MIDDLESEX BOARD OF EDUCATION

PARKER ELEMENTARY SCHOOL

SOUTH LINCOLN AVENUE
MIDDLESEX, NJ 08846

FACILITY ENERGY REPORT

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I. HISTORIC ENERGY CONSUMPTION/COST

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

Electric Utility Provider:	Public Service Electric & Gas
Electric Utility Rate Structure:	General Lighting & Power (GLP)
Third Party Supplier:	Direct Energy

Natural Gas Utility Provider:	Public Service Electric & Gas
Utility Rate Structure:	General Service Gas (GSG)
Third Party Supplier:	Woodruff Energy

The electric usage profile represents the actual electrical usage for the facility. 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 within each facility report shows the actual natural gas energy usage for the facility. 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.

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: PSE&G
Rate: GLP
Meter No: 678000835
Account # 6690242706
Third Party Utility Provider: Direct Energy
TPS Meter / Acct No: 1016248

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Jan-11	15,300	46.2	$2,334
Feb-11	15,150	45.6	$2,296
Mar-11	17,550	45.6	$2,387
Apr-11	16,890	47.0	$2,222
May-11	16,995	50.9	$2,358
Jun-11	18,615	54.5	$3,275
Jul-11	14,850	51.2	$2,729
Aug-11	10,500	48.3	$2,242
Sep-11	12,480	33.5	$2,108
Oct-11	13,950	52.5	$1,968
Nov-11	15,015	47.1	$2,009
Dec-11	17,505	48.6	$2,191
Totals	**184,800**	**54.5 Max**	**$28,117**

AVERAGE DEMAND **47.6 KW average**
AVERAGE RATE **$0.152** **$/kWh**

Figure 1
Electricity Usage Profile

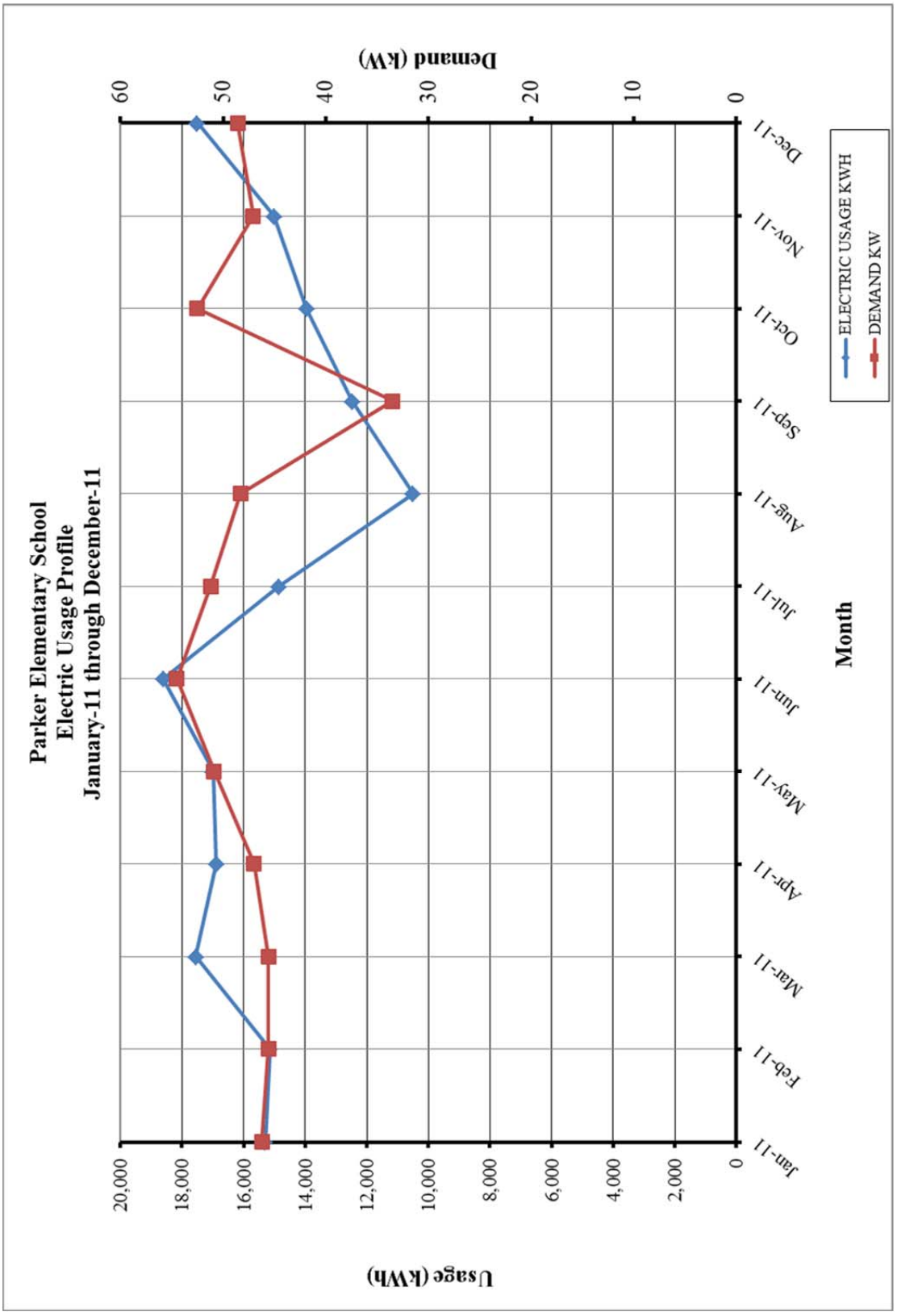
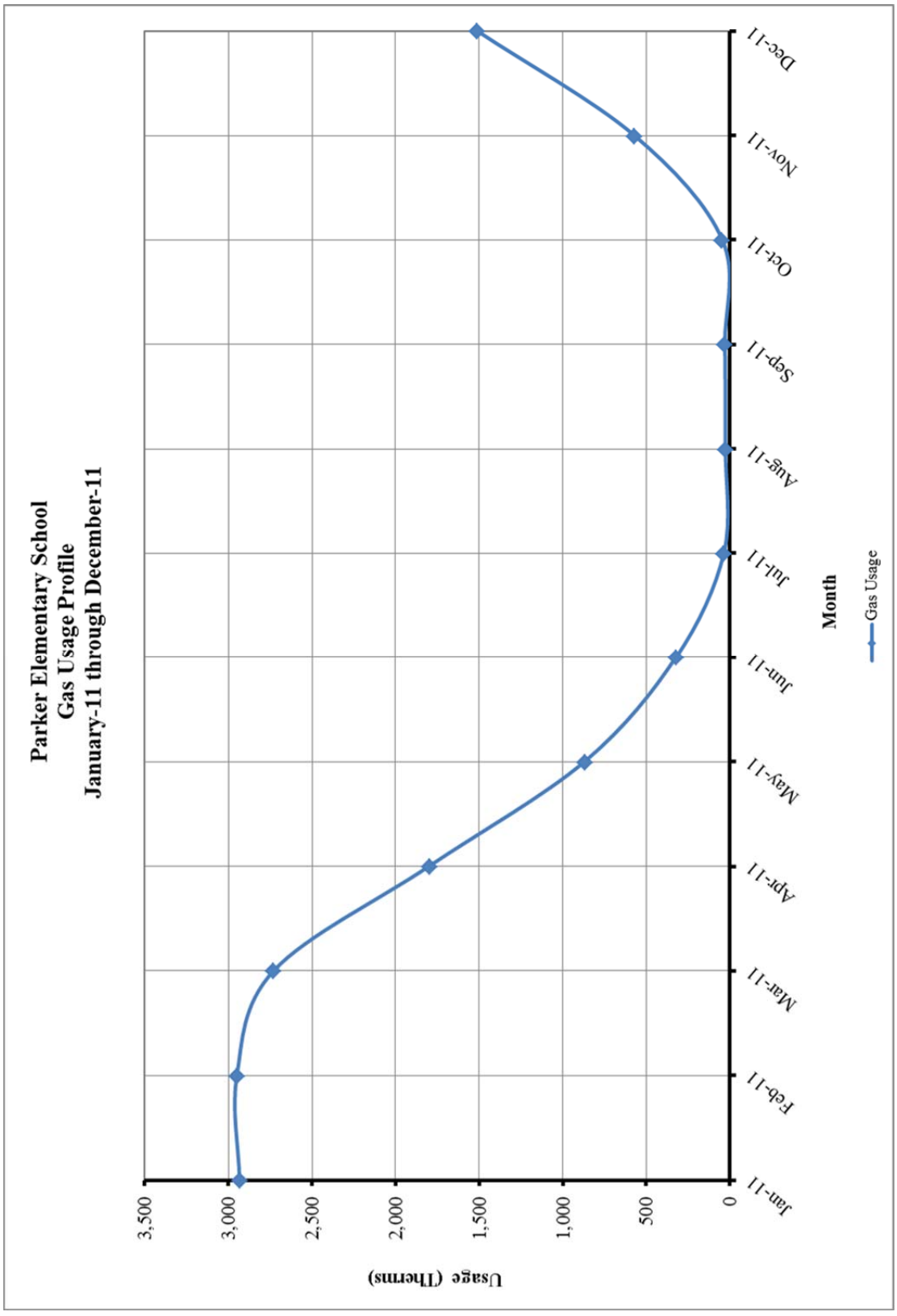


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: PSE&G		
Rate: GSG		
Meter No: 2415135		
Account # 6690242706		
Third Party Utility Provider: Woodruff Energy		
TPS Meter No: 507325		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jan-11	2,933.55	$3,340.50
Feb-11	2,949.10	$3,359.00
Mar-11	2,728.85	$3,106.93
Apr-11	1,798.75	$1,884.83
May-11	868.78	$916.37
Jun-11	322.24	$353.97
Jul-11	36.98	$49.74
Aug-11	27.42	$39.27
Sep-11	30.64	$39.13
Oct-11	46.54	$49.92
Nov-11	573.82	$534.03
Dec-11	1,513.96	$1,454.85
TOTALS	**13,830.64**	**$15,128.54**
AVERAGE RATE:	**$1.09**	**$/THERM**

Figure 2
Natural Gas Usage Profile



II. FACILITY DESCRIPTION

The Parker Elementary School is located on South Lincoln Avenue in the Borough of Middlesex, New Jersey. The 20,397 SF Public Elementary School was built in 1920 with an expansion in 1962, adding classrooms and an multi-purpose. Mechanical upgrades, including new unit ventilators and controls were done in 2001. The three story facility comprises of classrooms, multi-purpose room, mechanical room and offices.

Occupancy Profile

The he typical hours of operation for the Elementary School are Monday through Friday between 7:00 am and 2:45 pm. The Elementary School's population consists of 192 students and 27 staff.

Building Envelope

Exterior walls for the Middle School are typically 4" face brick, 8" concrete block, 2 ½"" metal studs and 5/8" gypsum wall board. The windows throughout the Middle School are original condition and appear to be maintained and in good condition. Typical windows are single pane, operable, ¼" clear glass with aluminum frames. Shades are utilized through the office and classroom areas of the facility for occupant comfort. The shades are valuable because they help to reduce heat loss in the winter and reduce solar heat in the summer. The roof is flat, sloped to roof drains, and is a grey color built up, ballasted type. The amount of insulation below the roof is unknown, but appears to be minimal.

HVAC Systems

The Elementary School heating systems consist of two (2) hot water boilers, unit ventilators and heating and ventilating (H&V) units. Cooling is provided by window air conditioners in the offices and several classrooms. All classrooms have ceiling mounted caged paddle fans, controlled by a wall switch.

Heating for the facility is provided by two HB Smith model Series 28A cast iron, gas-fired hot water boilers in the mechanical room. Heating hot water serves the hot water unit ventilators and H&V units throughout the school. The boilers are gas-fired, with an input of 2,499 MBH each with an estimated efficiency of 80%. The boilers were installed in 2001 and are within their useful service life as defined by ASHRAE. Hot water is circulated throughout the building's heating hot water loop via two sets of base mounted, end suction pumps. The first set are 1.5 HP, 1750 RPM and the second set are 3 HP, 1750 RPM and are located in the mechanical room. Each set are operated with one pump as the duty pump and the other, standby. The pump motors are standard efficiency motors.

Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters. Classroom outside air is exhausted through roof mounted exhaust fans, located over vertical shafts, which collect air from each floor in the 1920 three story section. Air is ducted from ceiling grilles to the vertical shafts in each classroom. In the 1962 section, the corridor ceiling acts as a plenum with a roof exhaust

fan located over each wing. Dropped ceilings were retrofitted to these classrooms in the 1962 section, blocking off the exhaust air path. This condition needs to be reviewed in more detail to assure adequate ventilation is provided to each room.

HVAC System Controls

The HVAC systems within the Elementary School are operated with the original pneumatic devices interfaced with a Honeywell DDC controller. Boiler HW temperature reset is provided via pneumatic transducers for DDC control of the existing HW mixing valves. Temperature control for classroom unit ventilators are via pneumatic 2-way valves connected to wall thermostats. There were no night setback or occupied/unoccupied mode capabilities observed in the system.

Domestic Hot Water

Domestic hot water for the school is provided by a single 120 MBH input, 71 gallon storage, AO Smith gas fired commercial domestic hot water heater. Domestic hot water is distributed throughout the building via a piping loop with pumped HW return circuits. The HW heater was installed in 2010, is in good working condition and is well within it's useful service life as defined by ASHRAE.

Lighting

Refer to the Investment Grade lighting Audit Appendix for a detailed list of the lighting throughout the facility and estimated operating hours per space.

III. MAJOR EQUIPMENT LIST

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

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

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 1
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade	$12,916	$1,883	6.9	118.7%
ECM #2	All Purpose Room Lighting Upgrade	$1,800	$300	6.0	150.0%
ECM #3	Lighting Controls Upgrade	$5,850	$1,520	3.8	289.7%
ECM #4	NEMA Premium Motors	$3,454	$206	16.8	7.4%
ECM #5	Domestic Hot Water Upgrade	$9,750	$325	30.0	-60.0%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	16.92 KW PV System	$109,251	$6,708	16.3	-7.9%
Notes:	A. Cost takes into consideration applicable NJ Smart StartTM incentives.				
	B. Savings takes into consideration applicable maintenance savings.				

Table 2
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
ECM #1	Lighting Upgrade	4.8	12,391	0
ECM #2	All Purpose Room Lighting Upgrade	1	1,976	0
ECM #3	Lighting Controls Upgrade	3.8	10,001	0
ECM #4	NEMA Premium Motors	0.3	1,353	0
ECM #5	Domestic Hot Water Upgrade	0.0	0	298
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
REM #1	16.92 KW PV System	16.9	19,552	0

Table 3
Facility Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL PROJECT					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Upgrade	$1,883	$13,086	$170	$12,916	6.9
All Purpose Room Lighting Upgrade	$300	$2,000	$200	$1,800	6.0
Lighting Controls Upgrade	$1,520	$6,900	$1,050	$5,850	3.8
NEMA Premium Motors	$206	$3,674	$220	$3,454	16.8
Domestic Hot Water Upgrade	$325	$10,000	$250	$9,750	30.0
Design / Construction Extras (15%)		*$5,349*		*$5,349*	
Total Project	**$4,234**	**$41,009**	**$1,890**	**$39,119**	**9.2**

Design / Construction Extras is shown as an additional cost for the facility project summary. This cost is included to estimate the costs associated with construction management fees for a larger combined project.

ECM #1: Lighting Upgrade – General

Description:

The majority of the interior lighting throughout the Parker Elementary School is provided with fluorescent fixtures with older generation, 700 series 32W T8 lamps and electronic ballasts. Although 700 series T8 lamps are considered fairly efficient, further energy savings can be achieved by replacing the existing T8 lamps with new generation, 800 series 28W T8 lamps without compromising light output. CE recommends, re-lamping all of the fixtures with 28W T8 lamps. In addition, there are a number of older and outdated fixtures with T12 lamps and magnetic ballasts. It is recommended to replace all of the T12 fixtures in these areas with higher efficiency fluorescent T8 fixtures with electronic ballasts. Furthermore, certain areas still have incandescent lamps. It is recommended to retrofit or replace all of the older incandescent lights in these areas with newer compact fluorescent lamps.

This ECM includes re-lamping of the existing fluorescent fixtures with 800 series, 28W T8 lamps. The ECM also includes retrofit of all older fluorescent fixtures with T8 or T5 fluorescent fixtures with electronic ballasts in the building. The new, energy efficient T8 fixtures will provide adequate lighting and will save on electrical costs due to better performance of the lamp and ballasts.

The ECM also includes replacement of any incandescent lamps with compact fluorescent lamps. Compact fluorescent lamps (CFL's) were designed to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light. The CFL is available in a myriad of shapes and sizes depending on the specific application. Typical replacements are: a 13-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 26-Watt CFL for a 100-Watt incandescent lamp. The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. CFL's are also available in 3000K, 3500K, and 4100K. The 4100K would be the "brightest" or "coolest" output. A CFL can be chosen to screw right into your existing fixtures, or hardwired into your existing fixtures. Where the existing fixture is controlled by a dimmer switch, the CFL bulb must be compatible with a dimmer switch. In some locations the bulb replacement will need to be tested to make sure the larger base of the CFL will fit into the existing fixture. 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. However, the maintenance savings due to reduced lamp replacement is offset by the higher cost of the CFL's compared to the incandescent lamps.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$13,086
NJ Smart Start Equipment Incentive ($):	$170
Net Installation Cost ($):	$12,916
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,883
Total Yearly Savings ($/Yr):	$1,883
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.9
Simple Lifetime ROI	118.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$28,245
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	$9,563.13

ECM #2: Lighting Upgrade – All-Purpose Room

Description:

The all-purpose room at Parker Elementary School is currently lit via twenty 8 foot, 75W T-12 fixtures with magnetic ballasts. The space would be better served with a more efficient, fluorescent lighting system. CE recommends upgrading the lighting to an energy-efficient T-8 system that includes new 28W T-8 4 lamp fixtures with new electronic ballasts.

This measure replaces all the 75W T-12fixtures with a well-designed T-8 lighting system. Twenty, 28 Watt T-8, 4 lamp fixtures will be required in order to meet the mandated 50 foot-candle average within the spaces.

Energy Savings Calculations:

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

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,000
NJ Smart Start Equipment Incentive ($):	$200
Net Installation Cost ($):	$1,800
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$300
Total Yearly Savings ($/Yr):	$300
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.0
Simple Lifetime ROI	150.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$4,500
Internal Rate of Return (IRR)	14%
Net Present Value (NPV)	$1,781.38

ECM #3: Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Parker Elementary School are 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 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 expected to be 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.

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:

- Occupancy Sensors for Lighting Control 20% - 28% energy savings.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors (The majority of the savings is expected to be after school hours when rooms are left with lights on)

This ECM includes installation of ceiling or switch mount sensors for individual offices, classrooms, large bathrooms, and Media Centers. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. 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 the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = \left(\%\ \text{Savings} \times \text{Controlled Light Energy}\ \left(\text{kWh/Yr}\right)\right)$$

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

Rebates and Incentives:

From the **NJ Smart Start® Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive:

Smart Start Incentive
= (# Wall mount sensors × $20 per sensor)
+ (# Ceiling mount sensors × $35 per sensor)

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,900
NJ Smart Start Equipment Incentive ($):	$1,050
Net Installation Cost ($):	$5,850
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,520
Total Yearly Savings ($/Yr):	$1,520
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.8
Simple Lifetime ROI	289.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$22,800
Internal Rate of Return (IRR)	25%
Net Present Value (NPV)	$12,295.66

ECM #4: Install NEMA Premium® Efficiency Motors

Description:

The improved efficiency of the NEMA Premium® efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate continuously 24 hours a day, even small increases in efficiency can yield substantial energy and dollar savings.

The electric motors driving the hot water pumps are candidates for replacing with premium efficiency motors. These standard efficiency motors run considerable amount of time over a year.

This energy conservation measure replaces existing inefficient electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
P-1	Hot Water Supply	1.5	3,876	84.0%	88.5%
P-2	Hot Water Supply	1.5	3,876	84.0%	88.5%
P-3	Hot Water Return	3	3,876	86.5%	89.5%
P-4	Hot Water Return	3	3,876	84.0%	89.5%

Energy Savings Calculations:

$$\text{Electric usage, kWh} = \frac{\text{HP} \times \text{LF} \times 0.746 \times \text{Hours of Operation}}{\text{Motor Efficiency}}$$

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric cost savings} = \text{Electric Usage Savings} \times \text{Electric Rate} \left(\frac{\$}{\text{kWh}}\right)$$

The calculations were carried out and the results are tabulated in the table below:

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	MOTOR HP	LOAD FACTOR	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY	POWER SAVINGS kW	ENERGY SAVINGS kWH	COST SAVINGS
P-1	1.5	90%	84.0%	88.5%	0.06	238	$36
P-2	1.5	90%	84.0%	88.5%	0.06	238	$36
P-3	3	90%	86.5%	89.5%	0.08	304	$46
P-4	3	90%	84.0%	89.5%	0.15	574	$87
TOTAL					**0.3**	**1,353**	**$206**

Equipment Cost and Incentives

Below is a summary of SmartStart Building® incentives for premium efficiency motors:

INCENTIVES	
HORSE POWER	NJ SMART START INCENTIVE
5	$60
7.5	$90
10	$100
15	$115
20	$125
25	$130
30	$150
40	$180

The following table outlines the summary of motor replacement costs and incentives:

MOTOR REPLACEMENT SUMMARY						
EQMT ID	MOTOR POWER HP	INSTALLED COST	SMART START INCENTIVE	NET COST	TOTAL SAVINGS	SIMPLE PAYBACK
P-1	1.5	$788	$50	$738	$36	20.4
P-2	1.5	$788	$50	$738	$36	20.4
P-3	3	$1,049	$60	$989	$46	21.4
P-4	3	$1,049	$60	$989	$87	11.3
TOTAL	**Totals:**	**$3,674**	**$220**	**$3,454**	**$206**	**16.8**

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,674
NJ Smart Start Equipment Incentive ($):	$220
Net Installation Cost ($):	$3,454
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$206
Total Yearly Savings ($/Yr):	$206
Estimated ECM Lifetime (Yr):	18
Simple Payback	16.8
Simple Lifetime ROI	7.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,708
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($620.78)

ECM #5: High Efficiency Gas Hot Water Heater

Description:

The Watchung Elementary School has an existing electric hot water heater which is located in a lower level janitor closet. The heater is well past its useful life and could be replaced with a much more efficient hot water heating system.

This ECM will replace the electric domestic water heater with a 98.5% thermal efficient Bradford White eF Series Natural Gas fired 125 MBH and 60 gallons of storage domestic water heater.

Energy Savings Calculations:

CONDENSING DOM. HOT WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Hot Water Heater	Bradford White High Efficiency	
Building Type	Education		
Building Square-foot	20,397	20,397	
Domestic Water Usage, kBtu	106,064.40	106,064.40	
DHW Heating Fuel Type	Gas	Gas	
Heating Efficiency	75%	95%	20%
Total Usage (kBTU)	141,419	111,647	29,772
Electric Cost ($/kWh)	$ -	$ -	
Nat Gas Cost ($/Therm)	$ 1.090	$ 1.090	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	0	0	0
Natural Gas Usage (Therms)	1,414	1,116	298
Energy Cost ($)	$1,541	$1,217	$325
COMMENTS:	Savings are based on Energy Information Administration Commercial Building Energy Consumption Survey 2003 Information		

Energy Density for "Education" type building = 5.2 kBtu / SF / year

$$DHW\ \ Heat\ Usage = Energy\ Density\left(\frac{kBtu\ yr}{SF}\right) \times Building\ Square\ Footage\ \ (SF)$$

$$DHW\ Total\ Usage = \frac{Dom\ HW\ \ Heat\ Cons.(Btu)}{Heating\ \ Eff.(\%) \times Fuel\ \ Heat\ Value\left(\frac{BTU}{Fuel\ Unit}\right)}$$

$$Energy\ Cost = Heating\ \ Fuel\ Usage(Fuel\ Units) \times Ave\ Fuel\ Cost\left(\frac{\$}{Fuel\ Unit}\right)$$

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,000
NJ Smart Start Equipment Incentive ($):	$250
Net Installation Cost ($):	$9,750
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$325
Total Yearly Savings ($/Yr):	$325
Estimated ECM Lifetime (Yr):	12
Simple Payback	30.0
Simple Lifetime ROI	-60.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,900
Internal Rate of Return (IRR)	-12%
Net Present Value (NPV)	($6,514.95)

REM #1: 16.92 kW Solar System

Description:

The Alexander Elementary School has available roof space that could accommodate a significant amount of solar generation. Based on the available area a 16.92 kilowatt solar array could be installed, assuming the existing roof structure is capable of supporting an array. The array will produce approximately 19,552 kilowatt-hours annually that will reduce the overall electric usage of the facility by 11%.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas. Financial results in table below are based on 100% financing of the system over a fifteen year period.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
System Size (KW_{DC}):	16.92
Electric Generation (KWH/Yr):	19,552
Installation Cost ($):	$109,251
SREC Revenue ($/Yr):	$3,736
Energy Savings ($/Yr):	$2,972
Total Yearly Savings ($/Yr):	$6,708
ECM Analysis Period (Yr):	15
Simple Payback (Yrs):	16.3
Analysis Period Electric Savings ($):	$55,274
Analysis Period SREC Revenue ($):	$54,122
Net Present Value (NPV)	($43,116.27)

V. 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. Maintain all weather stripping on windows and doors.

B. Clean all light fixtures to maximize light output.

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

D. Turn off computers when not in use. Ensure computers are not running in screen saver mode which saves the monitor screen not energy.

E. Ensure outside air dampers are functioning properly.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Middlesex BOE - Parker Elementary School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM #1	Lighting Upgrade	$13,086	$0	$170	$12,916	$1,883	$0	$1,883	15	$28,245	$0	118.7%	6.9	11.87%	$9,563.13
ECM #2	All Purpose Room Lighting Upgrade	$2,000	$0	$200	$1,800	$300	$0	$300	15	$4,500	$0	150.0%	6.0	14.47%	$1,781.38
ECM #3	Lighting Controls Upgrade	$6,900	$0	$1,050	$5,850	$1,520	$0	$1,520	15	$22,800	$0	289.7%	3.8	25.08%	$12,295.66
ECM #4	NEMA Premium Motors	$2,648	$1,026	$220	$3,454	$206	$0	$206	18	$3,708	$0	7.4%	16.8	0.76%	($620.78)
ECM #5	Domestic Hot Water Upgrade	$5,000	$5,000	$250	$9,750	$325	$0	$325	12	$3,900	$0	-60.0%	30.0	-11.89%	($6,514.95)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	16.92 KW PV System	$109,251	$0	$0	$109,251	$2,972	$3,736	$6,708	15	$100,620	$56,041	-7.9%	16.3	-1.01%	($29,171.46)

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

APPENDIX B

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of February 15, 2011:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $92 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
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2007

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, AFUE ≥ 92%

Ground Source Heat Pumps

Closed Loop	$450 per ton, EER ≥ 16 $600 per ton, EER ≥ 18 $750 per ton, EER ≥ 20

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per VFD rated hp
Compressors	$5,250 to $12,500 per drive
Cooling Towers ≥ 10 hp	$60 per VFD rated hp

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons, 0.67 energy factor or better	$50 per unit
Gas-Fired Water Heaters > 50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH
Gas Fired Tankless Water Heaters	$300 per unit

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$25 per fixture (1-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start Including Parking Lot	$25 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $200 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture

Prescriptive Lighting - LED

LED New Exit Sign Fixture Existing Facility < 75 kw Existing Facility > 75 kw	 $20 per fixture $10 per fixture
LED Display Case Lighting	$30 per display case
LED Shelf-Mtd. Display & Task Lights	$15 per linear foot
LED Portable Desk Lamp	$20 per fixture
LED Wall-wash Lights	$30 per fixture
LED Recessed Down Lights	$35 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	$175 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	$175 per fixture
LED Outdoor Wall-Mounted Area Luminaries	$100 per fixture
LED Parking Garage Luminaries	$100 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	$50 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	$150 per fixture
LED High-Bay-Aisle Lighting	$150 per fixture
LED Bollard Fixtures	$50 per fixture
LED Linear Panels (2x2 Troffers only)	$100 per fixture
LED Fuel Pump Canopy	$100 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

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
Daylight Dimming - office	$50 per fixture controlled

Premium Motors

Three-Phase Motors	$45 - $700 per motor
Fractional HP Motors Electronic Communicated Motors (replacing shaded pole motors in refrigerator/freezer cases)	$40 per electronic communicated motor

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2007 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive
Custom Measures	$0.16 KWh and $1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and a IRR of at least 10%.
Multi Measures Bonus	15%

APPENDIX C

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Middlesex BOE - Parker Elementary School

Building ID: 3113214
For 12-month Period Ending: November 30, 2011[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: May 21, 2012

Facility	Facility Owner	Primary Contact for this Facility
Middlesex BOE - Parker Elementary School South Lincoln Avenue Middlesex, NJ 08846	Middlesex Board of Education 300 Kennedy Drive Middlesex, NJ 08846	Michele Previte 300 Kennedy Drive Middlesex, NJ 08846

Year Built: 1920
Gross Floor Area (ft²): 20,397

Energy Performance Rating[2] (1-100) 14

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	629,202
Natural Gas (kBtu)[4]	1,376,685
Total Energy (kBtu)	2,005,887

Energy Intensity[4]

Site (kBtu/ft²/yr)	98
Source (kBtu/ft²/yr)	174

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	162

Electric Distribution Utility
Public Service Electric & Gas Co

National Median Comparison

National Median Site EUI	68
National Median Source EUI	121
% Difference from National Median Source EUI	44%
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[5] **for Indoor Environmental Conditions:**

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

Certifying Professional
Michael Fischette
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. Values represent energy intensity, annualized to a 12-month period.
5. 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) or a Registered Architect (RA) 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 or RA 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	Middlesex BOE - Parker 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	South Lincoln Avenue, Middlesex, NJ 08846	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 a hospital, k-12 school, hotel and senior care facility) nor can they be submitted as representing only a portion of a building.		☐
Middlesex BOE - Parker Elementary School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	20,397 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	36 (Default)	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	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	40 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	10(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: Public Service Electric & Gas Co

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
10/06/2011	11/05/2011	15,015.00
09/06/2011	10/05/2011	13,950.00
08/06/2011	09/05/2011	12,480.00
07/06/2011	08/05/2011	10,500.00
06/06/2011	07/05/2011	14,850.00
05/06/2011	06/05/2011	18,615.00
04/06/2011	05/05/2011	16,995.00
03/06/2011	04/05/2011	16,890.00
02/06/2011	03/05/2011	17,550.00
01/06/2011	02/05/2011	15,150.00
12/06/2010	01/05/2011	15,300.00

Electric Consumption (kWh (thousand Watt-hours))	**167,295.00**
Electric Consumption (kBtu (thousand Btu))	**570,810.54**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))	**570,810.54**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?	☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
10/06/2011	11/05/2011	573.80
09/06/2011	10/05/2011	46.50
08/06/2011	09/05/2011	30.60
07/06/2011	08/05/2011	27.40
06/06/2011	07/05/2011	37.00
05/06/2011	06/05/2011	322.20
04/06/2011	05/05/2011	868.80
03/06/2011	04/05/2011	1,798.80
02/06/2011	03/05/2011	2,728.90
01/06/2011	02/05/2011	2,949.10
12/06/2010	01/05/2011	2,933.50

Gas Consumption (therms)	**12,316.60**
Gas Consumption (kBtu (thousand Btu))	**1,231,660.00**
Total Natural Gas Consumption (kBtu (thousand Btu))	**1,231,660.00**
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 PE or RA 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
Middlesex BOE - Parker Elementary School
South Lincoln Avenue
Middlesex, NJ 08846

Facility Owner
Middlesex Board of Education
300 Kennedy Drive
Middlesex, NJ 08846

Primary Contact for this Facility
Michele Previte
300 Kennedy Drive
Middlesex, NJ 08846

General Information

Middlesex BOE - Parker Elementary School	
Gross Floor Area Excluding Parking: (ft^2)	20,397
Year Built	1920
For 12-month Evaluation Period Ending Date:	November 30, 2011

Facility Space Use Summary

Middlesex BOE - Parker Elementary School	
Space Type	K-12 School
Gross Floor Area (ft^2)	20,397
Open Weekends?	No
Number of PCs [d]	36
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	No
Percent Cooled	40
Percent Heated	100
Months [o]	10
High School?	No
School District [o]	Middlesex

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 11/30/2011)	**Baseline** (Ending Date 11/30/2011)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	14	14	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	98	98	53	N/A	68
Source (kBtu/ft^2)	174	174	94	N/A	121
Energy Cost					
$/year	N/A	N/A	N/A	N/A	N/A
$/$ft^2$/year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
$MtCO_2e$/year	162	162	88	N/A	112
$kgCO_2e/ft^2$/year	8	8	4	N/A	6

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 Median column presents energy performance data your building would have if your building had a median rating of 50.

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

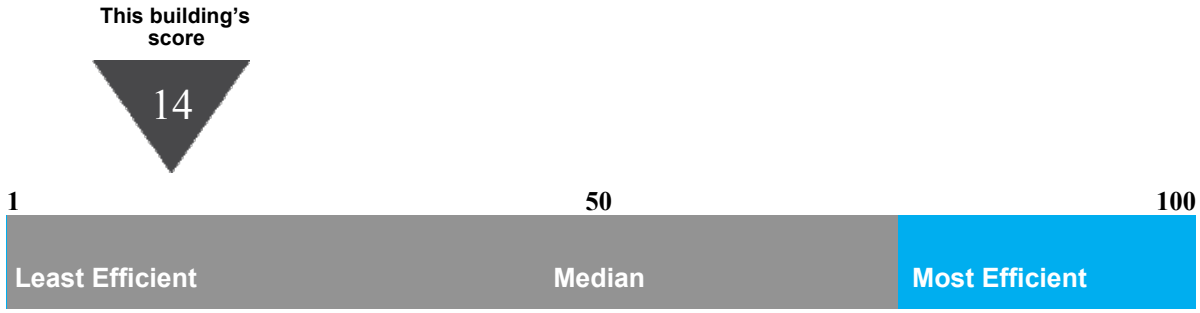
Statement of Energy Performance

2011

Middlesex BOE - Parker Elementary School
South Lincoln Avenue
Middlesex, NJ 08846

Portfolio Manager Building ID: 3113214

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 174 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending November 2011

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: 05/21/2012

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering Group

Parker Elementary School

AC Units

Tag			
Unit Type	Window Air Conditioning		
Qty	8		
Location	Parker Elementary		
Area Served	Classrooms		
Manufacturer	Various Manufacturers		
Model #	N/A		
Serial #	N/A		
Cooling Type	DX, R-22		
Cooling Capacity (Tons)	8,000 - 15,000 Btu/hr		
Cooling Efficiency (SEER/EER)	8-10.7 EER		
Heating Type	N/A		
Heating Input (MBH)	N/A		
Efficiency	N/A		
Fuel	N/A		
Approx Age	10		
ASHRAE Service Life	15		
Remaining Life	5		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Parker Elementary School

Boilers

Tag			
Unit Type	Cast Iron Boiler		
Qty	2		
Location	Boiler Room		
Area Served	Hot Water Loop		
Manufacturer	H.B. Smith		
Model #	Series 28A-8		
Serial #	N99-422		
Input Capacity (Btu/Hr)	2499 MBH	1,965	
Rated Output Capacity (Btu/Hr)	-		
Approx. Efficiency %	80.0%		
Fuel	Natural Gas		
Approx Age	13		
ASHRAE Service Life	35		
Remaining Life	22		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Parker Elementary School

Domestic Water Heaters

Tag			
Unit Type	Domestic Hot Water Boiler		
Qty	1		
Location	Boiler Room		
Area Served	Domestic Hot Water Loop		
Manufacturer	A.O. Smith		
Model #	BTR 120 104		
Serial #	MF990848910		
Size (Gallons)	71 Gallons		
Input Capacity (MBH/KW)	120 MBH		
Recovery (Gal/Hr)	116.4 Gal/Hr		
Efficiency %	75%		
Fuel	Natural Gas		
Approx Age	13		
ASHRAE Service Life	12		
Remaining Life	(1)		
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Parker Elementary School

Pumps

Tag	P-1,2	P-3,4	
Unit Type	Base Mounted End Suction	Base Mounted End Suction	
Qty	2	2	
Location	Boiler Room	Boiler Room	
Area Served	Hot Water Loop Supply	Hot Water Loop Return	
Manufacturer	Taco	Aurora	
Model #	FB2007E2C1E2L0A	09-180 1388	
Serial #	19733	-	
Horse Power	1.5 HP	3 HP	
Flow	-	90 GPM @ 50 FTHD	
Motor Info	Baldor	WEG / LEESON	
Electrical Power	208-230/460/3/60	208-230/460/3/60	
RPM	1740 RPM	1750 RPM	
Motor Efficiency %	84.0%	86.5% / 84%	
Approx Age	15	15	
ASHRAE Service Life	20	20	
Remaining Life	5	5	
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

APPENDIX E

Investment Grade Lighting Audit

CEG Job #: 9C11064

Project: Middlesex Twp. Schools — **Parker Elementary School**

Address: 300 Kennedy Drive — **South Lincoln Avenue**

Essex, NJ 08846 — **Middlesex, NJ 08846**

KWH COST: $0.152

Bldg. Sq. Ft.:. **20,397**

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
121.11	4th Floor	3000	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.16	468.0	$71.14	2	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.10	300	$45.60	$100.00	$200.00	0.06	168	$25.54	7.83
3520	4th Floor Restroom	1000	1	2	Surface Mount, Round Globe, (2) 60w A19	120	0.12	120.0	$18.24	1	2	13w CFL Lamp	26	0.03	26	$3.95	$20.00	$20.00	0.09	94	$14.29	1.40
232.21	Classroom 5	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$339.87	10	3	Relamp - Sylvania Lamp FO28/841/SS/ECO	75	0.75	1950	$296.40	$21.00	$210.00	0.11	286	$43.47	4.83
121.11	Classroom 5 Coatroom	600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.08	46.8	$7.11	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	30	$4.56	$100.00	$100.00	0.03	16.8	$2.55	39.16
232.21	Classroom 6	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$339.87	10	3	Relamp - Sylvania Lamp FO28/841/SS/ECO	75	0.75	1950	$296.40	$21.00	$210.00	0.11	286	$43.47	4.83
232.21	Classroom 7	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.69	1,788.8	$271.90	8	3	Relamp - Sylvania Lamp FO28/841/SS/ECO	75	0.60	1560	$237.12	$21.00	$168.00	0.09	228.8	$34.78	4.83
221.11	Speech	2600	5	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.29	754.0	$114.61	5	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.25	650	$98.80	$14.00	$70.00	0.04	104	$15.81	4.43
232.21	Classroom 8	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$339.87	10	3	Relamp - Sylvania Lamp FO28/841/SS/ECO	75	0.75	1950	$296.40	$21.00	$210.00	0.11	286	$43.47	4.83
121.11	Classroom 8 Coatroom	600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.08	46.8	$7.11	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	30	$4.56	$100.00	$100.00	0.03	16.8	$2.55	39.16
121.11	Corridor - 3rd Floor	3000	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.39	1,170.0	$177.84	5	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.25	750	$114.00	$100.00	$500.00	0.14	420	$63.84	7.83
221.11		3000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.06	174.0	$26.45	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	150	$22.80	$14.00	$14.00	0.01	24	$3.65	3.84
601		8760	1	2	(2) 7w CFL Exit Sign	16	0.02	140.2	$21.30	1	1	LED Exit Sign	5	0.01	43.8	$6.66	$65.00	$65.00	0.01	96.36	$14.65	4.44
121.11	Stairwell	3000	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.31	936.0	$142.27	4	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.20	600	$91.20	$100.00	$400.00	0.11	336	$51.07	7.83
121.11	Corridor - 2nd Floor	3000	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.31	936.0	$142.27	4	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.20	600	$91.20	$100.00	$400.00	0.11	336	$51.07	7.83
221.11		3000	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.12	348.0	$52.90	2	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.10	300	$45.60	$14.00	$28.00	0.02	48	$7.30	3.84
601		8760	1	2	(2) 7w CFL Exit Sign	16	0.02	140.2	$21.30	1	1	LED Exit Sign	5	0.01	43.8	$6.66	$65.00	$65.00	0.01	96.36	$14.65	4.44
232.21	Classroom 1	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$407.85	12	3	Relamp - Sylvania Lamp FO28/841/SS/ECO	75	0.90	2340	$355.68	$21.00	$252.00	0.13	343.2	$52.17	4.83
232.21	Classroom 2	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$339.87	10	3	Relamp - Sylvania Lamp FO28/841/SS/ECO	75	0.75	1950	$296.40	$21.00	$210.00	0.11	286	$43.47	4.83
232.21	Classroom 3	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$339.87	10	3	Relamp - Sylvania Lamp FO28/841/SS/ECO	75	0.75	1950	$296.40	$21.00	$210.00	0.11	286	$43.47	4.83

Investment Grade Lighting Audit

232.21	Classroom 4	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$339.87	10	3	Relamp - Sylvania Lamp FO28/841/SS/ECO	75	0.75	1950	$296.40	$21.00	$210.00	0.11	286	$43.47	4.83
121.11	Back Stairwell	3000	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.23	702.0	$106.70	3	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.15	450	$68.40	$100.00	$300.00	0.08	252	$38.30	7.83
121.11	Corridor - Basement	3000	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.39	1,170.0	$177.84	5	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.25	750	$114.00	$100.00	$500.00	0.14	420	$63.84	7.83
221.11		3000	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.17	522.0	$79.34	3	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.15	450	$68.40	$14.00	$42.00	0.02	72	$10.94	3.84
221.11	Library	2600	12	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.70	1,809.6	$275.06	12	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.60	1560	$237.12	$14.00	$168.00	0.10	249.6	$37.94	4.43
121.11		2600	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.39	1,014.0	$154.13	5	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.25	650	$98.80	$100.00	$500.00	0.14	364	$55.33	9.04
601		8760	2	2	(2) 7w CFL Exit Sign	16	0.03	280.3	$42.61	2	1	LED Exit Sign	5	0.01	87.6	$13.32	$65.00	$130.00	0.02	192.72	$29.29	4.44
121.11	Boiler Room	2600	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.23	608.4	$92.48	3	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.15	390	$59.28	$100.00	$300.00	0.08	218.4	$33.20	9.04
121.11	Conference Room	2600	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.31	811.2	$123.30	4	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.20	520	$79.04	$100.00	$400.00	0.11	291.2	$44.26	9.04
121.14	Maintenance	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.16	405.6	$61.65	2	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	301.6	$45.84	$100.00	$200.00	0.04	104	$15.81	12.65
242.21	Girls' Restroom	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.42	1,081.6	$164.40	4	0	Relamp - Sylvania Lamp FO28/841/SS/ECO	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Faculty Lounge	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.16	405.6	$61.65	2	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.10	260	$39.52	$100.00	$200.00	0.06	145.6	$22.13	9.04
221.11		2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.06	150.8	$22.92	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	130	$19.76	$14.00	$14.00	0.01	20.8	$3.16	4.43
121.11	Copy Room	2600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.08	202.8	$30.83	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	130	$19.76	$100.00	$100.00	0.03	72.8	$11.07	9.04
3756	Restroom - Adults Only	1200	1	2	Surface Mount, Round Globe, (2) 60w A19	120	0.12	144.0	$21.89	1	2	13w CFL Lamp	26	0.03	31.2	$4.74	$20.00	$20.00	0.09	112.8	$17.15	1.17
3756	Restroom - Adults Only	1200	1	2	Surface Mount, Round Globe, (2) 60w A19	120	0.12	144.0	$21.89	1	2	13w CFL Lamp	26	0.03	31.2	$4.74	$20.00	$20.00	0.09	112.8	$17.15	1.17
221.11	Nurse	2600	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.17	452.4	$68.76	3	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.15	390	$59.28	$14.00	$42.00	0.02	62.4	$9.48	4.43
121.11	Secretary	2600	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.31	811.2	$123.30	4	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.20	520	$79.04	$100.00	$400.00	0.11	291.2	$44.26	9.04
121.11	Principal's Office	2600	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.31	811.2	$123.30	4	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.20	520	$79.04	$100.00	$400.00	0.11	291.2	$44.26	9.04
121.14	Stage	1200	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.08	93.6	$14.23	1	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.06	69.6	$10.58	$100.00	$100.00	0.02	24	$3.65	27.41
612		1200	6	1	Pendant Mnt., 100w A19 Lamp	100	0.60	720.0	$109.44	6	1	(1) 26w CFL Lamp	26	0.16	187.2	$28.45	$20.00	$120.00	0.44	532.8	$80.99	1.48
602		8760	1	2	Incandescent Exit Sign	20	0.02	175.2	$26.63	1	1	LED Exit Sign	5	0.01	43.8	$6.66	$65.00	$65.00	0.02	131.4	$19.97	3.25
121.11	Corridor	3000	24	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	1.87	5,616.0	$853.63	24	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	1.20	3600	$547.20	$100.00	$2,400.00	0.67	2016	$306.43	7.83

Investment Grade Lighting Audit

601	1st Floor	8760	3	2	(2) 7w CFL Exit Sign	16	0.05	420.5	$63.91	3	1	LED Exit Sign	5	0.02	131.4	$19.97	$65.00	$195.00	0.03	289.08	$43.94	4.44
121.11	Classroom A	2600	10	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.78	2,028.0	$308.26	10	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.50	1300	$197.60	$100.00	$1,000.00	0.28	728	$110.66	9.04
221.11		2600	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.12	301.6	$45.84	2	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.10	260	$39.52	$14.00	$28.00	0.02	41.6	$6.32	4.43
121.11	Classroom B	2600	12	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.94	2,433.6	$369.91	12	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.60	1560	$237.12	$100.00	$1,200.00	0.34	873.6	$132.79	9.04
121.11	Girls' Restroom	2600	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.23	608.4	$92.48	3	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.15	390	$59.28	$100.00	$300.00	0.08	218.4	$33.20	9.04
121.11	Boys' Restroom	2600	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.23	608.4	$92.48	3	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.15	390	$59.28	$100.00	$300.00	0.08	218.4	$33.20	9.04
242.21	Classroom F	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.94	2,433.6	$369.91	9	0	Relamp - Sylvania Lamp FO28/841/SS/ECO	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Classroom E	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.94	2,433.6	$369.91	9	0	Relamp - Sylvania Lamp FO28/841/SS/ECO	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Classroom D	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.94	2,433.6	$369.91	9	0	Relamp - Sylvania Lamp FO28/841/SS/ECO	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Classroom C	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.94	2,433.6	$369.91	9	0	Relamp - Sylvania Lamp FO28/841/SS/ECO	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
740	Exterior	4000	2	1	28w LED	28	0.06	224.0	$34.05	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
741	LED Wallpack	4000	7	1	28w LED Wallpack	28	0.20	784.0	$119.17	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals						22.10	58,442	$8,883	278	96			12.9	34,227	$5,203		$13,086	4.8	12,391	$1,883	6.95

Investment Grade Lighting Audit

CEG Job #: 9C11064

Project: Middlesex Twp. Schools — **Parker Elementary School**

Address: 300 Kennedy Drive — **South Lincoln Avenue**

Essex, NJ 08846 — **Middlesex, NJ 08846**

KWH COST: $0.152

Bldg. Sq. Ft.:. **20,397**

ECM #2: Multi-Purpose Room Lighting Upgrade

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
128.14	All Purpose Room	2600	20	2	8' Channel, 2 Lamp, 75w T12, Mag. Ballast, Surface Mnt., No Lens	142	2.84	7,384.0	$1,122.37	20	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	2.08	5408	$822.02	$100.00	$2,000.00	0.76	1976	$300.35	6.66
	Totals						2.84	7,384	$1,122	20	4			2.1	5,408	$822		$2,000	0.8	1,976	$300	6.66

CEG Job #: 9C11064
Project: Middlesex Twp. Schools
Address: 300 Kennedy Drive
Building SF: Essex, NJ 08846

0

KWH COST: $0.152

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										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. Cont.	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
121.11	4th Floor	3000	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.156	468	$71.14	2	0	No Change	78	0.16	0%	468	$71.14	$0.00	$0.00	0.00	0	$0.00	0.00
3520	4th Floor Restroom	1000	1	2	Surface Mount, Round Globe, (2) 60w A19	120	0.12	120	$18.24	1	0	No Change	120	0.12	0%	120	$18.24	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 5	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	$339.87	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$271.90	$300.00	$300.00	0.17	447.2	$67.97	4.41
121.11	Classroom 5 Coatroom	600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.078	46.8	$7.11	1	0	No Change	78	0.08	0%	46.8	$7.11	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 6	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	$339.87	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$271.90	$300.00	$300.00	0.17	447.2	$67.97	4.41
232.21	Classroom 7	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.688	1788.8	$271.90	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.55	20%	1431.04	$217.52	$300.00	$300.00	0.14	357.76	$54.38	5.52
221.11	Speech	2600	5	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.29	754	$114.61	5	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.23	20%	603.2	$91.69	$150.00	$150.00	0.06	150.8	$22.92	6.54
232.21	Classroom 8	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	$339.87	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$271.90	$300.00	$300.00	0.17	447.2	$67.97	4.41
121.11	Classroom 8 Coatroom	600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.078	46.8	$7.11	1	0	No Change	78	0.08	0%	46.8	$7.11	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Corridor - 3rd Floor	3000	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.39	1170	$177.84	5	0	No Change	78	0.39	0%	1170	$177.84	$0.00	$0.00	0.00	0	$0.00	0.00
221.11		3000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.058	174	$26.45	1	0	No Change	58	0.06	0%	174	$26.45	$0.00	$0.00	0.00	0	$0.00	0.00
601		8760	1	2	(2) 7w CFL Exit Sign	16	0.016	140.16	$21.30	1	0	No Change	16	0.02	0%	140.16	$21.30	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Stairwell	3000	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.312	936	$142.27	4	0	No Change	78	0.31	0%	936	$142.27	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Corridor - 2nd Floor	3000	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.312	936	$142.27	4	0	No Change	78	0.31	0%	936	$142.27	$0.00	$0.00	0.00	0	$0.00	0.00
221.11		3000	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.116	348	$52.90	2	0	No Change	58	0.12	0%	348	$52.90	$0.00	$0.00	0.00	0	$0.00	0.00
601		8760	1	2	(2) 7w CFL Exit Sign	16	0.016	140.16	$21.30	1	0	No Change	16	0.02	0%	140.16	$21.30	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 1	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	$407.85	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$326.28	$300.00	$300.00	0.21	536.64	$81.57	3.68
232.21	Classroom 2	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	$339.87	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$271.90	$300.00	$300.00	0.17	447.2	$67.97	4.41
232.21	Classroom 3	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	$339.87	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$271.90	$300.00	$300.00	0.17	447.2	$67.97	4.41
232.21	Classroom 4	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	$339.87	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$271.90	$300.00	$300.00	0.17	447.2	$67.97	4.41
121.11	Back Stairwell	3000	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.234	702	$106.70	3	0	No Change	78	0.23	0%	702	$106.70	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Corridor - Basement	3000	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.39	1170	$177.84	5	0	No Change	78	0.39	0%	1170	$177.84	$0.00	$0.00	0.00	0	$0.00	0.00

221.11	Corridor - Basement	3000	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.174	522	$79.34	3	0	No Change	58	0.17	0%	522	$79.34	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Library	2600	12	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.696	1809.6	$275.06	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.56	20%	1447.68	$220.05	$300.00	$300.00	0.14	361.92	$55.01	5.45
121.11		2600	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.39	1014	$154.13	5	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.31	20%	811.2	$123.30	$300.00	$300.00	0.08	202.8	$30.83	9.73
601		8760	2	2	(2) 7w CFL Exit Sign	16	0.032	280.32	$42.61	2	0	No Change	16	0.03	0%	280.32	$42.61	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Boiler Room	2600	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.234	608.4	$92.48	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.19	20%	486.72	$73.98	$150.00	$150.00	0.05	121.68	$18.50	8.11
121.11	Conference Room	2600	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.312	811.2	$123.30	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.25	20%	648.96	$98.64	$150.00	$150.00	0.06	162.24	$24.66	6.08
121.14	Maintenance	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.156	405.6	$61.65	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.12	20%	324.48	$49.32	$150.00	$150.00	0.03	81.12	$12.33	12.17
242.21	Girls' Restroom	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.416	1081.6	$164.40	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.33	20%	865.28	$131.52	$150.00	$150.00	0.08	216.32	$32.88	4.56
121.11	Faculty Lounge	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.156	405.6	$61.65	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.12	20%	324.48	$49.32	$150.00	$150.00	0.03	81.12	$12.33	16.75
221.11		2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.058	150.8	$22.92	1			58	0.05	20%	120.64	$18.34			0.01	30.16	$4.58	
121.11	Copy Room	2600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.078	202.8	$30.83	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.06	20%	162.24	$24.66	$150.00	$150.00	0.02	40.56	$6.17	24.33
3756	Restroom - Adults Only	1200	1	2	Surface Mount, Round Globe, (2) 60w A19	120	0.12	144	$21.89	1	0	No Change	120	0.12	0%	144	$21.89	$0.00	$0.00	0.00	0	$0.00	0.00
3756	Restroom - Adults Only	1200	1	2	Surface Mount, Round Globe, (2) 60w A19	120	0.12	144	$21.89	1	0	No Change	120	0.12	0%	144	$21.89	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Nurse	2600	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.174	452.4	$68.76	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.14	20%	361.92	$55.01	$150.00	$150.00	0.03	90.48	$13.75	10.91
121.11	Secretary	2600	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.312	811.2	$123.30	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.25	20%	648.96	$98.64	$150.00	$150.00	0.06	162.24	$24.66	6.08
121.11	Principal's Office	2600	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.312	811.2	$123.30	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.25	20%	648.96	$98.64	$150.00	$150.00	0.06	162.24	$24.66	6.08
121.14	Stage	1200	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.078	93.6	$14.23	1	0	No Change	78	0.08	0%	93.6	$14.23	$0.00	$0.00	0.00	0	$0.00	0.00
612		1200	6	1	Pendant Mnt., 100w A19 Lamp	100	0.6	720	$109.44	6	0	No Change	100	0.60	0%	720	$109.44	$0.00	$0.00	0.00	0	$0.00	0.00
602		8760	1	2	Incandescent Exit Sign	20	0.02	175.2	$26.63	1	0	No Change	20	0.02	0%	175.2	$26.63	$0.00	$0.00	0.00	0	$0.00	0.00
128.14	All Purpose Room	2600	20	2	8' Channel, 2 Lamp, 75w T12, Mag. Ballast, Surface Mnt., No Lens	142	2.84	7384	$1,122.37	20	1	Dual Technology Occupancy Sensor - Remote Mnt.	142	2.27	20%	5907.2	$897.89	$300.00	$300.00	0.57	1476.8	$224.47	1.34
121.11	Corridor 1st Floor	3000	24	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	1.872	5616	$853.63	24	0	No Change	78	1.87	0%	5616	$853.63	$0.00	$0.00	0.00	0	$0.00	0.00
601		8760	3	2	(2) 7w CFL Exit Sign	16	0.048	420.48	$63.91	3	0	No Change	16	0.05	0%	420.48	$63.91	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Classroom A	2600	10	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.78	2028	$308.26	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.62	20%	1622.4	$246.60	$300.00	$300.00	0.16	405.6	$61.65	4.87
221.11		2600	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.116	301.6	$45.84	2	0	No Change	58	0.12	0%	301.6	$45.84	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Classroom B	2600	12	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.936	2433.6	$369.91	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.75	20%	1946.88	$295.93	$300.00	$300.00	0.19	486.72	$73.98	4.06
121.11	Girls' Restroom	2600	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.234	608.4	$92.48	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.19	20%	486.72	$73.98	$150.00	$150.00	0.05	121.68	$18.50	8.11
121.11	Boys' Restroom	2600	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.234	608.4	$92.48	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.19	20%	486.72	$73.98	$150.00	$150.00	0.05	121.68	$18.50	8.11

242.21	Classroom F	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.936	2433.6	$369.91	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$295.93	$300.00	$300.00	0.19	486.72	$73.98	4.06
242.21	Classroom E	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.936	2433.6	$369.91	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$295.93	$300.00	$300.00	0.19	486.72	$73.98	4.06
242.21	Classroom D	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.936	2433.6	$369.91	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$295.93	$300.00	$300.00	0.19	486.72	$73.98	4.06
242.21	Classroom C	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.936	2433.6	$369.91	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$295.93	$300.00	$300.00	0.19	486.72	$73.98	4.06
740	Exterior	4000	2	1	28w LED	28	0.056	224	$34.05	2	0	No Change	28	0.06	0%	224	$34.05	$0.00	$0.00	0.00	0	$0.00	0.00
741	LED Wallpack	4000	7	1	28w LED Wallpack	28	0.196	784	$119.17	7	0	No Change	28	0.20	0%	784	$119.17	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		0	0			24.9	65,826.3	$10,006	298	29			21.1		55,825.7	$8,485.50		$6,900	3.85	10,001	$1,520	4.54

APPENDIX F

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Total KW_{AC}	Panel Weight (41.9 lbs)	W/SQFT
Parker Elementary School	1775	SHARP NU-U235F2	72	17.5	1,263	16.92	19,552	13.7	3,017	13.40

.= Proposed PV Layout

Notes:

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

Project Name: **LGEA Solar PV Project - Parker Elementary School**
Location: **Middlesex, NJ**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$109,251
Annual kWh Production	19,552
Annual Energy Cost Reduction	$2,972
Average Annual SREC Revenue	$3,736

Simple Payback: **16.29** Years

Life Cycle Cost Analysis

Analysis Period (years): 15
Discount Rate: 3%
Average Energy Cost ($/kWh) **$0.152**
Financing Rate: 6.00%
Financing %: 100%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
Average SREC Value ($/kWh) $0.191

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	$0	0	0	0	$0	0	0	0	0
1	$0	19,552	$2,972	$0	$4,888	$6,429	$4,634	($3,203)	($3,203)
2	$0	19,454	$3,061	$0	$4,864	$6,143	$4,920	($3,138)	($6,342)
3	$0	19,357	$3,153	$0	$4,839	$5,840	$5,223	($3,071)	($9,413)
4	$0	19,260	$3,247	$0	$4,815	$5,518	$5,545	($3,001)	($12,413)
5	$0	19,164	$3,345	$197	$4,791	$5,176	$5,888	($3,125)	($15,538)
6	$0	19,068	$3,445	$196	$3,814	$4,812	$6,251	($4,001)	($19,538)
7	$0	18,973	$3,549	$195	$3,795	$4,427	$6,636	($3,915)	($23,454)
8	$0	18,878	$3,655	$194	$3,776	$4,018	$7,045	($3,827)	($27,280)
9	$0	18,783	$3,765	$193	$3,757	$3,583	$7,480	($3,735)	($31,016)
10	$0	18,690	$3,878	$193	$2,803	$3,122	$7,941	($4,574)	($35,590)
11	$0	18,596	$3,994	$192	$2,789	$2,632	$8,431	($4,471)	($40,061)
12	$0	18,503	$4,114	$191	$2,775	$2,112	$8,951	($4,364)	($44,426)
13	$0	18,411	$4,237	$190	$2,762	$1,560	$9,503	($4,254)	($48,679)
14	$0	18,319	$4,364	$189	$1,832	$974	$10,089	($5,056)	($53,735)
15	$0	18,227	$4,495	$188	$1,823	$351	$10,712	($4,933)	($58,668)
	Totals:	283,234	$55,274	$2,118	$54,122	$56,695	$109,251	($58,668)	($429,355)

Net Present Value (NPV) **($43,116)**