HOWELL TOWNSHIP SCHOOLS

SOUTHARD SCHOOL

115 KENT RD
HOWELL, NJ 07731

FACILITY ENERGY REPORT

TABLE OF CONTENTS

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:	JCP&L
Electric Utility Rate Structure:	General Service Secondary 3 Phase
Third Party Supplier:	N/A

Natural Gas Utility Provider:	NJ Natural Gas
Utility Rate Structure:	General Service Large Transportation (GSL)
Third Party Supplier:	Hess

The electric usage profile represents the actual electrical usage for the facility. The electric utilitymeasures 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: JCP&L
Rate: General Service Secondary - 3 Phase
Meter No: 79 171 263
Account # 10 00 18 9327 13
Third Party Utility N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Dec-10	33,120	62.4	$4,921
Jan-11	42,080	41.6	$6,009
Feb-11	6,720	62.4	$1,306
Mar-11	19,840	43.2	$2,815
Apr-11	18,080	54.4	$2,431
May-11	11,680	51.2	$1,698
Jun-11	10,240	51.2	$1,532
Jul-11	*19,680*	*59.2*	*$2,591*
Aug-11	*19,680*	*59.2*	*$2,591*
Sep-11	11,680	51.2	$1,698
Oct-11	15,520	54.4	$2,136
Nov-11	19,680	62.4	$2,673
Totals	**228,000**	**62.4 Max**	**$32,403**

AVERAGE DEMAND **54.4 KW average**
AVERAGE RATE **$0.142** **$/kWh**

Figure 1
Electricity Usage Profile

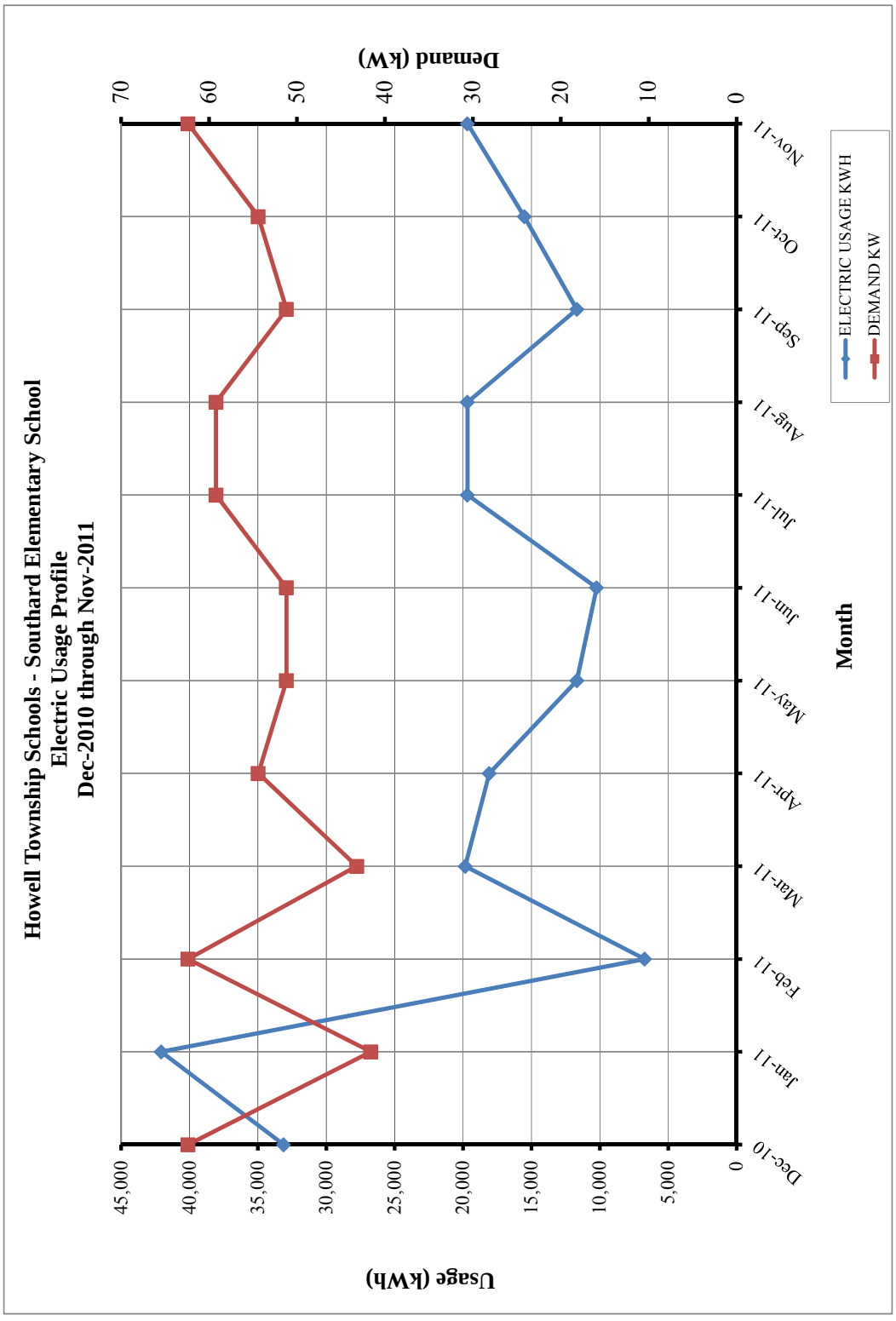
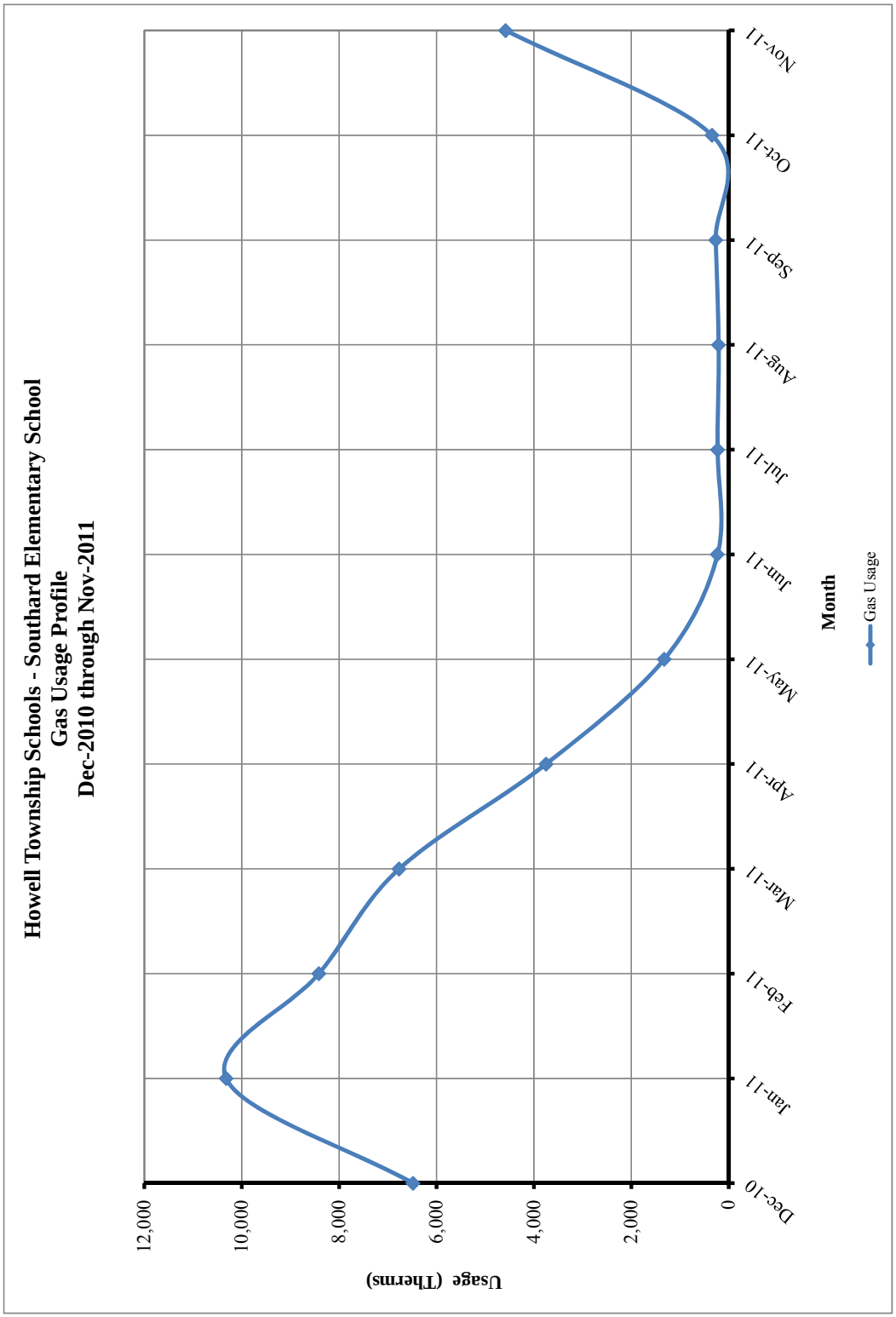


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	NJ Natural Gas	
Rate:	General Service Large Transportation (GSL)	
Meter No:	765887	
Account Number	22-0005-2191-16	
Third Party Utility Provider:	Hess	
TPS Meter No:	N/A	
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Dec-10	6,482.08	$7,325.79
Jan-11	10,321.37	$11,298.86
Feb-11	8,415.85	$9,320.45
Mar-11	6,768.51	$7,622.13
Apr-11	3,750.36	$4,510.89
May-11	1,325.20	$1,974.14
Jun-11	231.25	$874.92
Jul-11	229.26	$873.33
Aug-11	209.63	$854.11
Sep-11	267.86	$901.48
Oct-11	345.68	$972.34
Nov-11	4,580.22	$5,138.93
TOTALS	**42,927.27**	**$51,667.37**
AVERAGE RATE:	**$1.20**	**$/THERM**

Figure 2
Natural Gas Usage Profile



II. FACILITY DESCRIPTION

The Howell Township Southard Elementary School is located on 115 Kent Road in Howell, New Jersey. The Elementary School was built in 1955 with an addition in 1959 and in 1989. The facility has a total square footage of 73,940 SF. The Elementary School consists of classrooms, offices, gymnasium, an auditorium and cafeteria.

Occupancy Profile

The facility is currently leased for the Head Start program during the day and the PAL program in the early evenings. These programs only occupy a portion of the building. The rest of the facility is abandoned. The building is regularly occupied Monday through Friday form 7:00am to 5:00 pm. There approximately 10 employees at the facility with total student/child enrollment unknown.

Building Envelope

Exterior walls for the Elementary School facility are a 4" brick. The exterior wall assembly consists of 4 inches of brick, 2 inches of cavity and 6 inches of concrete block. The amount of insulation within the walls is not known. The windows throughout the School are in good condition and appear to be well maintained. Typical windows throughout facility are double pane, ¼" tinted glass with aluminum frames. Some sections of the school, such as hallways and entrances, have single pane, ¼", un-insulated glass windows.

The roof is a flat built up roofing system with a light stone covering. The amount of insulation below the roofing is unknown. The section of roofing over the media center room is a new, modified bitumen roofing system.

HVAC Systems

The boiler plant section consists of two (2) H.B Smith cast iron sectional boilers. The boilers are both gas-fired. Both boilers have an input raring of 5,525 MBH and output rating of approximately 4,362 MBH with an estimated efficiency of 75%. These boilers were installed approximately 25 years ago (based on model and condition), and appear to be replacements to the original building boilers. These boilers are within their ASHRAE recommended service life and are in good condition. Newer, high efficiency condensing boilers would provide superior operating efficiency over the existing boilers making these boilers candidates for replacement.

Hot water is circulated throughout the building's heating hot water loop via two (2) base mounted end suction pumps. These pumps have 15 HP motors and appear to be original to the building. The motors, however, appear to be replacements. These motors are ideal candidates for replacement.

The classrooms of the school are served primarily by two (2) central station air handling units. These units provide heating and ventilation air only and are constant volume systems with hot water heating coils. Each zone is served by supply and return air ducts with manual volume dampers.

The multi-purpose room is served by a roof mounted hot water H&V unit. This unit provides outside air and heating to the space. This unit is a McQuay model and is equipped with a hot water coil and three-way control valve.

The Media Center, Computer room, Music room and band rooms are each served by packaged rooftop air conditioning units with cooling only capabilities. These units are all McQuay models and vary in size. These units all appear to have been installed at the same time and range in size from 3-1/2 Tons up to 16 tons.

The main offices are served by two (2) packaged rooftop cooling only air conditioning unit. These units are each approximately 23 years old and have surpassed their useful service life.

Exhaust System

Air is exhausted from classrooms and toilet rooms through the roof mounted exhaust fans.

HVAC System Controls

The HVAC systems throughout the facility are controlled via vintage electronic controls, manufactured by Barber Coleman. The building equipment (Unit ventilators, exhaust fans, H&V units) operational status (on/off) are controlled through a switchboard, located in the boiler room. These controls operate based on a time clock. Individual space temperature is controlled via wall mounted thermostats.

The packaged rooftop units each have their own individually controlled space thermostat. The T-Stats in the main office and nurse's office are 7-programmable Honeywell thermostats.

Domestic Hot Water

Domestic hot water is provided by an A.O. Smith, hot water heater. The water heater is rated for 365 MBH input with an overall efficiency of up to 80%. This unit is in good condition and is within the ASHRAE recommended service life.

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 ofenergy 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 - Gymnasium	$23,400	$3,994	5.9	156.0%
ECM #2	Not Used	$0	$0	#DIV/0!	#DIV/0!
ECM #3	Boiler Replacement	$178,500	$5,801	30.8	-51.3%
ECM #4	RTU Replacement	$80,964	$3,695	21.9	-31.5%
ECM #5	Unit Ventilators w/ Energy Recovery	$85,000	$1,894	44.9	-66.6%
ECM #6	NEMA Premium Motors	$3,548	$156	22.7	-34.0%
ECM #7	Hot Water VFD	$20,000	$1,031	19.4	-22.7%
ECM #8	Demand Controlled Ventilation for MPR	$12,000	$1,258	9.5	57.3%
ECM #9	DDC System Installation / Expansion	$221,800	$4,194	52.9	-71.6%
ECM #10	Domestic Hot Water Heater Replacement	$10,500	$911	11.5	30.1%
ECM #11	Water Conservation	$14,824	$327	45.3	-66.9%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	166.85 Kw PV Array	$1,007,002	$115,759	8.7	72.4%
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 - Gymnasium	13.39	28,123	-
ECM #2	Not Used	-	-	-
ECM #3	Boiler Replacement	-	-	4,834
ECM #4	RTU Replacement	21.70	26,020	-
ECM #5	Unit Ventilators w/ Energy Recovery	-	603	1,507
ECM #6	NEMA Premium Motors	1.09	1,096	-
ECM #7	Hot Water VFD	-	7,261	
ECM #8	Demand Controlled Ventilation for MPR	-	-	1,048
ECM #9	DDC System Installation / Expansion	-	11,400	2,146
ECM #10	Domestic Hot Water Heater Replacement	-	-	759
ECM #11	Water Conservation	-	-	67
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
REM #1	166.85 Kw PV Array	135.1	219,821	-

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 - Gymnasium	$3,994	$23,400	$0	$23,400	5.9
Not Used	$0	$0	$0	$0	0.0
~~Boiler Replacement~~	~~$5,801~~	~~$182,500~~	~~$4,000~~	~~$178,500~~	~~30.8~~
RTU Replacement	$3,695	$84,500	$3,536	$80,964	21.9
~~Unit Ventilators w/ Energy Recovery~~	~~$1,894~~	~~$85,000~~	~~$0~~	~~$85,000~~	~~44.9~~
NEMA Premium Motors	$156	$3,652	$104	$3,548	22.7
Hot Water VFD	$1,031	$20,000	$0	$20,000	19.4
Demand Controlled Ventilation for MPR	$1,258	$12,000	$0	$12,000	9.5
~~DDC System Installation / Expansion~~	~~$4,194~~	~~$221,800~~	~~$0~~	~~$221,800~~	~~52.9~~
Domestic Hot Water Heater Replacement	$911	$11,000	$500	$10,500	11.5
~~Water Conservation~~	~~$327~~	~~$14,824~~	~~$0~~	~~$14,824~~	~~45.3~~
Design / Construction Extras (15%)		$23,183		*$23,183*	
Total Project	**$11,045**	**$177,735**	**$4,140**	**$173,595**	**15.7**

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 – General

Description:

The majority of the interior lighting throughout Southard Elementary School is provided with fluorescent fixtures with older generation, 700 series 32W T8 lamps and electronic ballasts. While newer, 800 series 28W T8 lamps would be more efficient, field survey of the existing ballasts revealed that they are not rated for 28W lamps.

The gymnasium is currently lit via thirty six HID, 400W, Metal Halide fixtures. The space would be better served with a more efficient, LED lighting system. CEG recommends upgrading the existing lighting to energy efficient, 93 Watt LED lamps. These lamps can be retrofitted within the existing MH fixture, reducing the overall cost of the replacement.

This ECM includes re-lamping of the existing HID fixtures with the 93 Watt LED Lamps.

Energy Savings Calculations:

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

Currently, there are no Smart Start incentives for re-lamping of existing fixtures.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$23,400
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$23,400
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,994
Total Yearly Savings ($/Yr):	$3,994
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.9
Simple Lifetime ROI	156.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$59,910
Internal Rate of Return (IRR)	15%
Net Present Value (NPV)	$24,280.11

ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

Because of the relatively low occupancy and usage of this facility, the installation of occupancy sensors throughout the building would be save much energy, and therefore would not be economically feasible.

ECM #3: Boiler Systems Upgrade – Condensing Boilers

Description:

Space heating for Southard School is provided by heating hot water loop. The source of hot water for this equipment is two cast iron sectional hot water boilers located in the boiler room.

The output capacity of each boiler is 4,362 MBH. The boilers were installed approximately 25 years ago, which brings them close to their ASHRAE service life. The units are in good condition; however it is recommended that they be replaced with newer high efficiency units. This ECM provides insight into the energy efficiency benefit of condensing boiler technology compared to standard cast iron boilers.

Standard (non-condensing) boilers provide lower than nominal efficiency compared to condensing boilers. Standard boilers suffer further efficiency losses at part load operating conditions mainly due to limitations in the reduction of the flue gas temperature. Current average combustion efficiency of each boiler is estimated to be 70% due to standard non-condensing boiler technology, limited turn down ratio, cycling losses and outdated design and controls. A new condensing boiler 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.

This ECM is based on the replacement of one of the existing hot water boilers with two (2) Aerco Benchmark 2.0 modular condensing boilers. This would allow the remaining boiler to act as a backup. Since the boilers currently installed operate as primary and standby, installing two boilers that would run at part load would result in less runtime at full load, compared to the existing boilers.

The annual average operating efficiency of the proposed boiler set is expected to be 90%, which gives the heating system a 20% increase in efficiency. This ECM is based on variable supply water temperature adjusted based on outdoor temperature. The owner is recommended to retain a professional engineer to confirm equipment sizing and finalize design.

BOILER REPLACEMENT SUMMARY		
EXISTING UNIT	**LOCATION**	**PROPOSED UNITS**
(1) Cast Iron Sectional Boiler	Boiler Room	(2) Aerco Benchmark 2.0

First, domestic hot water usage is estimated and subtracted from the total usage in order to estimate the net natural gas usage for space heating.

Current total hot water usage can be found in the table below:

ANNUAL GAS USAGE				
MONTH	**TOTAL USAGE THERMS**	**DOMESTIC HW USAGE**	**HEATING ONLY**	**COST**
Dec-10	6,482	435	4,535	$5,442
Jan-11	10,321	435	7,415	$8,898
Feb-11	8,416	435	5,986	$7,183
Mar-11	6,769	435	4,750	$5,700
Apr-11	3,750	435	2,487	$2,984
May-11	*1,325*	435	668	$801
Jun-11	*231*	231	0	$0
Jul-11	*229*	229	0	$0
Aug-11	*210*	210	0	$0
Sep-11	*268*	268	0	$0
Oct-11	*346*	346	0	$0
Nov-11	4,580	358	3,167	$3,800
TOTAL	**42,927**	**4,252**	**29,007**	**$34,808**

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

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

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

Energy savings calculations are summarized in the table below:

ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	(1) Existing Hot Water Boiler	(2) New Condensing Boilers	-
Boiler Input Capacity (MBH)	5,525	4,000	-
Boiler Output Capacity (MBH)	4,362	3,733	-
Existing Nat Gas (Therms)	29,007	-	-
Boiler Efficiency (%)	75%	90%	15%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	-
Building Heating Energy Usage (MMBTUs)	2,176	2,176	-
Ave. Gas Cost ($/Therm)	1.20	1.20	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	29,007	24,172	4,834
Energy Cost ($)	$34,808	$29,007	$5,801
COMMENTS:			

Project Cost, Incentives and Maintenance Savings

Estimated cost for removing the existing boilers and installing (2) Aerco Benchmark 2.0 condensing boilers plus labor is estimated to be $182,500.

From the **New Jersey Smart Start® Program Incentives Appendix**, installation of a high efficiency hot water boiler falls under the category "Gas Heating" and warrants an incentive based on efficiency at or above 84% for this type of equipment. The program incentives are calculated as follows:

GAS FIRED BOILER REBATE SUMMARY					
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/MBH**	**PROPOSED CAPACITY,**	**NUMBER OF UNITS**	**TOTAL REBATE, $**
≥ 300 MBH - 1500 MBH	84% AFUE for Hot Water boilers	$1.75	0	0	$0
>1500 - ≤ 4000 MBH	84% AFUE for Hot Water boilers	$1	2,000	2	$4,000
> 4000 MBH	84% AFUE for Hot Water boilers	$1	0	0	$0
TOTAL					**$4,000**

Maintenance savings associated with this ECM is estimated to be minimal.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$182,500
NJ Smart Start Equipment Incentive ($):	$4,000
Net Installation Cost ($):	$178,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$10,452
Total Yearly Savings ($/Yr):	$10,452
Estimated ECM Lifetime (Yr):	15
Simple Payback	17.1
Simple Lifetime ROI	-12.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$156,780
Internal Rate of Return (IRR)	-2%
Net Present Value (NPV)	($53,724.70)

ECM #4: RTU Upgrades

Description:

Portions of Southard Elementary School are air conditioned by packaged rooftop units. These units are in fair to 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 older air conditioning units 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	42,000	3.5	Carrier Weathermaster
RTU	RTU-2	1	42,000	3.5	Carrier Weathermaster
RTU	RTU-4	1	96,000	8	Carrier Weathermaster
RTU	RTU-5	1	60,000	5	Carrier Weathermaster
RTU	RTU-6	1	192,000	16	Carrier Weathermaster
RTU	RTU-7	1	96,000	8	Carrier Weathermaster
Total		**6**	**528,000**	**44**	

Some unit sizes are estimated. See Major Equipoment List Appendix.

The manufacturers used as the basis for this calculation is Carrier. 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	42,000	1,200	8.5 EER	13 EER	1	2,052	1.7
RTU	42,000	1,200	8.5 EER	13 EER	1	2,052	1.7
RTU	96,000	1,200	8.5 EER	13 EER	1	4,691	3.9
RTU	60,000	1,200	8.5 EER	13 EER	1	2,932	2.4
RTU	192,000	1,200	8 EER	12 EER	1	9,600	8.0
RTU	96,000	1,200	8.5 EER	13 EER	1	4,691	3.9
Total					**6**	**26,020**	**21.7**

Project Cost, Incentives and Maintenance Savings

From the NJ Smart Start® Program appendix, the replacement of split system AC units and unitary systems with high efficiency AC systems falls under the category "Unitary HVAC Split System" and warrants an incentive based on efficiency (EER/SEER). The program incentives are calculated as follows:

$$\text{SmartStart® Incentive} = (\text{Cooling Tons} \times \$/\text{Ton Incentive})$$

AC UNITS REBATE SUMMARY				
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/TON**	**PROPOSED CAPACITY TONS**	**TOTAL REBATE $**
≥20 to 30 tons	10.5 EER	$79	0	$0
≥ 11.25 to < 20 tons	11.5 EER	$79	16	$1,264
≥ 5.4 to < 11.25 tons	11.5 EER	$73	16	$1,168
5.4 tons or less Unitary AC and Split System	≥14 SEER	$92	12.0	$1,104
TOTAL			**44**	**$3,536**

Summary of cost, savings and payback for this ECM is below.

COST & SAVINGS SUMMARY							
ECM INPUTS	**UNIT COST**	**# OF UNITS**	**TOTAL COST**	**REBATES**	**NET COST**	**ENERGY SAVING**	**PAY BACK YEARS**
RTU	$9,250	1	$9,250	$322	$8,928	$291	30.6
RTU	$9,250	1	$9,250	$322	$8,928	$291	30.6
RTU	$16,250	1	$16,250	$584	$15,666	$666	23.5
RTU	$12,500	1	$12,500	$460	$12,040	$416	28.9
RTU	$21,000	1	$21,000	$1,264	$19,736	$1,363	14.5
RTU	$16,250	1	$16,250	$584	$15,666	$666	23.5
Total	**$84,500**	**6**	**$84,500**	**$3,536**	**$80,964**	**$3,695**	**21.9**

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

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$84,500
NJ Smart Start Equipment Incentive ($):	$3,536
Net Installation Cost ($):	$80,964
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,695
Total Yearly Savings ($/Yr):	$3,695
Estimated ECM Lifetime (Yr):	15
Simple Payback	21.9
Simple Lifetime ROI	-31.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$55,425
Internal Rate of Return (IRR)	-4%
Net Present Value (NPV)	($36,853.33)

ECM #5: Install Unit Ventilators with Energy Recovery

Description:

The heating and air conditioning for the classrooms in Southard School are provided by vintage American Air Filter unit ventilators, which are original to the building. Some of the units have had control upgrades/replacements; however, they are over 30 years old and far beyond the end of expected useful service life, which is fifteen (15) years per ASHRAE.

There are a total of 7 unit ventilators in the facility. The units are heating only and controlled with electronic controllers and actuators. It is recommended to replace older unit ventilators with modern unit ventilators with energy recovery wheels. The advantage of this setup is the utilization of the energy recovery system to recover the energy in the exhaust air in order to reduce the heating and cooling demand of the classrooms.

This ECM replaces existing 7 older unit ventilators with new unit ventilators with hot water heating coils and built-in energy recovery wheels. The basis for this ECM is Trane HUVC series unit ventilator with corresponding Energy Recovery ventilators. The ECM also includes attaching the unit ventilator controls to the Building Energy Management System (ECM#9) to achieve superior scheduling and controls.

Energy Savings Calculations:

The energy savings calculations are based reduction of the outside air heating, reduction of the overheating and infiltration due to opening of the windows and temperature setback during nights and weekends.

Nominal recovery capacity of the proposed unit is calculated based on typical outside air percentage, heating degree days and design day temperature difference. Total energy recovery of each unit at heating modes is calculated using heating degree days:

$$\text{Heating Energy Recovered}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Recovery Rate}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}(\text{Day }^{\circ}\text{F})\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times(0.60)}{65(^{\circ}\text{F})\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency }(\%)}$$

Amount of addition infiltration at each classroom due to open windows:

$$\text{Infiltration}\left(\text{BTU/Hr}\right)=\frac{\text{Ave Classroom Size (SF)}\times 10'\text{ Ceiling}\times\frac{\text{\# Air Changes}}{\text{Hr}}}{\frac{\text{60 Minutes}}{\text{Hr}}}\times 1.08\times 65°\text{F}$$

$$\text{Infiltration Energy}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Infiltration}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}\left(\text{Day }°\text{F}\right)\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times\left(0.60\right)}{65\left(°\text{F}\right)\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency }(\%)}$$

Fan Energy Cost:

$$\text{Fan Energy, kWh}=\frac{\text{Fan Power (HP)}\times\frac{0.746\text{kW}}{\text{HP}}\times 0.8\text{ (Load Factor)}\times\text{Annual Hrs}}{0.9\text{ (Power Factor)}}$$

Results of the calculations can be found in the table below:

UNIT VENTILATOR CALCULATIONS			
ECM INPUTS	**EXISTING UNITS**	**PROPOSED UNITS**	**SAVINGS**
ECM INPUTS	Existing Unit Ventilators UVs	New UVs with ERVs	
Number of Units	7	7	-
Ave. Unit Flow Capacity (CFM)	1000	1000	
Outside Air %	30%	30%	
Outside Air Flow (CFM)	300	300	
Heating Design Day Temp. Diff (°F)	65	65	
Average Classroom Size (SF)	1000	1000	
Additional Air Changes per Hour*	2	0	
Infiltration (CFM)	333	0	
Windows Open Hours/Day	4	0	
Infiltration Energy Loss (MBH/Unit)	23.4	0	
Heating Energy Recovery, MBH/Unit	-	21.1	21.1
ERV Operation Hours / Day	-	12	-
Supply Fan Motor HP	1/3	1/4	0
Fan Annual Hours of Operation	1560	1560	0
Heating Degree Days	4713	4713	-
Net Heating System Efficiency (Exist.)	70%	70%	-
Electric Cost ($/KWH)	$0.142	$0.142	0.142
Natural Gas Cost ($/Therm)	$1.20	$1.20	$1.20
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED UNITS**	**SAVINGS**
Fan Energy (kWh)	2,414	1,810	603
Heating Energy Infiltration (Therms)	407	0	407
Heating Energy Recovery (Therms)	0	-1,099	1,099
Fan Energy Cost ($)	$343	$257	$86
Infiltration Energy Cost ($)	$489	$0	$489
Heating Energy Recovered ($)	$0	-$1,319	$1,319
Total ($)	$831	-$1,062	$1,894
COMMENTS:	* Due to open windows and overheating		

Project cost, incentives and maintenance savings:

Total installed cost for 7 unit ventilators with hot water coils, energy recovery ventilators (ERV) and controls upgrade is $85,000.
The selected equipment does not qualify for any of the NJ Smart Start rebates.

There is no significant maintenance savings associated to this ECM.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$85,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$85,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,894
Total Yearly Savings ($/Yr):	$1,894
Estimated ECM Lifetime (Yr):	15
Simple Payback	44.9
Simple Lifetime ROI	-66.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$28,410
Internal Rate of Return (IRR)	-11%
Net Present Value (NPV)	($62,389.55)

ECM #6: 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. Due to the fact that many motors operate continuously 24 hours a day, even small increases in efficiency can yield substantial energy and dollar savings.

The school has one (1) motor that is a candidate to be replaced with a NEMA Premium® efficiency motor. The motors are located in the boiler room which serves the hot water loop and zone loops.

Boiler operating hours were estimated based on hours of operation obtained from the school. The pumps operate in in primary/standby mode, which means the operating time of each pump is accounts for the half of the total boiler operating time over the course of a year.

This energy conservation measure replaces the existing lower efficiency electric motor with a NEMA Premium® efficiency motor. NEMA Premium® is the most efficient motor designation in the marketplace today. The energy savings and payback are subject to change based on the pool filtration usage during the year. An implementation summary of the motor is provided below.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
P-2	Hot Water Loop	15	1,000	84.0%	92.4%

Energy Savings Calculations:

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

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

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

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

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-2	15	90%	84.0%	92.4%	1.09	1,096	$156
TOTAL					**1.1**	**1,095.8**	**$156**

Equipment Cost and Incentives

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

INCENTIVES	
HORSE POWER	**NJ SMART START INCENTIVE**
1	$45
1.5	$45
2	$54
3	$54
5	$54
7.5	$81
10	$90
15	$104
20	$113
25	$117
30	$135
40	$162

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-2	15	$3,652	$104	$3,548	$156	22.8
TOTAL		**$3,652**	**$104**	**$3,548**	**$156**	**22.8**

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,652
NJ Smart Start Equipment Incentive ($):	$104
Net Installation Cost ($):	$3,548
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$156
Total Yearly Savings ($/Yr):	$156
Estimated ECM Lifetime (Yr):	15
Simple Payback	22.7
Simple Lifetime ROI	-34.0%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$2,340
Internal Rate of Return (IRR)	-5%
Net Present Value (NPV)	($1,685.68)

ECM #7: Install HW Pump VFD's

Description:

The heating and ventilation units and the unit ventilators throughout the school are utilizing a constant volume pumping design.

2-way control valves provide flow through the heat exchanger equipment only when there is a call for heating or cooling, unlike 3-way control valves that allow constant flow of the water loop. 3-way control valves require full pumping energy continuously, while 2-way control valves allow the system to reduce flow when it is not needed. This measure includes capping off the bypass port on the 3-way control valves which effectively turns the valves into "2-way" control valves. When the unit is not calling for heating, the control valve closes reducing overall flow of the system. Variable frequency drives allow the pumps to slow down in response to a reduction in overall system flow. The reduction in operating flow allows the pumps to reduce energy consumption for all hours that the heating system is not at its peak load.

This ECM includes the installation of Variable Frequency Drives on the high efficiency motor pump (P-1) within the boiler room. The second pump would remain as a backup. To control flow through the system, this ECM includes piping modifications at the H&V units, and unit ventilators to cap off the bypass port on the 3-way control valves. The VFD's would be controlled by a differential pressure sensor in the water loop to measure demand for water (typical for each of the three pump sets). The furthest unit from the loop pumps would remain as 3-way control valves (constant flow) to eliminate dead heading potential. This ECM also includes replacement of the existing pump motors with inverter duty motors that meet NEMA Premium Efficiency Standard, which also helps to reduce energy consumption. CEG recommends that this ECM be implemented in conjunction with ECM#6, replacement of the existing hot water pump motors with inverter duty motors that meet NEMA Premium Efficiency Standard. Implementation of both measures will further reduce energy consumption.

Energy and cost savings calculations are based on calculation software "PumpSave v4.2," provided by ABB. The PumpSave calculation software is used to estimate the pumping energy for variable speed pump systems. The boiler water loop pumps operate approximately 4,320 Hrs per year since this system is used for about 6 month's total. The pump flow, HD, and resultant energy are calculated based on the existing pump horse power installed. The calculation is based on all existing equipment to be modified to operate as 2-way control valves. Where control valves are already 2-way style, these control valves shall remain. The exact quantity of equipment with hot water coils is unknown. The operation of all equipment control valves should be verified before implementing this ECM.

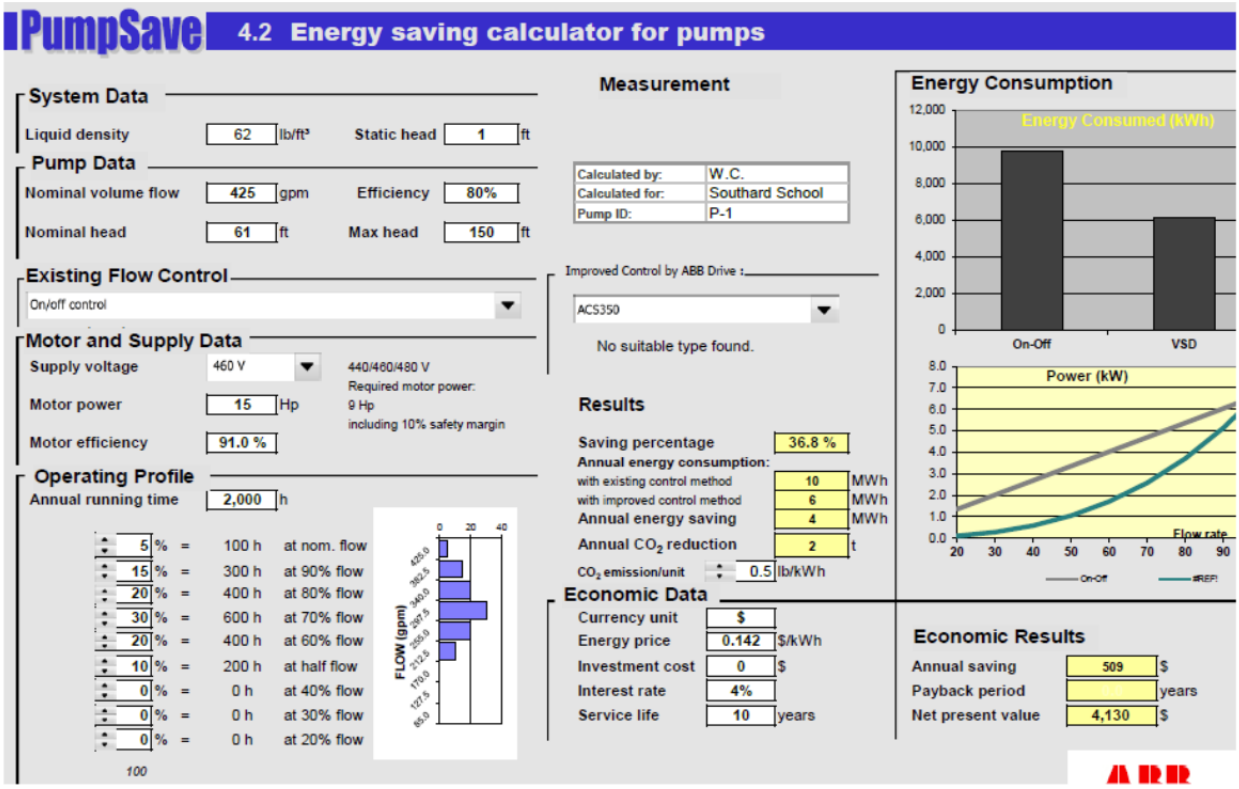
Energy Savings Calculations:

$$\text{Cons. Volume Power}\left(\text{HP}\right) = \frac{\text{Specific Gravity} \times \text{Flow Rate}\left(\frac{\text{Gal}}{\text{min}}\right) \times \text{Head}\left(\text{Ft}\right)}{3960 \times \text{Pump Efficiency}\left(\%\right) \times \text{Motor Efficiency}\left(\%\right)}$$

$$\text{Energy Cons.}\left(\text{kWh}\right) = \text{Power}\left(\text{HP}\right) \times 0.746 \left(\frac{\text{KW}}{\text{HP}}\right) \times \text{Operation}\left(\text{Hrs.}\right)$$

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

Boiler Room – P-1 Hot Water VFD Pumping Energy:



BOILER ROOM P-1 HOT WATER PUMP VFD CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CV Pumps	VFD Pumps	
Flow Control	CV	VFD	-
Total Flow* (GPM)	425	425	-
Head* (Ft)	61	61	-
Pump Efficiency (%)	80%	80%	-
Ave. Motor Efficiency (%)	91.0%	85.0%	-6.0%
Operating Hrs	2000	2000	-
Estimated Total Horse Power	9.0	9.6	-0.63
Elec Cost ($/kWh)	0.142	0.142	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	13,417	6,156	7,261
Electric Energy Cost ($)	$1,905	$874	$1,031
COMMENTS:	- VFD pump energy is based on ABB energy savings calculator for pumps, "Pump Save," version 4.2. Flow rate for VFD Pump calculation is summarized in the operating profile shown in the Pump Save output. - Hot water flow & head estimated based on pump horse power.		

Installation cost for one (1) VFD, piping work, re-balancing, capping of 3-way valves and controls is estimated to be $20,000.

Currently there are no **NJ Smart Start® Program Incentives** for installation of hot water pump Variable Frequency Drives.

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$20,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$20,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,031
Total Yearly Savings ($/Yr):	$1,031
Estimated ECM Lifetime (Yr):	15
Simple Payback	19.4
Simple Lifetime ROI	-22.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$15,465
Internal Rate of Return (IRR)	-3%
Net Present Value (NPV)	($7,691.99)

ECM #8: Demand Controlled Ventilation – Multipurpose Room

Demand Controlled Ventilation (DCV) is a means to provide active, zone level control of ventilation for spaces within a facility. The basic premise behind DCV is monitoring indoor CO2 levels versus outdoor CO2 levels in order to provide proper ventilation to the spaces within the facility as well as saving costly dollars treating unconditioned ventilation air. Carbon dioxide ventilation control or demand controlled ventilation (DCV) allows for the measurement and control of outside air ventilation levels to a target cfm/person ventilation rate in the space (i.e., 15 cfm/person) based on the number of people in the space. It is a direct measure of ventilation effectiveness and is a method whereby buildings can regain active and automatic zone level ventilation control, without having to open windows. The fixed ventilation approach depends on a set-it-and-forget-it methodology that is completely unresponsive to changes in the way spaces are utilized/occupied or how equipment is maintained. A DCV system utilizes various control algorithms to maintain a base ventilation rate. The system monitors space CO2 levels and the algorithm automatically adjusts the outdoor and return air dampers to provide the quantity of outdoor air to maintain the required CO2 level in the space. System designs are normally designed for maximum occupancy and the ventilation rates are designed for this (maximum) occupancy. In areas where occupancy swings are prevalent there is ample opportunity to reduce outdoor air quantity to satisfy the needs of the actual number of occupants present. By installing the DCV controls, energy savings are realized by the reduced quantities of outdoor air that do not require heating and cooling energy from the steam and chilled water plants.

There is one rooftop hot water heating and ventilation unit that serves the Multipurpose Room. When operating, this unit provides minimum amount of outside air to the space. The outside air volume is typically based on the maximum occupancy of the space conditioned. When a given space is not fully occupied the outside air quantity delivered to the space is greater than the amount needed for adequate ventilation.

This ECM includes the installation of CO_2 sensors integrated into a demand control ventilation system, for the unit mentioned above. This system allows the air handling unit to respond to changes in occupancy and therefore reduce the amount of outside air that has to be conditioned. Outside air accounts for a large portion of the energy consumption in the HVAC system, especially in high occupancy spaces.

The components required for the demand control ventilation system installation include damper actuators, Variable Frequency Drives, CO2 sensors, wiring, Energy Management System equipment expansion and programming. Each occupied zone would require minimum one CO_2 sensor installed to monitor occupancy levels.

Often heating and air conditioning units switch to occupied mode several hours before the actual occupancy in order to provide pre-heating or pre-cooling of the space. Energy savings achieved through “Demand Control Ventilation” is calculated based on actual occupancy of the spaces and the hours the units are in occupied mode.

Energy Savings Calculations:

Following table summarizes the estimated occupancy characteristics of the spaces and the HVAC equipment at this school.

ENERGY SAVINGS	
ECM INPUTS	**DCV**
Average Full Occupancy Hours	10:00 AM - 1:00 PM
Full Occupancy Hours per Day	3
HVAC Eqp. On Occupied Mode	7:00 AM - 4:00 PM
Occupied Hours per day	9
HVAC occupied / spaces not occupied	6
Est. Conditioned outside air savings	67%

Following is a list of HVAC equipment and corresponding spaces identified for Demand Controlled Ventilation.

IMPLEMENTATION SUMMARY							
INPUTS	**Service**	**# of CO2 SENSORS**	**HVAC Unit Type**	**Total Cooling Capaity, Tons**	**Total Heating Capaity, Mbh**	**Outside Air Cooling, Tons**	**Outside Air Heating, MBH**
DCV-1	Multi-Purpose Room	1	HV	0	1053	0	316
Total		**1**				**0**	**316**

Assumptions: 400 CFM/Ton, 30% average fresh air, 65°F design day ΔT

Total heating capacity estimated based on each unit with10,000 CFM flow capacity.

Max outside air heating capacity = 1.08 x Fresh Air CFM x design day ΔT

$$\text{Heating Energy (Therms)} = \frac{\text{Outside Air Heating Capacity}\left(\frac{\text{Btu}}{\text{Hr.}}\right) \times \text{HDD(Day °F)} \times 12\left(\frac{\text{Hr.}}{\text{Day}}\right) \times (0.60)}{65(\text{°F}) \times \text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right) \times \text{Heating Efficiency (\%)}}$$

$$\text{Heating Cost} = \text{Heating Energy(Therms)} \times \text{Ave Fuel Cost}\left(\frac{\$}{\text{Therms}}\right)$$

DEMAND CONTROLLED VENTILATION	
ECM INPUTS	**DCV**
Equipment	Multi Purpose Room HV-1
OA Heating Capacity, MBh (Est)	316
Net Heating Efficiency (Exis. Boilers)	70%
Heating Degree Days (65°F)	4193
Occupied Hours per day	9
Heating Energy Saving	67%
A/C Energy Savings	67%
Elec Cost ($/kWh)	$0.142
Natural Gas Cost ($/Therm)	$1.20
ENERGY SAVINGS	
ECM RESULTS	**DCV**
Heating Energy (Therms)	1,572
Heating Energy Savings (Therms)	1,048
Total Gas Cost Savings ($)	$1,258
Total Cost Savings ($)	$1,258
COMMENTS:	HDD estimated based on McGwire AFB, NJ OA: Outside Air

Cost and Incentives:

Estimated installed cost for demand controlled ventilation for the Multipurpose Room is $12,000. Estimated cost includes CO2 sensors, control wiring, VFD for supply fan, electrical wiring and controls.

There are currently no Smart Start ® incentives available for a Demand Control Ventilation System.

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$16,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$16,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,341
Total Yearly Savings ($/Yr):	$1,341
Estimated ECM Lifetime (Yr):	15
Simple Payback	11.9
Simple Lifetime ROI	25.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$20,115
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	$8.77

ECM #9: DDC Controls Upgrade

Description:

Southard School is currently controlled primarily through the use of vintage electronic control systems. CEG recommends installing a central DDC system to control the HVAC systems in the school including the air handling units, unit ventilators, wall thermostats, air conditioning units, rooftop units, boilers and pumps and incorporate the existing rooftop unit control system. The addition of DDC control systems will allow easier and remote operation for building facility management personnel.

This ECM includes installation of a Building Automation system to include control of the majority of the HVAC equipment in the facility. The system will include new temperature sensors and new local thermostats with limited over-ride capability, a front end computer and main controller. The system will also include central controls for lighting. With the communication between the control devices and the front end computer interface, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. Due to the fact that the building may have diverse hours of occupancy, including evening and weekend activities, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide significant savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 5% of the electricity and 5% for the gas utility in this building. The savings are estimated to be lower than the other schools because this facility has a much lower occupancy and usage rate.

The basis for the DDC system expansion is the Automated Logic Energy Management System or similar.

Energy Savings Calculations:

Since some of the key utility consumption and cost information was not available, estimated values are used for the unit cost of natural gas, total electricity usage and unit cost of electricity.

Energy savings for each utility is calculated with the equation below.

$$\text{Energy Savings (Utility)} = \text{Current Energy Consumption} \times \text{Estimated Savings, \%}$$

Following table summarizes energy savings for this facility via implementation of an Energy Management System:

DDC ENERGY MANAGEMENT SYSYEM CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Controls w/ Local Thermostats	DDC Controls	
Existing Nat Gas Usage (Therms)	42,927	-	
Existing Electricity Usage (kWh)	228,000	-	
Energy Savings, Nat. Gas	-	5%	
Energy Savings, Electricity	-	5%	
Gas Cost ($/Therm)	*$1.20*	$1.20	
Electricity Cost ($/kWh)	*$0.142*	$0.142	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	42,927	40,781	2,146
Electricity Usage (kWh)	228,000	216,600	11,400
Natural Gas Cost ($)	$51,512	$48,937	$2,576
Electricity Cost ($)	$32,376	$30,757	$1,619
Energy Cost ($)	$83,888	$79,694	$4,194
COMMENTS:			

Demand savings due to implementation of this ECM is minimal.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $3.00 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.

Cost of complete DDC System = ($3.00/SF x 73,940) = $221,820

Currently, there are no prequalified NJ SmartSmart Incentives for installation of the DDC system.

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$267,561
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$267,561
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$11,535
Total Yearly Savings ($/Yr):	$11,535
Estimated ECM Lifetime (Yr):	15
Simple Payback	23.2
Simple Lifetime ROI	-35.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$173,025
Internal Rate of Return (IRR)	-5%
Net Present Value (NPV)	($129,856.92)

ECM #10: High Efficiency Gas Fired Hot Water Heaters

Description:

Southard School has an existing gas-fired hot water heater. This hot water heater is an AO Smith 85 Gallon tank type heater with a 365 MBH input. This heater is within its useful service life; however it can still be replaced with a newer, much more efficient hot water heater. This ECM will replace the existing heater and install a new, high efficiency condensing style hot water heater. Basis for the replacement is as follows. It is recommended to retain a plumbing professional to confirm equipment sizing before pursuing with this ECM.

HOT WATER HEATER REPLACEMENT	
EXISTING	**PROPOSED**
One (1) A.O Smith 365 MBH Input	One (1) 100 Gallon - 250,000 BTU AO Smith Cyclone Xi BTH-250A

Energy Savings Calculations:

Calculations are estimated base on Domestic Hot Water Energy Usage for Educational buildings is 5.2 kBtu / SF / year.

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

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

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

CONDENSING DOM. HOT WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Hot Water Heater	AO Smith High Efficiency	
Building Type	Education	Education	
Building Square-foot	73,940	73,940	
Domestic Water Usage, kBtu	384,488	384,488	
DHW Heating Fuel Type	Gas	Gas	
Ave. Heating Efficiency	80%	95%	15%
Total Usage (kBTU)	480,610	404,724	75,886
Nat Gas Cost ($/Therm)	$1.20	$1.20	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	4,806	4,047	759
Energy Cost ($)	$5,767	$4,857	$911
COMMENTS:	Savings are based on Energy Information Administration Commercial Building Energy Consumption Survey 2003 Information		

Cost, Rebates and Incentives:

The total installed cost for the replacement of gas fired hot water heater with gas piping is estimated to be **$11,000.**

From the NJ Smart Start® Program appendix, the hot water heater installation falls under the category "Gas Water Heating" and warrants an incentive as follows:

NJ Smart Start ®Incentives:

$2/MBH x Unit Capacity, MBH (Water Heaters > 50 Gallons, up to 300 MBH)

250 MBH x $2/MBH = $500

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$11,000
NJ Smart Start Equipment Incentive ($):	$500
Net Installation Cost ($):	$10,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$911
Total Yearly Savings ($/Yr):	$911
Estimated ECM Lifetime (Yr):	15
Simple Payback	11.5
Simple Lifetime ROI	30.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$13,665
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	$375.46

ECM #11: Water Efficiency & Conservation

Description:

The school utilizes standard plumbing fixtures. The typical water closet and urinal water consumption only meet the minimum federally required standard for water efficiency. New fixtures are available that use less water than today's requirements and can add up to significant water reduction over a long period.

This ECM includes the replacement of the existing sink faucets, water closets and urinals within the bathrooms the facility. The estimated usage of the plumbing fixtures is based on the total population of the facility.

The proposed retrofit includes installation of auto flow sink faucets, low flow aerators, low flow flushometer style water closets that utilize 1.28 gallons per flush and ultra-low flushometer style urinals that utilize 1/8 gallons per flush. For the basis of this calculation the LEED rating system was used to estimate the occupancy usage for students within the school. When water consumption information was not available, the GPF values were estimated for the existing fixtures.

Energy Savings Calculations:

Urinals and Toilets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Flush}}{\text{Person per Day}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Flush}}\right)$$

Faucets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Use}}{\text{Person per Day}}\right) \times \text{Use Time}\left(\frac{\text{Sec}}{\text{Use}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Min}}\right)$$

$$\text{Water Cost} = \frac{\text{Water Consumption (Gallons)} \times \text{Ave Cost}\left(\frac{\$}{1000\ \text{Gal}}\right)}{1000(\text{Gal})}$$

$$\text{Gas Cost (Therms)} = \text{Faucet Water Consumption (Gallons)} \times \frac{8.34\ \text{BTU}}{\text{Gal}} \times \frac{\text{Therm}}{100{,}000\ \text{BTU}}$$

WATER CONSERVATION CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Fixtures	Low Flow / Auto Flow Fixtures	-
Total Number of Students	100	100	-
% Male to Female	50%	50%	-
Estimated % Floor Area Served by Older Bathrooms	100%	100%	-
Occupied Days Per Year	195	195	-
Lavatory Uses per Day per Person	3	3	-
Sink flow time per use, sec	15	12	-
Sink Aerator Flow, GPM	1.5	0.5	-
WC Uses per Day per Person	2.0	2.0	-
Urinal Uses per Day per Person	1.0	1.0	-
Total Urinal Flushes Per Day	50	50	-
Total WC Flushes Per Day	100	100	-
Urinal Gallons Per Flush (GPF)	1.0	0.125	0.875
WC Gallons Per Flush (GPF)	1.6	1.28	0.32
**** Water Cost ($/1000 Gal)**	$8.00	$8.00	-
Gas Cost ($/Therm)	$1.20	$1.20	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Water Consumption, Urinal and WC (Gal)	40,950	26,179	14,771
Water Consumption, Faucets (Gal)	21,938	5,850	16,088
Total Water Consumption, (Gal)	62,888	32,029	30,859
Water Cost ($)	$503	$256	$247
Gas Consumption (Therms)	91	24	67
Gas Cost ($/Year)	$110	$29	$81
Total Savings ($/Year)	-	-	$327
COMMENTS:	*Savings are based on LEED Reference Guide for Green Building Design and Construction - 2009 Edition for WC and Urinal water usage. ** Cost of Water estimated.		

The cost for installation and materials of water closets, low flow urinals and new auto flow sink faucets throughout the facility is estimated to be $14,824.

There are no Smart Start rebates for installation of low flow plumbing fixtures.

Energy Savings Summary:

ECM #11 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$14,824
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$14,824
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$327
Total Yearly Savings ($/Yr):	$327
Estimated ECM Lifetime (Yr):	15
Simple Payback	45.3
Simple Lifetime ROI	-66.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$4,905
Internal Rate of Return (IRR)	-11%
Net Present Value (NPV)	($10,919.80)

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 systempowerusage and maintain better IAQ.

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

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

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Howell Township BOE - Southard 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 - Gymnasium	$14,040	$9,360	$0	$23,400	$3,994	$0	$3,994	15	$59,910	$0	156.0%	5.9	14.96%	$24,280.11
ECM #2	Not Used	$0	$0	$0	$0	$0	$0	$0	15	$0	$0	#DIV/0!	#DIV/0!	#NUM!	$0.00
ECM #3	Boiler Replacement	$73,000	$109,500	$4,000	$178,500	$5,801	$0	$5,801	15	$87,015	$0	-51.3%	30.8	-7.88%	($109,248.04)
ECM #4	RTU Replacement	$55,500	$29,000	$3,536	$80,964	$3,695	$0	$3,695	15	$55,425	$0	-31.5%	21.9	-4.40%	($36,853.33)
ECM #5	Unit Ventilators w/ Energy Recovery	$51,000	$34,000	$0	$85,000	$1,894	$0	$1,894	15	$28,410	$0	-66.6%	44.9	-11.35%	($62,389.55)
ECM #6	NEMA Premium Motors	$1,942	$1,710	$104	$3,548	$156	$0	$156	15	$2,340	$0	-34.0%	22.7	-4.80%	($1,685.68)
ECM #7	Hot Water VFD	$10,000	$10,000	$0	$20,000	$1,031	$0	$1,031	15	$15,465	$0	-22.7%	19.4	-3.05%	($7,691.99)
ECM #8	Demand Controlled Ventilation for MPR	$6,000	$6,000	$0	$12,000	$1,258	$0	$1,258	15	$18,870	$0	57.3%	9.5	6.28%	$3,017.92
ECM #9	DDC System Installation / Expansion	$110,900	$110,900	$0	$221,800	$4,194	$0	$4,194	15	$62,910	$0	-71.6%	52.9	-12.76%	($171,732.30)
ECM #10	Domestic Hot Water Heater Replacement	$8,400	$2,600	$500	$10,500	$911	$0	$911	15	$13,665	$0	30.1%	11.5	-12.76%	$0.00
ECM #11	Water Conservation	$4,750	$10,074	$0	$14,824	$327	$0	$327	15	$4,905	$0	-66.9%	45.3	-12.76%	$0.00
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	166.85 Kw PV Array	$1,007,002	$0	$0	$1,007,002	$30,995	$84,764	$115,759	15	$1,736,385	$1,271,460	72.4%	8.7	7.74%	$374,921.43

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

APPENDIX B

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

Electric Chillers

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

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $92 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit, AFUE ≥ 92%

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

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

Natural Gas Water Heating

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

Prescriptive Lighting

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

Prescriptive Lighting - LED

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

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled
Daylight Dimming - office	$50 per fixture controlled

Premium Motors

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

Other Equipment Incentives

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

APPENDIX C

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Southard Elementary School

Building ID: 3130124
For 12-month Period Ending: November 30, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: May 09, 2012

Facility
Southard Elementary School
115 Kent Road
Howell, NJ 07731

Facility Owner
Howell Township Board of Education
200 Squankum Yellowbrook Road
Farmingdale, NJ 07727

Primary Contact for this Facility
N/A

Year Built: 1954
Gross Floor Area (ft²): 73,940

Energy Performance Rating[2] (1-100) 21

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	777,173
Natural Gas (kBtu)[4]	4,267,702
Total Energy (kBtu)	5,044,875

Energy Intensity[4]

Site (kBtu/ft²/yr)	68
Source (kBtu/ft²/yr)	96

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	337

Electric Distribution Utility
Jersey Central Power & Light Co [FirstEnergy Corp]

National Median Comparison

National Median Site EUI	52
National Median Source EUI	73
% Difference from National Median Source EUI	31%
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.

Certifying Professional
N/A

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**

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	Southard 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	115 Kent Road, Howell, NJ 07731	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.		☐
School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	73,940 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	15	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	20 %	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	12(Optional)	Is this school in operation for at least 8 months of the year?		☐

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

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Light Co [FirstEnergy Corp]

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
10/08/2011	11/07/2011	15,520.00
09/08/2011	10/07/2011	11,680.00
08/08/2011	09/07/2011	19,680.00
07/08/2011	08/07/2011	19,680.00
06/08/2011	07/07/2011	10,240.00
05/08/2011	06/07/2011	11,680.00
04/08/2011	05/07/2011	18,080.00
03/08/2011	04/07/2011	19,840.00
02/08/2011	03/07/2011	6,720.00
01/08/2011	02/07/2011	42,080.00
12/08/2010	01/07/2011	33,120.00
Electric Consumption (kWh (thousand Watt-hours))		**208,320.00**
Electric Consumption (kBtu (thousand Btu))		**710,787.84**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**710,787.84**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
10/08/2011	11/07/2011	345.68
09/08/2011	10/07/2011	267.86
08/08/2011	09/07/2011	209.63
07/08/2011	08/07/2011	229.26
06/08/2011	07/07/2011	231.25
05/08/2011	06/07/2011	1,325.20
04/08/2011	05/07/2011	3,750.36
03/08/2011	04/07/2011	6,768.51
02/08/2011	03/07/2011	8,415.85
01/08/2011	02/07/2011	10,321.37
12/08/2010	01/07/2011	6,482.08

Gas Consumption (therms)	**38,347.05**
Gas Consumption (kBtu (thousand Btu))	**3,834,705.00**
Total Natural Gas Consumption (kBtu (thousand Btu))	**3,834,705.00**
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
Southard Elementary School
115 Kent Road
Howell, NJ 07731

Facility Owner
Howell Township Board of Education
200 Squankum Yellowbrook Road
Farmingdale, NJ 07727

Primary Contact for this Facility
N/A

General Information

Southard Elementary School	
Gross Floor Area Excluding Parking: (ft^2)	73,940
Year Built	1954
For 12-month Evaluation Period Ending Date:	November 30, 2011

Facility Space Use Summary

School	
Space Type	K-12 School
Gross Floor Area (ft^2)	73,940
Open Weekends?	No
Number of PCs	15
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	No
Percent Cooled	20
Percent Heated	100
Months ◦	12
High School?	No
School District ◦	Howell Township

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 11/30/2011)	**Baseline** (Ending Date 11/30/2011)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	21	21	75	N/A	50
Energy Intensity					
Site (kBtu/ft²)	68	68	41	N/A	52
Source (kBtu/ft²)	96	96	57	N/A	73
Energy Cost					
$/year	$ 82,227.59	$ 82,227.59	$ 49,073.83	N/A	$ 62,752.32
$/ft²/year	$ 1.11	$ 1.11	$ 0.66	N/A	$ 0.85
Greenhouse Gas Emissions					
$MtCO_2e$/year	337	337	201	N/A	257
$kgCO_2e/ft^2$/year	5	5	3	N/A	4

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

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

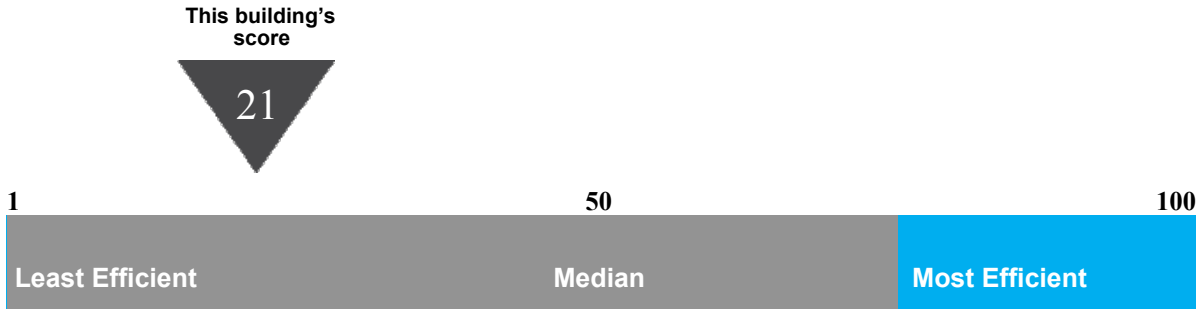
Statement of Energy Performance

2011

Southard Elementary School
115 Kent Road
Howell, NJ 07731

Portfolio Manager Building ID: 3130124

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 96 kBtu per square foot per year.*

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

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

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

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 05/09/2012

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering Group

Howell Township Schools -Southard Elementary School

AC Units

Tag	CU-1		
Unit Type	Ductless Split A/C Unit		
Qty	1		
Location	Roof		
Area Served	MDF/IDF Closet		
Manufacturer	Sanyo		
Model #	CL1271		
Serial #	0027493		
Cooling Type	D/X, R-22		
Cooling Capacity (Btuh)	11,900		
Cooling Efficiency (SEER/EER)	11.5		
Heating Type	N/A		
Heating Input (Btuh)	N/A		
Efficiency (COP)	N/A		
Fuel	N/A		
Approx Age	8		
ASHRAE Service Life	15		
Remaining Life	7		
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Howell Township Schools - Southard Elementary School

RTU, HV & UV

Tag	UV-1	AHU-1	AHU-2
Unit Type	Unit Ventilators	Hot Water Heating and Ventilating Unit	Hot Water Heating and Ventilating Unit
Qty	Approx 7	1	1
Location	Thru-wall in classroom	Boiler Room	Mechanical Room
Area Served	Classrooms	Classrooms	Classrooms
Manufacturer	American Air Filter	Trane - Torrivent	Trane
Model #	AKBEAAA	TVD835A	TVD825A
Serial #	-	K86HO7658	K86HO7659
Cooling Type	N/A	10 HP Fan	5 HP Fan
Cooling Capacity (Tons)	N/A	N/A	N/A
Cooling Efficiency (SEER/EER)	N/A	N/A	N/A
Heating Type	Hot Water	Hot Water	Hot Water
Heating Input (MBH)	-	-	-
Efficiency	N/A	N/A	N/A
Fuel	N/A	N/A	N/A
Approx Age	23	40	40
ASHRAE Service Life	20	20	20
Remaining Life	(3)	(20)	(20)
Comments	Various units have had controller, valve and actuator uprgrades	Fair condition, exceeded ASHRAE Service Life; no nameplate,	Fair condition, exceeded ASHRAE Service Life; programmable Honeywell T-stat

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Howell **Howell Township Schools - Southard Elementary School**

RTU, HV & UV

RTU, HV & UV

Tag	RTU-1	RTU-2	RTU-3
Unit Type	Packaged Rooftop Unit	Packaged Rooftop Unit	Roof Mounted H&V Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Main Office	Main Office	Multipurpose Room
Manufacturer	McQuay	McQuay	McQuay
Model #	RD5420603	RD5420603	RHS800BW
Serial #	R883400030	R883400020	3TG00136 14
Cooling Type	D/X, R-22	D/X, R-22	N/A
Cooling Capacity (Tons)	3-1/2	3-1/2	N/A
Cooling Efficiency (SEER/EER)	8.5 (Est)	8.5 (Est)	N/A
Heating Type	N/A	N/A	Hot Water
Heating Input (MBH)	N/A	N/A	-
Efficiency	N/A	N/A	-
Fuel	N/A	N/A	N/A
Approx Age	24	24	24
ASHRAE Service Life	15	15	20
Remaining Life	(9)	(9)	(4)
Comments	Poor condition, exceeded ASHRAE Service Life	Poor condition, exceeded ASHRAE Service Life	Fair condition, exceeded ASHRAE Service Life

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Howell **Howell Township Schools - Southard Elementary School**

RTU, HV & UV RTU, HV & UV

Tag	RTU-4	RTU-5	RTU-6
Unit Type	Packaged Rooftop Unit	Packaged Rooftop Unit	Packaged Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Music Room	Band Rooms	Media Center
Manufacturer	McQuay	McQuay	McQuay (Snyder General)
Model #	R080C0001	RD5320242 S	R160EFWC
Serial #	-	R883000012	5TG89055-00
Cooling Type	D/X, R-22	D/X, R-22	D/X, R-22
Cooling Capacity (Tons)	8	5	16
Cooling Efficiency (SEER/EER)	8.5 (Est)	8.5 (Est)	8 (est)
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	24	24	23
ASHRAE Service Life	15	15	20
Remaining Life	(9)	(9)	(3)
Comments	Poor condition, exceeded ASHRAE Service Life	Poor condition, exceeded ASHRAE Service Life	Poor condition, exceeded ASHRAE Service Life

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Howell **Howell Township Schools - Southard Elementary School**

RTU, HV & UV

RTU, HV & UV

Tag	RTU-7
Unit Type	Packaged Rooftop Unit
Qty	1
Location	Roof
Area Served	Computer Room
Manufacturer	-
Model #	R080C0001
Serial #	R882700004
Cooling Type	D/X
Cooling Capacity (Tons)	8
Cooling Efficiency (SEER/EER)	8.5 (est)
Heating Type	N/A
Heating Input (MBH)	N/A
Efficiency	N/A
Fuel	N/A
Approx Age	23
ASHRAE Service Life	15
Remaining Life	(8)
Comments	Poor condition, no nameplate, exceeded ASHRAE Service Life

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Howell Township Schools - Southard Elementary School

Boilers

Tag	B-1, 2		
Unit Type	Cast Iron Sectional		
Qty	2		
Location	Boiler Room		
Area Served	Heating hot water loop		
Manufacturer	H.B Smith		
Model #	Series 28A-17		
Serial #	N87 1308; N87 1309		
Input Capacity (Btu/Hr)	5,525,000		
Rated Output Capacity (Btu/Hr)	4,362,000		
Approx. Efficiency %	75.0%		
Fuel	Natural Gas		
Approx Age	25		
ASHRAE Service Life	35		
Remaining Life	10		
Comments	Boilers are in good condition		

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Howell Township Schools - Southard Elementary School

Pumps

Tag	P-1	P-2	
Unit Type	Base mounted end suction	Base mounted end suction	
Qty	1	1	
Location	Boiler Room	Boiler Room	
Area Served	Heating hot water loop	Heating hot water loop	
Manufacturer	Bell and Gossett	Bell and Gossett	
Model #	-	-	
Serial #		-	
Horse Power	15	15	
Flow	425 GPM @ 61ftHD		
Motor Info	AO Smith	Bell and Gossett	
Electrical Power	208-230V / 3Ph	208-230V / 3Ph	
RPM	1750	1745	
Motor Efficiency %	91.0%	84.0%	
Approx Age	15	23	
ASHRAE Service Life	20	20	
Remaining Life	5	(3)	
Comments			

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Howell Township Schools - Southard Elementary School

Domestic Water Heaters

Tag	HWH-1		
Unit Type	Storage Tank		
Qty	1		
Location	Boiler Room		
Area Served	Kitchen, Restrooms		
Manufacturer	AO Smith		
Model #	BTR 365 118		
Serial #	L06M008586		
Size (Gallons)	85		
Input Capacity (MBH/KW)	365		
Recovery (Gal/Hr)	353.93		
Efficiency %	80%		
Fuel	Natural Gas		
Approx Age	6		
ASHRAE Service Life	12		
Remaining Life	6		
Comments	Good condition		

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

APPENDIX E

Investment Grade Lighting Audit

CEG Job #: 9C11056

Project: Howell Twp. LGEA — **Southard Elementary School** — **KWH COST:**

Bldg. Sq. Ft. 73,940

ECM 1&2: Lighting Upgrade - General & Gym

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS		
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings
242.11	Boy's Restroom	800	1	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.11	85.6	$12.16	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
221.11	Boy's Restroom	800	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	99.2	$14.09	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.11	Girl's Restroom	800	1	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.11	85.6	$12.16	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
221.11	Girl's Restroom	800	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	99.2	$14.09	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
221.14	Custodial Closet	800	5	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.29	232.0	$32.94	5	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 1	800	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.03	825.6	$117.24	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 2	800	18	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.55	1,238.4	$175.85	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 2 Prep	800	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.26	206.4	$29.31	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 3	800	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.03	825.6	$117.24	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 4	800	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.03	825.6	$117.24	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 5	800	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.03	825.6	$117.24	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 6	800	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.03	825.6	$117.24	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 7	800	18	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.55	1,238.4	$175.85	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 8	800	31	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	2.67	2,132.8	$302.86	31	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
227.22	Classroom 8	800	13	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.75	603.2	$85.65	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 8	800	3	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.32	256.8	$36.47	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Servers	800	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.26	206.4	$29.31	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00

Investment Grade Lighting Audit

ECM 1&2: Lighting Upgrade - General & Gym

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS		
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings
232.22	Comference Room	800	7	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.60	481.6	$68.39	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Boy's Restroom	800	1	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.11	85.6	$12.16	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Girl's Restroom	800	1	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.11	85.6	$12.16	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
221.22	Corridors	2400	53	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	3.07	7,377.6	$1,047.62	53	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22		2400	37	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	3.18	7,636.8	$1,084.43	37	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
200	Custodial Closet	800	1	2	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	34	0.03	27.2	$3.86	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 34	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 33	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 32	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 31	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
652	Boiler Room - Old	800	2	1	"Industrial" Relector, 42w CFL	42	0.08	67.2	$9.54	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
770	Gym	2100	36	1	2x2 Recessed 400w MH, Prismatic Lens	465	16.74	35,154.0	$4,991.87	36	1	93 Watt LED Replacement Lamp, Nue-Tech Model 4293/yoke/mogul/adaptor/120-277V Driver	93	3.35	7030.8	$998.37	$650.00	$23,400.00	13.39	28123.2	$3,993.49
221.34	Stage	800	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.35	278.4	$39.53	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 37	800	20	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.72	1,376.0	$195.39	20	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 35	800	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.03	825.6	$117.24	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 35-37 - Prep	800	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.17	137.6	$19.54	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
221.11	Girl's Restroom	800	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	99.2	$14.09	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
221.11	Boy's Restroom	800	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	99.2	$14.09	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 30	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.21	Classroom 29	800	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	825.6	$117.24	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00

Investment Grade Lighting Audit

ECM 1&2: Lighting Upgrade - General & Gym

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS		
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings
232.21	Classroom 28	800	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	825.6	$117.24	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
200	Classroom 28-29 - Hall and Restrooms	800	3	2	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	34	0.10	81.6	$11.59	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 27	800	15	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	1.61	1,284.0	$182.33	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 26	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 25	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 24	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 23	800	2	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.21	171.2	$24.31	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Girl's Restroom	800	1	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.11	85.6	$12.16	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
241.34	Boiler Room	800	5	4	1x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Pendant Mnt., No Lens	107	0.54	428.0	$60.78	5	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Girl's Restroom	800	1	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.11	85.6	$12.16	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 22	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 21	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
200	Classroom 21-22 - Hall and Restrooms	800	3	2	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	34	0.10	81.6	$11.59	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 20	2600	15	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	1.61	4,173.0	$592.57	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 19	2600	18	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.55	4,024.8	$571.52	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 18	2600	18	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.55	4,024.8	$571.52	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 17	2600	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	2,225.6	$316.04	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 16	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 15	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 14	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00

Investment Grade Lighting Audit

ECM 1&2: Lighting Upgrade - General & Gym

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS		
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings
242.21	Guidance	800	4	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.43	342.4	$48.62	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Health	800	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.52	412.8	$58.62	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Copy Room	800	2	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.21	171.2	$24.31	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
221.11	Stage	800	3	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.19	148.8	$21.13	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
231.11	Cafeteria	800	50	3	1x4, 3 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	96	4.80	3,840.0	$545.28	50	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Kitchen	800	13	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	1.39	1,112.8	$158.02	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.11	Receiving	800	2	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.21	171.2	$24.31	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.11	Storage	800	1	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.11	85.6	$12.16	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 13	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 12	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 11	800	8	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	684.8	$97.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
242.21	Classroom 10	800	3	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.32	256.8	$36.47	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Classroom 9	800	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.52	412.8	$58.62	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Office - Breakroom	1800	9	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.77	1,393.2	$197.83	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Closet	800	1	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.09	68.8	$9.77	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Main Office	1800	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.69	1,238.4	$175.85	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Copy Room	1800	1	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.09	154.8	$21.98	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Office	1800	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.17	309.6	$43.96	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
232.22	Office	1800	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.17	309.6	$43.96	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00
	Totals		696	246				104,046	$14,775	696	1			3.3	7,031	$998		$23,400	13.4	28,123	$3,993

APPENDIX F

Project Name: **LGEA Solar PV Project - Middle School South - Howell Township BOE**
Location: **Howell, NJ**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$1,007,002
Annual kWh Production	219,821
Annual Energy Cost Reduction	$30,995
Average Annual SREC Revenue	$84,764

Simple Payback: **8.70** Years

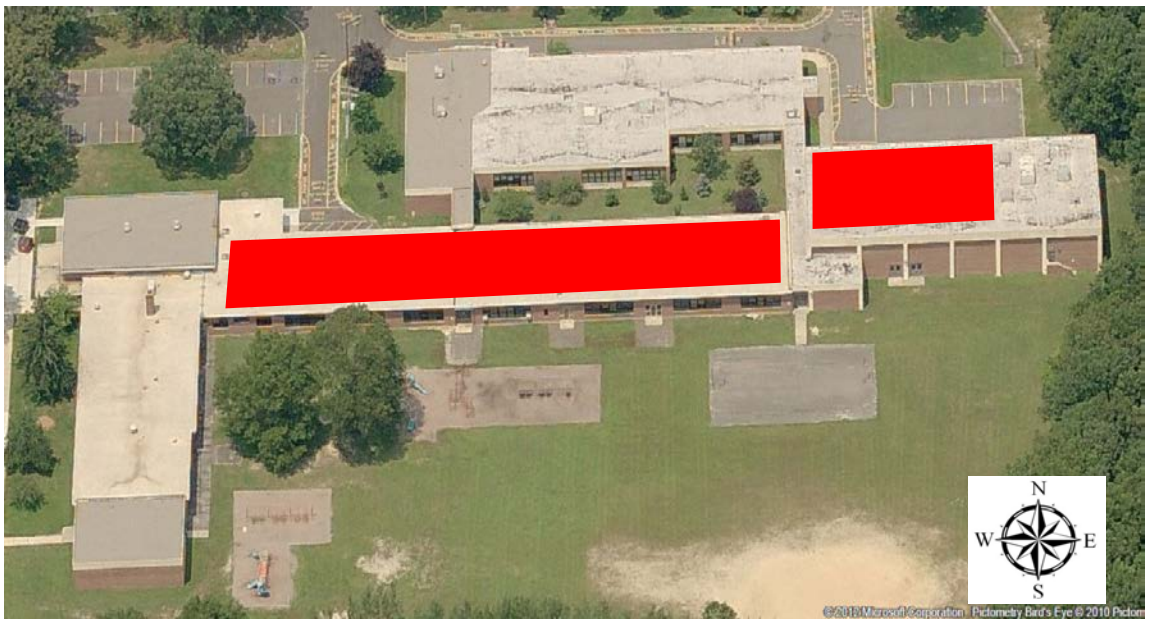
Life Cycle Cost Analysis

Analysis Period (years): 15
Discount Rate: 3%
Average Energy Cost ($/kWh) **$0.141**
Financing Rate: 6.00%
Financing %: 100%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
Average SREC Value ($/kWh) $0.386

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	219,821	$30,995	$0	$120,902	$59,258	$42,714	$49,924	$49,924
2	$0	218,722	$31,925	$0	$120,297	$56,624	$45,348	$50,250	$100,174
3	$0	217,628	$32,882	$0	$108,814	$53,827	$48,145	$39,725	$139,899
4	$0	216,540	$33,869	$0	$97,443	$50,857	$51,115	$29,340	$169,239
5	$0	215,457	$34,885	$2,219	$96,956	$47,705	$54,267	$27,650	$196,888
6	$0	214,380	$35,931	$2,208	$96,471	$44,358	$57,614	$28,222	$225,111
7	$0	213,308	$37,009	$2,197	$85,323	$40,804	$61,168	$18,164	$243,275
8	$0	212,242	$38,120	$2,186	$84,897	$37,031	$64,941	$18,858	$262,133
9	$0	211,181	$39,263	$2,175	$73,913	$33,026	$68,946	$9,029	$271,162
10	$0	210,125	$40,441	$2,164	$73,544	$28,773	$73,198	$9,849	$281,011
11	$0	209,074	$41,654	$2,153	$62,722	$24,259	$77,713	$251	$281,262
12	$0	208,029	$42,904	$2,143	$62,409	$19,466	$82,506	$1,198	$282,460
13	$0	206,988	$44,191	$2,132	$51,747	$14,377	$87,595	($8,166)	$274,294
14	$0	205,954	$45,517	$2,121	$51,488	$8,974	$92,998	($7,088)	$267,206
15	$0	204,924	$46,882	$2,111	$40,985	$3,238	$98,734	($16,215)	$250,991
Totals:		3,184,372	$576,469	$23,810	$1,227,911	$522,576	$1,007,002	$250,991	$3,295,030

Net Present Value (NPV) **$216,826**

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
Southard Elementary South Roof PV Array	17400	SHARP NU-U235F2	710	17.5	12,454	166.85	219,821	135.1	29,749	13.40



.= Proposed PV Layout

Notes:

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

Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	166.9 kW
DC to AC Derate Factor:	0.810
AC Rating:	135.1 kW
Array Type:	Fixed Tilt
Array Tilt:	39.5°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	14.2 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	3.61	15727	2233.23
2	4.20	16373	2324.97
3	4.78	19755	2805.21
4	5.23	20289	2881.04
5	5.44	21297	3024.17
6	5.48	19934	2830.63
7	5.55	20610	2926.62
8	5.41	20307	2883.59
9	5.23	19435	2759.77
10	4.60	18175	2580.85
11	3.59	14439	2050.34
12	3.17	13480	1914.16
Year	4.69	219821	31214.58