these fixtures is 10 hours per day x 365 days per year = 3,650 hours.

150 Watt HPS Input Wattage = 188 Watts

120 Watt Compact Fluorescent Input Wattage = 120 Watts

Energy Cost Savings = 6 Fixtures x (188 Watts – 120 Watts) x 3,650 hours x $0.144 / kWh = $215

Installation cost is $175 x 6 Units = $1,050

There are currently no Smart Start Incentives available for this ECM.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,050
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,050
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$215
Total Yearly Savings ($/Yr):	$215
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.9
Simple Lifetime ROI	207.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,225
Internal Rate of Return (IRR)	19%
Net Present Value (NPV)	$1,516.66

ECM #4: Install Compact Fluorescent Lamps

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 40-Watt incandescent lamp, a 15-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 23-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 your existing fixtures, or hardwired into your existing fixtures.

This ECM involves replacing all incandescent lamps in the facility with energy efficient compact fluorescent lamps.

Energy Savings Calculations:

There are five (5) 100-Watt and eight (8) 60-Watt incandescent lamps in the facility that can be upgraded to 23 and 18 Watt CFL units respectively. The average operating hours for these lamps is estimated to be 3,000.

Energy cost savings:

[5 units * (100W – 23W) + 8 units * (60W – 18W)] 3,000 hours * 1 kW/1,000 W * $0.144/kWh] = $311.47/yr

The installed cost of five (5) 23-Watt and eight (8) 18-Watt CFL's is $104.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$104
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$104
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$311
Total Yearly Savings ($/Yr):	$311
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.3
Simple Lifetime ROI	4392.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$4,672
Internal Rate of Return (IRR)	299%
Net Present Value (NPV)	$3,614.31

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation. The solar photovoltaic system calculation summary will be concluded as **REM#1** within this report.

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 3,375 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Using this square footage it was determined that a system size of 47.6 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 58,151 KWh annually, reducing the overall utility bill by approximately 23% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The 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.

The array system capacity was sized on available roof space on the existing facility. 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.

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

Table 7
Financial Summary – Photovoltaic System

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Direct Purchase	13.3 Years	-45%	6.1%

*The solar energy measure is shown for reference in the executive summary Renewable Energy Measure (REM) table

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. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate, and the kilowatt demand for the building is below the threshold (200 kW) for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

The Electric Usage Profile demonstrates a typical profile of a school facility. There is an increase at the start of the school year (September) and continues to increase steadily until March and begins to decline until June and thereafter. There are several sharp peaks and lows in the electrical demand throughout the year. The lows are due to minimal occupancy during the summer and spring and fall vacations. The highs are unexplainable, normally spikes like this are associated with uncontrolled air conditioning but the lack of central air conditioning throughout the school these peaks are unexplainable. A flatter load profile of this type will allow for more competitive energy prices when shopping for alternative suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile. The summer months (July – September) demonstrate extremely low consumption (complimenting the winter heating load). There is an increase in winter consumption (November – March). The increased winter load is caused by heating demand. In this facility the heat is supplied by natural gas fired hot water boilers located in the basement. These are the main contributors to the natural gas winter load profile. Also, domestic hot water is supplied by a natural gas fired hot water heaters. A base-load shaping (flat) will secure more competitive energy prices when procuring energy through an alternative energy source.

Tariff Analysis:

Electricity:

This facility receives electrical service through Atlantic City Electric (ACE) on an AGS (Annual General Service – 3 Phase) rate. Service classification AGS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer uses the service of Atlantic City Electric. This facility uses the Delivery Service of the utility (ACE). This delivery service includes the following charges: Delivery Service Charges, Distribution Demand Charges, Reactive Demand Charges, distribution Rates, 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.

Natural Gas:

This facility receives natural gas delivery service from the South Jersey Gas Company (SJG) on the Firm Transportation utility rate schedule. Customer may either purchase "gas supply" from a Third Party Supplier (TPS) or from South Jersey's Gas Basic Gas Supply Service default service as detailed in the rate schedule. The Pitman BOE has elected to utilize the Third Party Supply Services of PEPCO Energy Services to provide their natural gas commodity service.

The "delivery charges" under this tariff include the following: Customer Charge, Delivery Charge, BSC Volume Charge and Commodity Charge under this rate structure. The customer can elect to have its Supply (Commodity Charge) serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, then the customer will receive replacement service from the utility under an emergency sales rate schedule which carries an extremely high penalty cost of service, and is automatically delivered.

"TPS Supply Charges" are the charges for supply made by a Third Party company that makes delivery of supply to the local utility (City-Gate). Once delivered to the utility then the utility delivers the supply to the end-use customer. The delivery made by the utility, are the "delivery charges". The type of service provided by the utility tariff is said to be "firm transportation". Much like the telecom wires being deregulated, so were the natural gas pipelines. Various types of services are available within the pipeline. "Firm Service" is the highest reliability. "Firm Service" would be the last to be interrupted. Since this service is "firm" the utility would tell the TPS how much natural gas to delivery each month on behalf of the end-user.

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

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the BOE. Potential improvement is observed in both electric and natural gas costs. The average price per kWh (kilowatt hour) for all electricity based on a 1-year historical average price is $.111 / kWh (this is the average "price to compare" for energy supplied by Atlantic City Electric Company and for data supplied by Pitman BOE). The average price per decatherm for natural gas (as provided by PEPCO Energy Services as administered by the ACES agreement) is $10.94 / Dth (Dth, is the common unit of measure). This price is also the "price to compare".

The "price to compare" is the utility net price that would compare to an alternative suppliers offer. In electricity, this price would not include the utilities "wires" charges such as Transmission and Distribution. With regards to natural gas this would not include the utilities

"distribution" charges to the customers burner tip. The delivered product is said to be at the utilities City-Gate. From there the utility is in control of the delivery.

The BOE is able to have its electric or natural gas needs supplied via an alternative supply source TPS (Third Party Supplier). This supplier will make arrangements with producers, suppliers or hedge the product. TPS's are registered and licensed with the states Board of Public Utilities.
The Pitman BOE has gone a step further. The BOE has signed an agreement with the ACES (Alliance for Competitive Energy Services) which is an aggregator of energy for schools. The New Jersey School Board (NJSBA) is the acting lead agency, which can adopt a resolution to renew this agreement. PEPCO Energy Services has been contracted with the ACES/NJSBA agreement for natural gas service. CEG will *not* recommend a renewal of this agreement.

CEG does not recommend renewal of this agreement for contractual and economic reasons. It is our understanding that contracts cannot extend for (5) five years for schools. Additionally, CEG has observed that the BOE can see improvement in its energy costs if it were to arrange for supply from a Third Party Supplier on its own. CEG recommends the use of an "energy advisor" when making arrangements for its own "energy procurement program".

Furthermore the ACES (Alliance for Competitive Energy Services) agreement has a term through 2014. CEG is not in possession of the original ACES agreement only the resolution. CEG is aware that The Pitman BOE procures natural gas through the ACES agreement and it is possible that they also procure electricity through this agreement. If so CEG would also recommend that they not extend this agreement. If at all possible, CEG recommends terminating this agreement.

CEG does not recommend the use of the ACES agreement as it does not meet the needs of the schools. Schools, BOE and Local Governments are stricken by budgets. The ACES strategy does compliment the budget process. The budget needs to be created at the same time as the energy procurement.

Furthermore, the fixed price contract and the subsequent "blend and extend" strategy does not benefit the BOE. In order for an end-user to benefit from energy procurement: they must be able to protect the budget (through budget creation at the time of procurement), management of commodity (through active on-going involvement in the process), and by applying the "managed approach" to the procurement plan so that if prices fall the end-user can take advantage of that drop.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The BOE could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy increases. Based on annual historical consumption of this facility and current electric rates, the BOE could see an improvement in its electric costs of up to 19% or up to $47,000 annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's secondary recommendation coincides with the natural gas costs. Based on the current market, The BOE could improve its natural gas costs by up to 27% or up to $35,000 annually. CEG recommends that the BOE receive further advisement on these prices through an energy advisor. Through the use of an "energy advisor" the BOE should be able to procure natural gas on its own and create an "energy procurement program".

CEG also recommends that The BOE not renew its energy supply contract with the ACES aggregation and PEPCO Energy Solutions. The ACES agreement has demonstrated that the price is 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 The BOE 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 also recommends that The BOE schedule a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The BOE can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The BOE should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the 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 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. 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

Pitman Board of Education - Memorial Elementary School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Pneumatic Controls Conversion to DDC	$77,156	$77,156	$0	$154,312	$6,262	$3,000	$9,262	15	$138,930	$45,000	-10.0%	16.7	-1.28%	($43,742.85)
ECM #2	Air Handling Unit Replacement	$8,000	$4,000	$368	$11,632	$355	$0	$355	15	$5,325	$0	-54.2%	32.8	-8.48%	($7,394.03)
ECM #3	Exterior Building Lighting Upgrade	$600	$450	$0	$1,050	$215	$0	$215	15	$3,225	$0	207.1%	4.9	18.96%	$1,516.66
ECM #4	Install Compact Flourescent Lamps	$104	$0	$0	$104	$311	$0	$311	15	$4,665	$0	4385.6%	0.3	299.04%	$3,608.70
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	47.6 KW PV System	$380,880	$0	$0	$380,880	$8,374	$20,353	$28,727	25	$718,175	$508,825	88.6%	13.3	5.62%	$119,347.49

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

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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

STATEMENT OF ENERGY PERFORMANCE
Memorial Elementary School

Building ID: 1940873
For 12-month Period Ending: June 30, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: November 23, 2009

Facility
Memorial Elementary School
420 Hudson Ave.
Pitman, NJ 08071

Facility Owner
Pitman Board of Education
420 Hudson Avenue
Pitman, NJ 08071

Primary Contact for this Facility
Michele Roemer
420 Hudson Avenue
Pitman, NJ 08071

Year Built: 1962
Gross Floor Area (ft²): 38,578

Energy Performance Rating[2] (1-100) 74

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	851,226
Natural Gas (kBtu)[4]	1,717,246
Total Energy (kBtu)	2,568,472

Energy Intensity[5]

Site (kBtu/ft²/yr)	67
Source (kBtu/ft²/yr)	120

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	221

Electric Distribution Utility
Atlantic City Electric Co

National Average Comparison

National Average Site EUI	85
National Average Source EUI	154
% Difference from National Average Source EUI	-22%
Building Type	K-12 School

Stamp of Certifying Professional

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

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

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

Certifying Professional
Raymond Johnson
520 South Burnt Mill Rd.
Voorhees, NJ 08043

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

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

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Memorial Elementary School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	420 Hudson Ave., Pitman, NJ 08071	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Memorial Elementary School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	38,578 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.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	99	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	1	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	40 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	N/A(Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		

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))
06/01/2009	06/30/2009	17,920.00
05/01/2009	05/31/2009	19,200.00
04/01/2009	04/30/2009	31,840.00
03/01/2009	03/31/2009	19,280.00
02/01/2009	02/28/2009	20,640.00
01/01/2009	01/31/2009	21,520.00
12/01/2008	12/31/2008	24,160.00
11/01/2008	11/30/2008	19,280.00
10/01/2008	10/31/2008	24,160.00
09/01/2008	09/30/2008	16,920.00
08/01/2008	08/31/2008	17,920.00
07/01/2008	07/31/2008	16,640.00
Electric Meter Consumption (kWh (thousand Watt-hours))		**249,480.00**
Electric Meter Consumption (kBtu (thousand Btu))		**851,225.76**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**851,225.76**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Natural Gas Meter (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
06/01/2009	06/30/2009	46.58
05/01/2009	05/31/2009	126.27
04/01/2009	04/30/2009	2,587.67
03/01/2009	03/31/2009	1,103.17
02/01/2009	02/28/2009	3,443.78
01/01/2009	01/31/2009	3,787.62
12/01/2008	12/31/2008	3,248.94
11/01/2008	11/30/2008	2,056.46
10/01/2008	10/31/2008	546.96
09/01/2008	09/30/2008	75.63

08/01/2008	08/31/2008	65.79
07/01/2008	07/31/2008	83.59
Natural Gas Meter Consumption (therms)		**17,172.46**
Natural Gas Meter Consumption (kBtu (thousand Btu))		**1,717,246.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**1,717,246.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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.	☐

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
Memorial Elementary School
420 Hudson Ave.
Pitman, NJ 08071

Facility Owner
Pitman Board of Education
420 Hudson Avenue
Pitman, NJ 08071

Primary Contact for this Facility
Michele Roemer
420 Hudson Avenue
Pitman, NJ 08071

General Information

Memorial Elementary School	
Gross Floor Area Excluding Parking: (ft^2)	38,578
Year Built	1962
For 12-month Evaluation Period Ending Date:	June 30, 2009

Facility Space Use Summary

Memorial Elementary School	
Space Type	K-12 School
Gross Floor Area(ft^2)	38,578
Open Weekends?	No
Number of PCs	99
Number of walk-in refrigeration/freezer units	1
Presence of cooking facilities	Yes
Percent Cooled	40
Percent Heated	100
Months[o]	N/A
High School?	No
School District[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 06/30/2009)	**Baseline** (Ending Date 06/30/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	74	74	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	67	67	67	N/A	85
Source (kBtu/ft^2)	120	120	120	N/A	154
Energy Cost					
$/year	$ 62,612.00	$ 62,612.00	$ 62,555.58	N/A	$ 79,990.64
$/$ft^2$/year	$ 1.62	$ 1.62	$ 1.62	N/A	$ 2.07
Greenhouse Gas Emissions					
$MtCO_2e$/year	221	221	221	N/A	282
$kgCO_2e/ft^2$/year	6	6	6	N/A	8

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

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

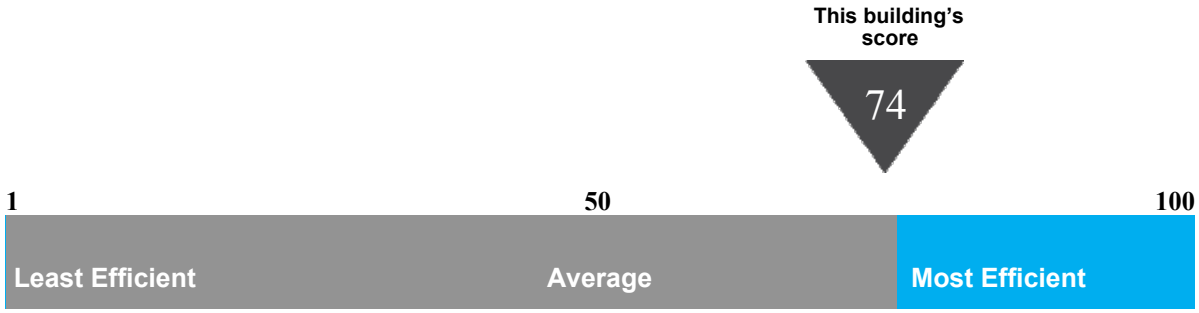
Statement of Energy Performance

2009

Memorial Elementary School
420 Hudson Ave.
Pitman, NJ 08071

Portfolio Manager Building ID: 1940873

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 120 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending June 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 11/23/2009

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Pitman Board of Education - Memorial Elementary School"

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Boiler Room	Entire School	Aerco	1	BMK-2.0LN	2,000	1860	92.3%	Natural Gas	3	20	17
Boiler Room	Entire School	Aerco	1	BMK-2.0LN	2,000	1860	92.3%	Natural Gas	3	20	17

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	Entire School	B & G	2	Series 1531	-	-	215JM	200	3	3	20	17	Pumps only run in winter months

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Capacity (gal)	kW Rating	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	Entire School	Bradford White	1	M280R6DS-1NCWW	80	2 elements, 3,500 watts per element	Electric	3	15	12	Operates only in summer months

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Cooling Type	Cooling Capacity	Cooling Efficiency	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Ph	Hz	Approx. Age	ASHRAE Service Life	Remaining Life
Rooftop	Child Study	York	1	D1NA030N05606C	DX R-22	2.5 tons	12.0 SEER	Natural Gas	70,000	56,000	80%	Natural Gas	208/230	1	60	2	15	13
Rooftop	Administration	Lennox	2	CHA16-261-3P	DX R-22	2 Ton	9.0 SEER	N/A	-	-	-	-	203/230	1	60	15	15	0

AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Refrigerant	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Roof	Computer	Lennox	1	13ACD-060	R-22	230	1	3	15	12
Roof	Guidance	Airedale	4	SCC12D	R-22	208/230	1	10	15	5
Roof	D110	Lennox	1	HS29-072	R-22	230	1	3	15	12
Roof	D111	Lennox	1	13ACD-042	R-22	230	1	3	15	12

Air Compressor

Location	Area Served	Manufacturer	Qty.	Model #	Capacity	Volts	Phase	FLA	Approx. Age	ASHRAE Service Life	Remaining Life
Boiler Room	All	Speedaire	1	5Z699B	60 GALLON	208/230	3	-	11	15	4

Unit Ventilators

Location	Area Served	Manufacturer	Qty.	Model #	Fan HP	Fan CFM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life
Classroom	Classrooms	AAF	-	U.V.AVS.6.S13	1/4	1,250	208	1	15	5	15	10

Investment Grade Lighting Audit

CEG Job #: 9C09067
Project: Pitman Board of Education
Address: 420 Hudson Ave.
Pitman NJ 08071
Building SF: 38,578

"Pitman Board of Education - Memorial Elementary School"

KWH COST: $0.144

EXISTING LIGHTINC										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	Boiler Room	400	5	1	Porcelain Socket, 1 25w CFL	28	0.14	56.0	$8.06	5	0	No Change Required (NCR)	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
2	Exterior	3000	8	1	50w HPS Flood	72	0.58	1,728.0	$248.83	8	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
3		3000	7	1	1x1 1 Lamp 50w HPS, Surface Mnt.	72	0.50	1,512.0	$217.73	7	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
4		3000	6	1	150w HPS Wall Pack	188	1.13	3,384.0	$487.30	6	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
5	Corridors	3000	29	2	1x4 2 Lamp 32w T8 Elect. Ballast, Wall Mnt., Prismatic	57	1.65	4,959.0	$714.10	29	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		3000	27	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	3.02	9,072.0	$1,306.37	27	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
7	Gym	3000	45	2	4' Channel, 2 Lamp 32w T8, Elect. Ballast, Pendant Mnt., No Lens	57	2.57	7,695.0	$1,108.08	45	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
8	Stage	3000	5	1	"Jelly Jar" Wall Mnt. 1 Lamp A19 100w	100	0.50	1,500.0	$216.00	5	1	23 Watt Compact Flourescent	23	0.12	345	$49.68	$8.00	$40.00	0.39	1155	$166.32	0.24
9	Gym Storage	400	2	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.11	45.6	$6.57	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Kitchen	3000	4	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.23	684.0	$98.50	4	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	Women's Restroom	3000	2	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.11	342.0	$49.25	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
1	Custodial Closet	400	2	1	Porcelain Socket, 1 25w CFL	28	0.06	22.4	$3.23	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	Men's restroom	3000	2	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.11	342.0	$49.25	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6	Child Study Team	3000	17	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	1.90	5,712.0	$822.53	17	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
10	Vault	3000	2	1	4' Channel, 1 Lamp 32w T8, Elect. Ballast, Pendant Mnt., No Lens	34	0.07	204.0	$29.38	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6	Main Entrance	3000	3	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.34	1,008.0	$145.15	3	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	Boy's Lav.	3000	2	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.11	342.0	$49.25	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	Girl's Lav.	3000	2	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.11	342.0	$49.25	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	Girl's Lav.	3000	2	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.11	342.0	$49.25	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	Boy's Lav.	3000	2	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.11	342.0	$49.25	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

6	Room 101B	3000	2	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.22	672.0	$96.77	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6	Room 101C	3000	2	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.22	672.0	$96.77	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6	Room 101D	3000	2	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.22	672.0	$96.77	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6	Room 101E	3000	2	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.22	672.0	$96.77	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	"Board" Storage	400	4	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.23	91.2	$13.13	4	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	Main Office	3000	12	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.68	2,052.0	$295.49	12	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
11		3000	2	4	1x4 4 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	112	0.22	672.0	$96.77	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		3000	4	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.45	1,344.0	$193.54	4	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Board Office	3000	28	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	1.60	4,788.0	$689.47	28	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Conference Room	3000	4	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.23	684.0	$98.50	4	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		3000	2	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.22	672.0	$96.77	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Board Office	3000	12	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.68	2,052.0	$295.49	12	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
12		3000	1	2	12" Round Surface Mnt., 2 Lamp A19 60w	120	0.12	360.0	$51.84	1	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6	Board Kitchen	3000	4	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.45	1,344.0	$193.54	4	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1		3000	4	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.23	684.0	$98.50	4	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6	Nurse's Office	3000	2	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.22	672.0	$96.77	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1		3000	4	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.23	684.0	$98.50	4	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
12	Nurse's Bathroom	400	1	2	12" Round Surface Mnt., 2 Lamp A19 60w	120	0.12	48.0	$6.91	1	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 108	3000	19	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	1.08	3,249.0	$467.86	19	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
14		3000	2	6	4x4 6 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic Lens	169	0.34	1,014.0	$146.02	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
15	Bathroom 108	3000	1	1	6"x6" 1 Lamp 60w A19, Prismatic Lens	60	0.06	180.0	$25.92	1	1	18 Watt Compact Flourescent	18	0.02	54	$7.78	$8.00	$8.00	0.04	126	$18.14	0.44

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9.1	Classroom 109	3000	19	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	1.08	3,249.0	$467.86	19	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
14		3000	2	6	4x4 6 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic Lens	169	0.34	1,014.0	$146.02	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
15	Bathroom 109	3000	1	1	6"x6" 1 Lamp 60w A19, Prismatic Lens	60	0.06	180.0	$25.92	1	1	18 Watt Compact Flourescent	18	0.02	54	$7.78	$8.00	$8.00	0.04	126	$18.14	0.44
13	Media Center	3000	48	2	4' Indirect 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt.	57	2.74	8,208.0	$1,181.95	48	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom D-110	3000	20	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	1.14	3,420.0	$492.48	20	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		3000	3	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.34	1,008.0	$145.15	3	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
15	Bathroom 110	3000	1	1	6"x6" 1 Lamp 60w A19, Prismatic Lens	60	0.06	180.0	$25.92	1	1	18 Watt Compact Flourescent	18	0.02	54	$7.78	$8.00	$8.00	0.04	126	$18.14	0.44
9.1	Classroom 111	3000	20	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	1.14	3,420.0	$492.48	20	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		3000	3	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.34	1,008.0	$145.15	3	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
15	Bathroom 111	3000	1	1	6"x6" 1 Lamp 60w A19, Prismatic Lens	60	0.06	180.0	$25.92	1	1	18 Watt Compact Flourescent	18	0.02	54	$7.78	$8.00	$8.00	0.04	126	$18.14	0.44
1	Storage 111	400	1	1	Porcelain Socket, 1 25w CFL	28	0.03	11.2	$1.61	1	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 112	3000	18	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	1.03	3,078.0	$443.23	18	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
15	Bathroom 112	3000	1	1	6"x6" 1 Lamp 60w A19, Prismatic Lens	60	0.06	180.0	$25.92	1	1	18 Watt Compact Flourescent	18	0.02	54	$7.78	$8.00	$8.00	0.04	126	$18.14	0.44
1	Storage 112	400	1	1	Porcelain Socket, 1 25w CFL	28	0.03	11.2	$1.61	1	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 113	3000	18	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	1.03	3,078.0	$443.23	18	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
15	Bathroom 113	3000	1	1	6"x6" 1 Lamp 60w A19, Prismatic Lens	60	0.06	180.0	$25.92	1	1	18 Watt Compact Flourescent	18	0.02	54	$7.78	$8.00	$8.00	0.04	126	$18.14	0.44
1	Storage 113	400	1	1	Porcelain Socket, 1 25w CFL	28	0.03	11.2	$1.61	1	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 114	3000	15	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.86	2,565.0	$369.36	15	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
15	Bathroom 114	3000	1	1	6"x6" 1 Lamp 60w A19, Prismatic Lens	60	0.06	180.0	$25.92	1	1	18 Watt Compact Flourescent	18	0.02	54	$7.78	$8.00	$8.00	0.04	126	$18.14	0.44
9.1	Classroom 115	3000	15	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.86	2,565.0	$369.36	15	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
15	Bathroom 115	3000	1	1	6"x6" 1 Lamp 60w A19, Prismatic Lens	60	0.06	180.0	$25.92	1	1	18 Watt Compact Flourescent	18	0.02	54	$7.78	$8.00	$8.00	0.04	126	$18.14	0.44
9.1	Classroom 116	3000	15	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.86	2,565.0	$369.36	15	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 117	3000	15	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.86	2,565.0	$369.36	15	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 118	3000	12	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.68	2,052.0	$295.49	12	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

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9.1	Classroom 119	3000	12	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.68	2,052.0	$295.49	12	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 120	3000	12	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.68	2,052.0	$295.49	12	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
11		3000	2	4	1x4 4 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	112	0.22	672.0	$96.77	2	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	Classroom 101A	3000	4	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.23	684.0	$98.50	4	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9	Classroom 101F	3000	8	2	1x4 2 Lamp 32w T8 Elect. Ballast, Surface Mnt., Prismatic	57	0.46	1,368.0	$196.99	8	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 103	3000	12	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.68	2,052.0	$295.49	12	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		3000	3	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.34	1,008.0	$145.15	3	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 104	3000	12	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.68	2,052.0	$295.49	12	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		3000	3	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.34	1,008.0	$145.15	3	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 105	3000	12	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.68	2,052.0	$295.49	12	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		3000	3	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.34	1,008.0	$145.15	3	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
9.1	Classroom 106	3000	12	2	1x4 2 Lamp 32w T8 Elect. Ballast, Pendant Mnt., Prismatic	57	0.68	2,052.0	$295.49	12	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		3000	3	4	2x4 4 Lamp 32w T-8 Elect Ballast, Recessed, Prismatic	112	0.34	1,008.0	$145.15	3	0	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		619	184			41.67	123,069	$17,721.91	619	9			0.26	777	$111.89		$104.00	0.72	2163	$311.47	0.33

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

2. Lamp totals only include T-12 tube replacement calculations

Project Name: **Pitman BOE - Memorial Elementary School**
Location: **Pitman, NJ 08071**
Description: **Photovoltaic System - Direct Purchase**

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$380,880
Annual kWh Production	58,151
Annual Energy Cost Reduction	$8,374
Annual SREC Revenue	$20,353
First Cost Premium	**$380,880**
Simple Payback:	**13.3** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.144**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$380,880	0	0	0	$0	(380,880)	0
1	$0	58,151	$8,374	$0	$20,353	$28,727	($352,153)
2	$0	57,860	$8,625	$0	$20,251	$28,876	($323,277)
3	$0	57,571	$8,884	$0	$20,150	$29,034	($294,244)
4	$0	57,283	$9,150	$0	$20,049	$29,199	($265,045)
5	$0	56,997	$9,425	$587	$19,949	$28,786	($236,258)
6	$0	56,712	$9,707	$584	$19,849	$28,972	($207,286)
7	$0	56,428	$9,999	$581	$19,750	$29,167	($178,118)
8	$0	56,146	$10,299	$578	$19,651	$29,371	($148,747)
9	$0	55,865	$10,608	$575	$19,553	$29,585	($119,162)
10	$0	55,586	$10,926	$573	$19,455	$29,808	($89,353)
11	$0	55,308	$11,254	$570	$19,358	$30,042	($59,312)
12	$0	55,031	$11,591	$567	$19,261	$30,285	($29,026)
13	$0	54,756	$11,939	$564	$19,165	$30,540	$1,513
14	$0	54,483	$12,297	$561	$19,069	$30,805	$32,318
15	$0	54,210	$12,666	$558	$18,974	$31,081	$63,399
16	$0	53,939	$13,046	$556	$18,879	$31,369	$94,769
17	$0	53,669	$13,437	$553	$18,784	$31,669	$126,437
18	$0	53,401	$13,841	$550	$18,690	$31,981	$158,418
19	$0	53,134	$14,256	$547	$18,597	$32,305	$190,724
20	$0	52,868	$14,683	$545	$18,504	$32,643	$223,366
21	$1	52,604	$15,124	$542	$18,411	$32,993	$256,360
22	$2	52,341	$15,578	$539	$18,319	$33,358	$289,718
23	$3	52,079	$16,045	$536	$18,228	$33,736	$323,454
24	$4	51,819	$16,526	$534	$18,137	$34,129	$357,583
25	$5	51,560	$17,022	$531	$18,046	$34,537	$392,120
	Totals:	1,109,399	$225,006	$9,049	$388,290	$773,000	$604,246
				Net Present Value (NPV)		**$392,145**	
				Internal Rate of Return (IRR)		**6.1%**	

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
Memorial Elementary School	3375	Sunpower SPR230	207	14.7	3,044	47.6	58,151	6,831	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:	47.6 kW
DC to AC Derate Factor:	0.810
AC Rating:	38.6 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	14.4 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.58	3092	445.25
2	3.33	3651	525.74
3	4.31	5099	734.26
4	5.20	5808	836.35
5	5.85	6634	955.30
6	6.14	6457	929.81
7	6.06	6523	939.31
8	5.54	5994	863.14
9	4.85	5154	742.18
10	3.76	4208	605.95
11	2.65	2949	424.66
12	2.23	2582	371.81
Year	4.38	58151	8373.74

.= Proposed PV Layout

Notes:

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