ENERGY AUDIT – FINAL REPORT

RUTHERFORD BOARD OF EDUCATION
RUTHERFORD HIGH SCHOOL
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RUTHERFORD, NJ 07070
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CEG PROJECT NO. 9C09074

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I. EXECUTIVE SUMMARY

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

Rutherford Board of Education
Rutherford High School
56 Elliott Place
Rutherford, NJ 07070

Municipal Contact Person: Anthony Paterno
Facility Contact Person:

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

The annual energy costs at this facility are as follows:

Electricity	$ 256,094
Natural Gas	$ 184,565
Total	$440,659

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

Table 1
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	Window Replacement Along the Mortimer Wing	$119,700	$9,305	12.9	-10.1%
ECM #2	Solar Array, New Roof, and Roof Insulation at Mortimer	$1,432,440	$92,050	15.6	-51.6%
ECM #3	NEMA Premium® Efficiency Motors	$12,268	$1,260	9.7	105.4%
ECM #4	Convert Pneumatics to DDC	$160,000	$14,200	11.3	-13.8%
ECM #5	Install Thermostatic Radiator Valves	$91,000	$11,228	8.1	52.1%
ECM #6	High-Efficiency Steam Boiler	$175,322	$22,499	7.8	192.3%
ECM #7	Pool Dehumidification/Heat Recovery System	$600,000	$54,843	10.9	37.1%
ECM #8	Replace Pool Hot Water Boiler & Hot Water Pump	$125,500	$18,204	6.9	222.8%
ECM #9	Dual Technology Lighting Controls	$5,655	$1,370	4.1	263.4%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	PV Roof system	$1,432,440	$92,050	15.6	-51.6%

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 are shown below in Table 2. The information in this table corresponds to the ECM's 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	Window Replacement Along the Mortimer Wing	0	0	2,578
ECM #2	Solar Array, New Roof, and Roof Insulation at Mortimer	0	195,395	0
ECM #3	NEMA Premium® Efficiency Motors	0	8,344	0
ECM #4	Convert Pneumatics to DDC	0	0	5,509
ECM #5	Install Thermostatic Radiator Valves	0	0	5,526
ECM #6	High-Efficiency Steam Boiler	0	0	12,275
ECM #7	Pool Dehumidification/Heat Recovery System	0	0	32,840
ECM #8	Replace Pool Hot Water Boiler & Hot Water Pump	0	0	9,703
ECM #9	Dual Technology Lighting Controls	0	9,072	0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	PV Roof system	0	195,395	0

Concord Engineering Group (CEG) strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The potential energy and cost savings from these ECM's are too great to pass upon. The following Energy Conservation Measures are recommended for the Rutherford High School:

- **ECM #2:** Solar Array, New Roof, and Roof Insulation at Mortimer Wing
- **ECM #3:** NEMA Premium® Efficiency Motors
- **ECM #5:** Install Thermostatic Radiator Valves

- **ECM #6:** High-Efficiency Steam Boiler
- **ECM #7:** Pool Dehumidification/ Heat Recovery System
- **ECM #8:** Replace Pool Hot Water Boiler/HW Pump
- **ECM #9:** Dual Technology Lighting Controls

Incentives provide financial motivation and much needed support for the implementation of energy conservation measures. Along with the NJ Smart Start program, the Pay for Performance Program incentives, sponsored by NJ Clean Energy Program, are suited favorably for this facility and its energy saving opportunities. It is expected through the implementation of multiple recommended ECMs, that this facility could reduce its overall energy consumption by more than 15%. The existing average operating demand above 200 KW and high energy consumption suggests the potential to qualify for the pay for performance program through the implementation of multiple ECMs. The incentive based on a 15% energy reduction for this facility would qualify for an additional $75,840 in the pay for performance program. This option is one to consider for a whole-building approach to energy reduction. CEG recommends the Owner review this option in more detail with a Pay for Performance Partner.

II. INTRODUCTION

This comprehensive energy audit covers the 148,627 square foot Rutherford High School facility that includes classrooms, pool, gymnasiums, fitness center, library, auditorium, cafeteria/kitchen, music rooms, administrative offices, locker rooms, computer labs, etc. The original structure was built in 1938 with a major renovation/addition in 2005.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

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

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

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

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

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

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from January-08 to December-08. The School District was able to gather the information for the above-reference period for our review and analysis. The Public Service Electric and Gas Company (PSE&G) provides electricity to the facility under their Large Power and Lighting Secondary Service (LPLS) Rate. This particular rate encompasses general purposes at secondary distribution voltages where the customer's demand exceeds 150 Kilowatts in any one month. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the most current rate structure available. PSE&G still provides the electric service distribution to the facility.

Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from January-08 to December-08. Rutherford High School receives natural gas via two means. Hess Corporation is a Third Party Supplier (TPS) that the owner has contracted with to provide the commodity side of the natural gas supply. PSE&G, under their basic general delivery rate, provides delivery of the natural gas supply to the facility.

Based on the utility data provide by the School District, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	15.1¢ / kWh
Natural Gas	$1.67 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: PSE&G
Rate: LPLS
Meter No: 778013371
Customer ID No: -
Third Party Utility -
TPS Meter / Acct No: -

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-08	136,500	354.0	$16,835
Feb-08	159,000	336.0	$19,240
Mar-08	133,800	330.0	$16,861
Apr-08	126,600	339.0	$15,859
May-08	129,451	409.6	$16,300
Jun-08	139,561	531.9	$17,980
Jul-08	168,578	564.7	$31,603
Aug-08	146,023	451.0	$27,521
Sep-08	117,536	398.0	$23,685
Oct-08	155,452	544.6	$30,410
Nov-08	147,367	395.1	$21,138
Dec-08	134,713	328.3	$18,662
Totals	**1,694,581**	**564.7 Max**	**$256,094**

AVERAGE DEMAND 415.2 KW average

AVERAGE RATE $0.151 $/kWh

Figure 1
Electricity Usage Profile

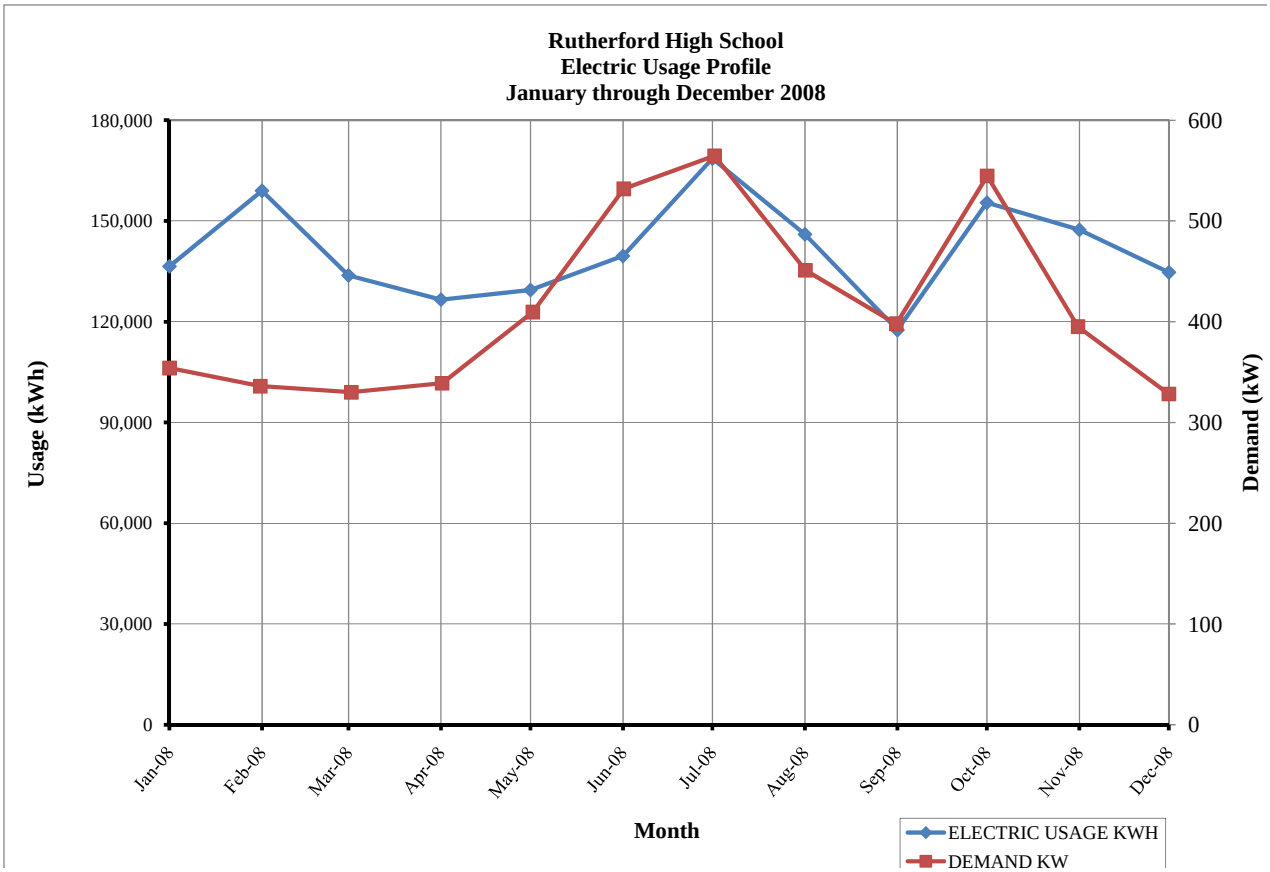


Table 4
Natural Gas Billing Data

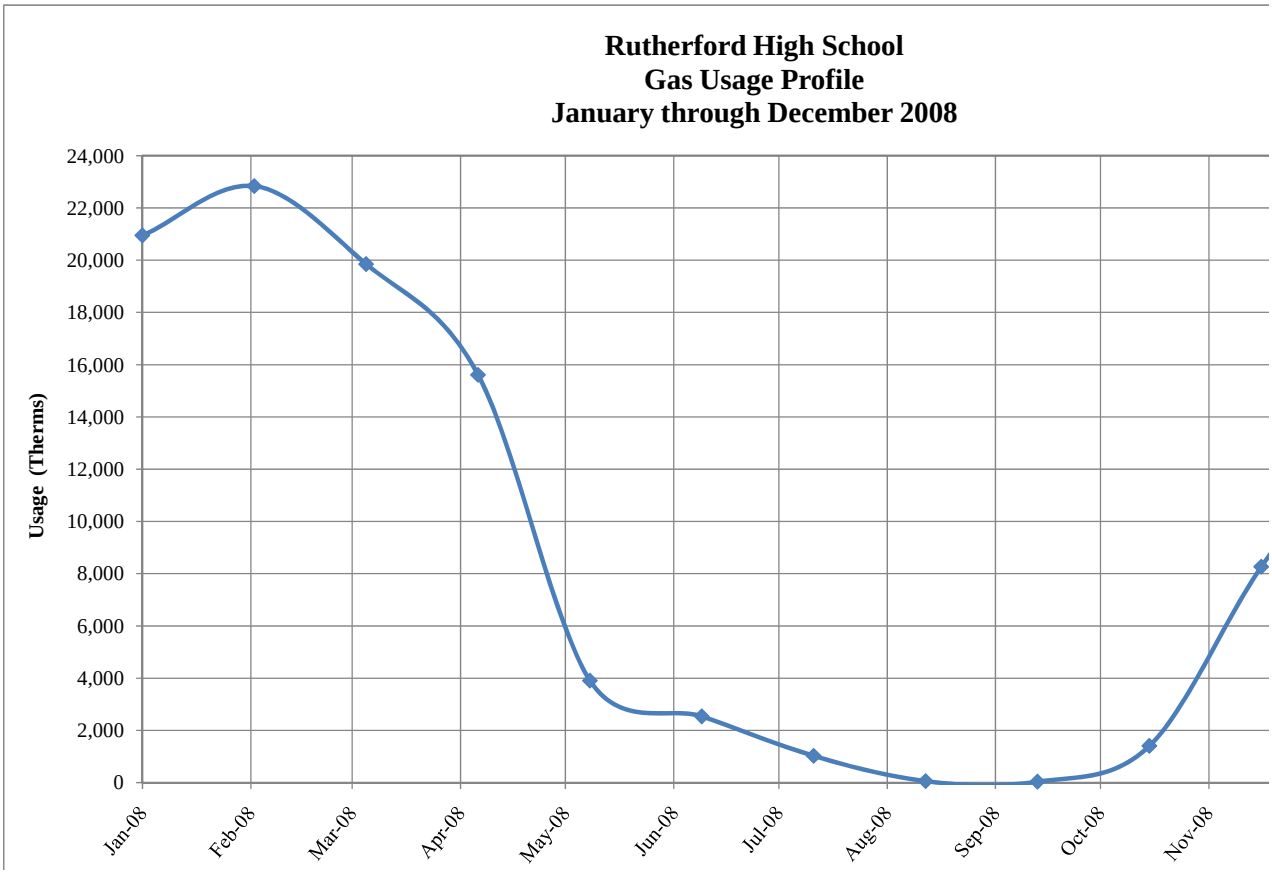
NATURAL GAS USAGE SUMMARY

Utility Provider: PSE&G
Rate: LVG
Meter No: 3166094 / 2209068
Point of Delivery ID: PE00000595919354421
Third Party Utility Provider: Hess
TPS Meter No: 21-003-470-12-2209068 / 21-003-470-12-3166094

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Jan-08	20,950.73	$36,495.98
Feb-08	22,839.73	$39,503.66
Mar-08	19,853.00	$34,316.83
Apr-08	15,612.31	$23,676.51
May-08	3,905.78	$6,080.48
Jun-08	2,538.76	$4,043.26
Jul-08	1,028.71	$1,944.71
Aug-08	60.85	$291.68
Sep-08	39.63	$239.55
Oct-08	1,409.82	$2,082.04
Nov-08	8,266.83	$14,173.83
Dec-08	13,806.02	$21,714.60
TOTALS	**110,312.16**	**$184,563.13**

AVERAGE RATE: $1.673 $/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:

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

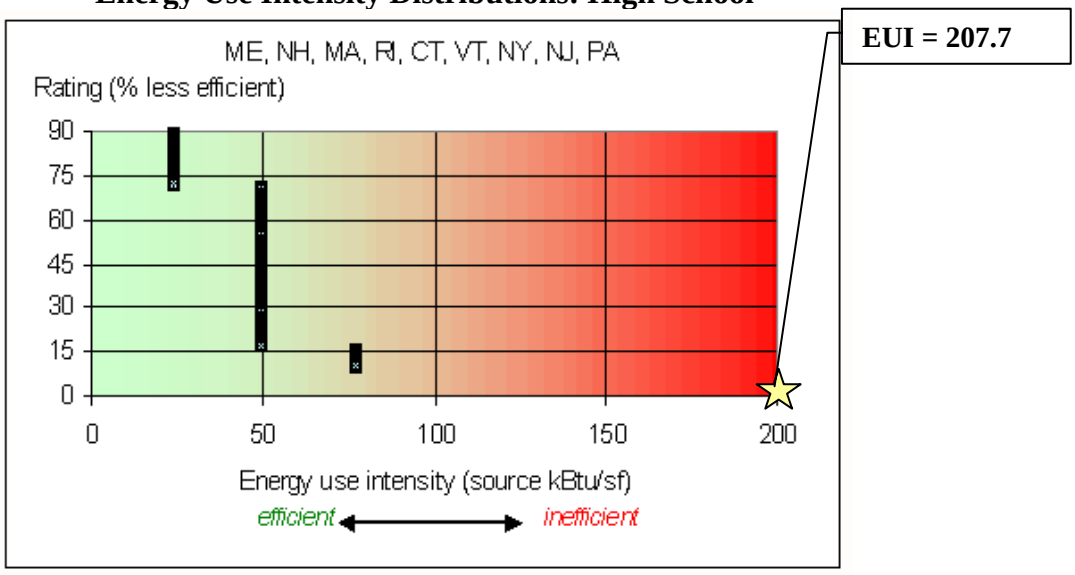
$$Building\ \ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio + Gas\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio)}{Building\ \ Square\ \ Footage}$$

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	1694581.0			5,785,300	3.340	19,322,900
NATURAL GAS		110312.1		11,031,212	1.047	11,549,679
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				16,816,511		30,872,579
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		148,627	SQUARE FEET			
BUILDING SITE EUI		*113.15*	kBtu/SF/YR			
BUILDING SOURCE EUI		*207.72*	kBtu/SF/YR			

Figure 3 below depicts a national EUI grading for the source use of *Schools*

Figure 3
Energy Use Intensity Distributions: High 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: rutherfordtwp
Password: lgeaceg2009

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

Utilizing the utility bills and other information gathered during the energy audit process, CEG entered the respective data into Portfolio Manager and the following is a summary of the results:

Table 6
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Rutherford High School	20	50

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

V. FACILITY DESCRIPTION

The 148,627 SF Rutherford High School is comprised of classrooms, a large auditorium with stage, administrative offices, a faculty room, pool, gymnasiums, laboratory classrooms, specialized media center, technology rooms, cafeteria, music rooms, etc. The typical hours of operation for this facility are between 7:00 am and 3:30 pm for the classrooms, and 6:30 am and 5:00 pm for the aforementioned offices. There are also numerous after school activities, pool usage and community functions in the evenings and weekends. Originally built in 1938, the school has undergone additions and renovations over the years with a large project in 2005. This renovation/addition was completed in 2007 and increased the square footage of the school. The 2005 structure is masonry walls with brick veneer. Floor deck construction is steel structure with steel decking and poured concrete. The new roof is a flat built-up type with approximately 2" rigid insulation, waterproof membrane, and not ballasted. The balance of the roof assemblies are constructed of a built-up roof with light color stone ballast. Typical windows throughout most of the facility are double pane ¼" thermal panels with aluminum frames.

The Mortimer Street Wing has single pane, plexi-glass windows and aluminum frames with high air leakage/infiltration rates. The caulking/weather stripping around the windows as deteriorated to the point that large air leakages can be felt at most windows. The roof has little to no insulation and is ponding with standing water after each rainfall.

Heating Plant

Some of the older sections of the school are heated by a 1989 Superior 150 LS steam boiler and a 1987 HB Smith steam boiler with 18 sections. The Superior 150 HP steam boiler is rated at 5,175 lb/hr steam @ 212ºF and the HB Smith steam boiler rating is 6,522 lb/hr steam @ 212ºF. The Superior boiler has a history of premature tube leaks and low-efficiency. The HB Smith boiler has a higher efficiency and less maintenance costs to date.

The balance of the older sections is heated by a Burkay Genesis Model No. GB 1850 modular, gas-fired, hot water boiler rated at 1,850 MBH input and 1,554 MBH output for a rated efficiency of 84%. Two Bell & Gossett Size 80 primary circulating pumps rated at 154 GPM each circulate the hot water thru the modular units. Two (2) Bell & Gossett Series VSC secondary hot water pumps rated at 442 GPM each with 20 HP motors send hot water to various hot water coils in the rooftop air handlers and other smaller terminal units.

The 2005 addition is heated by three (3) Patterson-Kelley Modu-Fire® Model No.N2000-MFD, forced draft, gas-fired, hot water boilers rated at 2,000 MBH input and 1,700 MBH output for a rated efficiency of 85%. The two (2) hot water pumps are Bell & Gossett, Series 1510, Model No. 4BC units rated at 540 GPM with 10 HP motors. Each pump is equipped with a variable speed drive and premium efficiency motors.

Cooling System

Cooling in the newer sections of the school is performed via chilled water produced by a Trane Model RTAC 2254, air-cooled chiller that has a nominal rating of 225 Tons. The chilled water is pumped to the York rooftop units and other smaller air handlers by two (2) Bell & Gossett Model

VSC BF pumps rated at 442 GPM with 20 HP motors and variable speed drives. The cooling in the oldest sections of the facility is performed by small window AC units. In addition, ductless split systems serve various data/phone closets with the condenser/compressor units on the roof. Cooling in the older sections of the building is performed by window AC units.

Air Distribution System

The rooftop air handling units consist of two (2) York Model CP215DWDIAF, 10,700 CFM units and one (1) York Model CP350DWDIAF, 15,100 CFM unit both with dual temperature, hot water heating and chilled water cooling coils. The indoor units consist of a York Solutions® Model XTI-060X078 rated at 12,000 CFM and an Annexair Energy Recovery Unit Model ERP-E-07-HW05-HC rated at 7,200 CFM with a heat recovery wheel. There are four (4) York air handling units in mechanical closets in Rooms 208/210 that range from 4-Tons to 6-Tons that were installed in 2005.

Exhaust System

Exhaust air for this facility is exhausted from each space via rooftop exhaust fans of various sizes. Exhaust fans are either operated based on the facility occupancy schedule or interlocked to the associated equipment via relays.

Domestic Hot Water

Domestic hot water for the 2005 addition to the facility is provided by a Rheem Model G91-200 gas-fired hot water heater with a 91-gallon capacity and 200,000 Btu/h input. Domestic hot water is circulated by a Bell & Gossett 1/6 HP pump. The older sections of the school are served by a Bradford White gas-fired hot water heater with a 80-gallon capacity and 180,000 Btu/h input..

HVAC Control System

The school district has upgraded the newer sections to an Automated Logic system. The 2005 addition, along with the newer HVAC equipment, is controlled via the DDC system and is operated on a facility occupancy schedule as set by the School District. The School District has control of the DDC system via a computer front-end located in the New Boiler Room.

The older sections of the facility have pneumatic controls that are manually operated via a control panel in the old boiler room. The pneumatic controls seem to be maintained properly with no apparent loss of air in the system – the air compressor was not cycling on and off during our site inspection. The valves, steam traps, and pneumatic controls seem to be well maintained.

Pool Systems

The pool is heated by a 1988 Bryan hot water boiler rated at 2,100 MBH input and 1,680 MBH output with a rated efficiency of 80% when it was new. The pool water pump is located in a pit, shows signs of heavy corrosion/rust and has a 15 HP motor. The pool facility is heated and ventilated by a 100% outside air Trane Penthouse Climate Changer Model PCCB constant volume unit rated at 6,000 CFM with hot water coil and an economizer for outside air cooling when appropriate. The pool facility is exhausted by a 5-HP fan on the roof that runs 24/7.

Lighting

The lighting in the 2005 Renovation/Addition project has 32-Watt T-8 lamps and electronic ballast while the older sections are lit by 28-Watt Super T-8 lamps. The New Gymnasium is lit by (32) T-5 light fixtures and the smaller, old gym is lit by (12) T-5 light fixtures located at approximately 30'-0" above the finished floor. Each fixture contains four 54-Watt High Output lamps. Compact Fluorescent Lamps (CFL) are used throughout the facility.

All exit signs are of the latest LED lamp design.

See Appendix E for a detailed listing of the lighting in this facility.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Exterior Window Replacement along the Mortimer Wing

Description:

The classrooms, woodshop, weight room, restrooms, offices, etc. on both sides of most of the Mortimer Wing have single pane, ¼ inch, non-insulated, glass with aluminum frame windows that are 1950's vintage and in deteriorated condition. The excessive heat loss and the cold/hot air infiltration make the HVAC system use much more energy to heat and ventilate the spaces.

This ECM would replace the single, non-insulated glass, aluminum frame, and hardware with the thermal pane, tinted windows and insulated frames that have been installed in the rest of the facility along with caulking/sealing around the new windows for substantially decreased infiltration. By installing these window upgrades, the heating energy costs along with the O&M costs of maintaining these old window systems will be greatly reduced.

A detailed measurement of all applicable exterior perimeter windows along both sides of the Mortimer Wing resulted in a total square footage of 12,448 SF.

Energy Savings Calculations:

The existing glass area is single glazed, non-tinted, and installed with plexi-glass sheets in many large areas. We have assumed that the existing air filtration is 0.8 CFM/SF and the U-value of the existing glass (plexi-glass) area is 0.87. The air filtration of the new window systems is 0.15 CFM/SF and the U-value of the new glass is 0.28

Savings are based upon the increased insulation provided by double-pane windows as compared to single-pane windows as well as the reduced amount of air leaking into the spaces from the new window installation. Weather data from the Newark airport and operating set points for the facility were used to determine the temperature difference throughout the year. The following equations were used for the purposes of energy savings calculations.

Energy savings calculations:

Heating Degree Days = 5,539°F – day/yr.

Cooling Degree Days = 918°F – day/yr.

Total window area to be retrofitted = 12,448 SF

Uexist. = 0.87 Btu/hr – ft^2 - °F

CEG would recommend replacement of the existing single pane windows with a commercial window product that meets or exceeds the following performance characteristic. U-Factor = 0.28, Solar Heat Gain Coefficient = 0.21 and Visible Transmittance = 0.49.

Unew = 0.28 Btu/hr – ft^2 - °F

Annual Energy Savings (Heating) = 10 hrs * Window Areas * (Uexist-Unew) * HDD

= 10 * 12,448 * (0.87-0.28) * 5,539 = 406.8 MMBtu = 4,068 Therms

Energy Savings = 4,068 Therms x $1.67 = $6,794

Upgraded window system with insulated panels above/below the windows is $1,244,800.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,244,800
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,244,800
Maintenance Savings ($/Yr):	$5,000
Energy Savings ($/Yr):	$6,794
Total Yearly Savings ($/Yr):	$11,794
Estimated ECM Lifetime (Yr):	25
Simple Payback	105.5
Simple Lifetime ROI	-10.1%
Simple Lifetime Maintenance Savings	$125,000
Simple Lifetime Savings	$107,625
Internal Rate of Return (IRR)	-9%

ECM #2: Solar Array, and New Roofs at Mortimer and 1922 Wings

Description:

Solar electric (photovoltaic or "PV") technology is a proven and highly dependable means of producing electricity from sunlight. PV modules, the basic building blocks of PV arrays, are warranted for 20-25 years. Most modules are expected to produce electricity for 30-40 years. The arrays are installed on a steel framework that is attached to the concrete slab under the roofing. Because PV arrays produce direct current (DC), it is necessary to convert to alternating current (AC) used in buildings. Therefore PV systems must incorporate "inverters" to perform this function.

The Mortimer Street Wing roof appears to have deteriorated insulation and is ponding with standing water after each rainfall. The roof is a built-up design with light colored ballast on a concrete slab. Even concrete decks, although less susceptible to damage, are not immune. Since wet insulation has no insulating value, the concrete deck below can be subjected to freeze/thaw damage. Any cracks in the concrete can let water in to the reinforcing steel, causing corrosion and possibly spalling the deck.

This ECM would install a 159 kW PV System on the open areas of the total building roof. The built-up roofing would be removed, a steel structure added to support the PV arrays, and a minimum of 4 inches of insulation added. The new roofing would then be added with all appropriate flashing.

The School District should consider a solar PPA that could install the new roofing systems along with the PV arrays with little or no capital investment (see Section IX of this report).

Solar PPAs are agreements between a provider and a customer to purchase on-going solar power at long-term rates. Solar PPA providers install and maintain solar facilities on customer rooftops or properties. Customers pay only for the power generated by the factility—not solar equipment or installation—greatly reducing the risk and complications of implementing a solar electricity solution.

Energy Savings Calculations:

See **Appendix F** for a detailed analysis of both solar/roofing projects and the open areas of the total roof that are candidates for a solar project.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,432,440
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,432,440
Maintenance Savings ($/Yr):	$64,306
Energy Savings ($/Yr):	$27,744
Total Yearly Savings ($/Yr):	$92,050
Estimated ECM Lifetime (Yr):	25
Simple Payback	15.6
Simple Lifetime ROI	-51.6%
Simple Lifetime Maintenance Savings	$1,607,650
Simple Lifetime Savings	$693,600
Internal Rate of Return (IRR)	4%
Net Present Value (NPV)	$170,440.24

ECM #3: Install NEMA Premium® Efficient Motors

Description:

The existing electric motors equal to or greater than one horsepower range from 78 to 81% efficient. The improved efficiency of the NEMA Premium® efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

This energy conservation measure would replace all motors equal to or greater than 3 HP with NEMA Premium® Efficient Motors. NEMA Premium® is the most efficient motor designation in the marketplace today. Using MotorMaster+, Version 4, the energy & cost savings were calculated for the fan/pump motors in this facility that are greater than or equal to 3 HP and have standard efficiency ratings.

Energy Savings Calculations:

For Example: A 3 HP Supply Air Fan Motor with the following:

Existing Motor Efficiency = 80.8%
Annual Hours of Operations = 2,800 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.151 / kWh

New NEMA Premium® Motor Efficiency = 86.5%

Existing 3 HP Motor Operating Cost =

{0.746 kW/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency

= [0.746 x 3 x 0.75 x 2,800 x $0.151/ kWh] ÷ 0.808 = $878/ Year

New NEMA Premium® Efficiency Motor Operating Cost =

{0.746 x 3 x 0.75 x 2,800 x $0.151} ÷ 0.865 = $820/ Year

Savings = $878 - $820 = $58 / Year

Installed Cost of a 3 HP NEMA Premium® Efficiency Motor = $518 minus the SmartStart Building® incentive of $54 is $464.

The following table outlines the motor replacement plan for this facility:

MOTOR REPLACEMENT PLAN

MOTOR HP	QTY	ENCL. TYPE	NO. OF POLES	INSTALLED COST **	TOTAL COST	TOTAL SAVINGS	SIMPLE PAYBACK
3	6	ODP	4-Pole	$464	$2,784	$348	8.0
5	2	ODP	4-Pole	$542	$1,084	$140	7.7
7.5	2	ODP	4-Pole	$750	$1,500	$167	8.9
10	3	ODP	4-Pole	$1,000	$3,000	$281	10.6
15	3	ODP	4-Pole	$1,300	$3,900	$324	12.0
				Totals:	*$12,268*	*$1,260*	*9.7*

**** Net Cost after the SmartStart Buildings® incentive is applied.**

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$13,444
NJ Smart Start Equipment Incentive ($):	$1,176
Net Installation Cost ($):	$12,268
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,260
Total Yearly Savings ($/Yr):	$1,260
Estimated ECM Lifetime (Yr):	20
Simple Payback	9.7
Simple Lifetime ROI	105.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$25,200
Internal Rate of Return (IRR)	8%
Net Present Value (NPV)	$6,477.62

ECM #4: Convert Pneumatics to DDC System

Description:

Throughout the oldest sections of the building there are pneumatic manual wall thermostats for various HVAC units and local pneumatic controls with adjustable settings on the heating units that were installed in 1950. 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 at 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 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 energy costs for this portion of the facility which is approximately $92,000 per year.
Annual Savings = 10% x $92,000 = $9,200

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 oldest sections of this facility is approximately $160,000 (based on approximately 40,000 SF).

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$160,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$160,000
Maintenance Savings ($/Yr):	$5,000
Energy Savings ($/Yr):	$9,200
Total Yearly Savings ($/Yr):	$14,200
Estimated ECM Lifetime (Yr):	15
Simple Payback	11.3
Simple Lifetime ROI	-13.8%
Simple Lifetime Maintenance Savings	$75,000
Simple Lifetime Savings	$138,000
Internal Rate of Return (IRR)	4%
Net Present Value (NPV)	$9,518.68

ECM #5: Install Thermostatic Steam Radiator Valves

Description:

The Rutherford High School has unit ventilators on the perimeter of the 1st and 2nd floors between Rooms 201 thru 228 and 301 thru 319. Some have steam coils and others have been converted to hot water coils. Due to the equipment age, old pneumatic/manual/thermostatic control valves, and the characteristics of steam, the rooms are often overheated and the teachers are forced to use the windows to control the heat further increasing energy costs. During our site survey, we counted a total of 70 existing valves that would be excellent candidates for replacement with these new valves.

This measure would install the newest generation of thermostatic radiator valves on the steam and hot water coils which would improve control of the heating in the older sections of the school. Thermostatic controls are self-contained, non-electric and are suitable for radiators, fin-tubes, baseboards or convector units. These new thermostatic valves have the capability of setting an upper limit to prevent overheating of the spaces. The valves include a remote sensor for accurately measuring the return air temperature for better heating control.

Energy Savings Calculations:

In our experience, we have seen a 10% to 15% reduction in energy use from installation of thermostatic radiator valves. The energy cost to heat this portion of the building is estimated to be approximately 1/3 of $184,563 per year in natural gas costs which equates to approximately $61,521 per year. Therefore, the annual energy cost savings would be approximately 15% of $61,521 or $9,228.

The basis of design is the ISTEC 2000 Series Thermostatic Radiator Valve or equal which has a total installation cost (including valve, sensor, calibration, piping changes, etc.) of $1,300 per unit. 70 existing valves x $1,300/unit = $91,000

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$91,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$91,000
Maintenance Savings ($/Yr):	$2,000
Energy Savings ($/Yr):	$9,228
Total Yearly Savings ($/Yr):	$11,228
Estimated ECM Lifetime (Yr):	15
Simple Payback	8.1
Simple Lifetime ROI	52.1%
Simple Lifetime Maintenance Savings	$30,000
Simple Lifetime Savings	$138,420
Internal Rate of Return (IRR)	9%
Net Present Value (NPV)	$43,039.14

ECM #6: Install a High-Efficiency Steam Boiler

Description:

Various areas of the older sections of the school are heated by a 1989 Superior 150 LS steam boiler and a 1987 HB Smith steam boiler with 18 sections. The Superior 150 HP steam boiler is rated at 5,175 lb/hr steam @ 212ºF and the HB Smith steam boiler rating is 6,522 lb/hr steam @ 212ºF. The Superior boiler has a history of premature tube leaks and low-efficiency. The HB Smith boiler has a higher efficiency and less maintenance costs to date. In addition, many of the older sections of the school have been converted to hot water unit ventilators making these steam boilers well oversized. Our initial heating load calculations for the steam needed to heat these existing spaces resulted in a steam load of only 2,420 lbs steam/hr @ 212ºF.

Note: Owner should have a Professional Engineer verify the steam heating loads for the portion of the building still using steam heat prior to moving forward with this ECM.

This measure would install a smaller, much more efficient, 80 HP Cleaver Brooks Model CB Steam Boiler with a 10:1 turndown, DDC controller, and more efficient burner. This steam boiler is rated at 2,760 lbs steam/hr @ 212ºF. The Superior steam boiler would be removed and the HB Smith steam boiler would remain as a backup and for extremely cold winter days.

Energy Savings Calculations:

It is assumed that the existing steam boilers are approximately 55% efficient during the partial steam loads that occur during the heating season due to their now being well oversized. The 150 BHP steam boilers can currently only operate with a 4:1 turndown ratio.

CEG recommends that one of the two (2) 150 BHP steam boilers be replaced by an 80 BHP high-efficiency steam (pony) boiler that would carry the steam load in the winter months. The natural gas to steam efficiency for an 80 BHP steam boiler with digital burner controls is approximately 84.5% over its operating range and with the advanced controls will have a 10:1 turn down ratio.

Existing 150 HP Steam Boiler During the Winter Months

Net Rated Capacity = 5,175 lbs/hr steam @ 212ºF

Estimated Fuel-to-Steam Efficiency = 55% as calculated at 15 psig operating pressure. Currently there is no metering of steam output, condensate return, or make-up water to verify actual base conditions of operation and efficiency.

Replacement 80 BHP High-Efficiency Steam Boiler

Net Rated Capacity = 2,760 lbs/hr steam @ 212ºF

Fuel-to-Steam Efficiency = 84.5% (Cleaver Brooks performance data)

Operating Data:

Heating Season Fuel Consumption = 35,160 Therms
(Based on gas billing data)

Average Cost of Natural Gas = $1.67/Therm

Energy Savings = Old Boiler Energy Input * [(New Boiler Efficiency – Old Boiler Efficiency) / New Boiler Efficiency)]

$$\text{Energy Savings} = 35{,}160 \text{ Therms} \times \frac{(0.845-0.55)}{(0.845)}$$

$$= 12{,}275 \text{ Therms}$$

Cost Savings = Annual Energy Savings * $/Therm = 12,275 Therms * $1.67/Therm

= $20,499 / yr.

The total installed cost of an 80 BHP (2,678 MBH) steam boiler including demolition/removal of existing steam boiler = $178,000 (budget equipment costs obtained from Cleaver Brooks). The salvage value of the removed boiler is expected to cover the cost of rigging sections of the old boiler out through the existing old boiler room. Allowance is made for piping, controls and the installation of a new feedwater pump.

The NJ SmartStart equipment incentive is $1 per MBH = $2,678

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$178,000
NJ Smart Start Equipment Incentive ($):	$2,678
Net Installation Cost ($):	$175,322
Maintenance Savings ($/Yr):	$2,000
Energy Savings ($/Yr):	$20,499
Total Yearly Savings ($/Yr):	$22,499
Estimated ECM Lifetime (Yr):	25
Simple Payback	7.8
Simple Lifetime ROI	192.3%
Simple Lifetime Maintenance Savings	50000
Simple Lifetime Savings	$512,475
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	$216,456.41

ECM #7: Pool Dehumidification/Heat Recovery System

Description:

The high school pool building and ventilation air is heated by a constant volume, rooftop unit with hot water coils and outside air capabilities. The pool area is 100% exhausted by a rooftop exhaust fan rated at 6,000 CFM. This existing Trane unit has to run constantly to be able to provide the correct amount of air changes for the pool area. This "push-pull" ventilation system wastes a significant amount of energy by exhausting both the sensible and latent heat of the enclosure. Code-required outdoor air ventilation is the largest source of energy loss in a pool enclosure. A new pool heat recovery system needs to take the following into account:

- Heating cold outdoor air
- Heating pool water to compensate for heat losses
- Cost of the dehumidification system
- Cost to operate the supply air fan
- Cost to operate the exhaust fan
- Cost of additional controls, dampers, ductwork, etc.
- Total sensible energy savings using an exhaust recovery system
- Corrosiveness of the chlorine air returning to the unit

This ECM would replace the existing Trane rooftop outdoor air handler with two (2) Desert Aire or equal units with combined rating of 44,000 CFM with hot water coils, supply/return fans, dehumidification with DX coils, and an exhaust heat recovery system. With this new system in place, major heating savings will be attained through the use of a heat rejection system. This heat rejection system will allow the excess heat from the unit to be used as energy to reheat the pool, instead of just being wasted as exhaust air. Although the new Desert Aire units will include addition cooling costs, the amount of added electric to run the compressors, compared to the cost savings of the heat rejection system back into the pool, will more than compensate. Additionally, the load on the boiler will be reduced due to the fact that these units will significantly help keep the water at its desired temperature.

The existing 5 HP exhaust fan would be permanently disconnected.

Energy Savings Calculations:

See Appendix G for the Desert Aire energy analysis program results.

The total installed cost of this unit including ductwork modifications, controls, etc. is $600,000 (pricing from Air Tectonics, Inc. and a Mechanical Contractor).

Existing net unit operational costs = $187,823

2 New Desert Aire net operational costs = $111,658

Final cost savings = $76,165

$$Heating\ Load\ Savings = Existing\ Heat\ Load\ Cost\ (\$) - New\ Heating\ Load\ Cost\ (\$)$$

$$Heating\ Load\ Savings = \$79,419 - \$24,576 = \$54,843$$

$$Gas\ Energy\ Savings = \frac{Heating\ Load\ Savings\ (\$)}{Cost\ per\ Therm\ (\frac{\$}{therm})}$$

$$Gas\ Energy\ Savings = \frac{\$54,843}{\$1.67\ /\ therm}$$

Gas Energy Savings = 32,840 Therms

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$600,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$600,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$54,843
Total Yearly Savings ($/Yr):	$54,843
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.9
Simple Lifetime ROI	37.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$822,645
Internal Rate of Return (IRR)	4%
Net Present Value (NPV)	$54,712.17

ECM #8: Replace Pool Hot Water Boiler/ HW Pump

Description:

The pool is heated by a 1988 Bryan Model CL-210W Flex Tube, hot water heater rated at 2,100 MBH input and 1,680 MBH output with a rated efficiency of 80% when it was new. Due to its age and condition, we have assumed a present efficiency of 60%. The pool water pump is located in a pit, shows signs of heavy corrosion/rust and has a 15 HP motor.

This ECM would replace the existing Bryan hot water boiler with a more efficient, modular Aerco Benchmark™ condensing, modulating, forced draft, hot water boiler rated at 2,000 MBH input and 1,780 MBH output with an average efficiency of 89%. In addition, the hot water pump and motor would be replaced with higher efficiency units.

Energy Savings Calculations:

Existing Pool HW Boiler:

Net Rated Capacity = 1,680 MBH
Combustion Efficiency = 60%
Radiation Losses = 5%
Net Efficiency = 55%

Replacement Boiler:

High Efficiency Aerco Benchmark™ 2.0 GWB Hot Water Modular Boiler or Equal

Net Rated Capacity = 1,780 MBH
Combustion Efficiency = 89.5%
Radiation Losses = 0.5%
Net Efficiency = 89%

Operating Data:

Pool Hot Water Boiler Annual Fuel Consumption = 25,400 Therms
(Based on gas billing data)

Average Cost of Natural Gas = $1.67/Therm

Energy Savings = Old Boiler Energy Input * [(New Boiler Efficiency – Old Boiler Efficiency) / New Boiler Efficiency)]

$$\text{Annual Energy Savings} = 25{,}400 \text{ Therms} \times \frac{0.89-0.55}{0.89}$$

= 9,703 Therms

Annual Cost Savings = Annual Energy Savings * $/Therm = 9,703 Therms * $1.67/Therm

= $16,204

Installed cost of an Aerco or equal modular, high-efficiency boiler @ 2,000 MBH input (including the new corrosion resistant pump/motor skid, vent piping, gas line modifications, new gas regulator, new flue, etc.) = $95,000 + $34,000 = $129,000 (budget costs obtained from Aerco & Bell & Gossett distributors).

The SmartStart Buildings® incentive is $1.75 per MBH which equates to $3,500.

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$129,000
NJ Smart Start Equipment Incentive ($):	$3,500
Net Installation Cost ($):	$125,500
Maintenance Savings ($/Yr):	$2,000
Energy Savings ($/Yr):	$16,204
Total Yearly Savings ($/Yr):	$18,204
Estimated ECM Lifetime (Yr):	25
Simple Payback	6.9
Simple Lifetime ROI	222.8%
Simple Lifetime Maintenance Savings	$50,000
Simple Lifetime Savings	$405,100
Internal Rate of Return (IRR)	14%
Net Present Value (NPV)	$191,488.94

ECM #9: Dual Technology Lighting Controls

Description:

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

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

Numerous studies by the US Department of Energy have shown that occupancy sensors have an energy savings potential of 20-30% for daytime occupancies. CEG recommends the installation of dual technology occupancy sensors in all private offices, conference rooms, faculty room, storage rooms, locker rooms, small mechanical rooms, and cafeteria.

CEG would recommend wall switches for individual rooms, ceiling mount sensors for larger rooms, office areas or restrooms, and fixture mount lighting sensors for some applications as manufactured by Sensorswitch, Watt Stopper or equivalent. There are approximately 39 sensors required for this project (12,000 SF of space).

Energy Savings Calculations:

From Appendix E of this report, we calculated the lighting power density (Watts/ft^2) of the existing offices, conferences rooms, file rooms, copy rooms, storage rooms, equipment rooms, etc. to be 0.9 Watts/SF. Thirty percent of this value is the resultant energy savings due to installation of occupancy sensors:

$$Energy\ Savings = \left(30\% \times\ Watts/SF \times Building\ SF \times Operating\ Hours\right)$$

$$Energy\ Savings = \left(30\% \times\ 0.9\, Watts/SF \times 12{,}000\ SF \times 2{,}800 hrs/yr\right) = \underline{9{,}072\ kWh}$$

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

$$Energy\ Savings = \left(9{,}072\, kWh \times \$0.151/kWh\right) = \underline{\$1{,}370\, per\ year}$$

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $165/unit including material and labor.

$$Installation\ Cost = (\#\ of\ \ sensors \times\ \$\ per\ sensor) = (39 \times \$165) = \$\,6{,}435$$

NJ Smart Start® Program Incentives are calculated as follows:

From Appendix B, the incentive for installing a lighting control is $20 per controller.

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ controller \times\ \$\ 20) = (39 \times \$\ 20) = \underline{\$}780$$

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,435
NJ Smart Start Equipment Incentive ($):	$780
Net Installation Cost ($):	$5,655
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,370
Total Yearly Savings ($/Yr):	$1,370
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.1
Simple Lifetime ROI	263.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$20,550
Internal Rate of Return (IRR)	23%
Net Present Value (NPV)	$10,699.97

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

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

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

CEG has reviewed the Mortimer Wing roof area for the purposes of determining a potential for a roof mounted photovoltaic system. An existing roof area of approximately 11,300 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in Appendix F. Using this square footage it was determined that a system size of 159.16 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 183,732 KWh annually, reducing the overall utility bill by approximately 10.8% percent. A detailed financial analysis can be found in Appendix F. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the present 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 20 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in Section X, Installation Funding Options. 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**
Self-Finance	15.56 Years	-51.6%	N/A
Direct Purchase	15.56 Years	-51.6%	4.6%

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

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

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

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

This facility is comprised of classrooms, a large auditorium with stage, administrative offices, a faculty room, pool, gymnasiums, laboratory classrooms, specialized media center, technology rooms, cafeteria, music rooms etc. The typical hours of operation for this facility are 7:00 a.m. -3:00 p.m. for the classrooms and 6:30 a.m.-5:00 p.m. for the offices. This facility has a lot of weekend and off hour activities.

The Electric Usage Profile demonstrates a fairly flat electric load profile throughout the year. However there are some distinct peaks in the following months: February, July and October. This could be associated with the extensive activities (such as the pool and cooling for July) on the school off hours. Cooling in the newer parts of the school is provided by chilled water from a Trane air cooled chiller. Chilled water is pumped to York roof top units and small air handlers. Roof top air handling units consisting of (2) York models, contain chilled water coils. There are also (4) York air handling units in the mechanical closets, ranging from 4 – 6 ton capacity. The balance of the year is elevated with a very steady load profile. This facility receives its electrical Delivery service from PSE&G (Public Service Electric and Gas Company) on a LPLS rate schedule and its Commodity (electric supply) from South Jersey Energy Company, a Third Party Supplier on the ACES agreement. A flatter load profile will allow for more competitive energy prices when shopping for alternative suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a typical natural gas (heat load) load shape. There is increased usage in the winter (October –April) that is associated with heating load. And there is little to now consumption in the summer (May-September) where there is no heating load expected.

The older sections of the facility are heated by a Superior steam boiler, and a H.B. Smith steam boiler with 18 sections. The balance of the older section is heated by a modular natural gas-fired, hot water boiler. The 2005 addition is heated by (3) forced draft, natural gas-fired, hot water boilers. Domestic hot water in the 2005 addition is provided by a Rheem natural gas-fired hat water heater with a 91 gallon capacity. The older sections of the school are provided hot water from a Bradford White natural gas-fired hot water heater with an 80 gallon capacity. This facility's natural gas delivery service is provided by PSE&G (Public Service Electric and Gas Company) on a LVG rate schedule. The Commodity service is provided by The Hess Corporation through the ACES

agreement. 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 Delivery service through the utility Public Service Electric and Gas Company (PSE&G) on a LPLS (Large Power and Lighting Service) rate schedule classification.

The Delivery Service is provided by PSE&G while the Commodity Service (electric supply) is provided by South Jersey Energy Company a Third Party Supplier (TPS) through the ACES (Alliance for Competitive Energy Services) Cooperative Pricing System, agreement.

The LPLS Delivery Service is for general purposes at secondary distribution voltages where the customer's measured peak demand exceeds 150 kilowatts in any month and also at primary distribution voltages. Customers may either purchase electric supply from a TPS or from PSE&G's Basic Generation Service default service as detailed in the rate schedule. Delivery Charges include the following: Service Charge, Distribution Charges, Societal Benefits Charge, Non-utility Generation Charge, Securitization Transition Charges. System Control Charge, Customer Account Services Charge, CIEP Standby Fee, Base-rate Adjustment Charge, Solar Pilot Recovery Charge, RGGI Recovery Charge and Capital Adjustment Charge.

The customer has the choice to procure the supply from PSE&G on its Basic Generation default supply or a Third Party Supplier (TPS). Currently this facility is provided electric supply from the TPS.

ACES is an alliance composed of the NJSBA and the NJASBO. The Rutherford BOE has stated if they want to procure alternative energy, they must through the ACES agreement. CEG will make a recommendation that is counter to this agreement. The term of the ACES agreement is the first meter read date on or after April 30, 2009 until the last meter read date, May, 2011. The ACES agreement provides for NJSBA to adopt a resolution for renewal for no more than a (5) consecutive year term. CEG will recommend against such a renewal.

Natural Gas:

This facility receives utility service through Public Service Electric and Gas Company (PSE&G). This facility utilizes the Delivery Service from PSE&G while receiving Commodity service from a Third Party Supplier (TPS), The Hess Corporation. The High School is on a LVG (Large Volume) rate classification.

LVG Rate: This utility tariff is for "firm" delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G

under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

"Firm" delivery service defines the reliability of the transportation segment of the pricing. Much like the telecom industry, natural gas pipelines were un-bundled in the late 1990's and the space was divided up and marketed into reliability of service. Firm Service is said to be the most reliable and last in the pecking order for interruption. This service should not be interrupted.

This facility utilizes the services of a Third Party Supplier, The Hess Corporation. The contract is administered by The Alliance for Competitive Service (ACES). ACES is the energy aggregation program of the New Jersey School Boards Association of School Administrator's. The process was reviewed and approved by the New Jersey Department of Community Affairs. Term of this agreement is June 1, 2006 and expiring on or before May 31, 2009. This agreement is subject to renewal with BOE resolution. The original agreement has been extended for (1) year through May 31, 2010. CEG will not recommend extending this agreement.

Please see CEG recommendations below.

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 the LPLS rate schedule based on 1-year historical average price is $.10581 / kWh (this is the average "price to compare" for energy supplied by South Jersey Energy Company). The average price per decatherm for natural gas (as provided by The Hess Corporation as administered by the ACES agreement) is $14.058 / dth (dth, is the common unit of measure). This price is also the "price to compare".

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 (September 2008 through August 2009) and current electric rates, the High School could see an improvement in its electric costs of up to 10% or up to $26,000 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 High School could improve its natural gas costs by up to 16% or up to $55,000 annually. CEG recommends that the BOE receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source.

CEG also recommends that The BOE not renew its energy supply contract with the ACES aggregation and The Hess Corporation, and the ACES agreement with South Jersey Energy and its

fixed price contract. The fixed priced contract does not accomplish the needs of the BOE. The BOE needs budget protection and CEG has shown that these energy prices are not competitive to the market. The ACES agreement has demonstrated that the price is much above market and the BOE has no way of adjusting the price should prices fall.

CEG further recommends that The BOE create an energy program through a "managed approach". The "managed approach" will take into account creating an "energy budget" that is in line with The BOE's budget year and risk tolerance. Risk tolerance is the appetite that 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 School District 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. Most contractors will finance the new roof, insulation, and solar array as a packaged financial deal.

iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)

2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.

3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.

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

XI. ADDITIONAL RECOMMENDATIONS

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

A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

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

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

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

F. Recalibrate existing sensors serving the office spaces

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

H. Clean all light fixtures to maximize light output.

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

J. Install faucet aerators at each sink

K. Install water-saving flush valve kits on all urinals.

In addition to the recommendations above, CEG would also like to suggest Retro-Commissioning. Retro-Commissioning is a means to verify your current equipment is operating at its designed capacity, airflow, etc. Commissioning Agents, after defining what the original system design parameters are, would recommend revisions to the current system operating characteristics and utilize an independent testing and balancing company to perform air and water balancing on the existing systems.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Rutherford High 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	Window Replacement Along the Mortimer Wing	$119,700	$0	$0	$119,700	$4,305	$5,000	$9,305	25	$107,625	$125,000	-10.1%	12.9	5.93%	$42,329.34
ECM #2	Solar Array, New Roof, and Roof Insulation at Mortimer Wing	$1,432,440	$0	$0	$1,432,440	$27,744	$64,306	$92,050	25	$693,600	$1,607,650	-51.6%	15.6	4.04%	$170,440.24
ECM #3	NEMA Premium® Efficiency Motors	$13,444	$0	$1,176	$12,268	$1,260	$0	$1,260	20	$25,200	$0	105.4%	9.7	8.11%	$6,477.62
ECM #4	Convert Pneumatics to DDC	$160,000	$0	$0	$160,000	$9,200	$5,000	$14,200	15	$138,000	$75,000	-13.8%	11.3	3.81%	$9,518.68
ECM #5	Install Thermostatic Radiator Valves	$91,000	$0	$0	$91,000	$9,228	$2,000	$11,228	15	$138,420	$30,000	52.1%	8.1	8.91%	$43,039.14
ECM #6	High-Efficiency Steam Boiler	$178,000	$0	$2,678	$175,322	$20,499	$2,000	$22,499	25	$512,475	$50,000	192.3%	7.8	12.09%	$216,456.41
ECM #7	Pool Dehumidification/Heat Recovery System	$600,000	$0	$0	$600,000	$54,843	$0	$54,843	15	$822,645	$0	37.1%	10.9	4.23%	$54,712.17
ECM #8	Replace Pool Hot Water Boiler & Hot Water Pump	$129,000	$0	$3,500	$125,500	$16,204	$2,000	$18,204	25	$405,100	$50,000	222.8%	6.9	13.95%	$191,488.94
ECM #9	Dual Technology Lighting Controls	$6,435	$0	$780	$5,655	$1,370	$0	$1,370	15	$20,550	$0	263.4%	4.1	23.16%	$10,699.97
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	PV Roof system	$1,432,440	$0	$0	$1,432,440	$27,744	$64,306	$92,050	25	$693,600	$1,607,650	-51.6%	15.6	4.04%	$170,440.24

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

EXISTING EQUIPMENT LIST

Concord Engineering Group

"Rutherford High School"

Boiler

Location	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Boiler Room	PK Modu-Fire FD	3	N2000-MFD	-	2,000	1,700	87%	Nat. Gas	2	35	33
Boiler Room	Superior	1	Steam Boiler	-	5,175 lb/h			Steam	20	35	15
Boiler Room	HB Smith	1	Steam Boiler	-	6,522 lb/h			Steam	22	35	13
Boiler Room	HydroTherm	1	-	-	1,900	1,760	387%	Nat. Gas	2	35	33
Boiler Room	HydroTherm	1	-	-	1,900	1,760	487%	Nat. Gas	2	35	33
Boiler Room	HydroTherm	1	-	-	1,900	1,760	587%	Nat. Gas	2	35	33
Boiler Room	HydroTherm	1	-	-	1,900	1,760	687%	Nat. Gas	2	35	33

HW Pump/Motors

Location	Motor Manufacturer	Qty	Motor Model #	Motor Serial #	HP	RPM	GPM	Ft. Hd	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Boiler Room	Bell & Gossett	2	VSC5X5X12	-	10	1770	210	75	230/460	3	2	20	18
Boiler Room	B & G	2	4BC 8.00 BF 1510 SERIES	-	10	1770	156	100	230/460	3	2	20	18
Boiler Room	Baldor	1	-	-	5	1750	110	75	230/460	3	2	20	18
Boiler Room	Baldor	1	-	-	3	1755	115	50	230/460	3	2	20	18

Domestic Hot Water Heater

Location	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Boiler Room	Rheem	1	G91-200	-	199,900		91			4	12	8
Boiler Room	PVI	1	-	-	565	800	250	94%	Nat. Gas	2	12	10
Boiler Room	PVI	1	-	-	565	800	250	94%	Nat. Gas	2	12	10
Boiler Room	PVI	1	-	-	565	800	250	94%	Nat. Gas	2	12	10
Boiler Room	PVI	1	-	-	565	800	250	94%	Nat. Gas	2	12	10
Boiler Room	PVI	1	-	-	565	800	250	94%	Nat. Gas	2	12	10

Domestic Hot Water Circulating Pumps

Location	Manufacturer	Qty	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Boiler Rm	Burkay Genesis	1	GB 1850	-	2	-	154	-	-	-	2	10	8
Boiler Rm	Burkay Genesis	1	-	-	1/6	3300	30*	20*	115	1	2	10	8
Boiler Rm	Burkay Genesis	1	-	-	1/6	3300	30*	20*	115	1	2	10	8
Boiler Rm	Burkay Genesis	1	-	-	1/6	3300	30*	20*	115	1	2	10	8
Boiler Rm	Burkay Genesis	1	-	-	1/6	3300	30*	20*	115	1	2	10	8
Boiler Rm	Burkay Genesis	1	-	-	1/6	3300	30*	20*	115	1	2	10	8
Boiler Rm	Burkay Genesis	1	-	-	1/6	3300	30*	20*	115	1	2	10	8
Boiler Rm	Burkay Genesis	1	-	-	1/6	3300	30*	20*	115	1	2	10	8

Air Cooled Chiller

Location	Manufacturer	Qty	Model #	Serial #	Cooling Capacity	Cooling Coil	Heating Capacity	Heating Coil	S/A Fan HP	E/A Fan HP	EER	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Roof	Trane	1	RTAC2254 UJON UAFN	-	225 Tons	-	-	-	-	-	-	-	-	0	20	20
Roof	York	1	-	-	18 Tons	-	-	-	10	7.5	-	-	-	0	20	20
Roof	York	1	-	-	-	-	-	-	15	1.5	-	-	-	0	20	20
Roof	Circul-Aire	1	-	-	-	-	-	-	2	2	-	-	-	0	20	20
Roof	Circul-Aire	1	-	-	-	-	-	-	15	7.5	-	-	-	0	20	20
Roof	Circul-Aire	1	-	-	-	-	-	-	5	-	-	-	-		20	20
Roof	Circul-Aire	1	-	-	-	-	-	-	1	-	-	-	-	0	20	20

Air Handling Units

Location	Manufacturer	Qty	Model #	Serial #	Cooling Capacity	Cooling Coil	Heating Capacity	Heating Coil	S/A Fan HP	E/A Fan HP	EER	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Roof	York	1	CP215DWDIAF107	-	18 Tons	-	-	-	10	<7.5	-	-	-	2	15	13
Roof	York	1	CP215DWDIAF107	-	18 Tons	-		-	10	7.5	-	-	-	2	15	13
Roof	York	1	XTI-060X078-HDLHD46A	-	-	-	-	-	15	5	-			2	15	13
Roof	York	1	CP350DWDIAF1510	-	-	-	-	-	15	10	-	-	-	2	15	13
Roof	Comfort Aire	2	A-HMC12AS	-	-	-	-	-	-	-		-	-	2	15	13
Roof	Annexair	1	ERP-1-07-HW-C	-	-	-	-	-	7.5	5	-	-	-	2	15	13
Roof	Circul-Aire	1	-	-	-	-	-	-	1	-	-	-	-	2	15	13
Roof	Addison Co.	1	-	-	158,400 BTUH	-	-	-	5	2	11	230/460	-	2	15	13
Roof	Thermal Zone	1	-	-	9,000	-	N/A	N/A	-	-	13	115	-	2	15	13
Roof	Thermal Zone	1	-	6934 M0106 09422	-	-	-	-	-	-	-	-	-	2	15	13
Roof	Heat Craft	1	-	T97F-00472	-	Copper-Tube	-	-	-	-	-	208-230	3	2	15	13
Music Room	Trane	1	-	-	-	DX	-	HW	-	-	-	-	-	2	20	18

AC Condensers

Location	Manufacturer	Qty	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Roof	Carrier Condensing Unit	1	-	-	50Tons	-	R-22	460	3	2	20	18
Roof	Ccnctcl International Inc.	1	-	66-1209C01101C	-	-	R-22	-	-	2	20	18
Roof	Fedders	1	-	ETS04803F	11,500	-	-	203/208	1	5	20	15
Roof	Fedders	1	-	-	-	-	-	-	-	5	20	15

STATEMENT OF ENERGY PERFORMANCE
Rutherford High School

Building ID: 1797217
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: November 12, 2009

Facility
Rutherford High School
56 Elliot Place
Rutherford, NJ 07070

Facility Owner
Rutherford Board of Education
176 Park Avenue
Rutherford, NJ 07070

Primary Contact for this Facility
Robert Brown
176 Park Avenue
Rutherford, NJ 07070

Year Built: 1922
Gross Floor Area (ft²): 148,627

Energy Performance Rating[2] (1-100) 20

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	5,781,910
Natural Gas (kBtu)[4]	11,031,217
Total Energy (kBtu)	16,813,127

Energy Intensity[5]

Site (kBtu/ft²/yr)	113
Source (kBtu/ft²/yr)	208

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	1,467

Electric Distribution Utility
PSE&G - Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	85
National Average Source EUI	156
% Difference from National Average Source EUI	33%
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
Ray Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

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

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Rutherford High 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	56 Elliot Place, Rutherford, NJ 07070	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		☐
Rutherford High School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	148,627 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?	Yes	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	260 (Default)	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	1 (Default)	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	30 %	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?	Yes	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: PSE&G - Public Service Elec & Gas Co

Fuel Type: Electricity

Meter: Electricity (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	134,713.00
11/01/2008	11/30/2008	147,367.00
10/01/2008	10/31/2008	155,452.00
09/01/2008	09/30/2008	117,536.00
08/01/2008	08/31/2008	146,023.00
07/01/2008	07/31/2008	168,578.00
06/01/2008	06/30/2008	139,561.00
05/01/2008	05/31/2008	129,451.00
04/01/2008	04/30/2008	126,600.00
03/01/2008	03/31/2008	133,800.00
02/01/2008	02/29/2008	159,000.00
01/01/2008	01/31/2008	136,500.00
Electricity Consumption (kWh (thousand Watt-hours))		**1,694,581.00**
Electricity Consumption (kBtu (thousand Btu))		**5,781,910.37**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**5,781,910.37**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Gas High School (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
12/01/2008	12/31/2008	13,806.02
11/01/2008	11/30/2008	8,266.83
10/01/2008	10/31/2008	1,409.82
09/01/2008	09/30/2008	39.63
08/01/2008	08/31/2008	60.85
07/01/2008	07/31/2008	1,028.71
06/01/2008	06/30/2008	2,538.76
05/01/2008	05/31/2008	3,905.78
04/01/2008	04/30/2008	15,612.31
03/01/2008	03/31/2008	19,853.00

02/01/2008	02/29/2008	22,839.73
01/01/2008	01/31/2008	20,950.73
Gas High School Consumption (therms)		**110,312.17**
Gas High School Consumption (kBtu (thousand Btu))		**11,031,217.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**11,031,217.00**
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
Rutherford High School
56 Elliot Place
Rutherford, NJ 07070

Facility Owner
Rutherford Board of Education
176 Park Avenue
Rutherford, NJ 07070

Primary Contact for this Facility
Robert Brown
176 Park Avenue
Rutherford, NJ 07070

General Information

Rutherford High School	
Gross Floor Area Excluding Parking: (ft^2)	148,627
Year Built	1922
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Rutherford High School	
Space Type	K-12 School
Gross Floor Area(ft^2)	148,627
Open Weekends?	Yes
Number of PCs[d]	260
Number of walk-in refrigeration/freezer units[d]	1
Presence of cooking facilities	Yes
Percent Cooled	30
Percent Heated	100
Months[o]	N/A
High School?	Yes
School District[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2008)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	20	20	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	113	113	67	N/A	85
Source (kBtu/ft^2)	208	208	122	N/A	156
Energy Cost					
$/year	$ 440,657.13	$ 440,657.13	$ 259,439.22	N/A	$ 331,778.36
$/$ft^2$/year	$ 2.96	$ 2.96	$ 1.74	N/A	$ 2.23
Greenhouse Gas Emissions					
$MtCO_2e$/year	1,467	1,467	864	N/A	1,105
$kgCO_2e/ft^2$/year	10	10	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.

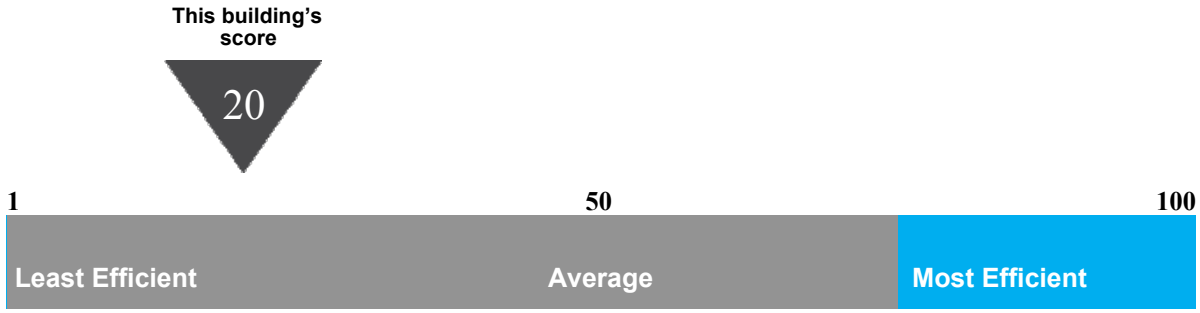
Statement of Energy Performance

2008

Rutherford High School
56 Elliot Place
Rutherford, NJ 07070

Portfolio Manager Building ID: 1797217

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 208 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending December 2008

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: 11/12/2009

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09074
Project: Rutherford BOE
Address: 56 Elliott Place
City: Rutherford, NJ 07070
Building SF: 148,627

"Rutherford High School"

DATE: 11/12/2009
KWH COST: $0.151

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1	B	Band Room	3	2' x 2' T8, 32 W, U6-Lamp	1800	70	0.21	378	$57.08	3			0.00	0	$0.00		$0.00	0.21	378	$57.08	0.00
2	K	Band Room	54	9" Diameter Recessed, 1-Lamp, 42 Watt, Compact Flourescent Light	1800	45	2.43	4374	$660.47	54			0.00	0	$0.00		$0.00	2.43	4374	$660.47	0.00
3	G1	Band Room	27	8' T5HO54W	1800	180	4.86	8748	$1,320.95	27			0.00	0	$0.00		$0.00	4.86	8748	$1,320.95	0.00
4	A	Offices	6	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.66	1188	$179.39	6			0.00	0	$0.00		$0.00	0.66	1188	$179.39	0.00
5	A1	Corridor	12	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.84	1512	$228.31	12			0.00	0	$0.00		$0.00	0.84	1512	$228.31	0.00
6	A	Electrical Rm	3	2' x 4' 3-Lamp, T8, 32 W lamps	400	110	0.33	132	$19.93	3			0.00	0	$0.00		$0.00	0.33	132	$19.93	0.00
7	A1	Band Rm Storage	3	2' x 4' 3-Lamp, T8, 32 W lamps	400	110	0.33	132	$19.93	3			0.00	0	$0.00		$0.00	0.33	132	$19.93	0.00
8	A	SGI Room	4	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.44	792	$119.59	4			0.00	0	$0.00		$0.00	0.44	792	$119.59	0.00

9	A1	Corridor	19	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	1.33	2394	$361.49	19			0.00	0	$0.00		$0.00	1.33	2394	$361.49	0.00
10	A	Science Rm	12	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.32	2376	$358.78	12			0.00	0	$0.00		$0.00	1.32	2376	$358.78	0.00
11	A1	Science Rm	8	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.88	1584	$239.18	8			0.00	0	$0.00		$0.00	0.88	1584	$239.18	0.00
12	A	Editing/SGI	12	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.32	2376	$358.78	12			0.00	0	$0.00		$0.00	1.32	2376	$358.78	0.00
13	B	Cafeteria	72	2' x 2' T8, 32 W, U6-Lamp	1800	70	5.04	9072	$1,369.87	72			0.00	0	$0.00		$0.00	5.04	9072	$1,369.87	0.00
14	K	Cafeteria	23	9" Diameter Recessed, 1-Lamp, 42 Watt, Compact Flourescent Light	1800	45	1.04	1863	$281.31	23			0.00	0	$0.00		$0.00	1.04	1863	$281.31	0.00
15	B	Pantry	6	2' x 2' T8, 32 W, U6-Lamp	800	70	0.42	336	$50.74	6			0.00	0	$0.00		$0.00	0.42	336	$50.74	0.00
16	A1	Corridor	7	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.49	882	$133.18	7			0.00	0	$0.00		$0.00	0.49	882	$133.18	0.00
17	A	Athletic Office	4	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.44	792	$119.59	4			0.00	0	$0.00		$0.00	0.44	792	$119.59	0.00
18	G1	Library	72	8' T5HO54W	1800	180	12.96	23328	$3,522.53	72			0.00	0	$0.00		$0.00	12.96	23328	$3,522.53	0.00
19	G2	Library	9	4' T5HO54W		90	0.81	0	$0.00	9			0.00	0	$0.00		$0.00	0.81	0	$0.00	#DIV/0!
20	B	Office/Work Rm	22	2' x 2' T8, 32 W, U6-Lamp	1800	70	1.54	2772	$418.57	22			0.00	0	$0.00		$0.00	1.54	2772	$418.57	0.00
21	B	Reference Rm	15	2' x 2' T8, 32 W, U6-Lamp	1800	70	1.05	1890	$285.39	15			0.00	0	$0.00		$0.00	1.05	1890	$285.39	0.00
22	A3	Photography	11	2' x 4' 4-Lamp, T8, 32 W lamps	1800	140	1.54	2772	$418.57	11			0.00	0	$0.00		$0.00	1.54	2772	$418.57	0.00
23	B	Dark Room	4	2' x 2' T8, 32 W, U6-Lamp	400	70	0.28	112	$16.91	4			0.00	0	$0.00		$0.00	0.28	112	$16.91	0.00
24	A3	Drwg Studio	17	2' x 4' 4-Lamp, T8, 32 W lamps	1800	140	2.38	4284	$646.88	17			0.00	0	$0.00		$0.00	2.38	4284	$646.88	0.00
25	A3	Storage	2	2' x 4' 4-Lamp, T8, 32 W lamps	400	140	0.28	112	$16.91	2			0.00	0	$0.00		$0.00	0.28	112	$16.91	0.00
26	F	Mech Closets	3	2' x 4' 2-Lamp, T8, 32 W lamps	400	70	0.21	84	$12.68	3			0.00	0	$0.00		$0.00	0.21	84	$12.68	0.00
27	A	Storage Room	2	2' x 4' 3-Lamp, T8, 32 W lamps	400	110	0.22	88	$13.29	2			0.00	0	$0.00		$0.00	0.22	88	$13.29	0.00
28	A	Art Rooms	18	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.98	3564	$538.16	18			0.00	0	$0.00		$0.00	1.98	3564	$538.16	0.00
29	A	Classroom	12	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.32	2376	$358.78	12			0.00	0	$0.00		$0.00	1.32	2376	$358.78	0.00
30	A1	Corridor	15	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	1.05	1890	$285.39	15			0.00	0	$0.00		$0.00	1.05	1890	$285.39	0.00
31	A	Electrical Rm	1	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.11	198	$29.90	1			0.00	0	$0.00		$0.00	0.11	198	$29.90	0.00
32	G1	Music RM	21	8' T5HO54W	1800	180	3.78	6804	$1,027.40	21			0.00	0	$0.00		$0.00	3.78	6804	$1,027.40	0.00
33	K	Music RM	58	9" Diameter Recessed, 1-Lamp, 42 Watt, Compact Flourescent Light	1800	45	2.61	4698	$709.40	58			0.00	0	$0.00		$0.00	2.61	4698	$709.40	0.00
34	A	Teacher's Office	3	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.33	594	$89.69	3			0.00	0	$0.00		$0.00	0.33	594	$89.69	0.00
35	A	Lobby	2	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.22	396	$59.80	2			0.00	0	$0.00		$0.00	0.22	396	$59.80	0.00
36	A	Conf Room	6	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.66	1188	$179.39	6			0.00	0	$0.00		$0.00	0.66	1188	$179.39	0.00
37	A1	Media Workroom	3	2' x 4' 2-Lamp, T8, 32 W lamps	400	70	0.21	84	$12.68	3			0.00	0	$0.00		$0.00	0.21	84	$12.68	0.00
38	B	Media Workroom	3	2' x 2' T8, 32 W, U6-Lamp	400	70	0.21	84	$12.68	3			0.00	0	$0.00		$0.00	0.21	84	$12.68	0.00
39	A1	Corridor	6	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.42	756	$114.16	6			0.00	0	$0.00		$0.00	0.42	756	$114.16	0.00
40	A1	Corridor	13	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.91	1638	$247.34	13			0.00	0	$0.00		$0.00	0.91	1638	$247.34	0.00
41	A	Faculty Room	5	2' x 4' 3-Lamp, T8, 32 W lamps	400	110	0.55	220	$33.22	5			0.00	0	$0.00		$0.00	0.55	220	$33.22	0.00
42	A	Guidance Dept	27	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	2.97	5346	$807.25	27			0.00	0	$0.00		$0.00	2.97	5346	$807.25	0.00
43	D	Electrical Rm	2	4' Ind. 2-Lamp, T8, 32 Watt	400	70	0.14	56	$8.46	2			0.00	0	$0.00		$0.00	0.14	56	$8.46	0.00
44	D	Mechanical Rm	12	4' Ind. 2-Lamp, T8, 32 Watt	400	70	0.84	336	$50.74	12			0.00	0	$0.00		$0.00	0.84	336	$50.74	0.00

45	A1	Corridor	18	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	1.26	2268	$342.47	18			0.00	0	$0.00		$0.00	1.26	2268	$342.47	0.00
46	B	Corridor	6	2' x 2' T8, 32 W, U6-Lamp	1800	70	0.42	756	$114.16	6			0.00	0	$0.00		$0.00	0.42	756	$114.16	0.00
47	D	Mechanical Rm	4	4' Ind. 2-Lamp, T8, 32 Watt	400	70	0.28	112	$16.91	4			0.00	0	$0.00		$0.00	0.28	112	$16.91	0.00
48	A1	Stairwell	4	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.28	504	$76.10	4			0.00	0	$0.00		$0.00	0.28	504	$76.10	0.00
49	R	Auditorium Balcony	9	Under Canopy Light, 100 Watt Metal Halide	400	120	1.08	432	$65.23	9			0.00	0	$0.00		$0.00	1.08	432	$65.23	0.00
50	K1	Auditorium Balcony	20	9" Diameter Recessed, 2-Lamp, 42 Watt, Compact Flourescent Light	400	90	1.80	720	$108.72	20			0.00	0	$0.00		$0.00	1.80	720	$108.72	0.00
51	A1	Corridor	8	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.56	1008	$152.21	8			0.00	0	$0.00		$0.00	0.56	1008	$152.21	0.00
52	K	Lobby	4	9" Diameter Recessed, 1-Lamp, 42 Watt, Compact Flourescent Light	1800	45	0.18	324	$48.92	4			0.00	0	$0.00		$0.00	0.18	324	$48.92	0.00
53	A	SGI Room	8	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.88	1584	$239.18	8			0.00	0	$0.00		$0.00	0.88	1584	$239.18	0.00
54	B	SGI Room	1	2' x 2' T8, 32 W, U6-Lamp	1800	70	0.07	126	$19.03	1			0.00	0	$0.00		$0.00	0.07	126	$19.03	0.00
55		Classroom #300	15	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.31	2349	$354.70	15			0.00	0	$0.00		$0.00	1.31	2349	$354.70	0.00
56		Classroom #301	18	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.57	2818.8	$425.64	18			0.00	0	$0.00		$0.00	1.57	2818.8	$425.64	0.00
57		Classroom #320	10	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.87	1566	$236.47	10			0.00	0	$0.00		$0.00	0.87	1566	$236.47	0.00
58		Classroom #319	6	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.52	939.6	$141.88	6			0.00	0	$0.00		$0.00	0.52	939.6	$141.88	0.00
55		Closet	2	2' x 4' 1-Lamp, T8, 28 W lamps	400	25	0.05	20	$3.02	2			0.00	0	$0.00		$0.00	0.05	20	$3.02	0.00
56		Penthouse Office #1	1	2' x 4' 1-Lamp, T8, 28 W lamps	400	25	0.03	10	$1.51	1			0.00	0	$0.00		$0.00	0.03	10	$1.51	0.00
57		Classroom #302	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29	2			0.00	0	$0.00		$0.00	0.17	313.2	$47.29	0.00
58		Boys Room	35	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	3.05	5481	$827.63	35			0.00	0	$0.00		$0.00	3.05	5481	$827.63	0.00
59		317/318 Classrooms	1	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.09	156.6	$23.65	1			0.00	0	$0.00		$0.00	0.09	156.6	$23.65	0.00
60		Science Stockrooms	1	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.09	34.8	$5.25	1			0.00	0	$0.00		$0.00	0.09	34.8	$5.25	0.00
61		Science Stockrooms	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72	1			0.00	0	$0.00		$0.00	0.05	18	$2.72	0.00
62		Science Office	6	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.52	939.6	$141.88	6			0.00	0	$0.00		$0.00	0.52	939.6	$141.88	0.00
63		Math/Science	6	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.52	939.6	$141.88	6			0.00	0	$0.00		$0.00	0.52	939.6	$141.88	0.00
64		Classroom #303	13	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.13	2035.8	$307.41	13			0.00	0	$0.00		$0.00	1.13	2035.8	$307.41	0.00
65		Girls Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46	2			0.00	0	$0.00		$0.00	0.09	162	$24.46	0.00
66		Classroom #303	3	2' x 2' 2-Lamp, T8, 28 W lamps	1800	45	0.14	243	$36.69	3			0.00	0	$0.00		$0.00	0.14	243	$36.69	0.00
67		Penthouse Office #2	1	2' x 4' 1-Lamp, T8, 28 W lamps	400	25	0.03	25	$3.78	1			0.00	0	$0.00		$0.00	0.03	25	$3.78	0.00
68		Classroom #304	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82	9			0.00	0	$0.00		$0.00	0.78	1409.4	$212.82	0.00
69		Classroom #305	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82	9			0.00	0	$0.00		$0.00	0.78	1409.4	$212.82	0.00
70		Computer Office	7	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.32	567	$85.62	7			0.00	0	$0.00		$0.00	0.32	567	$85.62	0.00
71		Classroom #312	3	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.14	243	$36.69	3			0.00	0	$0.00		$0.00	0.14	243	$36.69	0.00
72		Classroom #312A	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46	2			0.00	0	$0.00		$0.00	0.09	162	$24.46	0.00
73		Business Office	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29	2			0.00	0	$0.00		$0.00	0.17	313.2	$47.29	0.00
74		Classroom #311	13	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.13	2035.8	$307.41	13			0.00	0	$0.00		$0.00	1.13	2035.8	$307.41	0.00

75		Classroom #311	3	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.14	243	$36.69	3			0.00				$0.00				
76		Classroom #313	12	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.04	1879.2	$283.76	12			0.00				$0.00				
77		Classroom #310	20	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.74	3132	$472.93	20			0.00				$0.00				
78		Classroom #310	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23	1			0.00				$0.00				
79		Storage 310	3	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.26	104.4	$15.76	3			0.00				$0.00				
80		Classroom 324	12	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.04	1879.2	$283.76	12			0.00				$0.00				
81		Classroom 315	13	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.13	2035.8	$307.41	13			0.00				$0.00				
92		Classroom 309	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82	9			0.00				$0.00				
83		Classroom 315A	6	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.52	939.6	$141.88	6			0.00				$0.00				
84		Bathroom 310	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23												
85		Boys Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46												
86		Janitor Closet	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	25	0.03	10	$1.51												
87		Girls Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46												
88		Classroom 316	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82												
89		Classroom 308	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82												
90		Classroom 307	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82												
91		Classroom 306	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82												
92		Stockroom	2	2' x 4' 1-Lamp, T8, 28 W lamps	400	25	0.05	20	$3.02												
93		Coach Office	3	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.26	469.8	$70.94												
94		Foreign Language Office	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29												
95		Classroom 200	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82												
96		Classroom 201	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82												
97		P E Office	3	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.26	469.8	$70.94												
98		P E Office	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23												
99		P E Closet	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72												
100		Bathroom	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72												
101		Men's Faculty Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.09	36	$5.44												
102		Classroom 202	6	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.52	939.6	$141.88												
103		Classroom 203	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82												
104		Audio Visual Room	3	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.26	104.4	$15.76												
105		Main Ofice	8	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.36	648	$97.85												
106		Copy Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46												
107		File Room	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72												
108		Principal Office	4	2' x 4' 3-Lamp, T8, 28 W lamps	1800	66	0.26	475.2	$71.76												
109		Guidance Office	12	2' x 4' 3-Lamp, T8, 28 W lamps	1800	66	0.79	1425.6	$215.27												
110		Conference Rm	4	2' x 4' 3-Lamp, T8, 28 W lamps	1800	66	0.26	475.2	$71.76												

111		Jones Office	4	2' x 4' 3-Lamp, T8, 28 W lamps	1800	66	0.26	475.2	$71.76													
112		Weissman Office	2	2' x 4' 3-Lamp, T8, 28 W lamps	1800	66	0.13	237.6	$35.88													
113		Brown Office	2	2' x 4' 3-Lamp, T8, 28 W lamps	1800	66	0.13	237.6	$35.88													
114		Guidice Office	2	2' x 4' 3-Lamp, T8, 28 W lamps	1800	66	0.13	237.6	$35.88													
115		Scutti Office	2	2' x 4' 3-Lamp, T8, 28 W lamps	1800	66	0.13	237.6	$35.88													
116		Records Room	2	2' x 4' 3-Lamp, T8, 28 W lamps	400	66	0.13	52.8	$7.97													
117		Copier Rm	2	2' x 4' 3-Lamp, T8, 28 W lamps	1800	66	0.13	237.6	$35.88													
118		Faculty Men's Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	200	45	0.09	18	$2.72													
119		Women's Room	3	2' x 4' 2-Lamp, T8, 28 W lamps	200	45	0.14	27	$4.08													
120		Athletic Director	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23													
121		Athletic Director	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29													
122		Library Office	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29													
123		Classroom 224	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82													
124		Classroom 225	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82													
125		Classroom 204	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82													
126		Classroom 205	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82													
127		Classroom 206	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82													
128		Classroom 207	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82													
129		Classroom 208	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82													
130		Classroom 209	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82													
131		Nurse's Waiting Room	1	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.09	156.6	$23.65													
132		Nurse Office	6	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.52	939.6	$141.88													
133		Nurse Office	1	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.09	156.6	$23.65													
134		215A Office	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29													
135		Faculty Men's Room	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72													
136		Faculty Men's Room	1	2' x 4' 1-Lamp, T8, 28 W lamps	400	25	0.03	10	$1.51													
137		Book Closet	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72													
138		School Store	4	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.35	626.4	$94.59													
139		Vice Principal's Office	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29													
140		Attendance Office	3	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.26	469.8	$70.94													
141		Attendance Office	1	2' x 4' 1-Lamp, T8, 28 W lamps	1800	25	0.03	45	$6.80													
142		Office #1	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23													
143		Files Room	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72													
144		ISS Room	3	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.14	54	$8.15													
145		Office #2	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23													
146		Classroom 217	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46													

147		Classroom 217	6	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.52	939.6	$141.88														
148		Classroom 218	6	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.52	939.6	$141.88														
149		Classroom 215	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82														
150		Classroom 214	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82														
151		Rooms 219/220/221	36	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	3.13	5637.6	$851.28														
152		Rooms 219/220/221	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23														
153		Storage Rm	1	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.09	34.8	$5.25														
154		Classroom 222	12	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.04	1879.2	$283.76														
155		Classroom 213	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82														
156		222 - Storage	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72														
157		Boys Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46														
158		Girls Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46														
159		Storage Rm	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72														
160		Storage Rm	1	2' x 4' 1-Lamp, T8, 28 W lamps	400	25	0.03	10	$1.51														
161		Classroom 223	21	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.83	3288.6	$496.58														
162		Classroom 212	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82														
163		Classroom 211/210	18	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.57	2818.8	$425.64														
164		Stage Storage	2	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.17	69.6	$10.51														
165		Basement Storage	4	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.18	72	$10.87														
166		Basement Storage	3	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.14	54	$8.15														
167		Basement Storage	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72														
168		Xerox Paper Storage	2	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.09	36	$5.44														
169		Storage Rm	2	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.09	36	$5.44		0												
170		Electrical Rm	1	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.05	18	$2.72														
171		Track Stock Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.09	36	$5.44														
172		Athelitic Storage	2	2' x 4' 1-Lamp, T8, 28 W lamps	400	25	0.05	20	$3.02														
173		Computer Training Rm	6	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.52	208.8	$31.53														
174		Room 110 - Tech Lab	7	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.61	243.6	$36.78														
175		Room 110 - Tech Lab	6	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.27	108	$16.31														
176		Tech Storage	2	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.17	69.6	$10.51														
177		TV Control Rm	3	2' x 4' 1-Lamp, T8, 28 W lamps	400	25	0.08	30	$4.53														
178		Editing Room	7	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.61	243.6	$36.78														
179		TV Storage Rm	1	2' x 4' 4-Lamp, T8, 28 W lamps	400	87	0.09	34.8	$5.25														
180		HUB Room	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29														
181		Office - 110	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29														
182		Multi Media Room	12	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.04	1879.2	$283.76														

183		Pool Office # 1	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23												
184		Pool Office #2	1	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.09	156.6	$23.65												
185		Handicap Bathroom	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23												
186		Classroom 114	18	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.57	2818.8	$425.64												
187		Faculty Dining	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$212.82												
188		Woodshop 112	16	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.39	2505.6	$378.35												
189		Woodshop Office	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46												
190		Wood Storage	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23												
191		Finish Room	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46												
192		Trainer's Rm	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29												
193		Maintenance Breakroom	4	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.18	324	$48.92												
194		Weight Rm	11	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.96	1722.6	$260.11												
195		Weight Room	7	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.32	567	$85.62												
196		Office	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$12.23												
197		Boys Rm	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29												
198		Girls Rm	2	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.09	162	$24.46												
199		Coaches Office	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$47.29												
		Totals	1514				131.53	218175	$32,944.43	968			0.00	0	$0.00		$0.00	82.38	136627	$20,630.65	0.00

Project Name: Rutherford High School
Location: Rutherford, Nj
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$1,432,440
Annual kWh Production	183,732
Annual Energy Cost Reduction	$27,744
Annual SREC Revenue	$64,306
First Cost Premium	**$1,432,440**
Simple Payback:	**15.56** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	300	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.151**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$71,622	0	0	0	$0	0	0	(71,622)	0
1	$0	183,732	$27,744	$0	$64,306	$94,598	$20,818	($23,366)	($94,988)
2	$0	182,813	$28,576	$0	$63,985	$93,093	$22,323	($22,855)	($117,843)
3	$0	181,899	$29,433	$0	$63,665	$91,479	$23,937	($22,318)	($140,161)
4	$0	180,990	$30,316	$0	$63,346	$89,749	$25,667	($21,753)	($161,914)
5	$0	180,085	$31,226	$1,855	$63,030	$87,893	$27,522	($23,015)	($184,930)
6	$0	179,184	$32,162	$1,846	$62,715	$85,904	$29,512	($22,384)	($207,314)
7	$0	178,288	$33,127	$1,836	$62,401	$83,770	$31,646	($21,724)	($229,038)
8	$0	177,397	$34,121	$1,827	$62,089	$81,483	$33,933	($21,033)	($250,071)
9	$0	176,510	$35,145	$1,818	$61,779	$79,030	$36,386	($20,311)	($270,382)
10	$0	175,628	$36,199	$1,809	$61,470	$76,399	$39,017	($19,556)	($289,938)
11	$0	174,749	$37,285	$1,800	$61,162	$73,579	$41,837	($18,768)	($308,706)
12	$0	173,876	$38,404	$1,791	$60,856	$70,554	$44,861	($17,947)	($326,653)
13	$0	173,006	$39,556	$1,782	$60,552	$67,311	$48,105	($17,090)	($343,743)
14	$0	172,141	$40,742	$1,773	$60,249	$63,834	$51,582	($16,197)	($359,940)
15	$0	171,281	$41,965	$1,764	$59,948	$60,105	$55,311	($15,267)	($375,207)
16	$0	170,424	$43,224	$1,755	$59,648	$56,106	$59,309	($14,299)	($389,506)
17	$0	169,572	$44,520	$1,747	$59,350	$51,819	$63,597	($13,292)	($402,798)
18	$0	168,724	$45,856	$1,738	$59,053	$47,222	$68,194	($12,244)	($415,042)
19	$0	167,881	$47,232	$1,729	$58,758	$42,292	$73,124	($11,155)	($426,197)
20	$0	167,041	$48,648	$1,721	$58,464	$37,006	$78,410	($10,023)	($436,221)
21	$0	166,206	$50,108	$1,712	$58,172	$33,715	$72,083	$770	($435,451)
22	$0	165,375	$51,611	$1,703	$57,881	$27,244	$59,318	$21,227	($414,223)
23	$0	164,548	$53,159	$1,695	$57,592	$0	$0	$109,056	($305,167)
24	$0	163,725	$54,754	$1,686	$57,304	$0	$0	$110,372	($194,795)
25	$0	162,907	$56,397	$1,678	$57,017	$0	$0	$111,736	($83,059)
	Totals:	4,327,982	$1,011,509	$37,065	$1,514,794	$1,494,183	$1,006,491	($11,437)	($7,163,286)
						Net Present Value (NPV)		**($183,514)**	
						Internal Rate of Return (IRR)		**#DIV/0!**	

Project Name: **Rutherford High School**
Location: **Rutherford, Nj**
Description: **Photovoltaic System - Direct Purchase**

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$1,432,440
Annual kWh Production	183,732
Annual Energy Cost Reduction	$27,744
Annual SREC Revenue	$64,306
First Cost Premium	**$1,432,440**
Simple Payback:	**15.56** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.151**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$1,432,440	0	0	0	$0	(1,432,440)	0
1	$0	183,732	$27,744	$0	$64,306	$92,050	($1,340,390)
2	$0	182,813	$28,576	$0	$63,985	$92,561	($1,247,830)
3	$0	181,899	$29,433	$0	$63,665	$93,098	($1,154,732)
4	$0	180,990	$30,316	$0	$63,346	$93,663	($1,061,069)
5	$0	180,085	$31,226	$1,855	$63,030	$92,400	($968,669)
6	$0	179,184	$32,162	$1,846	$62,715	$93,031	($875,638)
7	$0	178,288	$33,127	$1,836	$62,401	$93,692	($781,946)
8	$0	177,397	$34,121	$1,827	$62,089	$94,383	($687,563)
9	$0	176,510	$35,145	$1,818	$61,779	$95,105	($592,458)
10	$0	175,628	$36,199	$1,809	$61,470	$95,860	($496,598)
11	$0	174,749	$37,285	$1,800	$61,162	$96,647	($399,951)
12	$0	173,876	$38,404	$1,791	$60,856	$97,469	($302,482)
13	$0	173,006	$39,556	$1,782	$60,552	$98,326	($204,156)
14	$0	172,141	$40,742	$1,773	$60,249	$99,219	($104,937)
15	$0	171,281	$41,965	$1,764	$59,948	$100,149	($4,789)
16	$0	170,424	$43,224	$1,755	$59,648	$101,117	$96,328
17	$0	169,572	$44,520	$1,747	$59,350	$102,124	$198,452
18	$0	168,724	$45,856	$1,738	$59,053	$103,171	$301,623
19	$0	167,881	$47,232	$1,729	$58,758	$104,261	$405,884
20	$0	167,041	$48,648	$1,721	$58,464	$105,392	$511,276
21	$1	166,206	$50,108	$1,712	$58,172	$106,568	$617,844
22	$2	165,375	$51,611	$1,703	$57,881	$107,789	$725,633
23	$3	164,548	$53,159	$1,695	$57,592	$109,056	$834,689
24	$4	163,725	$54,754	$1,686	$57,304	$110,372	$945,061
25	$5	162,907	$56,397	$1,678	$57,017	$111,736	$1,056,797
	Totals:	4,327,982	$1,011,509	$37,065	$1,514,794	$2,489,237	($4,529,620)
				Net Present Value (NPV)			**$1,056,822**
				Internal Rate of Return (IRR)			**4.6%**

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
High School	11300	Sunpower SPR230	692	14.7	10,175	159.16	183,732	22,836	15.64

.= Proposed PV Layout

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

PVWatts Version 1 Input Screen

PV System Specifications:

DC Rating (kW):	159.16	Inputted From Roof Space Cell "G2" Total KW
DC to AC Derate Factor:	0.81	Inputted From Derate Factor Calculated Below in Cell "B37"
Array Type:	Fixed Tilt 1 - Axis Tracking 2 - Axis Tracking	There are 3 inputs for Array Type in all cases you should be using **Fixed Tilt** as the Selection
Fixed Tilt of Single Axis Tracking System:		
Array Tilt (degrees):	10	Based on Roof Type: For Flat Roof use 10 degrees, For Pitched Roof this is based on roof pitch.
Array Azimuth (degrees):	180	Based on Direction Array is Facing.

PV Watts Derate Factor for AC Power Rating at STC		
Component Derate Factors	PVWatts Default	Range
PV module nameplate DC rating	1.00	0.80–1.05
Inverter and transformer	0.95	0.88–0.96
Mismatch	0.98	0.97–0.995
Diodes and connections	1.00	0.99–0.997
DC wiring	0.98	0.97–0.99
AC wiring	0.99	0.98–0.993
Soiling	0.95	0.30–0.995
System availability	0.95	0.00–0.995
Shading	1.00	0.00–1.00
Sun-tracking	1.00	0.95–1.00
Age	1.00	0.70–1.00
Overall DC-to-AC derate factor	**0.81**	0.96001–0.09999

PVWatts * * * **AC Energy & Cost Savings**

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	159.0 kW
DC to AC Derate Factor:	0.810
AC Rating:	128.8 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.39	9540	14.41
2	3.17	11565	17.46
3	4.07	16186	24.44
4	4.83	17933	27.08
5	5.70	21336	32.22
6	5.94	20849	31.48
7	5.77	20687	31.24
8	5.38	19160	28.93
9	4.65	16485	24.89
10	3.61	13570	20.49
11	2.35	8655	13.07
12	2.01	7766	11.73
Year	4.16	183732	277.44

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data — Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice

RReDC Return to RReDC home page (*http://rredc.nrel.gov*)

Pool Sizing Sheet | Enerlyzer Input Sheet | Notes Sheet

Total Cost of Operation

14-Oct-09

Project: Rutherford HS
City: NJ, NEWARK

		Continuous Push Pull Ventilation	Desert Aire Select-Aire Dehumidifier
% Time Under Control	Unocc.	60%	100%
	Occ	61%	100%
Costs			
Outside Air Heating		$79,419	$24,576
Water Heating		$88,668	$88,668
S/A Blower Electrical		$9,868	$39,471
E/A Blower Electrical		$9,868	$5,756
Compressor Electrical		n/a	$52,399
Estimated Building Skin Gain/Loss		Not Included	Not Included
Gross Operational Cost		$187,823	$210,871
Energy Recovery Cost		0	($99,212)
Net Operational Cost		$187,823	$111,658

Notes

1) Occupied hours are from 8 am to 10 pm (14hrs)
2) Cooling mode occurs when outside air temperature is > 70°F
3) Heating mode occurs when outside air temperature is < 60°F
4) This analysis does not add the additional cost of cooling hot outside air in the summer

Pool Load Worksheet

10/14/2009

Rev 2009_07C

AIR TECTONICS
333 N Oxford Valley Rd. Ste. 401
Fairless Hills, PA 19030

Ph: (215) 945-2600
Fax: (215) 945-2602

Project: Rutherford HS
Tag: PDU-1

United States Selected

NEW JERSEY
State: Newark
City:

Weather Data is from ASHRAE Dehumidification DB/MDP - Table 1B

ASHRAE 0.4% | ASHRAE 1% | ASHRAE 2%

Manual Selection of ASHRAE Weather Data

Outdoor Air Conditions: ASHRAE Weather Data | User-Entered Data

ASHRAE		User-Entered
80°Fdb	Summer	
75°Fwb	Summer	
121 gr/lb		
10°Fdb	Heating	
30 ft.	Elevation	

Power Source: 60 Hz | 50 Hz

Outdoor Condenser Design Temperature: 95°F

Pool Room Design Details

#1 Public (School/YMCA)	13,448	sq ft
Water Temp. 1st Pool:	80	°F
No 2nd Pool	0	sq ft
Water Temp. 2nd Pool:	0	°F
No 3rd Pool	0	sq ft
Water Temp. 3rd Pool:	0	°F
Pool Room Volume:	318,160	cu ft

Outside Air Design Details

Pool & Deck Area:	15,300	sq ft
Spectator / Bleacher Area:	0	sq ft
Number of Spectators:	0	

Design Pool & Deck:	7,344	cfm
Design Spectator:	0	cfm

Continous Outside Air

Design Ventilation Air CFM Within Selected Unit Capacity

Outside Air Is Providing 1.4 A/C per hour

No Outside Air Pre-heat Required

Indoor Air Design Details

Room Design Temp.	83	°F
RH Design Unoccupied	50	%
RH Design Occupied	60	%

Unoccupied Pool Evaporation Calculation

1st Pool:	311.6 lb/hr
2nd Pool:	0.0 lb/hr
3rd Pool:	0.0 lb/hr
Pool & Deck Outside Air:	0.0 lb/hr
Total @ 50%RH	**311.6 lb/hr**

Occupied Pool Evaporation Calculation

1st Pool:	470.1 lb/hr
2nd Pool:	0.0 lb/hr
3rd Pool:	0.0 lb/hr
Pool & Deck Outside Air:	88.3 lb/hr
Spectator Outside Air:	0.0 lb/hr
Spectator Latent:	0.0 lb/hr
Total @ 60%RH	**558.4 lb/hr**

Select Dehumidifier

Model: ND/SA50

ROC Model Type: Standard Line Three Phase

	UnOcc	Occ	
Unit Moisture Capacity:	228.6	287.7	lb/hr
Enter Unit Quantity:	2	2	
Total Moisture Capacity:	457.3	575.3	lb/hr

Room Air Changes: 8.3 A/C per hour

R410A Refrigerant Selected

Unit Details & Performance Values per Unit Occupied Conditions

Total Capacity	632.3	MBH
Sensible Capacity	330.2	MBH
Net Reheat Capacity	467.7	MBH
Unit Air Volume	22,000	CFM
Moisture Removal Capacity (MRC)	287.7	LB/HR
ND | SA MRE @ ARI 910 Rating*	0.0	MRE with No Pool Heat
ND | SA MRE @ Application Rating**	0.0	MRE with No Pool Heat
LAT in Reheat	102.7	°F
LAT in Cooling	69.1	°F
Power	64.8	kW
Maximum Outside Air	6000	CFM
Design Outside Air	7344	CFM
Outside Air Preheat	0	MBH
THR / Water Htg Capacity	797.9	MBH Total
Remote Condenser Model	**ROCH021D04C**	Both Circuits
ROC Circuit A Only	ROCH009S01C	Circuit A Only
ROC Circuit B Only	ROCH015S02B	Circuit B Only
Water Heating	317.8	MBH Cir A
Water Heating	480.1	MBH Cir B

*** Moisture Removal Efficiency (MRE) @ ARI 910 is at 82ºF / 60%RH No Pool Heat. ** Application MRE is at Occupied Conditions**
The above equipment selection is based on project information provided by others (e.g. pool water and air temperatures). Any changes may require different dehumidification capacity than the unit suggested above

DESERT AIRE

Pool Sizing Sheet | Energy Summary Sheet

10/14/2009

Project: Rutherford HS

Select City for Bin Hours of Operation

Selected City: NJ, NEWARK

Utility Costs

$ 1.670 $ / therm
$ 0.151 $ / kW

Pool Water Hgt
- ○ No Water Cond
- ◉ With Water Cond

Push Pull Ventilation Information

Unit Volume 13,800 cfm

Blower Size

◉ Automatic Selection	10	HP S/A
	10	HP E/A
	15	HP Exch. S/A
	15	HP Exch. E/A
○ Special Selection	0	HP S/A
	0	HP E/A
	0	HP Exch. S/A
	0	HP Exch. E/A

Standard DX Dehumidifier
ND/SA50

Dehumidifier

◉ Automatic Selection	20.0	HP S/A
	5.0	HP E/A
○ Special Selection	0.0	HP S/A
	0.0	HP E/A

Economizer Information

Economizer

◉ Automatic Selection	22,000	cfm
	25	HP S/A
	25	HP E/A
	50	HP Compr.
○ Special Selection	140,000	cfm
	20	HP S/A
	20	HP E/A
	30	HP Compr.

Pool Sizing Sheet | Enerlyzer Input Sheet | Notes Sheet

Total Cost of Operation

14-Oct-09

Project: Rutherford HS
City: NJ, NEWARK

		Continuous Push Pull Ventilation	Desert Aire Select-Aire Dehumidifier
% Time Under Control	Unocc.	60%	100%
	Occ	61%	100%
Costs			
Outside Air Heating		$79,419	$24,576
Water Heating		$88,668	$88,668
S/A Blower Electrical		$9,868	$39,471
E/A Blower Electrical		$9,868	$5,756
Compressor Electrical		n/a	$52,399
Estimated Building Skin Gain/Loss		Not Included	Not Included
Gross Operational Cost		$187,823	$210,871
Energy Recovery Cost		0	($99,212)
Net Operational Cost		$187,823	$111,658

Notes

1) Occupied hours are from 8 am to 10 pm (14hrs)
2) Cooling mode occurs when outside air temperature is > 70°F
3) Heating mode occurs when outside air temperature is < 60°F
4) This analysis does not add the additional cost of cooling hot outside air in the summer