NORTH BRUNSWICK TOWNSHIP
PUBLIC SCHOOL DISTRICT

LIVINGSTON PARK ELEMENTARY SCHOOL

RIDGEWOOD AVENUE
NORTH BRUNSWICK, NJ 08902

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:	Large Power and Lighting Service (LPLS)
Third Party Supplier:	South Jersey Energy

Natural Gas Utility Provider:	Public Service Electric & Gas
Utility Rate Structure:	Large Volume Gas (LVG)
Third Party Supplier:	N/A

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: LPLS
Meter No: 778017104
Account # E 42-124-014-01
Third Party Utility South Jersey Energy
TPS Meter / Acct No: -

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Sep-11	61,052	309.0	$8,838
Oct-11	59,568	288.0	$8,588
Nov-11	59,010	231.0	$8,349
Dec-11	53,304	204.0	$7,571
Jan-12	57,498	198.0	$8,086
Feb-12	57,476	198.0	$8,083
Mar-12	58,053	267.0	$8,393
Apr-12	46,948	264.0	$7,032
May-12	58,025	300.0	$10,993
Jun-12	36,719	288.0	$8,316
Jul-12	23,529	156.0	$2,949
Aug-12	31,800	297.0	$7,802
Totals	**602,982**	**309.0 Max**	**$94,998**

AVERAGE DEMAND **250.0 KW average**
AVERAGE RATE **$0.158 $/kWh**

Figure 1
Electricity Usage Profile

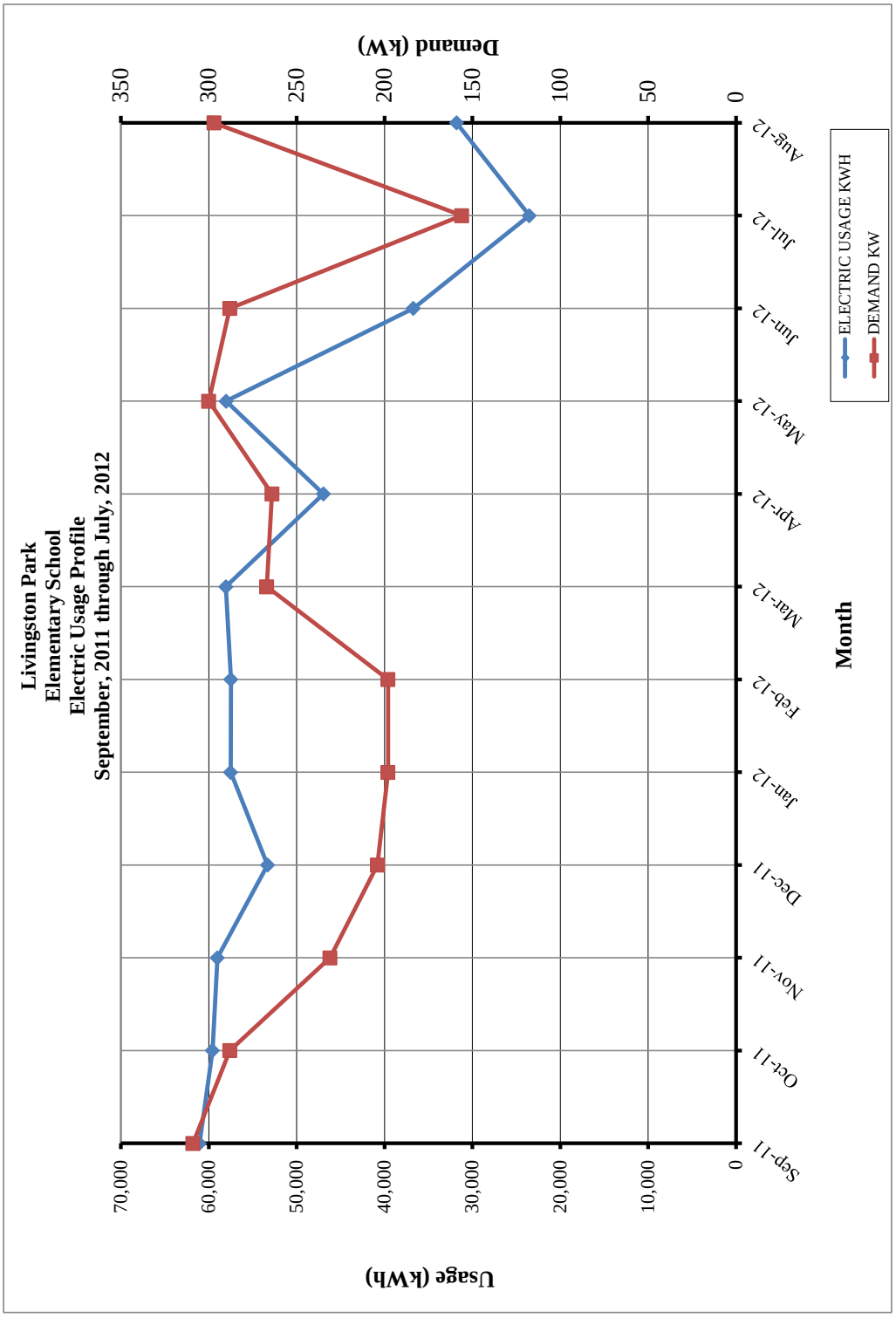
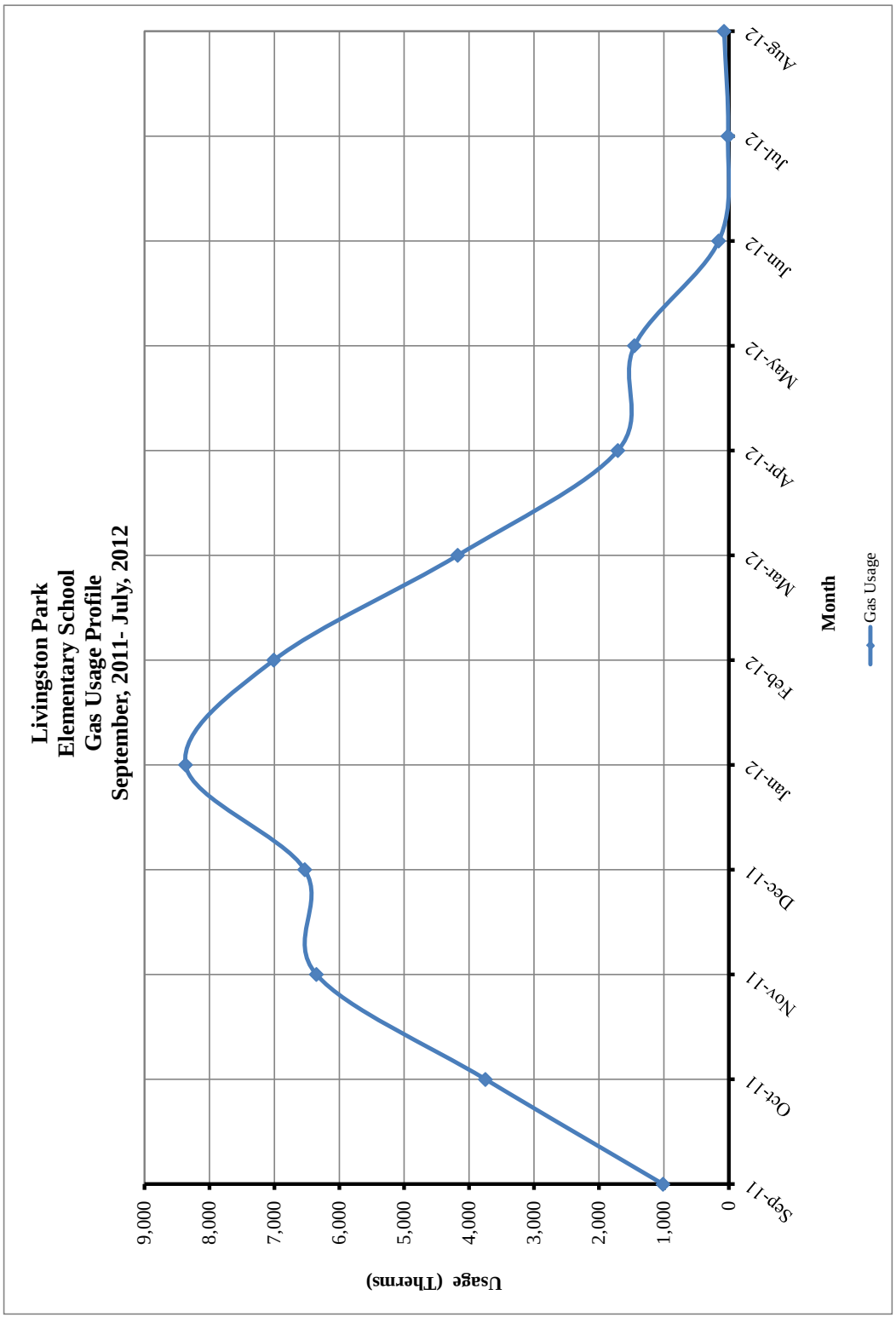


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	PSE&G	
Rate:	LVG	
Meter No:	2523526	
Point of Delivery ID:	G 42-124-014-01	
Third Party Utility Provider:	N/A	
TPS Meter No:	N/A	
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Sep-11	1,015.00	$877.82
Oct-11	3,748.00	$3,612.13
Nov-11	6,352.00	$5,819.91
Dec-11	6,532.00	$6,133.02
Jan-12	8,367.00	$7,324.79
Feb-12	7,006.00	$5,988.35
Mar-12	4,174.00	$2,603.21
Apr-12	1,709.00	$1,107.67
May-12	1,453.00	$959.94
Jun-12	155.00	$200.02
Jul-12	13.00	$108.61
Aug-12	73.11	$150.31
TOTALS	**40,597.11**	**$34,885.78**
AVERAGE RATE:	**$0.86**	**$/THERM**

Figure 2
Natural Gas Usage Profile



II. FACILITY DESCRIPTION

Livingston Park Elementary School is located on Ridgewood Avenue in North Brunswick, New Jersey. The 84,573 square foot elementary school was constructed in 1961 with an 18,627 square foot addition completed in 2008. The building is a single story building consisting of administrative offices, classrooms, multipurpose room/cafeteria, media center and gymnasium.

Occupancy Profile

The typical hours of operation for the school are Monday through Friday from 8:55 am to 3:30 pm from September through June. In addition, the building has limited occupancy during evening hours for after-school activities. The school's current estimated enrollment is approximately 680 students with approximately 50 teachers.

Building Envelope

Exterior walls for the high school are a 4" brick with a concrete block interior construction. The amount of insulation within the walls is unknown. The windows throughout the school are in good condition and appear to be maintained. Typical windows throughout the school are double pane, ¼" insulated glass with aluminum frames. The roof over the original section of the building either a is a tar covered roof painted silver or with a light stone covering. This section of the roof is in poor condition with noticeable areas of standing water. The roof over the newer addition is a flat, EPDM rubber roof on steel decking. The amount of insulation below the roofing is unknown, but the roof is in good condition.

HVAC Systems

Heating hot water is provided to the building via two (2) Cleaver Brooks firetube boilers model CB801-70. These boilers are original to the building and have surpassed their useful service life, per ASHRAE. Heating hot water is circulated throughout the building via zone pumps. There are a total of five (5) zones, each served by two (2) pumps. Two of the pumps have variable frequency drives (pumps P12 and P13, which serve classrooms 6 through 13).

The classrooms in the building are conditioned by Venmar classroom unit ventilators with hot water heating coils and split direct expansion cooling coils. The cooling coils have a remote condensing unit, located on the roof. There are a total of seventeen (17) remote condensing units and Venmar classroom unit ventilators, each rated for 3 tons of cooling capacity.

Classrooms 28 through 31 are served by two (2) Carrier packaged rooftop air conditioning units with gas fired heat. Each unit is rated for 7.5 tons of cooling and has a heating input rating of 180 MBH. These units are both nearly 20 years old and have surpassed their useful service life.

Classrooms 32 through 39 are served by a packaged rooftop Seasons 4 multi-zone unit, with direct expansion cooling and gas fired heat. This unit is rated for 30 tons of cooling. The unit is approximately 13 years old and is approaching the end of its useful life, per ASHRAE.

The Gymnasium is served by three (3) Trane model gas fired heating and ventilation units. These units are heating only.

The Media Center and computer lab area is served by split direct expansion air conditioning units with remote condensing sections, located on the roof.

The Main office is served by a Trane packaged rooftop unit, rated for 3 tons of cooling. This unit is 21 years old and has surpassed its useful service life.

Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters. The exhaust fans are controlled by the occupancy schedule in the BAS.

HVAC System Controls

The HVAC systems within school are controlled by a DDC system by Novar. All of the older multi-zone units have been retrofitted with newer controllers. The DDC system controls the operation, status and temperature set points of the all of the heating and cooling equipment in the facility.

Domestic Hot Water

Domestic hot water for the building is provided by an A.O. Smith gas fired hot water heater with separate storage tank. The water heater has an input rating of 300 MBH. The storage tank has 772 gallons of capacity. The domestic hot water heater is over 20 years old and has surpassed its useful service life. There is an additional electric hot water heater, located in a custodian closet that serves the restrooms labeled 3B and 3G. This water heater is an A.O. smith model with 30 gallons of storage, and a 4.5 kW heating element. This water heater was recently installed and is in good condition.

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	$11,380	$1,403	8.1	85.0%
ECM #2	Lighting Controls	$14,325	$3,561	4.0	272.9%
ECM #3	NEMA Premium Pump Motors	$4,896	$306	16.0	-6.3%
ECM #4	Boiler Replacement	$132,903	$3,660	36.3	-31.2%
ECM #5	Domestic Hot Water Heater Replacement	$19,515	$1,544	12.6	97.8%
ECM #6	Rooftop Unit Replacement	$40,379	$1,623	24.9	0.5%
ECM #7	Split System AC Unit Replacement	$104,950	$5,541	18.9	5.6%
ECM #8	Kitchen Domestic Booster Heater Replacement	$8,050	$783	10.3	45.9%
ECM #9	Set Computers to Automatic Stand-by or Hibernate	$1,000	$2,926	0.3	4289.0%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	347.8 KW Solar Array	$1,876,711	$141,706	13.2	13.3%

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	3.4	8,882	-
ECM #2	Lighting Controls	-	22,536	-
ECM #3	NEMA Premium Pump Motors	0.7	1,935	-
ECM #4	Boiler Replacement	-	-	4,256
ECM #5	Domestic Hot Water Heater Replacement	-	-	1,795
ECM #6	Rooftop Unit Replacement	9.0	10,273	-
ECM #7	Split System AC Unit Replacement	23.0	35,070	-
ECM #8	Kitchen Domestic Booster Heater Replacement	32.0	6,458	-276
ECM #9	Set Computers to Automatic Stand-by or Hibernate Modes	-	18,522	-
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
REM #1	347.8 KW Solar Array	281.7	405,935	-

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	$1,403	$11,400	$20	$11,380	8.1
Lighting Controls	$3,561	$14,950	$625	$14,325	4.0
~~NEMA Premium Pump Motors~~	~~$306~~	~~$5,136~~	~~$240~~	~~$4,896~~	~~16.0~~
Boiler Replacement	$3,660	$136,903	$4,000	$132,903	36.3
Domestic Hot Water Heater Replacement	$1,544	$20,040	$525	$19,515	12.6
~~Rooftop Unit Replacement~~	~~$1,623~~	~~$41,750~~	~~$1,371~~	~~$40,379~~	~~24.9~~
~~Split System AC Unit – Replacement~~	~~$5,541~~	~~$110,792~~	~~$5,842~~	~~$104,950~~	~~18.9~~
Kitchen Domestic Booster Heater Replacement	$783	$8,050	$0	$8,050	10.3
Set Computers to Automatic Stand-by or Hibernate Modes	$2,926	$1,000	$0	$1,000	0.3
Design / Construction Extras (15%)		*$28,851*		*$28,851*	
Total Project	**$13,877**	**$221,194**	**$5,170**	**$216,024**	**15.6**

Note: ECM's with the strike-through font are not included in the ESIP.

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

Description:

The majority of the interior lighting throughout Livingston Park Elementary School is provided with fluorescent fixtures with older generation, 32W T8 lamps and electronic ballasts. Although these 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. Concord Engineering recommends that these fixtures remain unmodified due to the extensive costs which will be incurred if these fixtures are to be re-lamped and re-ballasted, which results in a long payback period. 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.

Additionally, the gymnasium and cafeteria at Livingston Park Elementary School are currently lit via 400 watt Metal Halide HID fixtures. The space would be better served with a more efficient, fluorescent lighting system. Concord Engineering recommends upgrading the lighting to an energy-efficient T5 high output system that includes new six lamp, 54 watt high output fixtures.

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 #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$11,400
NJ Smart Start Equipment Incentive ($):	$20
Net Installation Cost ($):	$11,380
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,403
Total Yearly Savings ($/Yr):	$1,403
Estimated ECM Lifetime (Yr):	15
Simple Payback	8.1
Simple Lifetime ROI	85.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$21,049
Internal Rate of Return (IRR)	9%
Net Present Value (NPV)	$5,372.42

ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Livingston Park 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:

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

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

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 #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$14,950
NJ Smart Start Equipment Incentive ($):	$625
Net Installation Cost ($):	$14,325
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,561
Total Yearly Savings ($/Yr):	$3,561
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.0
Simple Lifetime ROI	272.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$53,411
Internal Rate of Return (IRR)	24%
Net Present Value (NPV)	$28,182.79

ECM #3: 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-12	Heating Hot Water	5	2,700	84.5%	90.2%
P-13	Heating Hot Water	5	2,700	84.5%	90.2%
P-3	Heating Hot Water	3	2,700	85.5%	89.5%
P-4	Heating Hot Water	3	2,700	85.5%	89.5%

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

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-12	5	90%	84.5%	90.2%	0.25	681	$108
P-13	5	90%	84.5%	90.2%	0.25	681	$108
P-3	3	90%	85.5%	89.5%	0.11	286	$45
P-4	3	90%	85.5%	89.5%	0.11	286	$45
TOTAL					**0.7**	**1,934.5**	**$306**

Equipment Cost and Incentives

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

INCENTIVES	
HORSE POWER	NJ SMART START INCENTIVE
1	$50
1.5	$50
2	$60
3	$60
5	$60
7.5	$90
10	$100

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-12	5	$1,519	$60	$1,459	$108	13.6
P-13	5	$1,519	$60	$1,459	$108	13.6
P-3	3	$1,049	$60	$989	$45	21.9
P-4	3	$1,049	$60	$989	$45	21.9
TOTAL	**Totals:**	**$5,136**	**$240**	**$4,896**	**$306**	**16.0**

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,136
NJ Smart Start Equipment Incentive ($):	$240
Net Installation Cost ($):	$4,896
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$306
Total Yearly Savings ($/Yr):	$306
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.0
Simple Lifetime ROI	-6.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$4,590
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($1,242.99)

ECM #4: Condensing Boiler Installation

Description:

There are two existing Cleaver Brooks CB fire tube boilers, located in the main mechanical room. These boilers are used as the primary source of heat for majority of the high school. These boilers operate as primary and standby, meaning only one boiler operates at a time.

These boilers are approximately fifty (50) years old and have far exceeded their useful service life. In addition, these boilers are very inefficient when compared to newer, condensing boilers, which makes replacement of these boilers an option that will provide substantial energy savings.

New condensing boilers could substantially improve the operating efficiency of the heating system of the building. Condensing boiler's peak efficiency tops out at 99% depending on return water temperature. Due to the operating conditions of the building, the annual average operating efficiency of the proposed condensing boiler is expected to be 92%. The existing boiler's efficiency is approximately 65%, which makes the condensing boilers an 27% increase in efficiency. This ECM is based on variable supply water temperature adjusted based on outdoor temperature.

This ECM includes installation of two (2) condensing gas fired boilers to replace one (1) of the existing Cleaver Brooks fire tube boilers. The basis for this ECM is Aerco condensing boiler; model number BMK-2.0. The boiler installation is based on a one for one replacement based on capacity of the existing boiler. The other boiler will remain and only serve as a backup to the new boilers.

Energy Savings Calculations:

The total gas consumption by the domestic hot water heater is calculated in ECM#5 and is estimated to be 6,283 therms. Additionally, it is estimated that the kitchen equipment accounts for approximately 3.5% of the building natural gas consumption, which is 1,421 therms.

Currently, the only other gas consuming equipment connected to the building gas meter, in addition to the boilers, is three (3) Trane gas fired makeup air unit that serve the Gymnasium, two (2) carrier rooftop units with gas heat, one (1) Trane rooftop unit that serves the main office and a gas fired domestic hot water heater. Therefore, annual energy consumption of the boilers has to be estimated. In this calculation, it is assumed that the energy consumption of the boilers will be in proportion with the ratio of the total heating capacity of each piece of equipment.

Below calculation is performed to estimate annual gas usage of the cast iron boilers:

Total facility heating capacity (Heating equipment output capacity):

(1) Cleaver Brookes fire tube boiler	= 2,343 MBH
(7) Gas fired Rooftop Units	= 240 MBH
Total Output Capacity	**= 4,330 MMBH**

Total facility gas heating capacity:	4,330 MBH
Total Capacity –Boiler only:	2,343 MBH
Percent usage by boilers:	54.1% of Total
Natural gas usage of facility	40,597 therms
Natural gas usage of DHW	- 6,283 therms
Natural gas usage of kitchen equip	- 1,421 therms
Total gas usage of heating equipment =	32,893
Estimated natural gas usage of boilers	54.1% of 32,893 Therms
Estimated natural gas usage	17,798 Therms

$$\text{Bldg Heat Required} = \text{Heating Nat. Gas (Therm)} \times \text{Heating Eff (\%)} \times \text{Fuel Heat Value } (\frac{\text{BTU}}{\text{Therm}})$$

$$\text{Proposed Heating Gas Usage} = \frac{\text{Bldg. Heat Required (BTU)}}{\text{New Heating Eff (\%)} \times \text{Fuel Heat Value } (\frac{\text{BTU}}{\text{Therm}})}$$

$$\text{Energy Cost} = \text{Heating Gas Usage (Therms)} \times \text{Ave Fuel Cost } (\frac{\$}{\text{Therm}})$$

Energy savings calculations are summarized in the table below:

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Cast Iron Boilers	New Condensing Boilers	
Existing Nat Gas (Therms)	17,798	0	
Boiler Efficiency (%)	70%	92%	22%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
Equivalent Building Heat Usage (MMBTUs)	1,246	1,246	
Gas Cost ($/Therm)	0.86	0.86	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	17,798	13,542	4,256
Energy Cost ($)	$15,306	$11,646	$3,660
COMMENTS:			

Note: Concord Engineering is utilizing a seasonal average efficiency of 92% to account for efficiencies based on an outside air reset schedule.

From the **NJ Smart Start Appendix**, the installation of new condensing boilers warrants the following incentive: $1.00 per MBH, or $4,000.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$136,903
NJ Smart Start Equipment Incentive ($):	$4,000
Net Installation Cost ($):	$132,903
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,660
Total Yearly Savings ($/Yr):	$3,660
Estimated ECM Lifetime (Yr):	25
Simple Payback	36.3
Simple Lifetime ROI	-31.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$91,500
Internal Rate of Return (IRR)	-3%
Net Present Value (NPV)	($69,170.57)

ECM #5: High Efficiency Gas Hot Water Heater

Description:

The domestic hot water for the elementary school is provided by an older, A.O. Smith gas fired hot water heater. The gas fired heater is approximately twenty three (23) years old and has surpassed it useful service life and is an ideal candidate for replacement with a new condensing style boiler.

This ECM will replace the original gas fired domestic water boiler with Natural Gas fired 98.0% thermal efficient A.O. Smith Cyclone condensing domestic hot water heater. The existing storage tank will remain.

Energy Savings Calculations:

DOM. HOT WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Gas Hot Water Heater	High Efficiency Heater	
Building Type	Education		
Building Square-foot	84,573	84,573	
Domestic Water Usage, kBtu	439,779.60	439,779.60	
DHW Heating Fuel Type	Gas	Gas	
Heating Efficiency	70%	98%	28%
Total Usage (kBTU)	628,257	448,755	179,502
Electric Cost ($/kWh)	$ 0.149	$ -	
Nat Gas Cost ($/Therm)	$ 0.860	$ 0.860	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	6,283	4,488	1,795
Energy Cost ($)	$5,403	$3,859	$1,544
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

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

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

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

From the **NJ Smart Start Appendix**, the installation of new condensing boilers warrants the following incentive: $1.75 per MBH, or $525.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$20,040
NJ Smart Start Equipment Incentive ($):	$525
Net Installation Cost ($):	$19,515
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,544
Total Yearly Savings ($/Yr):	$1,544
Estimated ECM Lifetime (Yr):	25
Simple Payback	12.6
Simple Lifetime ROI	97.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$38,600
Internal Rate of Return (IRR)	6%
Net Present Value (NPV)	$7,370.96

ECM #6: RTU Upgrades

Description:

Portions of Livingston Park Elementary School are air conditioned by packaged rooftop units. These units are in poor condition and have surpassed their useful ASHRAE service life. The units currently installed are less efficient compared to modern equipment and can be replaced with new high efficiency units. New air conditioners provide higher full load and part load efficiencies due to advances in inverter motor technologies, heat exchangers and refrigerants.

This ECM includes one-for-one replacement of the two (2) older rooftop air conditioning units that serve Classrooms 28 through 31 and the rooftop unit over the main office area with new higher efficiency systems. It is recommended to fully evaluate the capacity needed for all new systems prior to moving forward with this ECM. A summary of the unit replacements for this ECM can be found in the table below:

IMPLEMENTATION SUMMARY					
ECM INPUTS	**UNIT TAG**	**NUMBER OF UNITS**	**COOLING CAPACITY, BTU/HR**	**TOTAL CAPACITY, TONS**	**REPLACE UNIT WITH**
RTU	RTU-1	1	90,000	7.5	Trane Precedent RTU
RTU	RTU-2	1	90,000	7.5	Trane Precedent RTU
RTU	RTU-5	1	36,000	3.0	Trane Precedent RTU
Total		**3**	**216,000**	**18**	

The manufacturers used as the basis for this calculation is Trane. All units are one for one style replacements with matching capacity of the new units to the old units. The unit pricing and install cost were estimated based on current rates. The payback may change based on actual unit pricing and install costs if the ECM is implemented.

Energy Savings Calculations:

Cooling Energy Savings:

Seasonal energy consumption of the air conditioners at the cooling mode is calculated with the equation below:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity,} \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{SEER}_{\text{Old}}} - \frac{1}{\text{SEER}_{\text{New}}} \right) \times \frac{\text{Operation Hours}}{1000 \frac{\text{W}}{\text{kWh}}}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

$$\text{Cooling Cost Savings} = \text{Energy Savings, kWh} \times \text{Cost of Electricity} \left(\frac{\$}{\text{kWh}} \right)$$

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	**COOLING CAPACITY, BTU/Hr**	**ANNUAL COOLING HOURS**	**EXISTING UNITS (S)EER**	**NEW UNITS (S)EER**	**# OF UNITS**	**ENERGY SAVINGS kWh**	**DEMAND SAVINGS kW**
RTU	90,000	1,200	8.5 EER	13 EER	1	4,398	3.7
RTU	90,000	1,200	8.5 EER	13 EER	1	4,398	3.7
RTU	36,000	1,200	9 EER	13 EER	1	1,477	1.2
Total					**3**	**10,273**	**9**

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$41,750
NJ Smart Start Equipment Incentive ($):	$1,371
Net Installation Cost ($):	$40,379
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,623
Total Yearly Savings ($/Yr):	$1,623
Estimated ECM Lifetime (Yr):	25
Simple Payback	24.9
Simple Lifetime ROI	0.5%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$40,575
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	($12,117.46)

ECM #7: Replace AC Units with High Efficiency Units

Description:

Livingston Park Elementary School utilizes split system cooling units to condition several classrooms within the school. These units have remote; rooftop mounted condensing units. Please refer to the **Major Equipment List Appendix** for further information about the condensing units.

These outdoor condensing units are in fair condition though the current units in operation are not high efficiency units. These units can be replaced with new higher efficiency units. New remote condensing units provide higher full load and part load efficiencies due to advances in inverter motor technologies, heat exchangers and higher efficiency refrigerants such as R410A which would be used in place of R22 that is currently used in the units.

This ECM includes one-for-one replacement of the older split system units with new higher efficiency systems which include new outdoor condensing units, new evaporator coils and refrigerant lines for the Venmar classroom unit ventilators. The units in the Computer lab and Media Center include new indoor units. It is recommended to fully evaluate the capacity needed for all new systems prior to moving forward with this ECM. A summary of the unit replacements for this ECM can be found in the table below:

IMPLEMENTATION SUMMARY					
ECM INPUTS	**SERVICE FOR**	**NUMBER OF UNITS**	**COOLING CAPACITY, BTU/HR**	**TOTAL CAPACITY, TONS**	**REPLACE UNIT WITH**
SS	Classrooms (Venmar unit)	17	36,000	51.0	Trane w/ Climatuff Compressor
SS	Computer Lab	2	30,000	5.0	Trane w/ Climatuff Compressor
SS	Media Center	2	36,000	6.0	Trane w/ Climatuff Compressor
SS	Media Center	1	18,000	1.5	Trane w/ Climatuff Compressor
Total		**22**	**120,000**	**64**	

The manufacturers used as the basis for the calculation is Trane. The unit pricing and install cost were estimated based on current rates quotes and labor rates. The payback may change based on actual unit pricing and install costs if the ECM is implemented.

Energy Savings Calculations:

Cooling Energy Savings:

Seasonal energy consumption of the air conditioners at the cooling mode is calculated with the equation below:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity,} \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{SEER}_{\text{Old}}} - \frac{1}{\text{SEER}_{\text{New}}} \right) \times \frac{\text{Operation Hours}}{1000 \frac{\text{W}}{\text{kWh}}}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

$$\text{Cooling Cost Savings} = \text{Energy Savings, kWh} \times \text{Cost of Electricity}\left(\frac{\$}{\text{kWh}}\right)$$

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	**COOLING CAPACITY, BTU/Hr**	**ANNUAL COOLING HOURS**	**EXISTING UNITS SEER**	**SPLIT UNITS SEER**	**# OF UNITS**	**ENERGY SAVINGS kWh**	**DEMAND SAVINGS kW**
SS	36,000	1,200	10 SEER	16 SEER	17	27,540	23.0
SS	36,000	1,200	10 SEER	16 SEER	2	3,240	2.7
SS	36,000	1,200	10 SEER	16 SEER	2	3,240	2.7
SS	18,000	1,200	9 SEER	16 SEER	1	1,050	0.9
Total					22	35,070	23.0

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$110,792
NJ Smart Start Equipment Incentive ($):	$5,842
Net Installation Cost ($):	$104,950
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$5,541
Total Yearly Savings ($/Yr):	$5,541
Estimated ECM Lifetime (Yr):	20
Simple Payback	18.9
Simple Lifetime ROI	5.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$110,820
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($22,513.58)

ECM #8: Kitchen Domestic Gas Booster Heater

Description:

Tank-less style hot water heaters provide improved efficiencies compared to standard hot water heaters. In addition, heating with natural gas is far less expensive than domestic hot water heated with electric heat.

The existing commercial dishwasher at Livingston Park Elementary School utilizes a 32 kW electric booster heater to provide approximately 180°F hot water for sterilization.

This ECM includes replacement of the existing domestic water booster heater for the commercial kitchen dishwasher. The existing electric booster will be replaced with a Hatco natural gas fired booster model PMG-100 rated at 80% efficient. This ECM is based on installation of the hot water heater within the boiler room and piping hot water to the commercial kitchen dishwasher.

Energy Savings Calculations:

$$\text{Booster HW Heat (BTU)} = \text{Washer}\left(\frac{\text{Gal}}{\text{Min}}\right) \times 8.33\left(\frac{\text{Lbs}}{\text{Gal}}\right) \times \text{Use}\left(\frac{\text{Min}}{\text{Wk}}\right) \times \left(\frac{\text{Wk}}{\text{Yr}}\right) \times \text{Temp Rise (°F)} \times 1.0\left(\frac{\text{BTU}}{\text{Lb} \times \text{°F}}\right)$$

$$\text{Elec Booster Energy} = \frac{\text{Booster HW Heat (BTU)}}{\text{Elec Heat Value}\left(\frac{\text{BTU}}{\text{kWh}}\right)}$$

$$\text{Gas Booster Energy} = \frac{\text{Booster HW Heat (BTU)}}{\text{HWH Eff. (\%)} \times \text{Gas Heat Value}\left(\frac{\text{BTU}}{\text{Therm}}\right)}$$

$$\text{Elec Energy Cost} = \text{Energy Use, kWh} \times \text{Cost of Elec}\left(\frac{\$}{\text{kWh}}\right)$$

$$\text{Nat Gas Energy Cost} = \text{Energy Use, Therms} \times \text{Cost of Nat Gas}\left(\frac{\$}{\text{Therm}}\right)$$

INSTANT DOM. HWH BOOSTER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Elec Booster Heater	Nat Gas HWH	
Estimated Dish Washer Use (GPM)	3.5	3.5	
Dish Washer Use (Min/Week) *1 Hr Per Day	300	300	
Dish Washer Use (Week/Yr)	42	42	
Booster Temp Rise (°F)	60	60	
Dom. HWH Efficiency (%)	100%	80%	-20%
Booster HW Heat Required (kBTUs)	22,041	22,041	
Elec Cost ($/kWh)	0.158	0.158	
Gas Cost ($/Therm)	0.86	0.86	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Proposed Booster Dom. HW Natural Gas Usage (Therms)	0	276	-276
Elec Booster Energy (kWh)	6,458	0	6,458
Elec Energy Cost ($)	$1,020	$0	$1,020
Gas Energy Cost ($)	$0	$237	-$237
Total Energy Cost ($)	$1,020	$237	$783
COMMENTS:	This ECM is based on savings due to the fuel switching from electric to natural gas and includes affects from efficiency change.		

There is no maintenance savings due to implementation of this ECM.

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,050
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$8,050
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$783
Total Yearly Savings ($/Yr):	$783
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.3
Simple Lifetime ROI	45.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$11,745
Internal Rate of Return (IRR)	5%
Net Present Value (NPV)	$1,297.40

ECM #9: Set Computers to Automatic Stand-by or Hibernate Modes

Description:

During the survey, it was noticed that the majority of the computers were left at ON position with the monitors at Screen Saver or OFF positions.

Many personal computers (PC) came equipped with automatic Sleep Mode or Hibernate (power down) mode features. Normally computers boot up from Sleep Mode or Hibernate mode much faster than powering up from Shut Down position.

Based on an independent study by the U.S. Department of Energy, Energy star® rated computers use approximately 70% less power during Sleep Mode. It is recommended to set up the PCs at this facility to switch into Sleep Mode after a short period of inactivity and Hibernate mode after a long period of inactivity.

This ECM includes configuring the computers in the classrooms and the offices such that they automatically switch into:

- Sleep Mode after 15 minutes of inactivity
- Hibernate after 60 minutes of inactivity

The inactivity times above can be adjusted based on experience or preference. Even though this ECM can be implemented easily in house, the calculations assume an independent computer technician performing the task at a typical market rate.

Energy Savings Calculations:

Est. No. of Computers:	120
Operating Weeks per Yr:	42
Estimated percentage of computers left ON overnight:	75%

$$\text{Electric Usage} = \frac{\#\text{ of Computers} \times \text{Computer Power (W)} \times \text{Operation (Hrs)}}{1000\left(\frac{\text{W}}{\text{KW}}\right)}$$

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

The cost of configuring the computers to automatically sleep or hibernate is based on 5 minutes per computer per technician at an hourly rate indicated below.

Implementation Costs: = # Computers X Configuration Time X Cost per Hour
= 120 Computers X 5 Minutes/Computer X $100 per Hour

= $1,000

AUTOMATIC SLEEP OR HIBERNATE MODES FOR COMPUTERS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Manual Operation	Auto Power Save	-
# of Computers	120	120	-
% Computers left ON	75%	75%	-
Power when left ON (Watt)	50	50	-
Power at Stand-by (Watt)	5	5	-
Power at Hibernate (Watt)	4	4	-
Power when OFF (Watt)	0	0	-
Operating Weeks per Yr	42	42	-
Operating Hours per Week	168	168	-
Hours/Wk Computers ON	120	20	-
Hours/Wk at Sleep Mode	0	20	-
Hours/Wk at Hibernate Mode	0	80	-
Hours/Wk at Power Down	48	48	-
Elec Cost ($/kWh)	0.158	0.158	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	22,680	4,158	18,522
Energy Cost ($)	$3,583	$657	$2,926
COMMENTS:	Calculation assumes computers currently run throughout school week and get shut down over the weekend.		

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,926
Total Yearly Savings ($/Yr):	$2,926
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.3
Simple Lifetime ROI	4289.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$43,890
Internal Rate of Return (IRR)	293%
Net Present Value (NPV)	$33,930.40

REM #1: 347.8 kW Solar System

Description:

The Livingston Park Elementary School has available roof and parking lot space that could accommodate a significant amount of solar generation. Based on the available areas a 347.8 KW DC solar array could be installed, assuming the existing roof structure is capable of supporting an array. The array will produce approximately 405,935 kilowatt-hours annually that will reduce the overall electric usage of the facility by 67.3%.

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	
Installation Cost ($):	$1,876,711
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,876,711
Maintenance Savings ($/Yr):	$77,568
Energy Savings ($/Yr):	$64,138
Total Yearly Savings ($/Yr):	$141,706
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.2
Simple Lifetime ROI	13.3%
Simple Lifetime Maintenance Savings	$1,163,520
Simple Lifetime Savings	$2,125,590
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	($185,033.97)

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. 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. Ensure outside air dampers are functioning properly and only open during occupied mode.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

North Brusnwick Township BOE - Livingston Park Elementary School

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY														
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Upgrade	$6,460	$4,940	$20	$11,380	$1,403	$0	$1,403	15	$21,049	$0	85.0%	8.1	8.90%	$5,372.42
ECM #2	Lighting Controls	$13,050	$1,900	$625	$14,325	$3,561	$0	$3,561	15	$53,411	$0	272.9%	4.0	23.85%	$28,182.79
ECM #3	NEMA Premium Pump Motors	$3,312	$1,824	$240	$4,896	$306	$0	$306	15	$4,590	$0	-6.3%	16.0	-0.80%	($1,242.99)
ECM #4	Boiler Replacement	$79,561	$57,342	$4,000	$132,903	$3,660	$0	$3,660	25	$91,500	$0	-31.2%	36.3	-2.69%	($69,170.57)
ECM #5	Domestic Hot Water Heater Replacement	$9,494	$10,546	$525	$19,515	$1,544	$0	$1,544	25	$38,600	$0	97.8%	12.6	6.12%	$7,370.96
ECM #6	Rooftop Unit Replacement	$27,750	$14,000	$1,371	$40,379	$1,623	$0	$1,623	25	$40,575	$0	0.5%	24.9	0.04%	($12,117.46)
ECM #7	Split System AC Unit Replacement	$51,792	$59,000	$5,842	$104,950	$5,541	$0	$5,541	20	$110,820	$0	5.6%	18.9	0.52%	($22,513.58)
ECM #8	Kitchen Domestic Booster Heater Replacement	$3,500	$4,550	$0	$8,050	$783	$0	$783	15	$11,745	$0	45.9%	10.3	5.14%	$1,297.40
ECM #9	Set Computers to Automatic Stand-by or Hibernate Modes	$0	$1,000	$0	$1,000	$2,926	$0	$2,926	15	$43,890	$0	4289.0%	0.3	292.60%	$33,930.40
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	347.8 KW Solar Array	$1,876,711	$0	$0	$1,876,711	$64,138	$77,568	$141,706	15	$2,125,590	$1,163,520	13.3%	13.2	1.60%	($185,033.97)

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

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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 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
North Brunswick BOE - Livingston Park Elementary School

Building ID: 3316017
For 12-month Period Ending: August 31, 2012[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: November 07, 2012

Facility
North Brunswick BOE - Livingston Park Elementary School
Ridgewood Avenue
North Brunswick, NJ 08902

Facility Owner
North Brunswick Township Board of Education
300 Old Georges Road
North Brunswick, NJ 08902

Primary Contact for this Facility
Susan Irons
300 Old Georges Road
North Brunswick, NJ 08902

Year Built: 1960
Gross Floor Area (ft²): 84,573

Energy Performance Rating[2] (1-100) 50

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	2,129,824
Natural Gas (kBtu)[4]	4,099,595
Total Energy (kBtu)	6,229,419

Energy Intensity[4]

Site (kBtu/ft²/yr)	74
Source (kBtu/ft²/yr)	135

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	520

Electric Distribution Utility
Public Service Electric & Gas Co

National Median Comparison

National Median Site EUI	74
National Median Source EUI	135
% Difference from National Median Source EUI	0%
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	North Brunswick BOE - Livingston Park 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	Ridgewood Avenue, North Brunswick, NJ 08902	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.		☐
Livingston Park Elementary School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	84,573 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	122	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	90 %	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))
07/05/2012	08/04/2012	23,529.00
06/05/2012	07/04/2012	36,719.00
05/05/2012	06/04/2012	58,025.00
04/05/2012	05/04/2012	46,948.00
03/05/2012	04/04/2012	58,053.00
02/05/2012	03/04/2012	57,476.00
01/05/2012	02/04/2012	57,498.00
12/05/2011	01/04/2012	53,304.00
11/05/2011	12/04/2011	59,010.00
10/05/2011	11/04/2011	59,568.00
09/05/2011	10/04/2011	61,052.00
Electric Consumption (kWh (thousand Watt-hours))		**571,182.00**
Electric Consumption (kBtu (thousand Btu))		**1,948,872.98**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,948,872.98**
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)
07/05/2012	08/04/2012	13.00
06/05/2012	07/04/2012	155.00
05/05/2012	06/04/2012	1,453.00
04/05/2012	05/04/2012	1,709.00
03/05/2012	04/04/2012	4,174.00
02/05/2012	03/04/2012	7,006.00
01/05/2012	02/04/2012	8,367.00
12/05/2011	01/04/2012	6,532.00
11/05/2011	12/04/2011	6,352.00
10/05/2011	11/04/2011	3,748.00
09/05/2011	10/04/2011	1,015.00

gas Consumption (therms)	**40,524.00**
gas Consumption (kBtu (thousand Btu))	**4,052,400.00**
Total Natural Gas Consumption (kBtu (thousand Btu))	**4,052,400.00**
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
North Brunswick BOE - Livingston Park Elementary School
Ridgewood Avenue
North Brunswick, NJ 08902

Facility Owner
North Brunswick Township Board of Education
300 Old Georges Road
North Brunswick, NJ 08902

Primary Contact for this Facility
Susan Irons
300 Old Georges Road
North Brunswick, NJ 08902

General Information

North Brunswick BOE - Livingston Park Elementary School	
Gross Floor Area Excluding Parking: (ft^2)	84,573
Year Built	1960
For 12-month Evaluation Period Ending Date:	August 31, 2012

Facility Space Use Summary

Livingston Park Elementary School	
Space Type	K-12 School
Gross Floor Area (ft^2)	84,573
Open Weekends?	No
Number of PCs	122
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	Yes
Percent Cooled	90
Percent Heated	100
Months °	10
High School?	No
School District °	North Brunswick twp

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 08/31/2012)	**Baseline** (Ending Date 08/31/2012)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	50	50	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	74	74	58	N/A	74
Source (kBtu/ft^2)	135	135	106	N/A	135
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	520	520	408	N/A	521
$kgCO_2e/ft^2$/year	6	6	5	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.

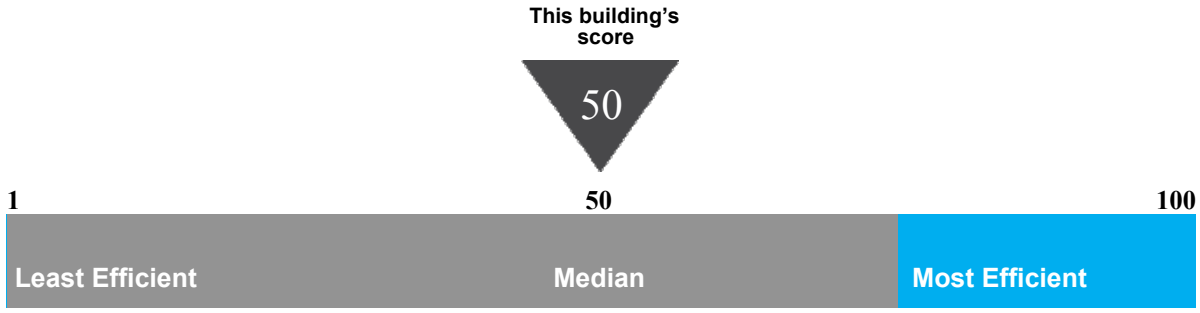
Statement of Energy Performance

2012

North Brunswick BOE - Livingston Park
Elementary School
Ridgewood Avenue
North Brunswick, NJ 08902

Portfolio Manager Building ID: 3316017

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 135 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending August 2012

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

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

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 11/07/2012

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering Group

Livingston Park Elementary School

AC Units

Tag	HV-1	HV-2	HV-3
Unit Type	Gas Fired Outdoor Unit Heater	Gas Fired Outdoor Unit Heater	Gas Fired Outdoor Unit Heater
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Gymnasium	Gymnasium	Locker Rooms
Manufacturer	Trane	Trane	Trane
Model #	GRAA70GDGB0N7BQ205H0	GRDA10GDGB0N2CH202A0	GRBA70GDGB0N7B0205H0
Serial #	A96B32784	A96B32785	A96B32786
Cooling Type	N/A	N/A	N/A
Cooling Capacity (Tons)	N/A	N/A	N/A
Cooling Efficiency (SEER/EER)	N/A	N/A	N/A
Heating Type	Gas HX	Gas HX	Gas HX
Heating Input (MBH)	700 MBH	100 MBH	700 MBH
Efficiency	80%	80%	80%
Fuel	Natural Gas	Natural Gas	Natural Gas
Approx Age	16	16	16
ASHRAE Service Life	15	15	15
Remaining Life	(1)	(1)	(1)
Comments			

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

AC Units

Tag	RTU-3	RTU-1,2	Venmar CU's
Unit Type	Packaged Rooftop Unit	Packaged Rooftop Unit	Split System Condensing Unit
Qty	1	2	17
Location	Roof	Roof	Roof
Area Served	Classrooms 32 through 39	Classrooms 28 through 31	Classroom Unit Ventilators
Manufacturer	Seasons 4	Carrier	Ducane
Model #	3MJI30-0392-MN5.4-13SE	48HJE008---501AA	2AC13B36P-1A
Serial #	B 9875-0108-01	2393G93379	4606C63595
Cooling Type	DX, R-22	DX, R-22	DX, R-22
Cooling Capacity (Tons)	30 Tons	7.5 Tons	3 Tons
Cooling Efficiency (SEER/EER)	-	8.5 EER	10 EER
Heating Type	Gas HX	Gas HX	N/A
Heating Input (MBH)	504 MBH	180 MBH	N/A
Efficiency	80%	80%	N/A
Fuel	Natural Gas	Natural Gas	N/A
Approx Age	13	19	6
ASHRAE Service Life	15	15	15
Remaining Life	2	(4)	9
Comments			

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

AC Units

Tag			CU-1,2
Unit Type	Split System Condensing Unit	Split System Condensing Unit	Split System Condensing Unit
Qty	1	1	2
Location	Roof	Roof	Roof
Area Served	Room 44	Art Room	Computer Lab
Manufacturer	Daikin	Thermal Zone	Trane
Model #	RKN12KEVJU	TZAA-324-2A757	TTD730B100A0
Serial #	C000716	8342W471004454	D16250143
Cooling Type	DX, R410A	DX, R-22	DX, R-22
Cooling Capacity (Tons)	1 Ton	2 Tons	2.5 Tons
Cooling Efficiency (SEER/EER)	13 SEER	13 SEER	9 SEER
Heating Type	N/A	N/A	N/A
Heating Input (MBH)	N/A	N/A	N/A
Efficiency	N/A	N/A	N/A
Fuel	N/A	N/A	N/A
Approx Age	1	2	23
ASHRAE Service Life	15	15	15
Remaining Life	14	13	(8)
Comments			

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

AC Units

Tag	CU-3,4	CU-5	RTU-4
Unit Type	Split System Condensing Unit	Split System Condensing Unit	Packaged Rooftop Unit
Qty	2	1	1
Location	Roof	Roof	Roof
Area Served	Media Center	Media Center	Classrooms 6 through 13
Manufacturer	Trane	Dynazone	Aaon
Model #	TTA036A300A0	S181FS/C181C	RM-040-8-0-BB04-EJH
Serial #	D04232565	DC 106530	200801-BNWV00539
Cooling Type	DX, R-22	DX, R-22	DX, R410A
Cooling Capacity (Tons)	3 Tons	1.5 Tons	40 Tons
Cooling Efficiency (SEER/EER)	9 SEER	9 SEER	9.5 EER
Heating Type	N/A	N/A	Hot Water Heat
Heating Input (MBH)	N/A	N/A	-
Efficiency	N/A	N/A	-
Fuel	N/A	N/A	Hot Water Heat
Approx Age	23	15	4
ASHRAE Service Life	15	15	15
Remaining Life	(8)	0	11
Comments			

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

AC Units

Tag	RTU-5		
Unit Type	Packaged Rooftop Unit	Split System Condensing Unit	Split System Condensing Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Main Office Area	Nurse	Custodian
Manufacturer	Trane	Sanyo	Sanyo
Model #	YCD036A3H0AB	CL1271	CL1872
Serial #	F401423070	0170603	0004891
Cooling Type	DX, R-22	DX, R-22	DX, R-22
Cooling Capacity (Tons)	3 Tons	1 Ton	1.5 Tons
Cooling Efficiency (SEER/EER)	9 EER	17 SEER	20 SEER
Heating Type	Natural Gas	N/A	N/A
Heating Input (MBH)	120 MBH	N/A	N/A
Efficiency	80%	N/A	N/A
Fuel	Natural Gas	N/A	N/A
Approx Age	21	1	3
ASHRAE Service Life	15	15	15
Remaining Life	(6)	14	12
Comments			

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

AC Units

Tag	AHU-1
Unit Type	Rooftop Air Handler
Qty	1
Location	Roof
Area Served	Classrooms OB21-OB25
Manufacturer	Carrier
Model #	39MW10B01012011XFS
Serial #	3006U17515
Cooling Type	Chilled Water
Cooling Capacity (Tons)	-
Cooling Efficiency (SEER/EER)	-
Heating Type	Hot Water
Heating Input (MBH)	-
Efficiency	-
Fuel	Hot Water
Approx Age	6
ASHRAE Service Life	15
Remaining Life	9
Comments	

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Livingston Park Elementary School

Boilers

Tag	B-1,2		
Unit Type	Firetube Boilers		
Qty	2		
Location	Boiler Room		
Area Served	Hot Water Loop		
Manufacturer	Cleaver Brooks		
Model #	CB801-70		
Serial #	L-24008		
Input Capacity (Btu/Hr)	3,347		
Rated Output Capacity (Btu/Hr)	2,343		
Approx. Efficiency %	70.0%		
Fuel	Natural Gas		
Approx Age	52		
ASHRAE Service Life	35	24	
Remaining Life	(17)	24	
Comments			

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Livingston Park Elementary School

Domestic Water Heaters

Tag			
Unit Type	Electric Domestic Hot Water Heater	Domestic Hot Water Heater	
Qty	1	1	
Location	Custodian Closet CC3	Boiler Room	
Area Served		Domestic Hot Water Loop	
Manufacturer	A.O. Smith	A.O. Smith	
Model #	ECT 30 200	HW 300 892	
Serial #	0849A025576	892 A 92 15108	
Size (Gallons)	30 Gallons	722 Gallons (Separate Storage Tank)	
Input Capacity (MBH/KW)	4.5 KW	300 MBH	
Recovery (Gal/Hr)	-	-	
Efficiency %	98%	70%	
Fuel	Electric	Natural Gas	
Approx Age	3	23	
ASHRAE Service Life	12	12	12
Remaining Life	9	(11)	12
Comments			

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Livingston Park Elementary School

Pumps

Tag	P-12,13	P-1,2	P-3,4
Unit Type	Base Mounted End Suction Pumps	Base Mounted End Suction Pumps	Base Mounted End Suction Pumps
Qty	2	2	2
Location	Boiler Room	Boiler Room	Boiler Room
Area Served	Hot Water Loop Front Classrooms/offices	Hot Water Loop Classrooms/ Cafeteria	HW Zone Pump Classrooms
Manufacturer	Bell & Gossett	-	-
Model #	1510 Series	-	
Serial #	C049511-01 070		
Horse Power	5 HP	5 HP	3 HP
Flow	120 GPM @ 90 FTHD	-	-
Motor Info	Emerson	Dayton	Dayton
Electrical Power	200/3/60	208-220/440/3/60	208-220/440/3/60
RPM	1755 RPM	1755 RPM	1755 RPM
Motor Efficiency %	89.5%	84.5%	85.5%
Approx Age	6	18	18
ASHRAE Service Life	18	18	18
Remaining Life	12	0	0
Comments			

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

Pumps

Tag	P-8,9	P-10,11	
Unit Type	In Line	In Line	
Qty	2	2	
Location	Boiler Room	Boiler Room	
Area Served	HW Zone Pump Second Floor	HW Zone Pump Media Center	
Manufacturer	Unidentifiable tag information	Unidentifiable tag information	
Model #			
Serial #			
Horse Power			
Flow			
Motor Info			
Electrical Power			
RPM			
Motor Efficiency %			
Approx Age			
ASHRAE Service Life	18	18	
Remaining Life	18	18	
Comments			

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

APPENDIX E

CEG Project #: 9C12053
Facility Name: Livingston Park Elementary School
Address: 1450 Redmond Street
City, State, Zip North Brunswick, NJ 08902

			Existing Fixtures						Proposed Fixtures Retrofit							Retrofit Energy Savings			Lighting Retrofit Costs					Proposed Lighting Controls					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
121.11	OB1B Restrrom	2600	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	2	78	1	0.08	203	Reballast & Relamp	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	2	50	1	0.05	130	0.03	73	$12	$30.00	$70.00	$100.00	$10.00	7.82	0	No New Controls	0	0.0%	0	$0
221.11	OB1B Restrrom	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	1	0.06	161	Existing to Remain	Existing to Remain	2	62	0	0.06	161	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.31	Utilities	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	4	0.13	343	Existing to Remain	Existing to Remain	1	33	0	0.13	343	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
121.11	OB1G Restroom	2600	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	2	78	1	0.08	203	Reballast & Relamp	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	2	50	1	0.05	130	0.03	73	$12	$30.00	$70.00	$100.00	$10.00	7.82	0	No New Controls	0	0.0%	0	$0
221.11	OB1G Restroom	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	1	0.06	161	Existing to Remain	Existing to Remain	2	62	0	0.06	161	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
222.21	Classroom OB14	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	10	0.62	1,612	Existing to Remain	Existing to Remain	2	62	0	0.62	1,612	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
222.21	Classroom OB13	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	5	0.31	806	Existing to Remain	Existing to Remain	2	62	0	0.31	806	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
242.21	Classroom OB25	2600	2x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	4	107	9	0.96	2,504	Existing to Remain	Existing to Remain	4	107	0	0.96	2,504	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	501	$79
222.21	Elevator Lobby	1200	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	2	0.12	149	Existing to Remain	Existing to Remain	2	62	0	0.12	149	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
222.21	Classroom OB24	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	8	0.50	1,290	Existing to Remain	Existing to Remain	2	62	0	0.50	1,290	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	258	$41
222.21	Workroom OB23	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	3	0.19	484	Existing to Remain	Existing to Remain	2	62	0	0.19	484	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	97	$15
242.21	Classroom OB21	2600	2x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	4	107	9	0.96	2,504	Existing to Remain	Existing to Remain	4	107	0	0.96	2,504	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	501	$79
242.21	Classroom OB22	2600	2x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	4	107	10	1.07	2,782	Existing to Remain	Existing to Remain	4	107	0	1.07	2,782	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	556	$88
222.21	Elevator Lobby	1200	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	4	0.25	298	Existing to Remain	Existing to Remain	2	62	0	0.25	298	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
222.21	Nurse	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	8	0.50	1,290	Existing to Remain	Existing to Remain	2	62	0	0.50	1,290	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	258	$41
211.34	Custodial Office	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	1	28	7	0.20	510	Existing to Remain	Existing to Remain	1	28	0	0.20	510	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	102	$16
651	Boiler Room	3000	"Industrial" Relector, 26w CFL	1	26	6	0.16	468	Existing to Remain	Existing to Remain	1	26	0	0.16	468	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.34	Boiler Room	3000	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	2	62	2	0.12	372	Existing to Remain	Existing to Remain	2	62	0	0.12	372	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
651	Electrical Room	1200	"Industrial" Relector, 26w CFL	1	26	3	0.08	94	Existing to Remain	Existing to Remain	1	26	0	0.08	94	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.14	Supply Room	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	2	62	6	0.37	967	Existing to Remain	Existing to Remain	2	62	0	0.37	967	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	193	$31
221.14	Kitchen	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	2	62	11	0.68	1,773	Existing to Remain	Existing to Remain	2	62	0	0.68	1,773	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	355	$56
232.22	Copy Room	2600	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	3	86	2	0.17	447	Existing to Remain	Existing to Remain	3	86	0	0.17	447	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
770	Cafeteria	2600	2x2 Recessed 400w MH, Prismatic Lens	1	465	12	5.58	14,508	Remove and Return	1x4, 6 Lamp, 54w T5HO, Elect. Ballast, Lo Bay	6	360	12	4.32	11,232	1.26	3,276	$518	$2,400.00	$1,800.00	$4,200.00	$0.00	8.11	4	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	2,246	$355
221.11	Girl's Restroom	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	4	0.25	645	Existing to Remain	Existing to Remain	2	62	0	0.25	645	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.11	Boy's Restroom	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	2	0.12	322	Existing to Remain	Existing to Remain	2	62	0	0.12	322	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0

			Existing Fixtures						Proposed Fixtures Retrofit							Retrofit Energy Savings			Lighting Retrofit Costs					Proposed Lighting Controls					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
222.21	Main Office	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	8	0.50	1,290	Existing to Remain	Existing to Remain	2	62	0	0.50	1,290	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	258	$41
222.21	Pricipal's Office	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	6	0.37	967	Existing to Remain	Existing to Remain	2	62	0	0.37	967	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	193	$31
221.13	Lobby	3000	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Direct/Indirect	2	62	8	0.50	1,488	Existing to Remain	Existing to Remain	2	62	0	0.50	1,488	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.41	Men's Restroom	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., Prismatic Lens	2	62	1	0.06	161	Existing to Remain	Existing to Remain	2	62	0	0.06	161	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
247.21	Men's Restroom	2600	2x2, 4 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	68	1	0.07	177	Existing to Remain	Existing to Remain	4	68	0	0.07	177	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
651	Custodial Closet	1200	"Industrial" Relector, 26w CFL	1	26	1	0.03	31	Existing to Remain	Existing to Remain	1	26	0	0.03	31	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
222.21	Office 5	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	4	0.25	645	Existing to Remain	Existing to Remain	2	62	0	0.25	645	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	129	$20
221.11	Classroom 14	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	20	1.24	3,224	Existing to Remain	Existing to Remain	2	62	0	1.24	3,224	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	645	$102
221.11	Classroom 15	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	20	1.24	3,224	Existing to Remain	Existing to Remain	2	62	0	1.24	3,224	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	645	$102
222.21	Boy's Restroom	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	2	0.12	322	Existing to Remain	Existing to Remain	2	62	0	0.12	322	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.11	Classroom 21	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
221.11	Classroom 22	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	22	1.36	3,546	Existing to Remain	Existing to Remain	2	62	0	1.36	3,546	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	709	$112
227.21	Classroom 22	2600	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	65	1	0.07	169	Existing to Remain	Existing to Remain	2	65	0	0.07	169	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.11	Classroom 23	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
221.11	Classroom 24	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
221.11	Classroom 25	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
221.11	Classroom 26	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
232.21	Classroom 28	2600	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	86	12	1.03	2,683	Existing to Remain	Existing to Remain	3	86	0	1.03	2,683	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	537	$85
232.21	Classroom 29	2600	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	86	13	1.12	2,907	Existing to Remain	Existing to Remain	3	86	0	1.12	2,907	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	581	$92
232.21	Classroom 30	2600	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	86	12	1.03	2,683	Existing to Remain	Existing to Remain	3	86	0	1.03	2,683	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	537	$85
232.21	Classroom 31	2600	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	86	12	1.03	2,683	Existing to Remain	Existing to Remain	3	86	0	1.03	2,683	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	537	$85
222.21	3G Girl's Restroom	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	5	0.31	806	Existing to Remain	Existing to Remain	2	62	0	0.31	806	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.29	Staff Restroom	1200	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Wallwasher	2	62	2	0.12	149	Existing to Remain	Existing to Remain	2	62	0	0.12	149	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
222.21	3B Boy's Restroom	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	5	0.31	806	Existing to Remain	Existing to Remain	2	62	0	0.31	806	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 32	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	8	0.69	1,789	Existing to Remain	Existing to Remain	3	86	0	0.69	1,789	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 33	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	8	0.69	1,789	Existing to Remain	Existing to Remain	3	86	0	0.69	1,789	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0

			Existing Fixtures						Proposed Fixtures Retrofit							Retrofit Energy Savings			Lighting Retrofit Costs					Proposed Lighting Controls					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
231.33	Classroom 34	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	12	1.03	2,683	Existing to Remain	Existing to Remain	3	86	0	1.03	2,683	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 35	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	14	1.20	3,130	Existing to Remain	Existing to Remain	3	86	0	1.20	3,130	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 36	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	14	1.20	3,130	Existing to Remain	Existing to Remain	3	86	0	1.20	3,130	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 37	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	14	1.20	3,130	Existing to Remain	Existing to Remain	3	86	0	1.20	3,130	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 38	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	8	0.69	1,789	Existing to Remain	Existing to Remain	3	86	0	0.69	1,789	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 39	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	16	1.38	3,578	Existing to Remain	Existing to Remain	3	86	0	1.38	3,578	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.21	Girl's Restroom	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	2	62	2	0.12	322	Existing to Remain	Existing to Remain	2	62	0	0.12	322	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.21	Boy's Restroom	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	2	62	2	0.12	322	Existing to Remain	Existing to Remain	2	62	0	0.12	322	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
769	Gym	2600	400w MH, Hi-Bay	1	465	20	9.30	24,180	Remove and Return	1x4, 6 Lamp, 54w T5HO, Elect. Ballast, Lo Bay	6	360	20	7.20	18,720	2.10	5,460	$863	$4,000.00	$3,000.00	$7,000.00	$0.00	8.11	4	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	3,744	$592
221.11	Classroom 50	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
231.33	Classroom 51	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	4	0.34	894	Existing to Remain	Existing to Remain	3	86	0	0.34	894	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.11	Classroom 52	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
231.33	Classroom 53	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	4	0.34	894	Existing to Remain	Existing to Remain	3	86	0	0.34	894	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.11	Classroom 54	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
221.11	Classroom 55	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
221.11	Classroom 56	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
221.11	Classroom 57	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	18	1.12	2,902	Existing to Remain	Existing to Remain	2	62	0	1.12	2,902	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	580	$92
232.22	Faculty Lounge	2600	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	3	86	19	1.63	4,248	Existing to Remain	Existing to Remain	3	86	0	1.63	4,248	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
247.21	4G Girl's Restroom	2600	2x2, 4 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	68	5	0.34	884	Existing to Remain	Existing to Remain	4	68	0	0.34	884	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
247.21	4B Boy's Restroom	2600	2x2, 4 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	68	5	0.34	884	Existing to Remain	Existing to Remain	4	68	0	0.34	884	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
222.21	Corridor by Media Center	3000	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	6	0.37	1,116	Existing to Remain	Existing to Remain	2	62	0	0.37	1,116	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
601	Corridor by Media Center	8760	(2) 7w CFL Exit Sign	2	16	3	0.05	420	Existing to Remain	Existing to Remain	2	16	0	0.05	420	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
232.22	Media Center Classroom	2600	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	3	86	18	1.55	4,025	Existing to Remain	Existing to Remain	3	86	0	1.55	4,025	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	805	$127
242.11	Office 45	2600	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	4	107	5	0.54	1,391	Existing to Remain	Existing to Remain	4	107	0	0.54	1,391	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	278	$44
242.11	Classroom 47	2600	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	4	107	14	1.50	3,895	Existing to Remain	Existing to Remain	4	107	0	1.50	3,895	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	779	$123
221.11	Classroom 41	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	62	22	1.36	3,546	Existing to Remain	Existing to Remain	2	62	0	1.36	3,546	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	3	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	709	$112

			Existing Fixtures						Proposed Fixtures Retrofit							Retrofit Energy Savings			Lighting Retrofit Costs					Proposed Lighting Controls					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
231.33	Classroom 6	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	10	0.86	2,236	Existing to Remain	Existing to Remain	3	86	0	0.86	2,236	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 7	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	16	1.38	3,578	Existing to Remain	Existing to Remain	3	86	0	1.38	3,578	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 8	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	16	1.38	3,578	Existing to Remain	Existing to Remain	3	86	0	1.38	3,578	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 9	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	16	1.38	3,578	Existing to Remain	Existing to Remain	3	86	0	1.38	3,578	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 10	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	16	1.38	3,578	Existing to Remain	Existing to Remain	3	86	0	1.38	3,578	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 11	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	6	0.52	1,342	Existing to Remain	Existing to Remain	3	86	0	0.52	1,342	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 12	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	6	0.52	1,342	Existing to Remain	Existing to Remain	3	86	0	0.52	1,342	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
231.33	Classroom 13	2600	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	3	86	10	0.86	2,236	Existing to Remain	Existing to Remain	3	86	0	0.86	2,236	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
	TOTAL					**803**	**71**	**184,281**					**34**	**67.49**	**175,399**	**3.42**	**8,882**	**$1,403**	**$6,460.00**	**$4,940.00**	**$11,400.00**	**$20.00**	**8.12**			**38**		**22,536**	**$3,561**

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
Livingston Park Elementary	24600	SHARP NU-U235F2	1480	17.5	25,960	347.80	405,935	281.7	62,012	13.40

.= Proposed PV Layout = Proposed Parking PV Layout

Notes:

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

Project Name: **LGEA Solar PV Project - Livingston Park Elementary**
Location: **North Brunswick, NJ**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$1,876,711
Annual kWh Production	405,935
Annual Energy Cost Reduction	$64,138
Average Annual SREC Revenue	$77,568

Simple Payback: **13.24** Years

Life Cycle Cost Analysis

Analysis Period (years):	15	Financing %:	100%
Discount Rate:	3%	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.158**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	6.00%	Average SREC Value ($/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	405,935	$64,138	$0	$101,484	$110,437	$79,604	($24,420)	($24,420)
2	$0	403,905	$66,062	$0	$100,976	$105,527	$84,514	($23,003)	($47,423)
3	$0	401,886	$68,044	$0	$100,471	$100,315	$89,726	($21,526)	($68,948)
4	$0	399,876	$70,085	$0	$99,969	$94,781	$95,260	($19,987)	($88,935)
5	$0	397,877	$72,188	$4,098	$99,469	$88,905	$101,136	($22,482)	($111,418)
6	$0	395,888	$74,353	$4,078	$79,178	$82,667	$107,374	($40,588)	($152,006)
7	$0	393,908	$76,584	$4,057	$78,782	$76,045	$113,996	($38,733)	($190,739)
8	$0	391,939	$78,881	$4,037	$78,388	$69,014	$121,027	($36,809)	($227,548)
9	$0	389,979	$81,248	$4,017	$77,996	$61,549	$128,492	($34,814)	($262,362)
10	$0	388,029	$83,685	$3,997	$58,204	$53,624	$136,417	($52,148)	($314,510)
11	$0	386,089	$86,196	$3,977	$57,913	$45,210	$144,831	($49,909)	($364,419)
12	$0	384,158	$88,782	$3,957	$57,624	$36,277	$153,764	($47,593)	($412,012)
13	$0	382,238	$91,445	$3,937	$57,336	$26,793	$163,248	($45,197)	($457,209)
14	$0	380,326	$94,188	$3,917	$38,033	$16,725	$173,316	($61,737)	($518,946)
15	$0	378,425	$97,014	$3,898	$37,842	$6,035	$184,006	($59,082)	($578,029)
	Totals:	5,880,458	$1,192,892	$43,969	$1,123,665	$973,905	$1,876,711	($578,029)	($3,818,924)

Net Present Value (NPV) **($415,879)**