ENERGY AUDIT – FINAL REPORT

RIVERVIEW ELEMENTARY SCHOOL

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DENVILLE, NJ 07834
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BUSINESS ADMINISTRATOR

CEG PROJECT NO. 9C09080

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I. EXECUTIVE SUMMARY

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

Denville Board of Education
Riverview Elementary School
33 St. Mary's Place
Denville, NJ 07834

Municipal Contact Person: John Serapiglia
Facility Contact Person:

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

The annual energy costs at this facility are as follows:

Electricity	$ 55,476
Natural Gas	$ 65,430
Total	$ 120,907

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

Table 1
Energy Conservation Measures (ECM's)

ECM NO.	DESCRIPTION	COST[A]	ANNUAL SAVINGS[B]	SIMPLE PAYBACK (YEARS)	SIMPLE ROI
1	Lighting Upgrade – General	$42,428	$5,525	7.7	13.0%
2	Lighting Controls	$4,015	$1,782	2.3	44.4%
3	HVAC System Controls	$189,684	$6,865	27.6	3.6%
4	Hot Water Reset Controller	$4,275	$3,243	1.3	75.9%
5	Solar PV – Direct Purchase	$989,460	$88,700	11.2	8.9%

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

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

Table 2
Estimated Energy Savings

ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELEC. DEMAND (KW)	ELEC. CONSUMPTION (KWH)	NAT GAS (THERMS)
1	Lighting Upgrade – General	15.7	31,532	-
2	Lighting Controls	-	10,673	-
3	HVAC System Controls	-	6,865	3,749
4	Hot Water Reset Controller	-	-	1,875
5	Solar PV – Direct Purchase	110	171,566	-

*Elec. Demand Savings are calculated for cooling season only. Elec. consumption savings are totaled annually.

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

- **ECM #1:** Lighting Upgrade
- **ECM #2:** Lighting Controls
- **ECM #4:** Hot Water Reset Controller

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

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

window level such as window air conditioners are particularly susceptible to dust and dirt created from landscaping and people activity.

2. Maintain all weather stripping on entrance doors. The majority of the entrance doors in the facility have significant leakage area around the doors which increases infiltration into the building.
3. Clean all light fixtures to maximize light output. Cleaned light fixtures providing full light output, may prevent added task lighting from being turned on and left on.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
5. Set hot water re-circ pump temperature set-point below the domestic hot water supply temperature setting. This will avoid continuous operation of the hot water re-circ pump while still providing the benefit of on demand hot water to the remote fixtures in the facility. Provide a time clock in addition to hot water re-circ aqua stat to stop hot water circulation during unoccupied periods. Keeping the hot water piping hot 24/7 is unnecessary when fixtures will not be used and adds energy consumption in the cooling season due to added cooling load in the building.
6. Set all computers and computer monitors to run in power saving (standby or sleep) mode when not in use. Added heat output from computers compounds the work that air conditioners have to do to remove the heat.
7. Repair leaking faucets in janitorial closets, bathrooms, and maintenance rooms. Although this is not associated with direct energy savings, dripping faucets will corrode and cause calcification on plumbing fixtures resulting in pre-mature replacement.
8. A major concern for the facility is the extremely high gas usage compared to the heating square footage. This building consumes more gas heat than Valleyview middle school which is almost two times the size. A major contributor could be the ceiling plenum ventilation system. Investigate and confirm that all ceiling plenum ventilation hoods are operating correctly and most importantly, opening only when needed in the heating season could result in significant heating savings.

II. INTRODUCTION

The comprehensive energy audit covers the 47,421 square foot Riverview Elementary School that includes classrooms, support spaces, a gymnasium, cafeteria/all purpose room, and administrative offices.

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

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 SmartStart 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 costs and savings are applied and a simple payback and simple return on investment (ROI) is calculated. The simple payback is based on the years that it takes for the savings to pay back the net installation cost (Net Installation divided by Net Savings.) A simple return on investment is calculated as the percentage of the net installation cost that is saved in one year (Net Savings divided by Net Installation.)

A simple life-time calculation is shown for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The energy savings is extrapolated throughout the life-time of the ECM. The total energy savings is calculated as the total life-time multiplied by the yearly savings.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The electric usage profile (below) represents the actual electrical usage for the facility. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Secondary Three-Phase rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. New Jersey Natural Gas (NJN) provides natural gas to the facility along with a third party provider Pepco Energy Services. NJN provides natural gas under the General Supply Large (GSL) rate structure. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

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

Description	Average
Electricity	16.7¢ / kWh
Natural Gas	$1.73 / Therm

Table 3
Electricity Billing Data

Utility Provider: JCP&L, General Service Secondary 3 Phase (Meter # G28742831)			
MONTH OF USE	**CONSUMPTION KWH**	**DEMAND**	**TOTAL BILL**
Jul-08	21,760	95.7	$4,139
Aug-08	26,080	66.7	$4,630
Sep-08	27,840	113.4	$5,138
Oct-08	25,920	87.4	$4,082
Nov-08	25,440	86.2	$4,028
Dec-08	29,120	98.9	$4,734
Jan-09	31,840	99.2	$5,242
Feb-09	30,560	96.5	$5,054
Mar-09	32,960	98.9	$5,334
Apr-09	32,800	94.2	$5,237
May-09	24,640	103.2	$4,015
Jun-09	22,400	115.5	$3,845
Totals	**331,360**	**115.5 Max**	**$55,476**
AVERAGE DEMAND 96.3 KW average			
AVERAGE RATE $0.167 $/kWh			

Figure 1
Electricity Usage Profile

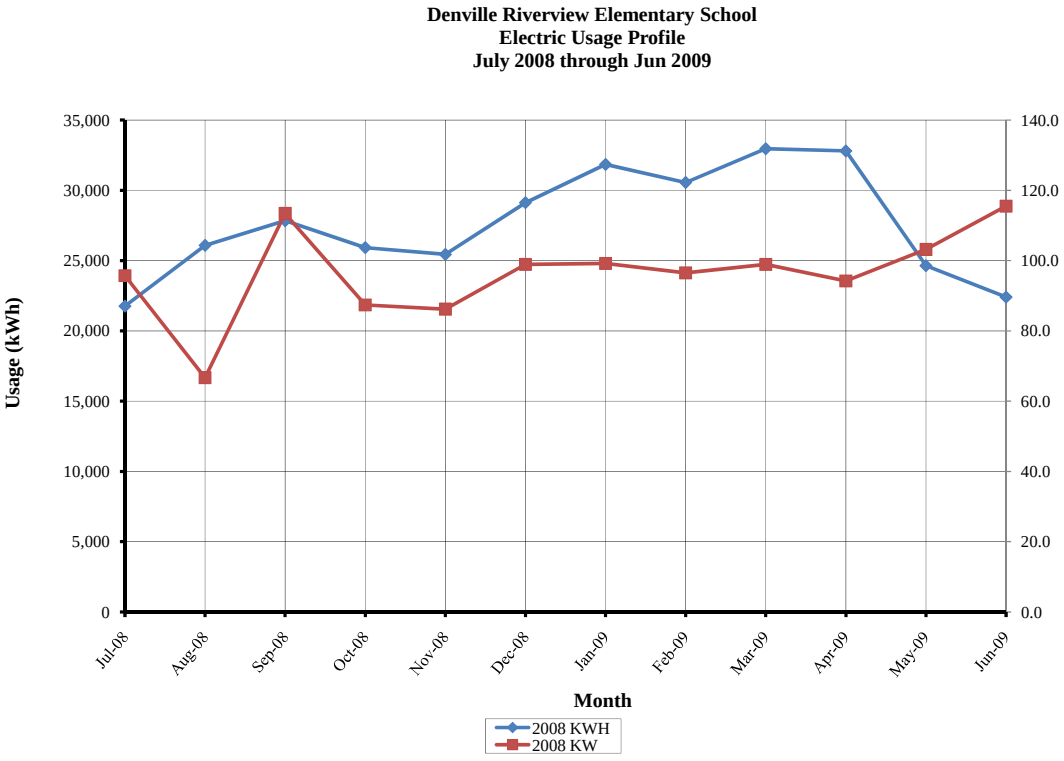
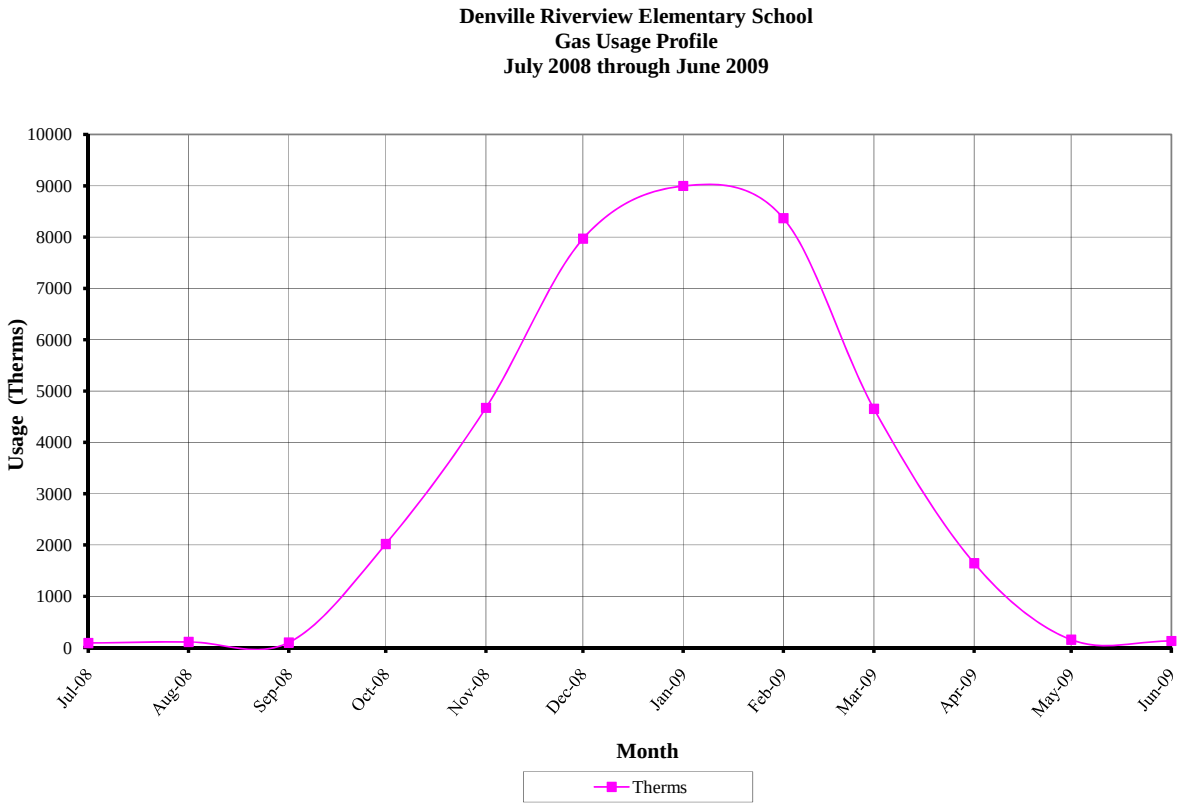


Table 4
Natural Gas Billing Data

Utility Provider: NJN, Rate - GSL, (Meter # 00546261)		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jul-08	89	$1,094.36
Aug-08	109	$1,087.26
Sep-08	97	$1,060.34
Oct-08	2,016	$3,697.08
Nov-08	4,672	$7,755.39
Dec-08	7,969	$12,762.98
Jan-09	8,996	$14,271.08
Feb-09	8,368	$12,859.09
Mar-09	4,653	$7,616.29
Apr-09	1,643	$3,226.44
May-09	152	$911.22
Jun-09	129	$875.17
TOTALS	**38,892**	**$67,217**
AVERAGE RATE:	**$1.73**	**$/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:

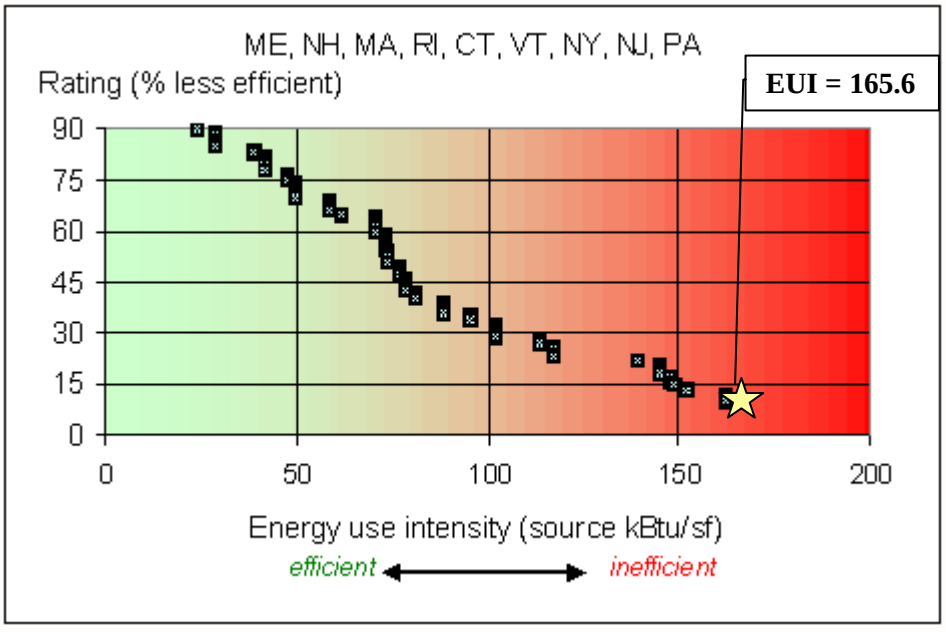
$$Building\ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Gas\ Usage\ in\ kBtu)}{Building\ Square\ Footage}$$

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

Table 5
Denville Riverview Elementary School EUI Calculations

ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu	RATIO	kBtu
ELECTRIC	331,360			1,131,263	3.340	3,778,419
NATURAL GAS		38,891.97		3,889,197	1.047	4,071,989
FUEL OIL			0.00	0	1.010	0
PROPANE			0.00	0	1.010	0
TOTAL				5,020,460		7,850,408
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		47,421		SQUARE FEET		
BUILDING SITE EUI		105.87		kBtu/SF/YR		
BUILDING SOURCE EUI		**165.55**		**kBtu/SF/YR**		

Figure 3
Source Energy Use Intensity Distributions: Schools



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 following is the user name and password for this account:

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

User Name:	denvilleboe
Password:	lgeaceg2009
Security Question:	What is your birth city?
Security Answer:	"Denville"

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

Table 6
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Denville Riverview ES	32	50

See the Statement of Energy Performance appendix for the detailed energy summary.

V. FACILITY DESCRIPTION

The 47,421 SF Elementary School is a two story facility comprised of classrooms, offices, cafeteria, kitchen, gymnasium, and library on the first floor, and additional classrooms on the 2nd floor. The building was originally a single story building built in 1951. A two story addition was added to the south side of the building in 1966, which includes a science room art room and classrooms. The typical school hours are between 8:30 am and 3:30 pm. The building construction is CMU block with face brick. The exterior walls have minimal insulation typical of the time period. It is unknown if the CMU blocks are filled. The windows throughout the facility are in good condition and appear to be maintained. The window type throughout the facility is double pane, clear glass with aluminum frames. Blinds are installed on the inside of some of the windows; however this is not standard throughout. The blinds are valuable because they help to reduce solar heat gain in the summer. The roof is a flat roof. Approximately 50% of the roof is a rubber roof and 50% light crushed stone. Roof insulation is above the metal deck. The amount of insulation below the roof membrane is unknown. Most doorways into the school are double doors with weather stripping either missing or in poor condition. The main entrance to the school does not have a vestibule.

HVAC Heating System

The School is heated by 3 large gas fired steam boilers. The boilers were installed in 2006 and are in good condition. Each boilers input capacity is 3753 MBH. The boilers are configured to produce low pressure steam since half of the building operates with steam terminal devices. Boiler steam is provided unit convectors, unit ventilators in the original part of the building. The addition portion of the building operates with a heating water loop. The boiler's steam runs through a shell and tube heat exchanger to provide heat for the heating water loop. The heating water loop is circulated with two 3 HP base mounted pumps (operating and standby). The pumps are controlled by a local control panel. The heating water is circulated throughout the building to baseboards, unit ventilators, air handling units with hot water coils. The unit ventilators are operated manually and the blower typically runs 24/7. The heating equipment is controlled by a pneumatic system. The baseboards and hot water coil water flow as well as the steam flow for the unit convectors and unit ventilators are regulated by old pneumatic driven control valves. Some components in the pneumatic system do not respond and leak. Space temperatures are over / under heating in some areas in the heating season. The unit ventilators in the original portion of the building are currently being replaced with new steam unit ventilators.

HVAC Cooling System

The building does not have a central cooling system. A few spaces are air conditioned by either window air conditioners, split systems or packaged rooftop air conditioners. Window air conditioners are installed throughout the building for perimeter offices, support spaces, and classrooms as needed. The window AC unit are of various size, age, and capacity, and the range of efficiencies for the window AC units is 8.6 – 11.0 energy efficiency ratio (EER). The Packaged rooftop units provide conditioned air for higher heat load areas including the front office, library, and computer lab. A ductless split system is dedicated for the IT closet for 24/7 cooling. Approximately 50% of the school is air conditioned.

Due to the lack of cooling originally designed for the building, large ventilation ducts and Exhaust fans / hoods are in place to ventilate the ceiling plenum space. The intent of the ventilation system is to provide hot air relief through stack effect or mechanical exhaust of the ceiling plenum. Common practice would include back draft dampers or motor operated dampers which would close the relief hoods and turn off the exhaust fans in unoccupied periods and in the heating season. The hoods / exhaust fans appear old and in very poor condition. The dampers may be stuck open or not operational.

Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters. The toilet room exhaust fans are operated manually by maintenance personnel and typically run 24/7. Many exhaust fans are manually disconnected from its electric supply, missing belts, and/or have burnt out motors. The ceiling plenum space is exhausted through large exhaust fans on the roof. Many of these units are not operating. It is unknown if the units include back draft dampers or motor operated dampers to prevent the loss of conditioned air in the heating season or unoccupied periods.

Domestic Hot Water

Domestic hot water for lavatories, office lounge, and kitchen facilities is provided by a dedicated gas fired hot water heater. The domestic hot water is independent of the central boiler system to avoid use of the heating boilers in the non heating season. The domestic hot water heater has a capacity of 71 gallons and input rating of 120 MBH. The domestic hot water is circulated throughout the building by a hot water re-circ pump. The circulation pump is controlled by an aqua stat. The set-point of the domestic hot water re-circ pump is set to 125°F which keeps the hot water circulating 24/7. The domestic hot water piping insulation appeared to be in good condition.

Lighting

Typical lighting throughout building is fluorescent tube lay-in fixtures with T-12 lamps and magnetic ballasts. Storage rooms and closets lit with a mixture of incandescent lamps and compact fluorescent lamps. The parking lot is lit with light poles and metal halide lamps. All interior lighting is manually controlled by the building occupants by wall switches. The gym is lit with high ceiling metal halide fixtures, and the auditorium is lit with high pressure sodium fixtures.

VI. MAJOR EQUIPMENT LIST

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

Refer to the Major Equipment List Appendix for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade – General

Description:

The lighting in Riverview elementary school is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts. There are a few storage rooms and closets with incandescent lighting and compact fluorescent fixtures.

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

This ECM also includes replacement of all incandescent fixtures to compact fluorescent fixtures. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Hours of Operation:

Classrooms, Hallways, Gym, Offices, Library, etc:
8 Hrs per day, 5 days per week, 47 weeks per year – 1880 Hrs per year.

Hallways:
10 Hrs per day, 5 days per week, 47 weeks per year – 2350 Hrs per year.

Storage rooms, Boiler room:
24% of normal hours (above) – 470 Hrs per year.

Outdoor Lighting:
10 Hrs per day, 7 days per week, 52 weeks per year – 3640 Hrs per year.

Energy Savings Calculations:

The Investment Grade Lighting Audit appendix outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the Smart Start Incentive appendix, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $10 per fixture; T-5 or T-8 (3-4 lamp) = $20 per fixture.

$$\text{Smart Start®}\ Incentive = (\#\ of\ 1-2\ lamp\ \ fixtures \times\ \$10) + (\#\ of\ 3-4\ lamp\ \ fixtures \times\ \$20)$$

$$\text{Smart Start®}\ Incentive = (407 \times\ \$10) + (57 \times\ \$20) = \underline{\$5{,}210}$$

Replacement and Maintenance Savings are calculated as follows:

$$Savings = (reduction\ in\ lamps\ replaced\ \ per\ \ year) \times (repacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp)$$

$$Savings = (37\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \underline{\$259}$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$47,638
NJ Smart Start Equipment Incentive ($):	($5,210)
Net Installation Cost ($):	$42,428
Maintenance Savings ($ / yr):	*$259*
Energy Savings ($ / yr):	*$5,266*
Net Savings ($ / yr):	*$5,525*
Simple Payback (yrs):	*7.7*
Simple Return On Investment (%):	*13.0%*
Estimated ECM Lifetime (Yr)	*25*
Simple Lifetime Savings ($)	*$138,125*

* ECM#1 Calculations DO NOT include lighting control changes implemented in ECM#2. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in storage rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas. Photocell control senses light levels and turn off or reduce lights when there is adequate daylight. Photocells are mostly used outside, but are becoming more popular in energy-efficient interior lighting designs as well.

ASHRAE Standard 90.1-2004 - Appendix G is a reference standard for modeling building efficiency. The standard estimates that lighting controls provide a 10% reduction in lighting power usage for daytime occupancies in buildings over 5,000 SF, and 15% reduction in buildings under 5,000 SF. This ECM includes dual technology occupancy sensors in each private office / faculty room, restrooms, classroom, and hallways.

The ECM includes replacement of standard wall switches with sensors wall switches for individual classrooms and offices. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. See the "Investment Grade Lighting Audit" appendix for details.

The "Investment Grade Lighting Audit" appendix of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by 10% for all areas that include occupancy sensor lighting controls.

Light Energy = 106,731 kWh/Yr. occupancy sensor controlled lighting

Energy Savings Calculations:

$$Energy\ Savings = 10\% \times Occuapancy\ Sensored\ Light\ Energy\ (kWh/Yr)$$

$$Energy\ Savings = 10\% \times 106{,}731\,(kWh) = 10{,}673\,(kWh)$$

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

$$Savings. = 10{,}673\,(kWh) \times 0.167\left(\frac{\$}{kWh}\right) = \$1{,}782$$

Installation cost per dual-technology sensor (Basis: Sensor switch or equivalent) is $75/unit including material and labor.

Installation Cost = $75 x 73 motion sensors = $5,475

From the NJ Smart Start appendix, the installation of a lighting control device warrants the following incentive: occupancy = $20 per fixture.

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ wall\ mount\ devices \times\ \$\,20) = (73 \times \$20) = \$1460$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY*	
Installation Cost ($):	$5,475
NJ Smart Start Equipment Incentive ($):	$1,460
Net Installation Cost ($):	*$4,015*
Maintenance Savings ($ / yr):	*$0*
Energy Savings ($ / yr):	*$1,782*
Total Energy Savings ($ / yr):	*$1,782*
Simple Payback (yrs):	*2.3*
Simple Return On Investment (%)	*44.4%*
Estimated ECM Lifetime (Yr)	*15*
Simple Lifetime Savings ($)	*$26,730*

* ECM#2 Calculations DO NOT include lighting changes implemented in ECM#1. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

ECM #3: HVAC System Controls

Description:

The existing control system is an outdated pneumatic control system. The zone thermostats are manually set pneumatic actuators controlling local control valves within the space. The system is original to the building's heating system installed in 1963. The space thermostats are inaccurate due to temperature drift over time, leakage, or frozen actuators. The thermostats do not have programmability such as night set back, or morning warm-up features. Modern thermostats and control systems have the capability of saving siginificant energy as well as improve occupant comfort.

This ECM includes installing a Building Automation system through Direct Digital Controls (DDC) wired through an Ethernet backbone and front end controller. The system will include new thermostat controllers for terminal unit ventilators, baseboard zones, and air handling units, wired back to a front end controller with computer interface. The front end device will provide communication between the devices and the main boilers. The system will respond to the overall building's needs and operating schedules as defined by the building operator. The DDC system will provide features such as space averaging, temperature override control, night set-back, morning warm-up mode, heating water loop temperature re-set, etc.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Energy Management and Control System Savings - 5%-15%.
- Commissioning - 5%-15%.
- Automatic Fault Detection and Diagnostics - 5%-15%.
- Occupancy Sensors for Lighting Control - 20%-28%.
- Photosensor-Based Lighting Control -20%-60%.
- Demand Controlled Ventilation (DCV) -10%-15%.

Energy savings achieved for "Energy Management and Control Systems," average 5%-15%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total energy cost for the facility.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $4.00 per SF. Savings from the implementation of this ECM will be primarily achieved through natural gas savings from reduced heating energy. A small portion of savings will result from the cooling system management for the central AC systems

Cost of complete DDC System = ($4.00/SF x 47,421 SF) = $189,684.

Total Gas usage = 38,892 Therms

Estimated non-Heat gas usage (kitchen & HW) = 140 Therms*
(*Averaged from May & June gas usage)
Average Cost of Gas = $1.73/Therm

Cooling Capacity (Office, Librayr, Comp Rm) = 26 tons
Cooling Season Full Load Cooling Hrs. = 800 hrs/yr.
Average Cooling Equipment EER = 11.0 EER
Average Cost of Electricity = $0.167/kWh

Energy Savings Calculations:

Heating Savings Calculations

$$Heating\ Gas\ Input = Total\ Cons.\left(Therms\right) - \left(Est.\ HW\ /\ Kitchen\ Use\left(\frac{Therms}{Month}\right) \times Use\left(\frac{Months}{Yr}\right)\right)$$

$$Heating\ Gas\ Input = 38{,}892\left(Therms\right) - \left(140\left(\frac{Therms}{Month}\right) \times 10\left(\frac{Months}{Yr}\right)\right) = 37{,}492\left(Therms\right)$$

$$Savings. = Heating\ Gas\ Input\left(Therms\right) \times 10\%\ Savings \times Ave\ Gas\ Cost\left(\frac{\$}{Therm}\right)$$

$$Savings. = 37{,}492\left(Therms\right) \times 10\% \times 1.73\left(\frac{\$}{Therm}\right) = \$6{,}486$$

Cooling Savings Calculations

$$Est\ Cool\ Cons. = \frac{Cool\ Load\left(Tons\right) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times Full\ Load\ Cooling\ Hrs.}{Ave\ Energy\ Efficiency\ Ratio\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)}$$

$$Est\ Cool\ Cons. = \frac{26\left(Tons\right) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times 800\ Hrs.}{11.0\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)} = 22{,}691\left(kWh\right)$$

$$Savings. = Cool\ Cons.\left(kWh\right) \times 10\%\ Savings \times Ave\ Elec\ Cost\left(\frac{\$}{kWh}\right)$$

$$Savings. = 22{,}691\,(kWh) \times 10\% \times 0.167\left(\frac{\$}{kWh}\right) = \$379$$

$$Total\ ECM\ \ Savings = \$6{,}486 + \$379 = \$6{,}865$$

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY*	
Installation Cost ($):	$189,684
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$189,684
Maintenance Savings ($ / yr):	*$0*
Energy Savings ($ / yr):	*$6,865*
Total Energy Savings ($ / yr):	*$6,865*
Simple Payback (yrs):	*27.6*
Simple Return On Investment (%)	*3.6%*
Estimated ECM Lifetime (Yr)	*15*
Simple Lifetime Savings ($)	*$102,975*

ECM #4: Hot Water Reset Controller

Description:

The existing control system is an outdated pneumatic control system. The space thermostats are inaccurate and therefore overheat many spaces throughout the building. A hot water temperature re-set controller adjusts the heating hot water loop temperature based on the outdoor temperature. If the ambient conditions are warmer, the boiler controller decreases the heating water supply temperature to match the skin load. This reduces standby losses in the heating water piping system as well as minimizes overshooting of space temperatures by old thermostats with poor control.

This ECM includes installing a heating water temperature re-set controller on the heating hot water portion of the building. The controller would be mounted in the boiler room with a remote outside air temperature sensor. The controller would be connected to the steam control valve to the heating hot water loop which feeds approximately 50% of the building. This ECM only applies to the heating system energy usage

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Energy Management and Control System Savings - 5%-15%.
- Commissioning - 5%-15%.
- Automatic Fault Detection and Diagnostics - 5%-15%.
- Occupancy Sensors for Lighting Control - 20%-28%.
- Photosensor-Based Lighting Control -20%-60%.
- Demand Controlled Ventilation (DCV) -10%-15%.

Energy savings achieved for "Energy Management and Control Systems," average 5%-15%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the heating energy for the facility.

The cost of a temperature re-set controller with the associated temperature sensors and field devices including labor is estimated at $4,275

Total Gas usage	= 38,892 Therms
Estimated non-Heat gas usage (kitchen & HW)	= 140 Therms*
(*Averaged from May & June gas usage)	
Average Cost of Gas	= $1.73/Therm

<u>Heating Savings Calculations</u>

$$Heating\ Gas\ Input = Total\ Cons.\left(Therms\right) - \left(Est.\ HW\ /\ Kitchen\ Use\left(\frac{Therms}{Month}\right) \times Use\left(\frac{Months}{Yr}\right)\right)$$

$$Heating\ Gas\ Input = 38{,}892\left(Therms\right) - \left(140\left(\frac{Therms}{Month}\right) \times 10\left(\frac{Months}{Yr}\right)\right) = 37{,}492\left(Therms\right)$$

$$Hot\ Water\ Portion\ of\ \ Building = Heating\ Gas\ Input\left(Therms\right) \times 50\%$$

$$Hot\ Water\ Portion\ of\ \ Building = 37{,}492\left(Therms\right) \times 50\% = 18{,}746\left(Therms\right)$$

$$Savings. = Heating\ Gas\ Input\left(Therms\right) \times 10\%\ Savings \times Ave\ Gas\ Cost\left(\frac{\$}{Therm}\right)$$

$$Savings. = 18{,}746\left(Therms\right) \times 10\% \times 1.73\left(\frac{\$}{Therm}\right) = \$3{,}243$$

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY*	
Installation Cost ($):	$4,275
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$4,275
Maintenance Savings ($ / yr):	*$0*
Energy Savings ($ / yr):	*$3,243*
Total Energy Savings ($ / yr):	*$3,243*
Simple Payback (yrs):	*1.3*
Simple Return On Investment (%)	*75.9%*
Estimated ECM Lifetime (Yr)	*15*
Simple Lifetime Savings ($)	*$64,125*

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

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

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

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 7020 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in Renewable / Distributed Energy Measures Calculation appendix. Using this square footage it was determined that a system size of 110 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 171,566 KWh annually, reducing the overall utility bill by approximately 51.8% percent. A detailed financial analysis can be found in the Renewable / Distributed Energy Measures Calculation appendix. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

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

PAYMENT TYPE	SIMPLE PAYBACK	SIMPLE ROI	INTERNAL RATE OF RETURN
Self-Finance	11.2 Years	8.9%	13.4%
Direct Purchase	11.3 Years	8.9%	8.1%

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 this 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.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

The Electric Usage Profile demonstrates a fairly flat (consistent) load shape throughout the year. There is some increased consumption in the winter period (November-March), with a slightly lower but very consistent usage April through October. This summer-time consumption is typically caused by air-conditioner load (cooling load). And in this case the cooling load is supplied by window units and packaged rooftop units. A flatter load profile of this type, will allow for more competitive energy prices when shopping for alternative suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile. The summer months (May – September) demonstrate extremely low consumption (complimenting the winter heating load). There is an increase in winter consumption (November – March). The increased winter load is caused by heating demand. In this facility the heat is supplied by 3 large natural gas fired boilers. Also adding to the natural gas demand is the presence of a natural gas fired hot water heater, which is independent of the central boiler system. A base-load shaping (flat) will secure more competitive energy prices when procuring energy through an alternative energy source.

Tariff Analysis:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 1 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a single or three phase service at secondary voltages. For electric supply (generation), the customer will use the utilities Basic Generation Service (BGS) or a Third Party Supplier (TPS). This facility uses Basic Generation service from the utility. Therefore, they will pay according to the BGS default service. The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW

Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI.

Natural Gas:

This facility receives natural gas Delivery Service through New Jersey Natural Gas Company on a GSL (General Service Large) tariff rate schedule. The GSL rate is available to any Customer in the entire territory served by the Company who uses 5,000 therms or more annually and uses gas for all purposes other than residential and interruptible service. Where the customer uses the Cooling, Air Conditioning and Pool Heating Service (CAC) under Special Provision 1 applicable to customers purchasing gas supply under Rider "A", the Company will, upon application of the Customer, meter the space heating and the "CAC" separately.

This service is considered a "firm" service, where the customer may either purchase gas from Company's Rider "A", for Basic Gas Supply Service (BGSS) or from a Marketer or Broker. A "firm service" is a higher priority of delivery on the natural gas pipeline. Typically the firm users do not have the capability of being interrupted by the utility, so the utility must provide a higher level of service. Much like the telecom industry, the natural gas pipelines were deregulated and various levels of delivery service were created. The "firm service" was the most reliable because it is last on the pecking order for interruption.

The basic charges under this tariff are for: Customer Charge, Demand Charge, Delivery Charge and if the customer elects, the BGSS Supply Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Currently Denville is using the services of a TPS, Pepco Energy Services. Note: Should the TPS not deliver, then the customer will receive replacement service from the utility which carries an extremely high penalty cost of service, and is automatically delivered.

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

The information provided by Denville states that they are currently utilizing the service of a Third Party Supplier, Pepco Energy Services. CEG believes there is room within these energy costs, for improvement (please see comments under recommendations).

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the BOE. The primary area for potential improvement is seen in the electric costs. The average price per kWh (kilowatt hour) for all buildings based on 1-year historical average price is $.1388/kWh (this is the average "price to compare" if the client intends to shop for energy). The average price per decatherm for natural gas is $ 12.11 / dth (dth, is the common unit of measure). Energy commodities are among the most volatile of all commodities, however at this point and time,

energy is extremely competitive. The BOE could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on annual historical consumption (July 2008 through June 2009) and current electric rates, the BOE could see an improvement in its electric costs of up to 35% 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, Denville could improve its natural gas costs by up to 24%. Currently the BOE is utilizing the services of a Third Party Supplier, Pepco Energy Services. CEG recommends 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 scheduling 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 Denville BOE should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

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

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

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

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

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

XI. ADDITIONAL RECOMMENDATIONS

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

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

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

E. Recalibrate existing temperature sensors serving the existing hot water portion of the building.

F. Confirm that outside air dampers on the rooftop units are functioning properly to take advantage of free cooling for AC unit and avoid excessive outside air on AC and heating unit in unoccupied periods.

G. Set hot water re-circ pump temperature set-point below the domestic hot water supply temperature setting to avoid 24/7 re-circ pumping.

H. Set computers to run in sleep mode when not in use.

I. Repair leaking faucets to avoid domestic water waste and maintain plumbing fixture life.

J. Confirm dampers are functioning properly in all exhaust fans and ventilation hoods throughout the building.

In addition to the recommendations above, implementing Retro-Commissioning would be beneficial for this facility. Retro-Commissioning is a means to verify your current equipment is operating at its designed efficiency, capacity, airflow, and overall performance. Retro-Commissioning provides valuable insight into systems or components not performing correctly or efficiently. The commissioning process defines the original system design parameters and recommends revisions to the current system operating characteristics.

INSTALLATION COST AND REBATES

CONCORD ENGINEERING GROUP

Denville - Riverview Elementary School

ECM 1: LIGHTING UPGRADE

	Qty	Unit Cost $	Material $	Labor $	Total $
Lighting Fixture Replacement	LS	$47,638	-	-	$47,638
Utility Incentive - NJ Smart Start (1-2) lamp fixture	407	$10.00			($4,070)
Utility Incentive - NJ Smart Start (3-4) lamp fixture	57	$20.00			($1,140)
Total Cost Less Incentive					$42,428

ECM 2: LIGHTING CONTROLS

	Qty	Unit Cost $	Material $	Labor $	Total $
Dual - Technology Sensor	73	$75	$1,095	$4,380	$5,475
Utility Incentive - NJ Smart Start	73	$20			($1,460)
Total Cost Less Incentive					$4,015

ECM 3: HVAC SYSTEM CONTROLS

	SF	Unit Cost $	Material $	Labor $	Total $
DDC Automation System	47421	$4	-	-	$189,684
Utility Incentive - NJ Smart Start					$0
Total Cost Less Incentive					$189,684

ECM 4: HOT WATER RESET CONTROLLER

	Qty	Unit Cost $	Material $	Labor $	Total $
Hot Water Reset Controller	1	$4,275	$3,250	$1,025	$4,275
Utility Incentive - NJ Smart Start					$0
Total Cost Less Incentive					$4,275

ECM 5: BOILER REPLACEMENT

	Qty	Unit Cost $	Material $	Labor $	Total $
2887 MBH High Eff Boiler	3	$34,100	$86,550	$15,750	$102,300
Old Boiler Demolition	2	$10,800		$21,600	$21,600
Utility Incentive - NJ Smart Start (8,661 MBH	8,661	$1			($8,661)
Total Cost Less Incentive					$115,239

ECM 6: SOLAR PV SYSTEM

	Qty	Unit Cost $	Material $	Labor $	Total $
Solar PV System	1	$989,460			$989,460
Utility Incentive - (see Renewable Energy Measures appendix for details)					-
Total Cost Less Incentive					$989,460

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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

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Denville Riverview Elementary School"

Domestic Hot Water Heater

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Input	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Building HW	Boiler Room	A.O. Smith	Gas Fired	1	BTR-120-110	9280725002	120 MBH	116.36	71	-	Nat Gas	5	10	5

AC Units

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Cooling Type	Cooling Capacity	EER	Heating Type	Heating Capacity (Input)	Heating Capacity (Output)	Efficiency (%)	Fan HP	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Office	Roof	Trane	Packaged CV	1	YCH061C3HBBE	L491032370	DX R-22	60 MBH	11.3	Gas	120 MBH	97.2 MBH	81%	-	208	3	13	15	2
Library	Roof	Trane	Packaged CV	1	YCH151C3H0AA	L50101928D	DX R-22	150 MBH	11.3	Gas	250 MBH	203 MBH	81%	-	208	3	13	15	-
Computer Room	Roof	Trane	Packaged CV	1	YCH103C3L0AA	L49100101D	DX R-22	102 MBH	11.3	Gas	150 MBH	122 MBH	81%	-	208	3	13	15	-
GYM	Roof	AAON	Packaged CV	1	40 Ton Nom Frame	-	None	-	-	Gas	-	-	-	-	208	3	Unknown	15	-
Auditorium	Roof	AAON	Packaged CV	1	15 Ton Nom Frame	-	None	-	-	Gas	-	-			208	3	Unknown	15	-

*Equipment efficiencies listed above are based on new equipment product data.

Boilers

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Heating Type	Input Capacity	Output Capacity	Efficiency (approx)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Heating Water Loop	Bsmt Boiler Room	Weil McLain	Dual Fuel - Steam	3	88 Series, Size 1288		Gas	3753 MBH	2329 MBH	62%	Gas	3	25	22	Gas Fired, Generating Steam

Boiler Pumps

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Flow	Head	RPM	HP	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Heating Water Loop	Bsmt Boiler Room	Bell & Gossett	End Suction Cons Volume	2	-	-	-	-		3		-	4	20	16	WEG electric motor

Split Systems

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Cooling Type	Cooling Capacity	EER	Heating Type	Heating Capacity (Approx)	Eff	Fan HP	Motor RPM	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
IT closet	AHU - IT Rm	Carrier	Ductless Split System Heat Pump	1	40QAE048320	-	DX R-22	48 MBH	-	None	48 MBH	-	-	-	208	1	Unknown	15	-
	CU - Roof			1	38QR048C500	-							-	-	208	1	Unknown	15	-

STATEMENT OF ENERGY PERFORMANCE
Riverview Elementary School

Building ID: 1802628
For 12-month Period Ending: May 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: September 04, 2009

Facility
Riverview Elementary School
33 St. Mary's Place
Denville, NJ 07834

Facility Owner
Denville Board of Education
501 Openaki Road
Denville, NJ 07834

Primary Contact for this Facility
John Serapiglia
501 Openaki Road
Denville, NJ 07834

Year Built: 1951
Gross Floor Area (ft²): 47,421

Energy Performance Rating[2] (1-100) 32

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,146,456
Natural Gas (kBtu)[4]	3,891,519
Total Energy (kBtu)	5,037,975

Energy Intensity[5]

Site (kBtu/ft²/yr)	106
Source (kBtu/ft²/yr)	167

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	382

Electric Distribution Utility
Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	91
National Average Source EUI	142
% Difference from National Average Source EUI	17%
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	Riverview Elementary School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	33 St. Mary's Place, Denville, NJ 07834	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		☐
Riverview Elementary School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	47,421 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	130	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	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	50 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	N/A(Optional)	Is this school in operation for at least 8 months of the year?		☐

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

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Lt 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))
05/01/2009	05/31/2009	24,640.00
04/01/2009	04/30/2009	32,800.00
03/01/2009	03/31/2009	32,390.00
02/01/2009	02/28/2009	30,560.00
01/01/2009	01/31/2009	31,840.00
12/01/2008	12/31/2008	29,120.00
11/01/2008	11/30/2008	25,440.00
10/01/2008	10/31/2008	25,920.00
09/01/2008	09/30/2008	27,840.00
08/01/2008	08/31/2008	26,080.00
07/01/2008	07/31/2008	21,760.00
Electricity Consumption (kWh (thousand Watt-hours))		**308,390.00**
Electricity Consumption (kBtu (thousand Btu))		**1,052,226.68**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,052,226.68**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
05/01/2009	05/31/2009	151.84
04/01/2009	04/30/2009	151.84
03/01/2009	03/31/2009	1,642.54
02/01/2009	02/28/2009	4,653.33
01/01/2009	01/31/2009	8,368.26
12/01/2008	12/31/2008	8,996.22
11/01/2008	11/30/2008	7,968.89
10/01/2008	10/31/2008	4,671.59
09/01/2008	09/30/2008	2,015.82
08/01/2008	08/31/2008	97.07
07/01/2008	07/31/2008	108.93

06/01/2008	06/30/2008	88.86
Natural Gas Consumption (therms)		**38,915.19**
Natural Gas Consumption (kBtu (thousand Btu))		**3,891,519.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**3,891,519.00**
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
Riverview Elementary School
33 St. Mary's Place
Denville, NJ 07834

Facility Owner
Denville Board of Education
501 Openaki Road
Denville, NJ 07834

Primary Contact for this Facility
John Serapiglia
501 Openaki Road
Denville, NJ 07834

General Information

Riverview Elementary School	
Gross Floor Area Excluding Parking: (ft^2)	47,421
Year Built	1951
For 12-month Evaluation Period Ending Date:	May 31, 2009

Facility Space Use Summary

Riverview Elementary School	
Space Type	K-12 School
Gross Floor Area(ft^2)	47,421
Open Weekends?	No
Number of PCs	130
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	Yes
Percent Cooled	50
Percent Heated	100
Months°	N/A
High School?	No
School District°	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 05/31/2009)	**Baseline** (Ending Date 05/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	32	32	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	106	106	71	N/A	91
Source (kBtu/ft^2)	167	167	111	N/A	142
Energy Cost					
$/year	$ 75,808.80	$ 75,808.80	$ 50,498.76	N/A	$ 64,577.34
$/$ft^2$/year	$ 1.60	$ 1.60	$ 1.07	N/A	$ 1.36
Greenhouse Gas Emissions					
$MtCO_2e$/year	382	382	254	N/A	325
$kgCO_2e/ft^2$/year	8	8	5	N/A	7

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

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

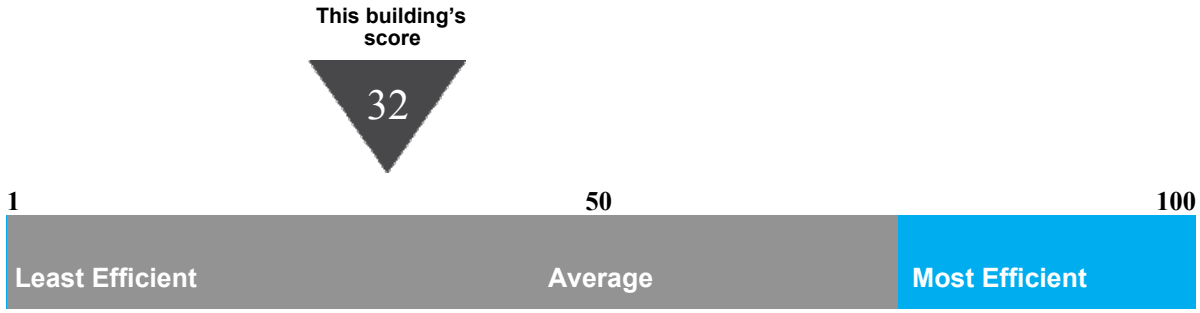
Statement of Energy Performance

2009

Riverview Elementary School
33 St. Mary's Place
Denville, NJ 07834

Portfolio Manager Building ID: 1802628

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 167 kBtu per square foot per year.*

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

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

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

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 09/04/2009

CEG Job #: 9C09080
Project: Denville Riverview ES
Address: 33 St. Mary's Place
Denville, NJ 07834
Building SF: 47,421

"Denville Riverview Elementary School"

KWH COST: $0.167

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	Classroom 17	1880	10	4	4-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens (only 2 bulbs in)	94	0.94	1,767.2	$295.12	10	2	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.61	1146.8	$191.52	$120.00	$1,200.00	0.33	620.4	$103.61	11.58
1	Classroom 19	1880	10	4	4-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens (only 2 bulbs in)	94	0.94	1,767.2	$295.12	10	2	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.61	1146.8	$191.52	$120.00	$1,200.00	0.33	620.4	$103.61	11.58
2	Boys Bathroom	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.19	353.4	$59.02	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	206.8	$34.54	$100.00	$200.00	0.08	146.64	$24.49	8.17
2	Girls Bathroom	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.19	353.4	$59.02	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	206.8	$34.54	$100.00	$200.00	0.08	146.64	$24.49	8.17
1	Classroom 21	1880	10	4	4-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens (only 2 bulbs in)	94	0.94	1,767.2	$295.12	10	2	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.61	1146.8	$191.52	$120.00	$1,200.00	0.33	620.4	$103.61	11.58
3	Faculty Room	1880	6	4	4-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens (only 2 bulbs in)	94	0.56	1,060.3	$177.07	6	2	2'X4' 2-Lamp 32W T-8 Parabolic Lens/Elect Ballast; Metalux M/N 2GC8	61	0.37	688.08	$114.91	$120.00	$720.00	0.20	372.24	$62.16	11.58
2		1880	1	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.09	176.7	$29.51	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	103.4	$17.27	$100.00	$100.00	0.04	73.32	$12.24	8.17
4	Faculty Bathroom	1880	1	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.09	176.7	$29.51	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	103.4	$17.27	$100.00	$100.00	0.04	73.32	$12.24	8.17
4	Classroom 24	1880	2	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.19	353.4	$59.02	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	206.8	$34.54	$100.00	$200.00	0.08	146.64	$24.49	8.17
4	Classroom 23	1880	9	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.85	1,590.5	$265.61	9	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.50	930.6	$155.41	$100.00	$900.00	0.35	659.88	$110.20	8.17
4	Office 23	1880	2	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic	94	0.19	353.4	$59.02	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	206.8	$34.54	$100.00	$200.00	0.08	146.64	$24.49	8.17
4	Classroom 22	1880	14	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.32	2,474.1	$413.17	14	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.77	1447.6	$241.75	$100.00	$1,400.00	0.55	1026.48	$171.42	8.17
5	Computer Lab 20	1880	30	0	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Parabolic Lens	58	1.74	3,271.2	$546.29	30	0	No Change	58	1.74	3271.2	$546.29	$0.00	$0.00	0.00	0	$0.00	0.00
4	Communications Closet	470	1	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.09	44.2	$7.38	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	25.85	$4.32	$100.00	$100.00	0.04	18.33	$3.06	32.67

5	Library	1880	60	0	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Parabolic Lens	58	3.48	6,542.4	$1,092.58	60	0	No Change	58	3.48	6542.4	$1,092.58	$0.00	$0.00	0.00	0	$0.00	0.00
6	Conference Room	1880	3	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	151	0.45	851.6	$142.22	3	3	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.27	513.24	$85.71	$120.00	$360.00	0.18	338.4	$56.51	6.37
5	Librarian's Office	1880	4	0	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Parabolic Lens	58	0.23	436.2	$72.84	4	0	No Change	58	0.23	436.16	$72.84	$0.00	$0.00	0.00	0	$0.00	0.00
4	Hallway 1	2350	11	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.03	2,429.9	$405.79	11	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.61	1421.75	$237.43	$100.00	$1,100.00	0.43	1008.15	$168.36	6.53
4	Classroom 25	1880	14	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.32	2,474.1	$413.17	14	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.77	1447.6	$241.75	$100.00	$1,400.00	0.55	1026.48	$171.42	8.17
4	Boys Bathroom	1880	1	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.09	176.7	$29.51	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	103.4	$17.27	$100.00	$100.00	0.04	73.32	$12.24	8.17
4	Classroom 26	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.47	879.84	$146.93	8.17
4	Boys Bathroom	1880	3	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.28	530.2	$88.54	3	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.17	310.2	$51.80	$100.00	$300.00	0.12	219.96	$36.73	8.17
4	Janitor's Closet	1880	1	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.09	176.7	$29.51	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	103.4	$17.27	$100.00	$100.00	0.04	73.32	$12.24	8.17
4	Girls Bathroom	1880	4	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.38	706.9	$118.05	4	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.22	413.6	$69.07	$100.00	$400.00	0.16	293.28	$48.98	8.17
4	Classroom 27	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.47	879.84	$146.93	8.17
4	Classroom 28	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.47	879.84	$146.93	8.17
4	Classroom 29	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.47	879.84	$146.93	8.17
4	Classroom 30	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.47	879.84	$146.93	8.17
4	Classroom 31	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.47	879.84	$146.93	8.17
4	Classroom 32	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.47	879.84	$146.93	8.17
4	Hallway 2	2350	9	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.85	1,988.1	$332.01	9	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.50	1163.25	$194.26	$100.00	$900.00	0.35	824.85	$137.75	6.53

2	Classroom 16	1880	3	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.28	530.2	$88.54	3	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.17	310.2	$51.80	$100.00	$300.00	0.12	219.96	$36.73	8.17
2	Copy Room	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.19	353.4	$59.02	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	206.8	$34.54	$100.00	$200.00	0.08	146.64	$24.49	8.17
4	Hallway 3	2350	5	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.47	1,104.5	$184.45	5	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.28	646.25	$107.92	$100.00	$500.00	0.20	458.25	$76.53	6.53
14	Custodial Closet	470	2	0	1 Lamp Incandscents, Surface Mount	52	0.10	48.9	$8.16	2	0	18 W CFL Lamp	18	0.04	16.92	$2.83	$5.75	$11.50	0.07	31.96	$5.34	2.15
7	Cafeteria Girls' Room	1880	2	0	2-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic	58	0.12	218.1	$36.42	2	0	No Change	58	0.12	218.08	$36.42	$0.00	$0.00	0.00	0	$0.00	0.00
7	Cafeteria Boys' Room	1880	2	0	2-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	58	0.12	218.1	$36.42	2	0	No Change	58	0.12	218.08	$36.42	$0.00	$0.00	0.00	0	$0.00	0.00
15	Auditorium	1880	12	0	High Pressure Sodium Lights (GE Mercurt H400DX33-1)	464	5.57	10,467.8	$1,748.13	12	0	No Change	464	5.57	10467.84	$1,748.13	$0.00	$0.00	0.00	0	$0.00	0.00
2	Kitchen	1880	3	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.28	530.2	$88.54	3	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.17	310.2	$51.80	$100.00	$300.00	0.12	219.96	$36.73	8.17
16	Custodial Closet	470	1	0	13 Watt CFL, Surface Mount	13	0.01	6.1	$1.02	1	0	No Change	13	0.01	6.11	$1.02	$0.00	$0.00	0.00	0	$0.00	0.00
17	Custodial Closet	470	1	0	1 Lamp Flood Light	90	0.09	42.3	$7.06	1	0	26 W CFL Lamp	26	0.03	12.22	$2.04	$5.75	$5.75	0.06	30.08	$5.02	1.14
8	Stage	1880	12	0	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Prismatic Lens	58	0.70	1,308.5	$218.52	12	0	No Change	58	0.70	1308.48	$218.52	$0.00	$0.00	0.00	0	$0.00	0.00
16		1880	8	0	13 Watt CFL, Surface Mount	13	0.10	195.5	$32.65	8	0	No Change	13	0.10	195.52	$32.65	$0.00	$0.00	0.00	0	$0.00	0.00
9	Gym Foyer	1880	3	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	130	0.39	733.2	$122.44	3	3	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.27	513.24	$85.71	$120.00	$360.00	0.12	219.96	$36.73	9.80
18	Gym	1880	24	0	1 Lamp Metal Halide	295	7.08	13,310.4	$2,222.84	24	0	No Change	295	7.08	13310.4	$2,222.84	$0.00	$0.00	0.00	0	$0.00	0.00
10	Gym Storage	1880	7	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, No Lens	80	0.56	1,052.8	$175.82	7	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.39	723.8	$120.87	$100.00	$700.00	0.18	329	$54.94	12.74
9	Gym Office	1880	2	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	130	0.26	488.8	$81.63	2	3	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	342.16	$57.14	$120.00	$240.00	0.08	146.64	$24.49	9.80
10	Custodial Office	1880	1	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, No Lens	80	0.08	150.4	$25.12	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	103.4	$17.27	$100.00	$100.00	0.03	47	$7.85	12.74
10	Hallyway 4	2350	8	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, No Lens	80	0.64	1,504.0	$251.17	8	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.44	1034	$172.68	$100.00	$800.00	0.20	470	$78.49	10.19
11		2350	7	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.56	1,316.0	$219.77	7	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.39	904.75	$151.09	$100.00	$700.00	0.18	411.25	$68.68	10.19
11	Classroom 15	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.16	300.8	$50.23	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	206.8	$34.54	$100.00	$200.00	0.05	94	$15.70	12.74
11	Classroom 14	1880	6	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.48	902.4	$150.70	6	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.33	620.4	$103.61	$100.00	$600.00	0.15	282	$47.09	12.74

11	Classroom 13	1880	6	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.48	902.4	$150.70	6	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.33	620.4	$103.61	$100.00	$600.00	0.15	282	$47.09	12.74
12	Storage	1880	2	2	2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	80	0.16	300.8	$50.23	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	206.8	$34.54	$100.00	$200.00	0.05	94	$15.70	12.74
16		1880	5	0	13 Watt CFL, Surface Mount	13	0.07	122.2	$20.41	5	0	No Change	13	0.07	122.2	$20.41	$0.00	$0.00	0.00	0	$0.00	0.00
11	Hallway 5	1880	10	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.80	1,504.0	$251.17	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	1034	$172.68	$100.00	$1,000.00	0.25	470	$78.49	12.74
11	Science Lab	1880	19	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.52	2,857.6	$477.22	19	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	1.05	1964.6	$328.09	$100.00	$1,900.00	0.48	893	$149.13	12.74
17		1880	1	0	1 Lamp Flood Light	90	0.09	169.2	$28.26	1	0	26 W CFL Lamp	26	0.03	48.88	$8.16	$5.75	$5.75	0.06	120.32	$20.09	0.29
11	Classroom 11	1880	17	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.36	2,556.8	$426.99	17	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.94	1757.8	$293.55	$100.00	$1,700.00	0.43	799	$133.43	12.74
11	Communications Room	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.16	300.8	$50.23	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	206.8	$34.54	$100.00	$200.00	0.05	94	$15.70	12.74
11	Classroom 10	1880	17	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.36	2,556.8	$426.99	17	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.94	1757.8	$293.55	$100.00	$1,700.00	0.43	799	$133.43	12.74
16		1880	1	0	13 Watt CFL, Surface Mount	13	0.01	24.4	$4.08	1	0	No Change	13	0.01	24.44	$4.08	$0.00	$0.00	0.00	0	$0.00	0.00
11	Classroom 8	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.30	564	$94.19	12.74
11	Classroom 9	1880	20	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.60	3,008.0	$502.34	20	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	1.10	2068	$345.36	$100.00	$2,000.00	0.50	940	$156.98	12.74
16	Stairwell	8760	4	0	13 Watt CFL, Surface Mount	13	0.05	455.5	$76.07	4	0	No Change	13	0.05	455.52	$76.07	$0.00	$0.00	0.00	0	$0.00	0.00
11	Hallway 6	2350	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	2,256.0	$376.75	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1551	$259.02	$100.00	$1,200.00	0.30	705	$117.74	10.19
11	Classroom 1	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.30	564	$94.19	12.74
19	Bathroom	1880	1	0	2-Lamp 13 Watt CFL, Surface Mount	30	0.03	56.4	$9.42	1	0	No Change	30	0.03	56.4	$9.42	$0.00	$0.00	0.00	0	$0.00	0.00
11	Classtoom 2	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.30	564	$94.19	12.74
19	Bathroom	1880	2	0	2-Lamp 13 Watt CFL, Surface Mount	30	0.06	112.8	$18.84	2	0	No Change	30	0.06	112.8	$18.84	$0.00	$0.00	0.00	0	$0.00	0.00
11	Classroom 3	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.30	564	$94.19	12.74
11	Classroom 4	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.30	564	$94.19	12.74

11	Classroom 5	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.30	564	$94.19	12.74
11	Classroom 6	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.30	564	$94.19	12.74
11	Classroom 7	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.66	1240.8	$207.21	$100.00	$1,200.00	0.30	564	$94.19	12.74
11	Custodial Restroom	1880	1	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.08	150.4	$25.12	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	103.4	$17.27	$100.00	$100.00	0.03	47	$7.85	12.74
20	Main Stairwell	8760	4	0	2-Lamp 20 Watt CFL, Surface Mount	42	0.17	1,471.7	$245.77	4	0	No Change	42	0.17	1471.68	$245.77	$0.00	$0.00	0.00	0	$0.00	0.00
9	Main Office	1880	9	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	130	1.17	2,199.6	$367.33	9	3	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.82	1539.72	$257.13	$120.00	$1,080.00	0.35	659.88	$110.20	9.80
9	Main Office Offices	1880	4	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	130	0.52	977.6	$163.26	4	3	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.36	684.32	$114.28	$120.00	$480.00	0.16	293.28	$48.98	9.80
13	Trailer 1	1880	10	0	4-Lamp, T8, Electronic Ballast, Recessed Mount, Prismatic Lens	109	1.09	2,049.2	$342.22	10	0	No Change	109	1.09	2049.2	$342.22	$0.00	$0.00	0.00	0	$0.00	0.00
13	Trailer 2	1880	10	0	4-Lamp, T8, Electronic Ballast, Recessed Mount, Prismatic Lens	109	1.09	2,049.2	$342.22	10	0	No Change	109	1.09	2049.2	$342.22	$0.00	$0.00	0.00	0	$0.00	0.00
13	Outside Trailers	1880	2	0	4-Lamp, T8, Electronic Ballast, Recessed Mount, Prismatic Lens	109	0.22	409.8	$68.44	2	0	No Change	109	0.22	409.84	$68.44	$0.00	$0.00	0.00	0	$0.00	0.00
21	Outside Lighting	3640	10	0	1-Lamp Metal Halide	455	4.55	16,562.0	$2,765.85	10	0	No Change	455	4.55	16562	$2,765.85	$0.00	$0.00	0.00	0	$0.00	0.00
22		3640	16	0	1-Lamp Metal Halide	240	3.84	13,977.6	$2,334.26	16	0	No Change	240	3.84	13977.6	$2,334.26	$0.00	$0.00	0.00	0	$0.00	0.00
23		3640	3	0	1-Lamp Metal Halide	125	0.38	1,365.0	$227.96	3	0	No Change	125	0.38	1365	$227.96	$0.00	$0.00	0.00	0	$0.00	0.00
24		3640	9	0	18 Watt CFL, Surface Mount	18	0.16	589.7	$98.48	9	0	No Change	18	0.16	589.68	$98.48	$0.00	$0.00	0.00	0	$0.00	0.00
17		3640	13	0	1 Lamp Flood Light	90	1.17	4,258.8	$711.22	13	0	26 W CFL Lamp	26	0.34	1230.32	$205.46	$5.75	$74.75	0.83	3028.48	$505.76	0.15
	Totals		713	133			73.49	159,131.4	$26,574.95	713	125			57.776	127599.78	########		$47,637.75	15.71	31531.6	$5,265.78	9.05

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

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

CEG Job #: 9C09080
Project: Denville Riverview ES
Address: 33 St. Mary's Place
Denville, NJ 07834
Building SF: 47,421

"Denville Riverview Elementary School"

KWH COST: $0.167

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	Classroom 17	1880	10	4	4-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens (only 2 bulbs in)	94	0.94	1,767.2	$295.12	10	4	Dual Technology Occupancy Sensor	94	0.94	10%	1590.48	$265.61	$75.00	$75.00	0.00	176.72	$29.51	2.54
1	Classroom 19	1880	10	4	4-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens (only 2 bulbs in)	94	0.94	1,767.2	$295.12	10	4	Dual Technology Occupancy Sensor	94	0.94	10%	1590.48	$265.61	$75.00	$75.00	0.00	176.72	$29.51	2.54
2	Boys Bathroom	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.19	353.4	$59.02	2	2	Dual Technology Occupancy Sensor	94	0.19	10%	318.096	$53.12	$75.00	$75.00	0.00	35.344	$5.90	12.71
2	Girls Bathroom	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.19	353.4	$59.02	2	2	Dual Technology Occupancy Sensor	94	0.19	10%	318.096	$53.12	$75.00	$75.00	0.00	35.344	$5.90	12.71
1	Classroom 21	1880	10	4	4-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens (only 2 bulbs in)	94	0.94	1,767.2	$295.12	10	4	Dual Technology Occupancy Sensor	94	0.94	10%	1590.48	$265.61	$75.00	$75.00	0.00	176.72	$29.51	2.54
3	Faculty Room	1880	6	4	4-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens (only 2 bulbs in)	94	0.56	1,060.3	$177.07	6	4	Dual Technology Occupancy Sensor	94	0.56	10%	954.288	$159.37	$75.00	$75.00	0.00	106.032	$17.71	4.24
2		1880	1	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.09	176.7	$29.51	1	2		94	0.09	10%	159.048	$26.56	$0.00	$0.00	0.00	17.672	$2.95	0.00
4	Faculty Bathroom	1880	1	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.09	176.7	$29.51	1	2	Dual Technology Occupancy Sensor	94	0.09	10%	159.048	$26.56	$75.00	$75.00	0.00	17.672	$2.95	25.41
4	Classroom 24	1880	2	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.19	353.4	$59.02	2	2	Dual Technology Occupancy Sensor	94	0.19	10%	318.096	$53.12	$75.00	$75.00	0.00	35.344	$5.90	12.71
4	Classroom 23	1880	9	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.85	1,590.5	$265.61	9	2	Dual Technology Occupancy Sensor	94	0.85	10%	1431.432	$239.05	$75.00	$75.00	0.00	159.048	$26.56	2.82
4	Office 23	1880	2	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic	94	0.19	353.4	$59.02	2	2	Dual Technology Occupancy Sensor	94	0.19	10%	318.096	$53.12	$75.00	$75.00	0.00	35.344	$5.90	12.71
4	Classroom 22	1880	14	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.32	2,474.1	$413.17	14	2	Dual Technology Occupancy Sensor	94	1.32	10%	2226.672	$371.85	$75.00	$75.00	0.00	247.408	$41.32	1.82
5	Computer Lab 20	1880	30	0	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Parabolic Lens	58	1.74	3,271.2	$546.29	30	0	Dual Technology Occupancy Sensor	58	1.74	10%	2944.08	$491.66	$75.00	$75.00	0.00	327.12	$54.63	1.37
4	Communications Closet	470	1	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.09	44.2	$7.38	1	2	Dual Technology Occupancy Sensor	94	0.09	10%	39.762	$6.64	$75.00	$75.00	0.00	4.418	$0.74	101.65

5	Library	1880	60	0	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Parabolic Lens	58	3.48	6,542.4	$1,092.58	60	0	Dual Technology Occupancy Sensor	58	3.48	10%	5888.16	$983.32	$75.00	$75.00	0.00	654.24	$109.26	0.69
6	Conference Room	1880	3	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	151	0.45	851.6	$142.22	3	3	Dual Technology Occupancy Sensor	151	0.45	10%	766.476	$128.00	$75.00	$75.00	0.00	85.164	$14.22	5.27
5	Librarian's Office	1880	4	0	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Parabolic Lens	58	0.23	436.2	$72.84	4	0	Dual Technology Occupancy Sensor	58	0.23	10%	392.544	$65.55	$75.00	$75.00	0.00	43.616	$7.28	10.30
4	Hallway 1	2350	11	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.03	2,429.9	$405.79	11	2	Dual Technology Occupancy Sensor	94	1.03	10%	2186.91	$365.21	$75.00	$75.00	0.00	242.99	$40.58	1.85
4	Classroom 25	1880	14	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.32	2,474.1	$413.17	14	2	Dual Technology Occupancy Sensor	94	1.32	10%	2226.672	$371.85	$75.00	$75.00	0.00	247.408	$41.32	1.82
4	Boys Bathroom	1880	1	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.09	176.7	$29.51	1	2	Dual Technology Occupancy Sensor	94	0.09	10%	159.048	$26.56	$75.00	$75.00	0.00	17.672	$2.95	25.41
4	Classroom 26	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	Dual Technology Occupancy Sensor	94	1.13	10%	1908.576	$318.73	$75.00	$75.00	0.00	212.064	$35.41	2.12
4	Boys Bathroom	1880	3	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.28	530.2	$88.54	3	2	Dual Technology Occupancy Sensor	94	0.28	10%	477.144	$79.68	$75.00	$75.00	0.00	53.016	$8.85	8.47
4	Janitor's Closet	1880	1	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.09	176.7	$29.51	1	2	Dual Technology Occupancy Sensor	94	0.09	10%	159.048	$26.56	$75.00	$75.00	0.00	17.672	$2.95	25.41
4	Girls Bathroom	1880	4	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.38	706.9	$118.05	4	2	Dual Technology Occupancy Sensor	94	0.38	10%	636.192	$106.24	$75.00	$75.00	0.00	70.688	$11.80	6.35
4	Classroom 27	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	Dual Technology Occupancy Sensor	94	1.13	10%	1908.576	$318.73	$75.00	$75.00	0.00	212.064	$35.41	2.12
4	Classroom 28	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	Dual Technology Occupancy Sensor	94	1.13	10%	1908.576	$318.73	$75.00	$75.00	0.00	212.064	$35.41	2.12
4	Classroom 29	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	Dual Technology Occupancy Sensor	94	1.13	10%	1908.576	$318.73	$75.00	$75.00	0.00	212.064	$35.41	2.12
4	Classroom 30	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	Dual Technology Occupancy Sensor	94	1.13	10%	1908.576	$318.73	$75.00	$75.00	0.00	212.064	$35.41	2.12
4	Classroom 31	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	Dual Technology Occupancy Sensor	94	1.13	10%	1908.576	$318.73	$75.00	$75.00	0.00	212.064	$35.41	2.12
4	Classroom 32	1880	12	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	1.13	2,120.6	$354.15	12	2	Dual Technology Occupancy Sensor	94	1.13	10%	1908.576	$318.73	$75.00	$75.00	0.00	212.064	$35.41	2.12
4	Hallway 2	2350	9	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.85	1,988.1	$332.01	9	2	Dual Technology Occupancy Sensor	94	0.85	10%	1789.29	$298.81	$75.00	$75.00	0.00	198.81	$33.20	2.26

2	Classroom 16	1880	3	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.28	530.2	$88.54	3	2	Dual Technology Occupancy Sensor	94	0.28	10%	477.144	$79.68	$75.00	$75.00	0.00	53.016	$8.85	8.47
2	Copy Room	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.19	353.4	$59.02	2	2	Dual Technology Occupancy Sensor	94	0.19	10%	318.096	$53.12	$75.00	$75.00	0.00	35.344	$5.90	12.71
4	Hallway 3	2350	5	2	2-Lamp, T12, Magnetic Ballast, Recessed Mounted, Prismatic Lens	94	0.47	1,104.5	$184.45	5	2	Dual Technology Occupancy Sensor	94	0.47	10%	994.05	$166.01	$75.00	$75.00	0.00	110.45	$18.45	4.07
14	Custodial Closet	470	2	0	1 Lamp Incandscents, Surface Mount	52	0.10	48.9	$8.16	2	0	Dual Technology Occupancy Sensor	52	0.10	10%	43.992	$7.35	$75.00	$75.00	0.00	4.888	$0.82	91.88
7	Cafeteria Girls' Room	1880	2	0	2-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic	58	0.12	218.1	$36.42	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	196.272	$32.78	$75.00	$75.00	0.00	21.808	$3.64	20.59
7	Cafeteria Boys' Room	1880	2	0	2-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	58	0.12	218.1	$36.42	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	196.272	$32.78	$75.00	$75.00	0.00	21.808	$3.64	20.59
15	Auditorium	1880	12	0	1-Lamp, High Pressure Sodium	464	5.57	10,467.8	$1,748.13	12	0	Dual Technology Occupancy Sensor	464	5.57	10%	9421.056	$1,573.32	$75.00	$75.00	0.00	1046.784	$174.81	0.43
2	Kitchen	1880	3	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	94	0.28	530.2	$88.54	3	2	Dual Technology Occupancy Sensor	94	0.28	10%	477.144	$79.68	$75.00	$75.00	0.00	53.016	$8.85	8.47
16	Custodial Closet	470	1	0	13 Watt CFL, Surface Mount	13	0.01	6.1	$1.02	1	0	Dual Technology Occupancy Sensor	13	0.01	10%	5.499	$0.92	$75.00	$75.00	0.00	0.611	$0.10	735.03
17	Custodial Closet	470	1	0	1 Lamp Flood Light	90	0.09	42.3	$7.06	1	0	Dual Technology Occupancy Sensor	90	0.09	10%	38.07	$6.36	$75.00	$75.00	0.00	4.23	$0.71	106.17
8	Stage	1880	12	0	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Prismatic Lens	58	0.70	1,308.5	$218.52	12	0	None	58	0.70	0%	1308.48	$218.52	$0.00	$0.00	0.00	0	$0.00	0.00
16		1880	8	0	13 Watt CFL, Surface Mount	13	0.10	195.5	$32.65	8	0	None	13	0.10	0%	195.52	$32.65	$0.00	$0.00	0.00	0	$0.00	0.00
9	Gym Foyer	1880	3	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	130	0.39	733.2	$122.44	3	3	Dual Technology Occupancy Sensor	130	0.39	10%	659.88	$110.20	$75.00	$75.00	0.00	73.32	$12.24	6.13
18	Gym	1880	24	0	1 Lamp Metal Halide	295	7.08	13,310.4	$2,222.84	24	0	None	295	7.08	0%	13310.4	$2,222.84	$0.00	$0.00	0.00	0	$0.00	0.00
10	Gym Storage	1880	7	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, No Lens	80	0.56	1,052.8	$175.82	7	2	Dual Technology Occupancy Sensor	80	0.56	10%	947.52	$158.24	$75.00	$75.00	0.00	105.28	$17.58	4.27
9	Gym Office	1880	2	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	130	0.26	488.8	$81.63	2	3	Dual Technology Occupancy Sensor	130	0.26	10%	439.92	$73.47	$75.00	$75.00	0.00	48.88	$8.16	9.19
10	Custodial Office	1880	1	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, No Lens	80	0.08	150.4	$25.12	1	2	Dual Technology Occupancy Sensor	80	0.08	10%	135.36	$22.61	$75.00	$75.00	0.00	15.04	$2.51	29.86
10	Hallyway 4	2350	8	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, No Lens	80	0.64	1,504.0	$251.17	8	2	Dual Technology Occupancy Sensor	80	0.64	10%	1353.6	$226.05	$75.00	$75.00	0.00	150.4	$25.12	2.99
11		2350	7	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.56	1,316.0	$219.77	7	2	Dual Technology Occupancy Sensor	80	0.56	10%	1184.4	$197.79	$75.00	$75.00	0.00	131.6	$21.98	3.41
11	Classroom 15	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.16	300.8	$50.23	2	2	Dual Technology Occupancy Sensor	80	0.16	10%	270.72	$45.21	$75.00	$75.00	0.00	30.08	$5.02	14.93
11	Classroom 14	1880	6	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.48	902.4	$150.70	6	2	Dual Technology Occupancy Sensor	80	0.48	10%	812.16	$135.63	$75.00	$75.00	0.00	90.24	$15.07	4.98

11	Classroom 13	1880	6	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.48	902.4	$150.70	6	2	Dual Technology Occupancy Sensor	80	0.48	10%	812.16	$135.63	$75.00	$75.00	0.00	90.24	$15.07	4.98
12	Storage	1880	2	2	2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	80	0.16	300.8	$50.23	2	2	None	80	0.16	0%	300.8	$50.23	$0.00	$0.00	0.00	0	$0.00	0.00
16		1880	5	0	13 Watt CFL, Surface Mount	13	0.07	122.2	$20.41	5	0	None	13	0.07	0%	122.2	$20.41	$0.00	$0.00	0.00	0	$0.00	0.00
11	Hallway 5	1880	10	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.80	1,504.0	$251.17	10	2	Dual Technology Occupancy Sensor	80	0.80	10%	1353.6	$226.05	$75.00	$75.00	0.00	150.4	$25.12	2.99
11	Science Lab	1880	19	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.52	2,857.6	$477.22	19	2	Dual Technology Occupancy Sensor	80	1.52	10%	2571.84	$429.50	$75.00	$75.00	0.00	285.76	$47.72	1.57
17		1880	1	0	1 Lamp Flood Light	90	0.09	169.2	$28.26	1	0		90	0.09	10%	152.28	$25.43	$0.00	$0.00	0.00	16.92	$2.83	0.00
11	Classroom 11	1880	17	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.36	2,556.8	$426.99	17	2	Dual Technology Occupancy Sensor	80	1.36	10%	2301.12	$384.29	$75.00	$75.00	0.00	255.68	$42.70	1.76
11	Communications Room	1880	2	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.16	300.8	$50.23	2	2	Dual Technology Occupancy Sensor	80	0.16	10%	270.72	$45.21	$75.00	$75.00	0.00	30.08	$5.02	14.93
11	Classroom 10	1880	17	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.36	2,556.8	$426.99	17	2	Dual Technology Occupancy Sensor	80	1.36	10%	2301.12	$384.29	$75.00	$75.00	0.00	255.68	$42.70	1.76
16		1880	1	0	13 Watt CFL, Surface Mount	13	0.01	24.4	$4.08	1	0		13	0.01	10%	21.996	$3.67	$0.00	$0.00	0.00	2.444	$0.41	0.00
11	Classroom 8	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	Dual Technology Occupancy Sensor	80	0.96	10%	1624.32	$271.26	$75.00	$75.00	0.00	180.48	$30.14	2.49
11	Classroom 9	1880	20	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.60	3,008.0	$502.34	20	2	Dual Technology Occupancy Sensor	80	1.60	10%	2707.2	$452.10	$75.00	$75.00	0.00	300.8	$50.23	1.49
16	Stairwell	8760	4	0	13 Watt CFL, Surface Mount	13	0.05	455.5	$76.07	4	0	Dual Technology Occupancy Sensor	13	0.05	10%	409.968	$68.46	$75.00	$75.00	0.00	45.552	$7.61	9.86
11	Hallway 6	2350	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	2,256.0	$376.75	12	2	Dual Technology Occupancy Sensor	80	0.96	10%	2030.4	$339.08	$75.00	$75.00	0.00	225.6	$37.68	1.99
11	Classroom 1	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	Dual Technology Occupancy Sensor	80	0.96	10%	1624.32	$271.26	$75.00	$75.00	0.00	180.48	$30.14	2.49
19	Bathroom	1880	1	0	2-Lamp 13 Watt CFL, Surface Mount	30	0.03	56.4	$9.42	1	0	Dual Technology Occupancy Sensor	30	0.03	10%	50.76	$8.48	$75.00	$75.00	0.00	5.64	$0.94	79.63
11	Classtoom 2	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	Dual Technology Occupancy Sensor	80	0.96	10%	1624.32	$271.26	$75.00	$75.00	0.00	180.48	$30.14	2.49
19	Bathroom	1880	2	0	2-Lamp 13 Watt CFL, Surface Mount	30	0.06	112.8	$18.84	2	0	Dual Technology Occupancy Sensor	30	0.06	10%	101.52	$16.95	$75.00	$75.00	0.00	11.28	$1.88	39.81
11	Classroom 3	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	Dual Technology Occupancy Sensor	80	0.96	10%	1624.32	$271.26	$75.00	$75.00	0.00	180.48	$30.14	2.49
11	Classroom 4	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	Dual Technology Occupancy Sensor	80	0.96	10%	1624.32	$271.26	$75.00	$75.00	0.00	180.48	$30.14	2.49

11	Classroom 5	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	Dual Technology Occupancy Sensor	80	0.96	10%	1624.32	$271.26	$75.00	$75.00	0.00	180.48	$30.14	2.49
11	Classroom 6	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	Dual Technology Occupancy Sensor	80	0.96	10%	1624.32	$271.26	$75.00	$75.00	0.00	180.48	$30.14	2.49
11	Classroom 7	1880	12	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.96	1,804.8	$301.40	12	2	Dual Technology Occupancy Sensor	80	0.96	10%	1624.32	$271.26	$75.00	$75.00	0.00	180.48	$30.14	2.49
11	Custodial Restroom	1880	1	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.08	150.4	$25.12	1	2	Dual Technology Occupancy Sensor	80	0.08	10%	135.36	$22.61	$75.00	$75.00	0.00	15.04	$2.51	29.86
20	Main Stairwell	8760	4	0	2-Lamp 20 Watt CFL, Surface Mount	42	0.17	1,471.7	$245.77	4	0	Dual Technology Occupancy Sensor	42	0.17	10%	1324.512	$221.19	$75.00	$75.00	0.00	147.168	$24.58	3.05
9	Main Office	1880	9	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	130	1.17	2,199.6	$367.33	9	3	Dual Technology Occupancy Sensor	130	1.17	10%	1979.64	$330.60	$75.00	$75.00	0.00	219.96	$36.73	2.04
9	Main Office Offices	1880	4	3	3-Lamp, T12, Magnetic Ballast, Recessed Mounted, Parabolic Lens	130	0.52	977.6	$163.26	4	3	Dual Technology Occupancy Sensor	130	0.52	10%	879.84	$146.93	$75.00	$75.00	0.00	97.76	$16.33	4.59
13	Trailer 1	1880	10	0	4-Lamp, T8, Electronic Ballast, Recessed Mount, Prismatic Lens	109	1.09	2,049.2	$342.22	10	0	Dual Technology Occupancy Sensor	109	1.09	10%	1844.28	$307.99	$75.00	$75.00	0.00	204.92	$34.22	2.19
13	Trailer 2	1880	10	0	4-Lamp, T8, Electronic Ballast, Recessed Mount, Prismatic Lens	109	1.09	2,049.2	$342.22	10	0	Dual Technology Occupancy Sensor	109	1.09	10%	1844.28	$307.99	$75.00	$75.00	0.00	204.92	$34.22	2.19
13	Outside Trailers	1880	2	0	4-Lamp, T8, Electronic Ballast, Recessed Mount, Prismatic Lens	109	0.22	409.8	$68.44	2	0	None	109	0.22	0%	409.84	$68.44	$0.00	$0.00	0.00	0	$0.00	0.00
21	Outside Lighting	3640	10	0	1-Lamp Metal Halide	455	4.55	16,562.0	$2,765.85	10	0	None	455	4.55	0%	16562	$2,765.85	$75.00	$0.00	0.00	0	$0.00	0.00
22		3640	16	0	1-Lamp Metal Halide	240	3.84	13,977.6	$2,334.26	16	0	None	240	3.84	0%	13977.6	$2,334.26	$75.00	$0.00	0.00	0	$0.00	0.00
23		3640	3	0	1-Lamp Metal Halide	125	0.38	1,365.0	$227.96	3	0	None	125	0.38	0%	1365	$227.96	$75.00	$0.00	0.00	0	$0.00	0.00
24		3640	9	0	18 Watt CFL, Surface Mount	18	0.16	589.7	$98.48	9	0	None	18	0.16	0%	589.68	$98.48	$75.00	$0.00	0.00	0	$0.00	0.00
17		3640	13	0	1 Lamp Flood Light	90	1.17	4,258.8	$711.22	13	0	None	90	1.17	0%	4258.8	$711.22	$75.00	$0.00	0.00	0	$0.00	0.00
	Totals		713	133			73.49	159,131.4	$26,574.95	713	133			73.485		148458.3	########		$5,475.00	0.00	10673.1	$1,782.41	3.07

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

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

Project Name: LGEA Solar PV Project - Denville Riverview Elementary School
Location: Denville, NJ
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$989,460
Annual kWh Production	171,566
Annual Energy Cost Reduction	$28,652
Annual SREC Revenue	$60,048
First Cost Premium	**$989,460**
Simple Payback:	**11.16** Years

Life Cycle Cost Analysis

Analysis Period (years): 25
Financing Term (mths): 240
Average Energy Cost ($/kWh) **$0.167**
Financing Rate: 7.00%
Financing %: 95%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
SREC Value ($/kWh) $0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$49,473	0	0	0	$0	0	0	(49,473)	0
1	$0	171,566	$28,652	$0	$60,048	$65,091	$22,362	$1,247	($48,226)
2	$0	170,709	$29,511	$0	$59,748	$63,474	$23,978	$1,807	($46,419)
3	$0	169,855	$30,396	$0	$59,449	$61,741	$25,712	$2,393	($44,026)
4	$0	169,006	$31,308	$0	$59,152	$59,882	$27,570	$3,008	($41,018)
5	$0	168,161	$32,248	$1,732	$58,856	$57,889	$29,564	$1,919	($39,099)
6	$0	167,320	$33,215	$1,723	$58,562	$55,752	$31,701	$2,601	($36,497)
7	$0	166,483	$34,212	$1,715	$58,269	$53,460	$33,992	$3,313	($33,184)
8	$0	165,651	$35,238	$1,706	$57,978	$51,003	$36,450	$4,057	($29,127)
9	$0	164,823	$36,295	$1,698	$57,688	$48,368	$39,085	$4,833	($24,294)
10	$0	163,999	$37,384	$1,689	$57,399	$45,542	$41,910	$5,642	($18,653)
11	$0	163,179	$38,505	$1,681	$57,112	$42,513	$44,940	$6,485	($12,168)
12	$0	162,363	$39,661	$1,672	$56,827	$39,264	$48,188	$7,363	($4,806)
13	$0	161,551	$40,850	$1,664	$56,543	$35,781	$51,672	$8,277	$3,471
14	$0	160,743	$42,076	$1,656	$56,260	$32,045	$55,407	$9,228	$12,699
15	$0	159,939	$43,338	$1,647	$55,979	$28,040	$59,413	$10,217	$22,916
16	$0	159,140	$44,638	$1,639	$55,699	$23,745	$63,708	$11,245	$34,161
17	$0	158,344	$45,977	$1,631	$55,420	$19,139	$68,313	$12,314	$46,476
18	$0	157,552	$47,357	$1,623	$55,143	$14,201	$73,251	$13,425	$59,900
19	$0	156,765	$48,777	$1,615	$54,868	$8,906	$78,547	$14,578	$74,478
20	$0	155,981	$50,241	$1,607	$54,593	$3,228	$84,225	$15,775	$90,253
21	$0	155,201	$51,748	$1,599	$54,320	$2,736	$77,429	$24,305	$114,558
22	$0	154,425	$53,300	$1,591	$54,049	$1,873	$63,717	$40,169	$154,727
23	$0	153,653	$54,899	$1,583	$53,778	$0	$0	$107,095	$261,822
24	$0	152,884	$56,546	$1,575	$53,510	$0	$0	$108,481	$370,303
25	$0	152,120	$58,243	$1,567	$53,242	$0	$0	$109,918	$480,221
Totals:		3,273,128	$769,879	$26,698	$1,145,595	$809,063	$939,987	$1,081,132	$1,348,470
				Net Present Value (NPV)			**$75,630**		
				Internal Rate of Return (IRR)			**13.4%**		

Project Name: LGEA Solar PV Project - Denville Riverview Elementary School
Location: Denville, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$989,460
Annual kWh Production	171,566
Annual Energy Cost Reduction	$28,652
Annual SREC Revenue	$60,048
First Cost Premium	**$989,460**
Simple Payback:	**11.16** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.167**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$989,460	0	0	0	$0	(989,460)	0
1	$0	171,566	$28,652	$0	$60,048	$88,700	($900,760)
2	$0	170,709	$29,511	$0	$59,748	$89,259	($811,501)
3	$0	169,855	$30,396	$0	$59,449	$89,846	($721,655)
4	$0	169,006	$31,308	$0	$59,152	$90,460	($631,195)
5	$0	168,161	$32,248	$1,732	$58,856	$89,372	($541,823)
6	$0	167,320	$33,215	$1,723	$58,562	$90,054	($451,769)
7	$0	166,483	$34,212	$1,715	$58,269	$90,766	($361,004)
8	$0	165,651	$35,238	$1,706	$57,978	$91,509	($269,494)
9	$0	164,823	$36,295	$1,698	$57,688	$92,285	($177,209)
10	$0	163,999	$37,384	$1,689	$57,399	$93,094	($84,115)
11	$0	163,179	$38,505	$1,681	$57,112	$93,937	$9,822
12	$0	162,363	$39,661	$1,672	$56,827	$94,815	$104,638
13	$0	161,551	$40,850	$1,664	$56,543	$95,729	$200,367
14	$0	160,743	$42,076	$1,656	$56,260	$96,680	$297,047
15	$0	159,939	$43,338	$1,647	$55,979	$97,670	$394,716
16	$0	159,140	$44,638	$1,639	$55,699	$98,698	$493,414
17	$0	158,344	$45,977	$1,631	$55,420	$99,767	$593,181
18	$0	157,552	$47,357	$1,623	$55,143	$100,877	$694,059
19	$0	156,765	$48,777	$1,615	$54,868	$102,030	$796,089
20	$0	155,981	$50,241	$1,607	$54,593	$103,227	$899,316
21	$1	155,201	$51,748	$1,599	$54,320	$104,470	$1,003,786
22	$2	154,425	$53,300	$1,591	$54,049	$105,759	$1,109,544
23	$3	153,653	$54,899	$1,583	$53,778	$107,095	$1,216,640
24	$4	152,884	$56,546	$1,575	$53,510	$108,481	$1,325,121
25	$5	152,120	$58,243	$1,567	$53,242	$109,918	$1,435,039
	Totals:	3,273,128	$769,879	$26,698	$1,145,595	$2,424,499	$1,888,776
				Net Present Value (NPV)		**$1,435,064**	
				Internal Rate of Return (IRR)		**8.1%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Denville Riverview Elementary School	7020	Sunpower SPR230	478	14.7	7,029	109.94	171,566	15,774	15.64

.= Proposed PV Layout

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