Little Egg Harbor School District

Energy Savings Plan

Project Number: ESG-Project #EPBWI00589

Little Egg Harbor, New Jersey | December 2nd, 2019

Revision #1

energy systems group

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SECTION 1. EXECUTIVE SUMMARY

Various energy conservation measures were evaluated in the development of this Energy Savings Plan (ESP). Energy Systems Group has performed field verifications, collected data and taken field measurements to ensure the development of the most cost-effective solutions as well as accurate savings calculations. Various solutions were reviewed with the school district's administration to develop a set of Energy Conservation Measures (ECMs) that allow the school district to address the facility's priority items while reducing the total annual energy spend for the District. This study expands upon the original energy audit conducted by TRC Energy Services (TRC). The original audit information was used for building descriptions as well as an overall indication of the District needs.

Priority items include:

- Upgrade Interior lighting throughout the district
- Replace the Building Automation System
- Replace Rooftop Units when possible
- Building envelope upgrades throughout the district

Energy Savings

Energy saving calculations performed in the development of this ESP was completed using Microsoft Excel worksheets with Bin weather data to accurately model the building systems. Additional spreadsheets were used for measures that are not affected by the weather, such as lighting savings. Energy savings have been provided electronically for ease of review. All of the energy savings calculations that have been performed are in accordance with the New Jersey Clean Energy Program Protocols to Measure Resource Savings.

Benefits

The measures investigated in this Energy Savings Plan could result in an annual utility savings of 1,143,745 kWhs of electricity, 5,623 therms of natural gas, and 618 kGals of water. The total utility cost savings is $3,788,940 over the life of the project (20 years). Additionally, these energy savings will result in a net reduction of greenhouse gases and will reduce the school district's carbon footprint by 1,637,295 lbs. of CO_2 annually. All these savings are achieved while improving the classroom environment and renewing many items that have been in service beyond useful life expectancy.

SECTION 2. PROJECT DESCRIPTION

This Energy Savings Plan (ESP) addresses the following facilities. Any description in this report-stating "district wide" or similar refers only to the buildings listed below:

Little Egg Harbor School District	
Joanne C. Burd Administration Building	307 Frog Pond Road Little Egg Harbor NJ 08087
Frog Pond Elementary School	305 Frog Pond Road Little Egg Harbor NJ 08087
George J. Mitchell Elementary School	950 County Road 539 Little Egg Harbor NJ 08087
Robert C. Wood Senior Early Childhood Center	950 County Road 539 Little Egg Harbor NJ 08087

Facility Descriptions

Joanne C. Burd Administration Building

Background Information

The Joanne C. Burd Administration Building is located at 307 Frog Pond Road, Little Egg Harbor, New Jersey. This 4,000 ft^2 building was originally built in 1998. The residential style building is one floor and has conference rooms, office space, and a kitchenette.

Building Occupancy

The building is occupied by about 15 full time staff.

<u>Hours of Operation</u>

- Monday through Friday 8:00 AM to 6:00 PM (staff)

Envelope

Building Envelope

The building is constructed of concrete block with a vinyl-siding façade on the front and side and a stone façade on the front. It has a pitched roof that is covered with asphalt shingles. The building has double-pane windows, which are in good condition and show little sign of excessive infiltration. The exterior doors are constructed of metal and glass and are in good condition.

Lighting

Administration Building Lighting

<u>Lighting & controls</u>: The building is primarily lit by linear fluorescent fixtures which contain 32-Watt T8 lamps with electronic ballasts as well as some compact fluorescent lamps (CFL). Majority of fixtures are 2-lamp or 4-foot long troffers with diffusers. Exit signs throughout the building use LED technology. Majority of rooms throughout the building have manual wall switches for lighting controls.

Mechanical Systems

HVAC Systems: The building is heated by a forced air system which consists of a gas-fired 450 MBH output furnace that is of standard 80% efficiency and in fair condition. Cooling is provided through the use of split system air conditioning units with an approximate total capacity of 8 tons. At least two supplementary, window AC units were also observed.

Domestic Hot Water Systems

The domestic hot water heating system for the facility consists of a gas fired 40-gallon storage tank water heater. It has a standard 80% efficiency. This heater provides domestic hot water to sinks throughout the building.

Building Controls (HVAC Controls)

The cooling and heating systems are controlled by a programmable Honeywell thermostat. The typical occupied set points are 76°F for cooling and 70°F for heating during occupied hours. During the week, current programmed occupied hours are from 5:30 AM to 5 PM. During the weekend, the occupied hours are set between 8 AM to 5 PM. The unoccupied temperature setpoints are 80°F and 58°F (68°F on weekends).

Plug Load

The plug loads in the building include general office and café equipment. There are roughly 8 computer work stations throughout the facility. It appears that there is no centralized PC power management software installed.

Building Plug Load

ESG observed to following significant plug load technologies:

Device Type:	# of Devices
Medium Printer	4
Large Printer/Copier	1
H/C Water Dispenser	1
Electric Water Heater	1
TOTAL	**7**

Plumbing/Water System

There are two (2) restrooms in the Administrative Building. All fixtures were observed to meet low flow standards.

Frog Pond Elementary School

Background Information

Frog Pond Elementary School is located at 305 Frog Pond Road, Little Egg Harbor, New Jersey. This 103,800 ft^2 school was originally built in 1989 with renovations completed in 1997 and 2007 and is in good condition. Frog Pond Elementary School consists of one floor of classroom space, office space, library, and a gymnasium.

Building Occupancy

Approximate enrollment is 688 students with a staff of 65 people. (65 classroom teachers)

Hours of Operation

- Monday through Friday 8:15 am to 3:05 pm (students/staff) (September through June)
- Monday through Friday 6:30 am to 6:00 pm (admin) (September through June)

Envelope

The building is constructed of concrete block and structural steel. The majority of the building is covered by a flat roof along with some pitched roof sections both of which are in good condition. The building has double-pane windows in decent condition with no apparent excess air infiltration. The exterior doors are typically aluminum and are in good condition.

Lighting

The majority of the facility lighting are linear fluorescent 32 W, T8 fixtures. Some areas have already been converted to LED. The exterior lighting is provided by wall pack fixtures, metal halide area lighting fixtures, and some compact fluorescent wall pack fixtures at the entrance of the building.

Lighting Controls: Lighting fixtures throughout the building are generally manually controlled by wall switches.

Motors

Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and high efficiency. These systems include hot water pump motors, exhaust fan motors and supply fan motors.

Mechanical Systems

HVAC Systems and Equipment: The building is heated by a hot water system consisting of two (2) natural gas fired 1500 MBH condensing hot water boilers, a circulation loop, and distribution devices. The boilers have a nominal combustion efficiency of up to 99%. Hot water is supplied at 180°F when the outside air temperature is low and the set point is adjusted linearly to 130°F when the outside air is above 65°F. The boilers provide hot water to heating-ventilation (HV) units, perimeter radiators, and hot water unit heaters. The boilers are fully modulating. They are in good condition and well maintained.

Boilers

There are a total of 17 Rooftop Units which provide heating and cooling to various parts of the school. In addition to these, there is a Variable Refrigerant Flow system consisting of 14 condensing units which supply supplemental heating and cooling to the classrooms.

Domestic Hot Water Systems


Domestic Hot Water

The domestic hot water heating system for the facility consists of two natural gas fired 300 MBH boilers with a separate hot water storage tank. This system has a nominal efficiency of 82% and serves the entire building. This equipment was installed a few years ago and is in good condition. This system serves hand washing sinks throughout the building and the kitchen.

Building Controls (HVAC Controls)

The building currently employs a CM3 based Building Automation System (CM3). The system controls the HVAC system from the major pieces of equipment including the Rooftop Units (RTUs) and boilers. It also controls the terminal units like the Variable Air Volume (VAV) boxes. Feedback is provided by thermostats located in the various zones.

The Variable Refrigerant Flow (VRF) system which serves classrooms is monitored but not controlled by the CM3 BAS. It is a standalone system where the thermostats are in each space. There is a central VFD control panel which aggregates the thermostat feedback to control the condensing units.


BAS Thermostat


VRF Controller Head Unit

Plug Load

There are 163 computers/laptops and an additional 674 Chromebooks in the school. It is assumed that there is no centralized PC power management software installed. Plug loads throughout the building include general café and office equipment. There are classroom typical loads with as projectors and fans.

ESG observed to following significant plug load technologies:

Device Type:	# of devices
Projector	34
Projector/Smartboard Combo	7
Charging Cart	22
Medium Printer	14
Large Printer/Copier	3
Snack Vending	1
Soda Vending	1
Large Coffeemaker	1
H/C Water Dispenser	2
Electric Hot Water Heater	2
TOTAL	**87**

Plumbing/Water System

There are restrooms throughout this facility. A sampling of restrooms found that majority of the faucets are rated for 2.0 gallons per minute.

George Mitchell Elementary School

Background Information

George Mitchell Elementary School is located at 950 County Road 539, Little Egg Harbor, New Jersey. This 110,600 ft^2 school was originally built in 1959, with additions in 1964, 1976, 1999, and 2009 and is in fair condition. The building is one floor consisting of classroom space, a gymnasium, a kitchen, a cafeteria, a library, and office spaces.

Building Occupancy

Approximate enrollment is 810 students with a staff of 160 people.

Hours of Operation

- Monday through Friday 8:30 am to 3:30 pm (students/staff), 11:30 pm for custodians
- Summer classes hours Monday through Friday 8:30 am to 12:00 pm

Envelope

The building has a mostly sloped roof that is in good condition. The building has double-pane windows with metal frames in fair condition. The exterior doors are constructed of aluminum or metal with glass panes and are in good condition.

Lighting

The building is primarily lit by 32-Watt linear fluorescent T8 lamps with electronic ballasts, as well as some compact fluorescent lamps (CFL), incandescent, and LED general purpose lamps. Fixture types include 2-lamp or 4-lamp, 2-foot or 4-foot long troffers, surface mounted wraparound fixtures and some of the original finned continuous row fixtures. Most fixtures are in good condition.

Exterior wall pack fixtures include metal halide lamps and ballasts.

George Mitchell Elementary School Lighting

Mechanical Systems

Motors

Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and high efficiency. These systems include hot water pump motors, exhaust fan motors and variable speed supply fan motors.

Boilers

HVAC Systems and Equipment: The building is heated through a combination of natural gas fired RTUs and a hot water system which serves baseboard hot water in the classrooms. The baseboard hot water is heated using two natural gas-fired boilers: two (2) 1,500 MBH condensing AERCO Modulex boilers, in fair condition and installed in 2009. The condensing boilers have a nominal thermal efficiency of 93%. There are also two (2) Weil-McLain noncondensing boilers, which are abandoned in place.

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
Boiler	2	Boiler Room	Entire Building	A. O. Smith	BTH 199 100	±2008	96%	1,500 MBH
Boiler	2	Boiler Room	Entire Building	Weil-McLain	BTH 199 100	±2000	83%	-

Domestic Hot Water Systems

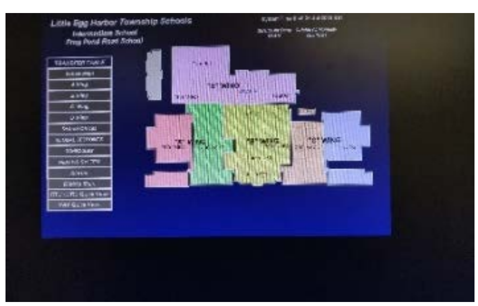
Domestic Hot Water

The domestic hot water heating is employs one A.O. Smith water heater with integrated 100 gallon storage tank which supplies hot water to the kitchen. An additional (~20) small electric hot water heaters supply hot water to restrooms throughout the building. The systems are in good condition.

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
DHW	1	Boiler Room	Entire Building	A. O. Smith	BTH 199	±2008	96%	100 gal
DHW	~20	Restrooms	Individual Restroom	STATE	-	-	-	-

Building Controls (HVAC Controls)

The Rooftop Units and Variable Air Volume boxes which serve the building have supply fan motors, dampers, and burners that operate through the use of a Direct Digital Control system. The control system is functioning for the most part but has had communication problems noted.



Building Controls

Kitchen Equipment

The school has a kitchen that is used to prepare lunches for each school day. Most of the cooking is done using a number of electric ovens and one stove. There is an electric fryer and bulk prepared foods are held in a number of electric holding cabinets. A majority of this equipment is high efficiency and in good condition.

The kitchen has two walk-in coolers and one walk-in freezer. These are used to store food prepared for school lunches. One walk-in cooler temperature had a temperature of 38°F with a setpoint of 47°F with the other cooler not yet running. The walk-in freezer had a temperature of 6°F with a setpoint of 18°F. All equipment is standard to high efficiency and in fair to good condition.

Plug Load

There are roughly 221 computers/laptops and 280 Chromebooks throughout the facility. It is assumed that there is no centralized PC power management software installed. Plug loads throughout the building include general café and office equipment. There are classroom typical loads such as smart boards, projectors, and fans.

Building Plug Load

There are also several residential style refrigerators throughout the building. These vary in condition and efficiency. Refrigerated drink machines located in the faculty room and cafeteria do not currently have controls.

ESG observed to following significant plug load technologies:

Device Type:	# of Devices
Projector	12
Smartboard TV	39
Charging Cart	2
Small Printer	0
Medium Printer	14
Large Printer/Copier	1
Snack Vending	1
Soda Vending	1
Large Coffeemaker	1
H/C Water Dispenser	1
Electric Hot Water Heater	7
TOTAL	**79**

Plumbing/Water System

There are restrooms throughout this facility. A sampling of restrooms found that majority of the faucets are rated for 2.0 gallons per minute.

Robert C. Wood Senior Early Childhood Center

Background Information

The Robert C. Wood Senior Early Childhood Center is located at 950 County Road 539, Little Egg Harbor Township, New Jersey. This 18,700 ft^2 facility was originally built in 2012 and is in good condition. The building is one floor and consists of classroom space, and a main office.

Building Occupancy

Approximate enrollment is 155 students with a staff of 35 people.

Hours of Operation

- Monday through Friday 8:30 am to 3:30 pm

Envelope

The building has a shingled roof that is in good condition. This structure is constructed of concrete block and structural steel with a vinyl facade. The facility has double-pane windows, which are in fair condition. The exterior doors are constructed of aluminum and are in good condition.

Lighting

Early Childhood Center
Classroom Lighting

The building is primarily lit by 32-Watt linear fluorescent T8 lamps with electronic ballasts as well as some compact fluorescent lamps (CFL). Most of the fixtures are 2-lamp, 3-lamp or 4- lamp, 4-foot long troffers or wrap fixtures.

Lighting Controls: The classroom lights are manually controlled by wall switches. The majority of classroom bathrooms have remote-mounted occupancy sensors.

Mechanical Systems

Heat Pump

HVAC Systems and Equipment: The building is heated and cooled by wall mounted heat pump units. Each unit has a capacity of 3.5 tons and a 9.1 SEER rating. Programmable thermostats in each space control their respective units. They have scheduled setbacks and allow the occupants to change them. There is no setpoint reset protocol.

Domestic Hot Water Systems

The bathrooms in the building have their hot water served by small, dedicated electric water heaters. They are less than 10 years old and in good, working order.

Plug Load

There are roughly 28 computers/laptops throughout the facility. It is assumed that there is no centralized PC power management software installed.

ESG observed to following significant plug load technologies:

Device Type:	# of Devices
Projector	9
Smartboard TV	3
Medium Printer	2
Snack Vending	1
Electric Hot Water Heater	1
TOTAL	**16**

Plumbing/Water System

There are several restrooms at Early Childhood Center. A sampling of restrooms found that majority of the faucets are rated for 2.0 gallons per minute (gpm).

Utility Baseline Analysis

Electric

Electrical energy is delivered to Little Egg Harbor School District by Atlantic City Electric (ACE), which is the electric transport company for the entire district.

There are several electric providers which include Atlantic City Electric, East Coast Power & Gas, and Plymouth Rock Energy. East Coast Power & Gas is the supplier for the largest accounts in the district.

The primary electric rate used by the buildings at Little Egg Harbor School District, is the Annual General Service (AGS). Monthly Generation Service is used by several accounts in the district and there are 3 accounts associated with street lighting. However, AGS accounts for 88% of the total electrical consumption in the district. One kWh usage is equivalent to 1000 watts running for one hour.

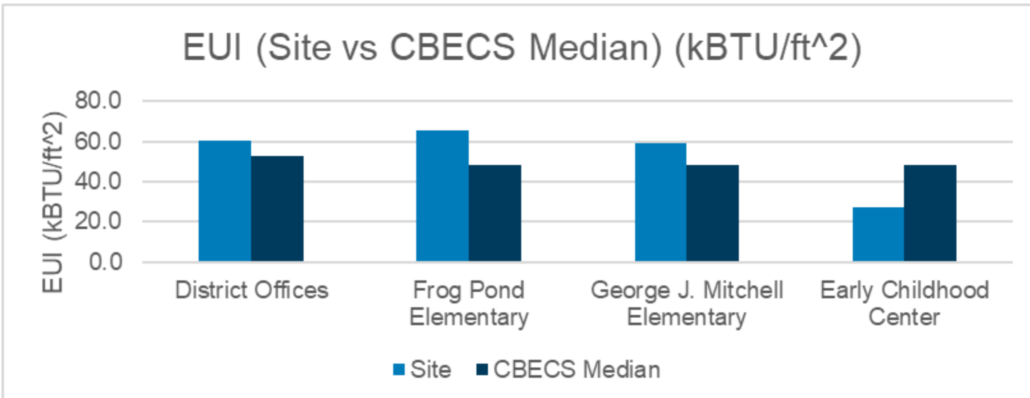
Natural Gas

Little Egg Harbor School District has natural gas transported by New Jersey Natural Gas (NJNG) and the supplier is South Jersey Energy (SJE) for the largest account with NJNG supplying the rest. The gas utility measures consumption in cubic feet x 100 (CCF) and converts the quantity into therms of energy. The buildings fall primarily under the General Service Large (GSL) with 94% of the total district consumption. Some smaller buildings have General Service Small (GSS) accounts for natural gas.

Energy Usage Summary

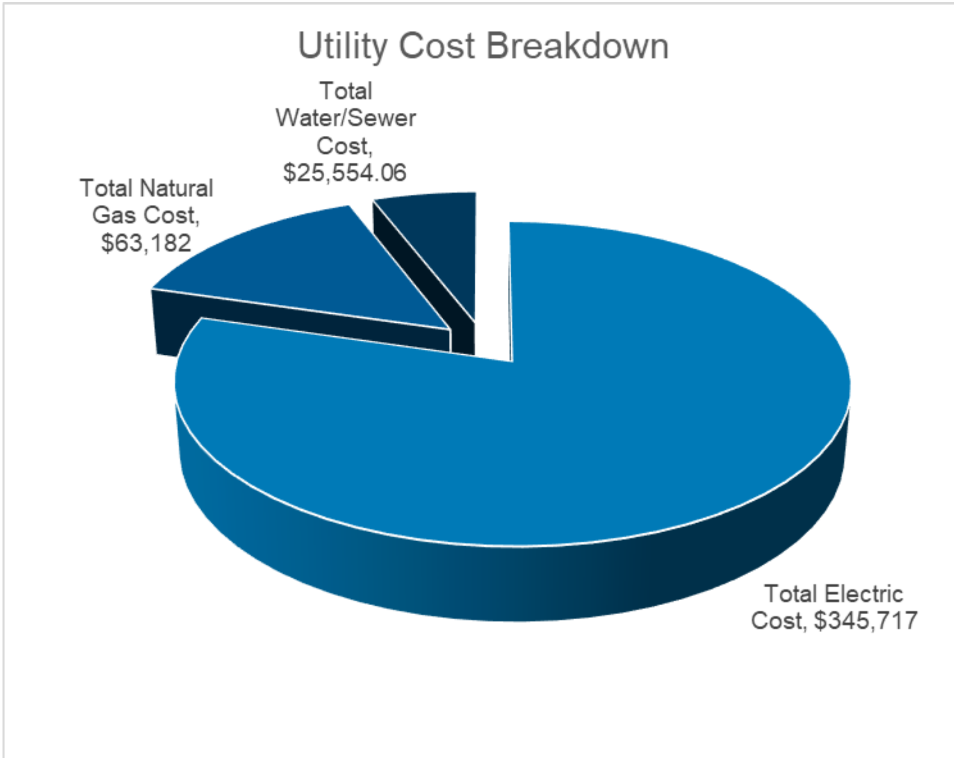
Baseline Data											
		Electric		Natural Gas		Water					
Building Name	Building Square Footage (ft^2)	Electricity (kWh)	Total Electric Cost	Natural Gas (Therms)	Total Natural Gas Cost	Water (kGal)	Total Water/Sewer Cost	Total Utility Cost	Total Energy Use (kBTU)	EUI (kBTU/ft^2) (Site)	Median Reference Values (CBECS) Site
District Offices	3,500	26,088	$4,198	1,233	$1,294	0	$0	$5,493	212,294	60.7	52.4
Frog Pond Elementary	103,800	1,112,296	$151,816	30,075	$33,176	837	$9,253	$194,246	6,802,121	65.5	48.5
George J. Mitchell Elementary	110,600	1,123,656	$170,599	26,771	$28,711	1,327	$16,301	$215,611	6,510,506	58.9	48.5
Early Childhood Center	18,700	147,920	$19,103	0	$0	0	$0	$19,103	504,724	27.0	48.5
Summary	**236,600**	**2,409,960**	**$345,717**	**58,079**	**$63,182**	**2,164**	**$25,554.06**	**$434,453**	**14,029,644**	**59.3**	**49.5**

Little Egg Harbor School District Energy Summary Analysis Table



Little Egg Harbor School District Energy Use Index (EUI) Analysis

The pie chart below shows the distribtuion of these utility costs relative to the entire District energy consumption. At 80% of the total consumption, electricity comprises a larger share of the energy costs.



Little Egg Harbor School District Utility Cost Breakdown

Marginal Rates

For the purposes of determining how energy conservation measures will affect the utility bill, it is important to understand what portions of the cost can be saved. In general, there are costs associated with utility bills that are fixed and independent of usage, such as the monthly meter charge. For example, in the case of a monthly meter charge, this charge often exists even if the energy usage were zero. An energy conservation measure often cannot produce a cost savings on this portion of the bill. The utility rate structure has to, therefore, be analyzed to determine what portion of the bill a cost savings can be produced using a specific energy conservation measure. For the purposes of this report, the effective rate is the portion of the bill effected by energy saving or the applied energy conservation measure.

The utility rates identified below were used for purposes of calculating the dollar effect of the energy

Electric

Electric Rates	$/kWh	$/kW
AGS	$0.1009	$11.07

The effective suppy rate is based on the most recent available bills for Little Egg Harbor School District The effective transport $/kWh and $/kW demand rates are based on the ACE tariff rates effective 4/1/2019. The total effective $/kWh and $/kW rates are the summation of the supply and transport effective rates.

Natural Gas

Natural Gas Rates	$/Therm
GSL	$1.088

The effective natural gas rate, $/Therm, is based on the total natural gas consumption and natural gas costs for the 2018-2019 baseline period.

Water/Sewer

$/kGal
$11.67

The effective weater/sewer rate, $/kGal, is based on the water/sewer consumption and water/sewer costs for the 2018-2019 baseline period.

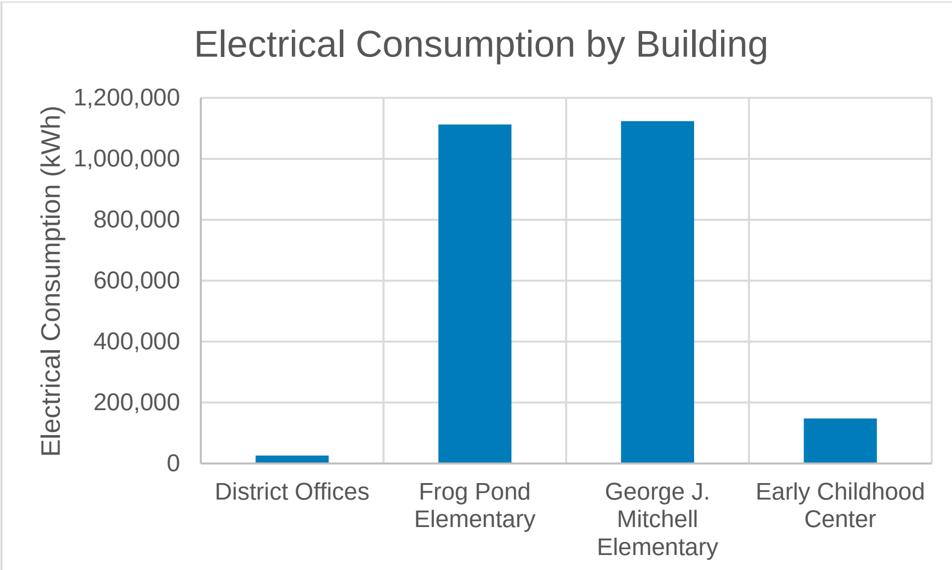
Electric

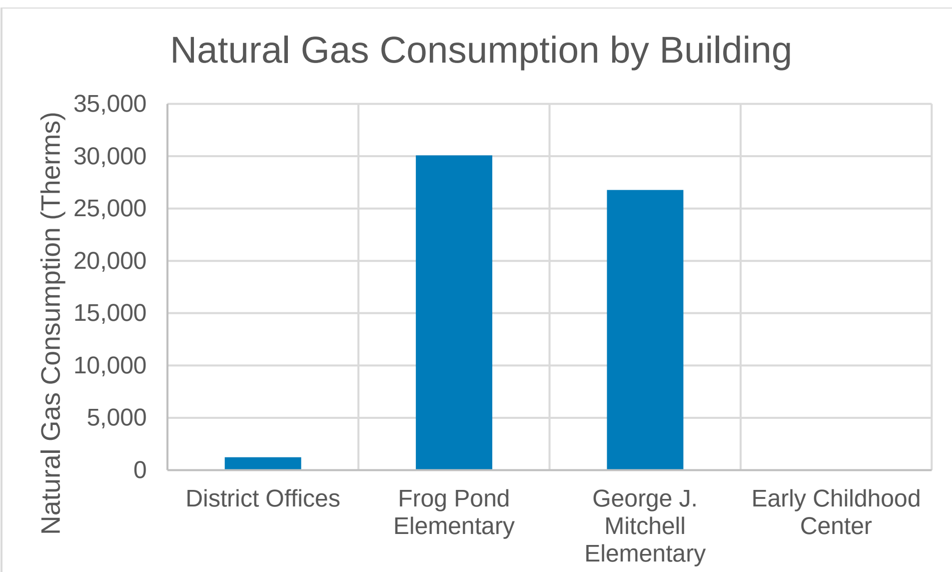
Building Name	Square Footage	Account Number	Rate	Supply Company	Transport Company	Electricity *kWh*	Total Demand *kW*	Peak Demand *kW*	Total Electricity *Total Cost*	Baseline *Period*
District Offices	3,500	55001346471	MGS	ECPGNJ	Atlantic City Electric	26,088	174	20	$4,198	2018-2019
Frog Pond Elementary	103,800	55001347172	AGS	ECPGNJ	Atlantic City Electric	1,065,680	3,420	355	$141,770	2018-2019
		55010623464	MGS	ECPGNJ	Atlantic City Electric	2,275	8	7	$438	2017-2018
		55006718732	Street Lighting	Plymouth Rock	Atlantic City Electric	44,341	0	0	$9,624	2017-2018
George J. Mitchell Elementary	110,600	55007529104	MGS	Atlantic City Electric	Atlantic City Electric	5,754	42	5	$1,038	2018-2019
		55005681451	AGS	Atlantic City Electric	Atlantic City Electric	907,520	3,600	340	$125,653	2018-2019
		55005680560	Street Lighting	Plymouth Rock	Atlantic City Electric	42,051	0	0	$11,799	2017-2018
		55001329642	MGS	Atlantic City Electric	Atlantic City Electric	0	0	0	$0	2018-2019
		55001329238	MGS	Atlantic City Electric	Atlantic City Electric	16	0	0	$110	2018-2019
		55001328800	MGS	Atlantic City Electric	Atlantic City Electric	61,195	426	58	$17,014	2018-2019
		55005499003	MGS	ECPGNJ	Atlantic City Electric	107,120	719	84	$16,276	2017-2018
Early Childhood Center	18,700	55005680990	AGS	Atlantic City Electric	Atlantic City Electric	147,920	791	113	$26,720	2017-2018

Natural Gas

Building Name	Square Footage	Rate	Natural Gas *Therms*	Natural Gas *Cost*	Baseline Period
District Offices	3,500	GSS	1,233	$1,294	2018-2019
Frog Pond Elementary	103,800	GSL	29,498	$32,372	2018-2019
		GSS	578	$804	2018-2019
George J. Mitchell Elementary	110,600	GSL	25,247	$27,094	2018-2019
		GSS	1,524	$1,617	2018-2019

Utility Breakdown by Building





Utility Escalation Rates

For purposes of calculating the extended value of the energy savings of this project, the following utility escalation rates have been used.

Name of School	Energy					
	Electric Consumption		Annual Electric Demand		Natural Gas	
	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation
District Offices	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Frog Pond Elementary	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
George J. Mitchell Elementary	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Early Childhood Center	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1

SECTION 3. FINANCIAL IMPACT

Energy Savings and Cost Summary

The table below provides a summary of the costs and savings associated with the measures recommended in the Energy Savings Plan. The savings have been calculated based on the savings methodology detailed throughout this report and included in the appendix of this report. Costs for each measure have been estimated based on project implementation experience and industry standards.

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
1	BOE Offices	LED Lighting Upgrade + Controls (Int. and Ex.)	$9,313	$1,348	6.9
2	Early Childhood Center	LED Lighting Upgrade + Controls (Int. and Ex.)	$35,708	$2,173	16.4
3	Frog Pond Elementary School	LED Lighting Upgrade + Controls (Int. and Ex.)	$214,449	$19,503	11.0
4	George Mitchell School	LED Lighting Upgrade + Controls (Int. and Ex.)	$204,892	$19,768	10.4
5	Frog Pond Elementary School	Building Envelope Repairs and Improvements	$49,419	$5,708	8.7
6	George Mitchell School	Building Envelope Repairs and Improvements	$90,210	$7,800	11.6
7	Early Childhood Center	Building Envelope Repairs and Improvements	$2,593	$335	7.7
8	BOE Offices	Building Envelope Repairs and Improvements	$8,220	$716	11.5
9	District Wide	District Wide Water Fixture Tuning and Diaphragm Valve Upgrade	$71,067	$8,399	8.5
10	District Wide	District Wide PC Power Management Controls	$16,000	$3,742	4.3
11	District Wide	Plug Load Controls	$27,228	$3,017	9.0
12	George Mitchell School	Single 35 kW CHP for DHW and HW	$242,000	$11,284	21.4
13	George Mitchell School Frog Pond Elementary	Kitchen Hood VFDs and Controls	$44,100	$2,329	18.9
14	District Wide	District Wide Retrocommissioning of Controls	$126,300	$27,094	4.7
15	Frog Pond Elementary School	Walk-In Cooler Improvements	$2,407	$1,446	1.7
16	George Mitchell School	Walk-In Cooler Improvements	$2,407	$1,532	1.6
17	Frog Pond Elementary School	Upgraded, High Efficiency Electrical Transformers	$91,624	$7,609	12.0
18	George Mitchell School	Upgraded, High Efficiency Electrical Transformers	$88,609	$6,814	13.0
19	Frog Pond Elementary School	Replace RTUs at Frog Pond Elementary School	$75,068	$1,932	38.9
20	BOE Offices	Replacing AC and Furnaces at BOE Offices	$73,950	$2,394	30.9

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
21	District Wide	Upgrade the Building Automation System	$196,400	$2,245	87.5
22	Frog Pond Elementary School	HVAC Coil Rejuvenation Protection (FP and GM)	$59,600	$8,715	6.8
23	George Mitchell School	HVAC Refrigerant Optimization (FP and GM)	$47,350	$6,657	7.1
24	Frog Pond Elementary School	Convert existing (3) R22 RTUs Refrigerant	$19,800	$110	180.0
25	District Wide	Construction Contingency	$235,000	$0	N/A
26	District Wide	Windows and Doors (Allowance)	$160,000	$274	583.9
		TOTALS	**$2,193,714**	**$152,944**	**14.3**

Operational Savings Estimates

The lighting retrofits recommended for this project will reduce the amount of lamps that need to be replaced each year due to the longer lasting lamps and new technology fixtures. The LED lighting recommended for the exterior fixtures will last much longer than the current high intensity discharge (HID) lighting and will generate material cost savings.

A brief description of the operational savings estimated for this project is included below. Energy Systems Group has worked with the District to quantify the exact sources of savings by going through past invoices and expenses. The operational savings will not be escalated.

Operational Savings for Financial Model	
ECM Description	**Annual Savings**
LED Lighting Upgrades – District Wide	$5,660
HVAC Upgrades / Equipment Replacement	$5,617
Totals	**$11,277**

Potential Revenue Generation Estimates

As part of the Energy Savings Plan for the Little Egg Harbor School District, several avenues for obtaining rebates and incentives have been investigated which include:

- NJ Smart Start Equipment Incentives
- Pay for Performance
- Combined Heat and Power Incentive

The estimated incentive amount for each program is listed below. Upon final selection of project scope and award of subcontractor bids, the incentive applications will be filed.

NJ Smart Start Equipment Incentives

The NJ Smart Start Equipment Incentives provide prescriptive rebates for defined retrofits. Incentives are applied on a unit-by-unit basis for making energy efficiency upgrades. The table below summarizes the equipment incentives, which will be applied for at Little Egg Harbor School District:

NJ Clean Energy Rebates	
Energy Conservation Measure	**Energy Rebate/ Incentives**
BOE Offices - Lighting Upgrades - LED	$1,203
Early Childhood Center - Lighting Upgrades - LED	$3,667
Frog Pond Elementary - Lighting Upgrades - LED	$26,087
George Mitchell Elementary - Lighting Upgrades - LED	$21,130
Frog Pond Elementary – RTU Replacements	$2,173
BOE Offices – AC Units and Furnace Replacements	$2,650
Totals	**$56,909**

Demand Response Energy Efficiency Credit

The LED Lighting Upgrades recommended for the District will be eligible for the Energy Efficiency Credit available through PJM. The Energy Efficiency Credit pays consumers based on the permanent load reduction through the installation of energy efficiency measures. The following table summarizes the available Demand Response Incentives available due to the lighting upgrades to be performed in the District.

Demand Response Energy – Emergency Capacity Credit	
PJM Payment Year	Annual Customer Capacity Benefit
2021/2022	$2,074
2022/2023	$2,684
2023/2024	$2,684
2024/2025	$2,684
Totals	$10,126

Pay for Performance Incentives

Pay for Performance incentives were investigated for this project. Due to the costs of the required energy modeling and uncertainty in available rebates it was determined that Pay for Performance investment did not fit the project well. Prescriptive incentives offer a great value with reduced risk.

Cogeneration Incentives

This project is not currently including Cogeneration Incentives to be conservative regarding Effective Full Load Run Hours requirements.

Incentive Breakout for Recommended Project

NJ Clean Energy Rebates	
Energy Conservation Measure	**Energy Rebate/ Incentives**
BOE Offices - Lighting Upgrades - LED	$1,203
Early Childhood Center - Lighting Upgrades - LED	$3,667
Frog Pond Elementary - Lighting Upgrades - LED	$26,087
George Mitchell Elementary - Lighting Upgrades - LED	$21,130
Frog Pond Elementary – RTU Replacements	$2,173
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2021/2022	$2,074
2022/2023	$2,684
2023/2024	$2,684
2024/2025	$2,684
Totals	$10,126

Business Case for Recommended Project

FORM VI - ENERGY SAVINGS PLAN

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
Project Name
ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO Name: ENERGY SYSTEMS GROUP **Project Scenario 2**

Note: Respondents must use the following assumptions in all financial calculations

(a) The cost of all types of energy should be assumed to inflate at 2.2% gas, 2.4% electric per year; anc

1. Term of Agreement: 19 years
2. Construction period² (months): 12
3. Cash Flow Analysis Format:

Total Financed Amount[4]	$	2,808,367
ESP Development	$	9,900
ESIP Implementation	$	151,366
Construction Administration	$	39,487
BC/FA	$	30,000
Total ESG Project Cost [1]	$	2,577,614

Pass | **Project Status**

Interest Rate to be used for Proposal Purposes: 2.90%

	Annual Energy Savings	Annual Operational Savings	Energy Rebates/ Incentives	Solar PPA	Total Annual Savings	Annual Project Costs	Board Costs	Annual Service Costs	Net Cash-Flow to client	Cumulative Cash Flow
Installation[3]	$ 54,824	$ -	$ -	$ -	$ 54,824	$ -	$ -	$ -	$ 54,824	$ 54,824
1	$ 156,307	$ 11,277	$ 58,465	$ -	$ 226,049	$ 222,649	$ 222,649	$ -	$ 3,400	$ 58,224
2	$ 159,743	$ 11,277	$ 2,013	$ -	$ 173,033	$ 169,633	$ 169,633	$ -	$ 3,400	$ 61,624
3	$ 163,255	$ 5,660	$ 2,013	$ -	$ 170,928	$ 167,528	$ 167,528	$ -	$ 3,400	$ 65,024
4	$ 166,844	$ 5,660	$ 2,013	$ -	$ 174,518	$ 171,118	$ 171,118	$ -	$ 3,400	$ 68,424
5	$ 170,513	$ 5,660	$ -	$ -	$ 176,173	$ 172,773	$ 172,773	$ -	$ 3,400	$ 71,824
6	$ 174,262	$ -	$ -	$ -	$ 174,262	$ 170,862	$ 170,862	$ -	$ 3,400	$ 75,224
7	$ 178,093	$ -	$ -	$ -	$ 178,093	$ 174,693	$ 174,693	$ -	$ 3,400	$ 78,624
8	$ 182,009	$ -	$ -	$ -	$ 182,009	$ 178,609	$ 178,609	$ -	$ 3,400	$ 82,024
9	$ 186,011	$ -	$ -	$ -	$ 186,011	$ 182,611	$ 182,611	$ -	$ 3,400	$ 85,424
10	$ 190,101	$ -	$ -	$ -	$ 190,101	$ 186,701	$ 186,701	$ -	$ 3,400	$ 88,824
11	$ 194,281	$ -	$ -	$ -	$ 194,281	$ 190,881	$ 190,881	$ -	$ 3,400	$ 92,224
12	$ 198,553	$ -	$ -	$ -	$ 198,553	$ 195,153	$ 195,153	$ -	$ 3,400	$ 95,624
13	$ 202,918	$ -	$ -	$ -	$ 202,918	$ 199,518	$ 199,518	$ -	$ 3,400	$ 99,024
14	$ 207,380	$ -	$ -	$ -	$ 207,380	$ 203,980	$ 203,980	$ -	$ 3,400	$ 102,424
15	$ 211,941	$ -	$ -	$ -	$ 211,941	$ 208,541	$ 208,541	$ -	$ 3,400	$ 105,824
16	$ 216,601	$ -	$ -	$ -	$ 216,601	$ 213,201	$ 213,201	$ -	$ 3,400	$ 109,224
17	$ 221,364	$ -	$ -	$ -	$ 221,364	$ 217,964	$ 217,964	$ -	$ 3,400	$ 112,624
18	$ 226,232	$ -	$ -	$ -	$ 226,232	$ 222,832	$ 222,832	$ -	$ 3,400	$ 116,024
19	$ 231,207	$ -	$ -	$ -	$ 231,207	$ 211,071	$ 211,071	$ -	$ 20,136	$ 136,160
20	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
21	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
22	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
23	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
25	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Totals	$ 3,692,439	$ 39,535	$ 64,504	$ -	$ 3,796,477	$ 3,660,317	$ 3,660,317	$ -	$ 136,160	$ -

NOTES:

1. **Includes: Hard costs and project service fees defined in ESCO's PROPOSED 'FORM V'**
2. **No payments are made by the Board during the construction period.**
3. **Installation period savings for Energy Savings and Operational Savings are guaranteed. These savings will be used in addition to the first loan payment.**
4. **Total Financed Cost includes all Fees and project costs.**
5. Interest rate is indicative rate only. Final rate will vary with market conditions at time of closing
6. ESG is an energy services and engineering company, not a financial advisor.
7. ESG is not a financial advisor and the presented cash flow proforma is for information onl
8. The cash flow shown is for illustration purposes, and is not intended as financial advice
9. Loan repayment includes interest accumulation in the construction perioc
10. Loan repayment assumes that the 1st repayment starts immediately after construction
11. The annual energy escalation are in accordance with the BPL
12. The utility incentive amount shown is typical expected and is not indicative of the actual amount as project timing, changes to utility program and availability of funds affect the outcom
13. The consultant's fee is in accordance with input from the consultant
14. M&V service and associated costs have been excluded
15. Demand Response incentives have a 75% confidence factor applied in cash flow calculations

Greenhouse Gas Reductions

AVOIDED EMISSIONS	Total Electric Savings	Total Natural Gas Savings	Total Annual Avoided Emissions
Annual Unit Savings	**1,143,745 kWh**	**5,623 Therms**	**Total**
NO_X	1,270 lbs	52 lbs	1,321 lbs
SO_2	1,121 lbs	0 lbs	1,121 lbs
CO_2	1,571,506 lbs	65,789 lbs	1,637,295 lbs

Factors Used in Calculations:

CO_2 Electric Emissions:	1,374 lbs. per MWh saved
CO_2 Gas Emissions:	11.7 lbs. per therm saved
NO_X Electric Emissions:	1.11 lbs. per MWh saved
NO_X Gas Emissions:	0.0092 lbs. per therm saved
SO_2 Electric Emissions:	0.98 lbs. per MWh saved

SECTION 4. ENERGY CONSERVATION MEASURES

Comprehensive LED Lighting Upgrades

ECM Summary


Frog Pond Elementary School Light Fixtures

Lighting Retrofit and Replacement: Most of the lighting fixtures throughout the Little Egg Harbor School District utilize older technologies that can be upgraded. Improvements to lighting will reduce electrical consumption and improve lighting levels. The costs of material to maintain the current systems will also be reduced since these renovations replace items (i.e., lamps and ballasts) that are near the end of their life cycle and/or considered environmentally hazardous.

Where appropriate, lighting levels will be adjusted to meet Illumination Engineering Society (IES) standards.

Lighting Levels: Our proposed lighting system improvements will maximize savings while maintaining or improving existing light levels in each area. All installations will comply with IES standards. Post-retrofit light levels are typically increased because of the improved design and installation of newer equipment, but areas that are currently over lit will be adjusted to maintain IES recommended light level. Before and after sample light level reading will be performed to confirm expected results.

Exterior Lighting: In an effort to reduce electricity consumption and provide better security for Little Egg Harbor School District buildings, ESG is proposing to retrofit the existing outside lighting on the buildings with newer, LED technology. In addition, every effort will be made to standardize the installed components for equipment uniformity and maintenance simplicity. Typical LED lighting system exhibit the following characteristics:

- Extremely Long Life – up to 50,000+ hours
- Highly efficient with very low wattage consumption
- Solid state lighting technology ensures that the fixtures are highly durable

Lighting Controls: Lighting controls are effective in areas where lighting is left on unnecessarily, mainly because it is a common area or due to the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in rooms that are occupied for only short periods and only a few times per day. Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed.

Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas. Lighting controls will be installed in various offices, break rooms, restrooms, and other locations where appropriate. In the next phase, ESG will perform detailed sample measurements to determine coincident lighting room occupancy and overall lighting level information to accurately determine and identify spaces suitable for lighting controls throughout each facility.

Facilities Recommended for this Measure

- BOE Offices
- Frog Pond Elementary School
- George J. Mitchell Elementary School
- Early Childhood Center

Scope of Work

- Verify availability of ambient light through detailed light level readings in the spaces
- Safely disconnect the existing lighting fixture from live circuit
- Remove existing Fluorescent Lamps
- Where necessary remove existing receptacles in the fixtures
- Remove existing ballasts
- Install the retrofit kit and install 10.5 watt LED line voltage tubes
- Reconnect all the wiring
- Test for operation
- Clean-up work area
- Properly dispose of removed material
- Provide training to staff on operation of new lighting system
- Refer to Line by Line inventory included in Appendix #6.

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method		
Baseline Energy Usage (kWh / yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh / yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh / yr)	=	Baseline Energy Usage – Estimated Energy Usage
Baseline Demand (kW)	=	Existing Fixture Watts / 1000 Watts
Retrofit Demand (kW)	=	Proposed Fixture Watts / 1000 Watts
Energy Savings (kW)	=	(Existing Fixture Watts – Proposed Fixture Watts) x 1 kW / 1000 Watts

Sample Calculation for a Classroom in the Frog Pond Elementary School

Current Hours = 1,600

Total Number of Fixtures = 12

Current Total Watts = 720

Current kWh = Hours * Watts / 1000 = 1,152 kWh

Proposed Hours = 1,112

Proposed Total Watts = 252

Proposed kWh = Hours * Watts / 1000 = 280 kWh

kWh Savings = Current kWh – Proposed kWh = 1,152 kWh – 280 kWh = 872 kWh

kW Savings = (Current Watts – Proposed Watts)/1000 = (720W – 252 W)/1000 = 0.468 kW

Maintenance

Lighting will need to be routine maintenance to ensure that devices/fixtures a clean and in working condition.

Benefits

- Electrical energy savings
- Improved exterior light quality
- Reduction in maintenance of exterior lighting system
- Improved safety around school perimeter
- Reduced lamp replacement for 5 to 10 years for LEDs

Install Kitchen Hood Controls

ECM Summary

In this measure we examined optimizing kitchen hood operation through TEL Kitchen Control System (or equal) control system. The proposed system is designed for commercial kitchen ventilation systems and can save fan energy by improving the efficiency of the hoods.

This measure includes converting the existing Constant Air Volume (CAV) kitchen hood systems to a Demand Control Ventilation (DCV), Variable Air Volume (VAV) system. This will be accomplished through the installation of TEL microprocessor based kitchen control system on the exhaust fan that serves the exhaust hoods in the kitchen. The TEL controls system utilizes temperature and IR sensors automatically regulate exhaust fan speed (via new VFD) based on cooking load, smoke dispersion, time of day and hood temperature.

Facilities Considered for this Measure

- George Mitchell Elementary School
- Frog Pond Elementary School

Scope of Work

George Mitchell Elementary School

- Provide and install the following:
    - (2) Single hood controller, 3 duct temp sensor, 2 room temp sensors, 3 IR kits, 2 controllers, 2- 7 day time clocks, 2 pre-wired terminal rails, relays, power supplies, 2 – 6A circuit breaker, 2 - door mounted display / configuration units, 2 – door mounted live indicators, 2 - door interlocked isolator, ABS enclosure and UL listed.
    - (2) VFD – for Exhaust Fan – ABB - ACS 310 with smart key pad and NEMA 1 enclosure
- Provide project engineering, project management, start-up, commissioning and O&Ms

Clarifications:

- All wire below ceiling will be housed in conduit.
- All low voltage wire above ceiling will be plenum rated and not housed in conduit.
- Assumes all motor starters are within 50’ of kitchen and VFD’s can be mounted indoors.
- Assumes existing motors are inverter duty rated
- Payment and Performance Bond are not included
- Hazardous Materials abatement not included
- Sales Tax not included
- Stamped Drawings not included

Savings Methodology

Energy Savings for a Kitchen Hood Demand Controlled Ventilation (KDCV) System are estimated with an hourly simulation of the air handling systems serving the space. Local weather is simulated by using hourly data from the Typical Meteorological Year (TMY3) weather file from the closest, or most representative location. Operation of the air conditioning process is then simulated, step by step through the system, until the air is exhausted from the space.

The calculation models each “system” independently, and models the Pre- and Post- scenarios separately. The exact makeup of a system can vary, but it’s typically effective to consider a system to be all the equipment associated with either a single supply fan, or a single exhaust fan, or a single space.

In general the savings calculations are as follows:

Annual Energy Saved

$$=1.08 \times \Sigma \left[\{(CFM_{existing} \times (Ti - To)_{existing} / (HV \times \eta_H)_{exostomg}) - (CFM_{proposed} \times (Ti - To)_{propose} / (HV \times \eta_H)_{proposed})\} \times H\right]$$

Where, Ti – Indoor air temperature
To – Outdoor air temperature
H – Bin Hours at To
η_H – Heating system efficiency
HV – BTU to therm conversion factor

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

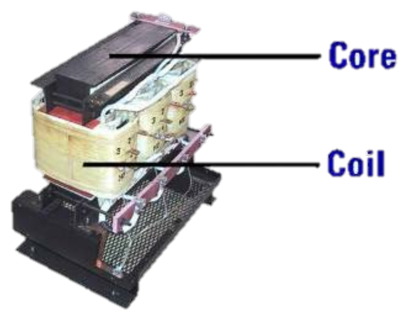
- Electrical and Natural Gas energy savings
- Quieter operation
- Reduced HVAC equipment maintenance
- Decreased grease entrapment

Transformer Upgrades

ECM Summary

The primary goal of this ECM is increased energy savings through replacement of old, inefficient transformers with new, ultra-high efficient transformers. While facilities can be unique, electrical infrastructure is almost always based on U.S. industry standard transformers. Transformers are typically purchased as part of a total electrical distribution package, installed, and forgotten for 40-50 years. The majority of these transformers are operating at a small fraction of their nameplate capacity, resulting in very low efficiency, and are producing large amounts of excess heat, resulting in energy losses and higher utility costs. In addition, half of all existing transformers, according to the Dept. of Energy, are approaching a mean time to failure of 32 years. Replacing these units prior to a sudden end of life, results in lower risk of facility down time.

For a transformer retrofit to deliver real energy savings, the losses of the new transformer must be measurably lower than those of the existing transformer. This may sound obvious, but losses of existing transformers are not widely understood in relation to actual load conditions and load profiles. Given a real world setting, estimating or “stipulating” savings using factory or industry test data/standards for either the existing or typical replacement unit would be significantly flawed.



Transformers are comprised of two major components: a steel core, and windings made of aluminum or copper.

Because transformers are in operation 24-hours/day, 365-days/year, they produce energy losses around the clock. Core losses, also known as no-load-losses, are constant. The core remains energized at all times, regardless of the % load (so losses are always the same). Coil losses, also known as load losses, vary with the load placed upon them, i.e. as load increases, as do the losses.

Code and all published data are based on performance at a 35% linear load. Therefore, almost all transformers are designed for highest efficiency under that load profile. However, this profile does not typically exist in the real world. Linear loads essentially ceased to exist with the advent of computers and VFD’s, and the average load on a transformer in 2016, across almost all verticals, is only about 13%. To reach this extreme percentile, the vast majority must be loaded at lower than 10%! Under this lower load profile, virtually all the losses are found in the core. Through the use of design and manufacturing advances, but more importantly, better materials (i.e. higher grade insulation, copper, aluminum and, most critically, steal in the core), energy efficient transformers lower resistance, producing extremely low no-load-losses and minimized load-losses.

Facilities Recommended for this Measure

- Frog Pond Elementary School
- George Mitchell Elementary School

Scope of Work

In general, most of the transformers in the buildings are original. Building age various depending on location from original construction in 1964 through the various expansions in averaging once per decade. The old, inefficient transformers will be removed and replaced with new high-efficient transformers. To the maximum extent practicable, the existing conductors and conduit will be reused. Below is the list of schools and transformer sizes, which are in the scope.

Frog Pond Elementary School

Location ID	Transformer Size (kVA)	Qty
212	225	1
112	75	1
Storage	30	1
Storage	150	1
613B	15	1
612 Electrical	30	1
612 Boiler	75	1
607C	75	1
512	30	1
411	15	1
405A	225	1
Total		**11**

George Mitchell Elementary School

Location ID	Transformer Size (kVA)	Qty
317	112.5	1
317	45	1
317	112.5	1
317	75	1
307	45	1
127	75	1
127	37.5	1
Old Boiler	50	1
Staff Lounge	50	1
Total		**9**

Savings Methodology

Savings are calculated using the following methodology for all the transformers:

Savings Calculation Methodology		
Baseline Annual losses from Transformers (kWh/yr)	=	(Baseline Transformer kW Losses (Normal Operation) x Equipment Operating hrs/ day x Equipment Operating days/yr) + Baseline Transformer kW Losses (Outside Op. hrs) x (24 x 365 - Equipment Operating hrs/ day x Equipment Operating days/yr)
Powersmith Annual losses from Transformers (kWh/yr)	=	(Powersmiths Transformer kW Losses (Normal Operation) x Equipment Operating hrs/ day x Equipment Operating days/yr) + Powersmiths Transformer kW Losses (Outside Op. hrs) x (24 x 365 - Equipment Operating hrs/ day x Equipment Operating days/yr)
Electrical Savings (kWh/yr)	=	Baseline Annual losses from Transformers – Powersmith Annual losses from Transformers

Baseline transformer losses are based on meter results from a sampling of transformers throughout the district.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

Electrical energy savings.

Refurbish Rooftop Units and Install HVAC Armor

ECM Summary

Condensing unit coils and their performance are key to the efficiency of a unit's energy performance. Coils that have deterioration, scaling, decomposition, or damage due to fin collapse consume more energy than original design. As most of the current RTUs were manufactured in 2008, they are not yet at end of life. This refurbishment will improve their performance and reverse the degradation which has occurred reducing their efficiency. It will also help protect the units going forward thereby increasing their anticipated lifespan.

HVAC Armor is a product and a service. The product is a restorative coating that is impregnated with 65% aluminum in a base of industrial grade polyurethane. This combination provides an impenetrable layer of protection that provides a heat transfer medium thus the energy savings. The service includes our stringent application procedure, to clean and strip the coil of dirt, scale and debris prior to the product application.

Facilities Recommended for this Measure

- Frog Pond Elementary School
- George Mitchell Elementary School

Scope of Work

- General cleanup of overall unit and wash-down of coils. Deep clean condenser coils to remove final materials in coils, and corrosion.
- Disassemble equipment to perform deep clean of condenser coils, removing final materials in coils and corrosion.
- Straighten aluminum fins.
- Spray each condenser coil with HVAC Armor from both outside-in and inside-out, applying even coverage.
- Assemble and ensure equipment is operating.

  Anticipated installation time can range from 3 hours to 2 days per unit depending on size. Machines will need to be powered down and locked out for the duration of the installation.

Savings Methodology

Refer to Appendix for savings calculations and methodology.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Improvement in efficiency, and saving energy consumption at the unit.
- Physical protection of coil.
- Extends life of HVAC equipment

Replacement of Rooftop Units

ECM Summary

At Frog Pond Elementary School, there are two rooftop units which have exceeded their useful lifespan. The two TRANE RTUs which serve the Gymnasium are greater than 20 years old and employ R22 refrigerant which is no longer being replaced. Due newer technologies having greater efficiency and general performance degradation over time, these units are no longer operating efficiently compared to current options. Maintenance costs over time increase as more components age and begin to fail. The appropriate solution is to replace these two units.

One of the two TRANE RTUs serving the Gym to be Replaced

Facilities Recommended for this Measure

- Frog Pond Elementary School

Scope of Work

- Evacuate and reclaim R-22 refrigerant from (2) R-22 rooftop systems
- Disconnect all electrical, gas lines, condensate lines and ducting for removal by crane
    - Old units will be removed from roof and set on flatbed trailer and hauled away to approved disposal site
- F&I new RTU's for areas as follows:
    - GYMNASIUM -
        - Qty. (1) York / JCI Model ZJ150N24 (12.5 Ton, R-410A, 240MBH Heating) high efficiency packaged gas / electric rooftop unit
        - Qty. (1) York / JCI Model ZJ180N30 (15 Ton, R-410A, 300MBH Heating) high efficiency packaged gas / electric rooftop unit
- Option included with new RTUs
    - Airside economizer with dual enthalpy control.
    - Modulating gas heat and multi-stage compressors, as applicable.
    - Return and supply smoke detectors, if required.
    - Custom curb adapters to match existing curb s to new proposed rooftop units.
    - New unit electrical disconnects
    - Reconnect gas lines to new units with new shut off valves.
    - Install new condensate drain lines at units.
    - Reconnect existing electrical power wiring to new unit disconnects provided in units.
    - Provide crane for removing and setting of new and flatbed trailer(s) for proper disposal of old RTU's.
    - Provide Pre & Post Air Balance and Testing at each unit.
    - Start up and test of new units.

Savings Methodology

Refer to Appendix for savings calculations and methodology.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Improvement in efficiency, and saving energy consumption at the unit
- Reduced maintenance costs

Convert Existing R22 RTUs Refrigerant

ECM Summary

One of the three RTUs currently using R22 refrigerant to be retrofit

At Frog Pond Elementary School, there are several rooftop units still use R22 refrigerant. As of January 1st, 2020, production and import of R22 will be illegal in the United States. While this doesn't outlaw the use of units with R22 refrigerant, it does mean that the ability to obtain more R22 in the future will become much more difficult and considerable more expensive. Two of the units, those serving the gym, are being replaced due to age. However, there are another 3 units which still have a lot of life left. In avoid future problems in obtaining refrigerant for repairs, the units will be converted to a new, more readily available type.

Different types of refrigerants have very different operating temperatures and pressures. This means replacing one for another is generally very difficult as it requires a large investment to replace multiple components of the refrigeration system. Bluon R-458A was designed specifically to be a direct replacement for R22. It doesn't require any replacement of mechanical components and maintains the same system efficiency. It is warrantied by the manufacturer and is EPA SNAP-listed. This allows for the RTUs to stay in place while ensuring long term maintenance costs don't skyrocket.

Facilities Recommended for this Measure

- Frog Pond Elementary School

Scope of Work

- Evacuate and reclaim R-22 refrigerant from (3) R-22 rooftop systems
- The RTUs will be recharged with Bluon refrigerant
- Systems will be tested and operation confirmed

Savings Methodology

Refer to Appendix for savings calculations and methodology.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Reduced lifetime maintenance costs

Retro-commissioning Study & HVAC Improvements

ECM Summary

Due to the complexity of today's HVAC systems and controls, it is likely for systems to be operating incorrectly or not as efficiently as they could be. Retro-commissioning studies reveal hidden deficiencies and highlights operational & maintenance (O&M) issues that could have been avoided as well as exposes hidden control system problems. There are valuable benefits to retro-commissioning in existing buildings. It is a detailed and specialized process that reviews how an HVAC system is controlled and designed to operate. Applying retro-commissioning to existing facilities includes planning, discovering root causes of inefficiencies, development of a cost-effective project delivery and a focus on optimizing value to the building owner. The study includes functional system testing under various modes, such as heating or cooling loads, occupied and unoccupied modes, varying outside air temperature and space temperatures. Examples of noted deficiencies include building schedules which do not match occupancy, temperature setpoints, particularly on the VRF units, which are set well outside of ASHRAE guidelines, and economizers which aren't being used effectively.

This is a systematic process to ensure that the building energy systems perform interactively according to the original design intent and the current operational needs of the facility. Retro-commissioning is a common practice recommended by the American Society of Heating Refrigeration and Energy (ASHRAE) to be revisited every couple of years. We recommend that an engineering firm who specializes in energy control systems and retro-commissioning be contacted for a detailed evaluation and implementation costs. Facility operations personnel would work with the engineers to develop goals and objectives. During on-site testing, the qualified personnel conducting the study would immediately make any no/low cost improvements as identified. Furthermore, any suggested corrective actions which require the purchase of material, a contractor who specializes in that scope of work would be contacted to implement the remaining improvements.

Facilities Recommended for this Measure

- BOE Offices
- Frog Pond Elementary
- George Mitchell Elementary
- Early Childhood Center

Scope of Work

<u>Task 1: Site Visit to define RCx plan</u>
This Task will include a kick-off meeting on site with all parties to review project scope, deliverables, schedule, required information and safety/ security procedures.
Following the Kick-off meeting each school bill be visited (based on a mutually agreed upon schedule) and become familiar with the operations and maintenance of the existing HVAC equipment and controls. This will be accomplished by observing controls operation, staff interviews and review of any original design documentation available. HVAC equipment includes RTUs, ventilators, and boilers.

Upon completion of the site investigations, a Retro-Commissioning plan will be written outlining the recommended changes needed to correct noted deficiencies and to bring existing equipment and controls to the original design operating sequences. This task would include providing a budget estimate for the recommended repairs and estimated energy savings.
Deliverables
• Kick-Off Meeting Minutes.
• Retro-Commissioning Plan- Existing Equipment – PDF Format.

Task 2: Retro-Commissioning of Existing Equipment
This will include the actual retro-commissioning activities of the deficiencies identified in Task 1. General activities will include point-to-point controls verification and calibration adjustments, adjustments to current sequences and schedules to optimize equipment performance, and identification of broken valves, belts, damper actuators, damper linkages, clogged coils and filters. This task may require Testing and Balancing of air and water flows, which would be additional services.

Deliverables
• Retro-Commissioning Deficiencies Log (Interactive- Excel based).
• Cost Estimate.

Task 3: Prepare Commissioning Plan for New Equipment
This task would include developing a Commissioning Plan for the proposed equipment and controls. Specifically, the plan would include the Owner's Project Requirements (OPR), identify all responsible parties and their roles in the commissioning process, pre-functional checklists and functional checklists. This plan would also identify maintenance and operations procedures and required staff training. The Commissioning plan is based upon the Engineered Design documents, OPR and approved submittals, including the Temperature Controls Sequence of Operations. The plan is to be part of the contact documents that are to be used for bidding/ procuring.

Deliverables
• Commissioning Plan – New Equipment- PDF Format.

Task 4: Commissioning of New Equipment
This task will include the actual Commissioning of the new equipment. General activities include review of approved submittals, documenting start-up procedures, witnessing the demonstration of the new equipment and controls and verifying that the equipment and controls function in accordance with the approved Engineered Designs. The installing contractor(s) shall be responsible for completing and submitting the pre-functional checklists and any manufacture's start-up checklists. All operational deficiencies will be compiled and distributed to the responsible parties using a living document (Excel based) until all deficiencies are either verified as corrected or resolved.

Deliverables
• Commissioning Deficiencies Log (Interactive- Excel based).

Task 5: Prepare Final Reports
This Task includes the preparation of final RCx and Cx reports. The reports table of contents typically includes:
• Executive Summary
• Project Summary
• RCx and Cx Plans
• Deficiency logs
• Operations and Maintenance requirements
• Training Requirements

• Recommendation for Improvements
• Appendices (Site Photos, correspondence, Cost Estimates and Energy Savings Calculations Completed Pre-Functional checklists, Competed Start-up Reports Completed Functional Checklists)

Deliverables
• Final Commissioning and Retro-Commissioning Report, PDF format.

<u>Assumptions</u>
1) RCx and Cx Tasks will not include:
- Lighting and lighting controls.
- Building Envelop.
- Kitchen Equipment.
- Water Consuming Equipment.
- Computer / plug load management.

2) RCx Task 2 scope of work and fee will be re-evaluated after Task 1 is complete.
3) Provide functional testing for 30% of each type of HVAC equipment for RCx tasks.
4) Provide functional testing for 100% of each type of HVAC equipment and controls for Cx tasks.
5) Building equipment access will be granted during scheduled RCx/Cx tasks and CHA employees will have escorts as needed.
6) Retro-commissioning will use original design criteria as a benchmark for final operation.
7) Building Energy Management Controls vendors and/or School Personnel knowledgeable in the operation and manipulation of the controls systems will be present during scheduled RCx/ Cx Tasks.
8) New HVAC equipment and controls will be fully operational and fully tested by the installing contractors prior to Cx (point to point verification by others).
9) Existing HVAC equipment to receive RCx testing will be operational to the fullest extent possible.

Savings Methodology

Savings Calculation Method		
Cooling Savings (kWh)	=	Stipulated Savings % * Total Annual Electrical Usage
Heating Savings (Therm)	=	Stipulated Savings % * Total Annual Natural Gas Usage

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric and Natural Gas savings

Building Envelope Upgrades

ECM Summary

Infiltration drives energy costs higher by allowing unconditioned outside air to enter the building, thus adding to the building load and causing additional unnecessary heating and cooling loads. All Little Egg Harbor School District buildings were surveyed in order to identify potential improvements for outside air infiltration reduction. The main observations are listed below:

- Most entrance doors need weather stripping, sweeps or the closure or strike plate adjusted
- Sealant is recommended around the perimeter of several windows
- Sealing of existing attic air barrier

These deficiencies mostly reflect the skin of the buildings, which either have existed since original construction of the building, were added during some retrofit periods, or were caused by deterioration.

Facilities Recommended for this Measure

- BOE Offices
- Frog Pond Elementary
- George Mitchell Elementary
- Early Childhood Center

Scope of Work

A building envelope audit was performed for the entire district. The results of the audit were the identification of several areas of envelope deficiency. The deficient areas were tabulated and their savings potential calculated. Building Envelope Scope drawings are listed in the Appendix.

<u>Assumptions & Exclusions</u>

- Asbestos in the Work Area – it is assumed that no comprehensive asbestos remediation project is planned; as a result, it is assumed that all of the areas of asbestos insulation that were found during BER’s on-site inspections will remain in place. Under these assumptions, work areas that are directly adjacent to likely asbestos-containing material cannot be included in the scope of work because installing the retrofit insulation would disrupt potentially hazardous material. Any work areas that are directly adjacent to likely asbestos-containing material or would potentially disrupt asbestos-containing material are excluded from the scope of work.
- Electrical Hazards – testing and/ or repair of hazardous electrical components (knob and tube wiring, open junction boxes, etc.) that are encountered are excluded from the B|E Retrofit scope of work and pricing. Others are responsible for testing and/ or repair of electrical hazards.
- Hazardous Materials – testing, remediation and/ or removal of any potentially hazardous material that is encountered is excluded from the B|E Retrofit scope of work and pricing. Others are responsible for testing, remediation and/ or removal of potentially hazardous material.

Savings Methodology

The energy savings derived from this measure are a result of the heating and cooling systems (DX cooling and boilers) not having to work as hard to achieve the desired environmental conditions. The amount of savings is dependent on the existing building conditions and the amount of air leakage under the current operating conditions.

Energy savings are based on the ASHRAE crack method calculations. If the process reveals any variation in the as-built conditions, then savings will be adjusted accordingly. Determination of air current air leakage rates is based on many factors, including:

- Linear feet of cracks
- Square feet of openings
- Stack coefficient
- Shield class
- Average wind speed
- Heating or cooling set point
- Average seasonal ambient temperatures

INFILTRATION/ EXFILTRATION SAVINGS CALCULATION METHODOLOGY

Heating Savings

			Flow Factor		$(\Delta P)^n$		A		CFM Reduction
1)	Q	=	Flow Factor	x	Wind Pressure	x	Aggregate Air Leakage Pathway Hole	=	Cubic Feet / Minute (CFM)
			Q		HDD		Fuel $/MMBTU		
2)	Savings	=	CFM	x	HDD for Location	x	Fuel Cost in $	=	Savings in Dollars
					Fuel / Mechanical Efficiency Factor				
					Efficiency Factor				

3) Savings from Air Leakage Control .... = Savings in Dollars

4) Project Investment .... = Investment in Dollars

5) Simple Payback .... = Investment / Savings

INFILTRATION/ EXFILTRATION SAVINGS CALCULATION METHODOLOGY

Cooling Savings

		Flow Factor		$(\Delta P)^n$		A		CFM Reduction
1) Q	=	Flow Factor	x	Wind Pressure	x	Aggregate Air Leakage Pathway Hole	=	Cubic Feet / Minute (CFM)
		Total Heat Constant		CFM Reduction		Enthalpy		Tons
2) Tons	=	4.5	x	CFM Reduction	x	Enthalpy Value	=	Tons
				12,000				
				BTU Hour per Ton				
3) kWh Savings	=	Tons		kW per Ton		Cooling Hours		kWh
		Tons	x		x	Cooling Hours for Location	=	kWh
4) Savings	=	kWh		Fuel Cost/kWh				
		kWh Savings	x	Fuel Cost in $	=	Savings in Dollars		
5) Savings from Air Leakage Control				....			=	Savings in Dollars
6) Project Investment				....			=	Investment in Dollars
7) Simple Payback				....			=	Investment / Savings

THERMAL INSULATION SAVINGS CALCULATION METHODOLOGY

Heating and Cooling Savings

1) Pre-retrofit Heat Loss

		U-Value		ΔT		A		
Heat Loss	=	Existing U	x	HDD (or CDD) *24 hrs/day * 0.75	x	Surface Area	=	Pre-retrofit Heat Loss in MMBtu
				1,000,000				
				Convert MMBtu				

		MMBtu		$ / Unit		Efficiency		
Heat Loss	=	Pre-Retrofit Heat Loss in MMBtu	x	Cost / MMBtu	x	Heating Efficiency Factor	=	Pre-retrofit Heat Loss in $

2) Post-retrofit Heat Loss - Same Calculations as Above = Post-retrofit Heat Loss in $

		#1 Result		#2 Result		
3) Savings	=	Pre-retrofit Loss	-	Post-retrofit Loss	=	Savings in Dollars

4) Project Investment .... = Investment in Dollars

5) Simple Payback .... = Investment / Savings

Maintenance

After the building envelopes have been improved, operations and maintenance should be reduced, due to improved space conditions and lower humidity during the cooling season. The maintenance staff should maintain the newly installed equipment per manufacturers' recommendations. The manufacturer specification sheets will be provided for exact maintenance requirements.

Benefits

- Electrical energy savings
- Natural Gas energy savings
- Increased thermal comfort

Refrigeration Control Upgrades

ECM Summary

Two of the schools in the Little Egg Harbor School District contain walk-in freezers and walk-in coolers. These units are controlled by a dry bulb temperature and as a result run continuously throughout the year. Installing an eTemp control retrofit was assessed. The refrigeration systems usually monitor circulating air temperature in order to decide when to switch on and off. The circulating air temperature tends to rise far more quickly than the food temperature, and as result, the refrigeration unit works harder than necessary to maintain stored products at the right temperature. This, in turn, leads to excessive electricity consumption and undue wear and tear on the equipment. With eTemp, the thermostat regulates the refrigeration temperature based upon product temperature rather than air temperature, thereby maintaining product at the proper temperature. Savings is a result of reduced frequency of the compressor cycles, which are now based on food temperature rather than volatile air temperature. The equipment present in the middle school are shown in the table below.

Facilities Recommended for this Measure

- Frog Pond Elementary
- George Mitchell Elementary

Scope of Work

- Furnish and install one (1) eTemp on the following locations.
- Fit eTemp to the thermostat sensor that controls the compressor.
- Provide start up and warranty.
- Provide training for maintenance personnel.

Building	Type	Quantity
Frog Pond	Walk-In Freezer	1
	Walk-In Cooler	2
George Mitchell	Walk-In Freezer	1
	Walk-In Cooler	2

Savings Methodology

Savings are calculated using the following methodology:

Energy savings will result from reducing the compressor cycling. In general, ESG uses the following approach to determine savings for this specific measure:

Savings Calculation Method		
Pre - kW	=	Compressor (HP) x 0.746 x Pre Cycles/hr
Post - kW	=	Compressor (HP) x 0.746 x Post Cycles/hr
Summer Season Hrs (Hs)	=	Total Hrs/yr x 55%
Winter Season Hrs (Hw)	=	Total Hrs/yr x 45%
Compressor Summer Cycling (% On) (Cs)	=	55%
Compressor Winter Cycling (% On) (Cw)	=	45%
Compressor Summer Operating (Hrs)	=	Hs x Cs
Compressor Winter Operating (Hrs)	=	Hw x Cw
Savings (kW)	=	Pre – Post (KW)
Savings (kWh)	=	(Compressor Summer Operating (Hrs)+ Compressor Winter Operating (Hrs)) x (Pre – Post (KW))

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electrical energy savings

Plug Load Controls

ECM Summary

Office equipment is regularly left in the 'on' state at all times allowing the individual machine to revert to the 'Sleep' mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.

Facilities Recommended for this Measure

- BOE Offices
- Frog Pond Elementary
- George Mitchell Elementary
- Early Childhood Center

Scope of Work

Energy Systems Group recommends utilizing specialty wall sockets from BERT that have software to track real-time electrical usage of your appliances. The software also allows you to use your web browser to view this usage and automatically turn on/off any and all appliances plugged into these outlets.

BOE Offices

Device Type:	Baseline Hours ON:	# of BERTS
Medium Printer	8760	4
Large Printer/Copier	8760	1
H/C Water Dispenser	8760	1
Electric Water Heater	8760	1
TOTAL		**7**

Frog Pond Elementary

Device Type:	Baseline Hours ON:	# of BERTS
Projector	8760	34
Projector/Smartboard Combo	8760	7
Charging Cart	8760	22
Medium Printer	8760	14
Large Printer/Copier	8760	3
Snack Vending	8760	1
Soda Vending	8760	1
Large Coffeemaker	8760	1
H/C Water Dispenser	8760	2
Electric Hot Water Heater	8760	2
TOTAL		**87**

George Mitchell Elementary

Device Type:	Baseline Hours ON:	# of BERTS
Projector	8760	12
Smartboard TV	8760	39
Charging Cart	8760	2
Small Printer	8760	0
Medium Printer	8760	14
Large Printer/Copier	8760	1
Snack Vending	8760	1
Soda Vending	8760	1
Large Coffeemaker	8760	1
H/C Water Dispenser	8760	1
Electric Hot Water Heater	8760	7
TOTAL		**79**

Early Childhood Center

Device Type:	Baseline Hours ON:	# of BERTS
Projector	8760	9
Smartboard TV	8760	3
Medium Printer	8760	2
Snack Vending	8760	1
Electric Hot Water Heater	8760	1
TOTAL		**16**

Savings Methodology

Savings are calculated using the following methodology for all devices plugged in:

Savings Calculation Methodology		
Baseline Energy Usage (kWh / yr)	=	Average kW x Baseline Weekly Hours x 4.348 wks/mo. x Months/yr
Proposed Energy Usage (kWh/ yr)	=	Average kW x Proposed Weekly Hours x 4.348 wks/mo. x Months/yr
Electrical Savings (kWh/ yr)	=	Baseline Energy Usage – Proposed Energy Usage

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electrical energy savings

Cogeneration (CHP)

ECM Summary

Energy Systems Group proposes to install one (1) 35 kW cogeneration machine at George Mitchell Elementary to supply electricity and heat to the building, which will offset a portion of the boiler load. The recovered heat will be rejected into the boiler hot water heating system and domestic hot water system.

Location: There is ample space behind school where the service driveway is. The unit will be installed outside with wall penetrations going to the boiler room. The radiator, which will reject the excess heat, will be installed on the unit. The radiator location must be verified and agreed upon with Little Egg Harbor School District.

Example of Typical CHP Unit

Facilities Recommended for this Measure

- George Mitchell Elementary School

Scope of Work

New YANMAR 35 kW system will be located next to existing boilers on concrete pad with module, etc.

New Installation Work:

Furnish & Install (1) Yanmar Model CP35D1 (35kW) using natural gas. The high-efficiency generator provides 35kW of electrical power. The engine heat is captured and heats water at a rated temperature of 176°F for immediate use or storage in your facility.

- Natural gas fired CHP unit with heat rejection system
- F&I new gas piping to CHP unit from main gas meter bank.
- F&I new insulated hot water piping overhead from Yanmar CHP pump module to heating hot water system piping and heat rejection system.
- F&I new electrical power from Yanmar CHP unit to building electrical main switchgear.

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method	
Energy:	35 kW/module x 1 module(s) x 1 net after "parasitic losses"
	= 35 net kW output x $/kWh avg. displaced energy x run hours
Demand :	35 kW/module x 1 module(s) available x 1 net after "parasitic losses"
When Heat Used to Displace Boiler Gas Use:	$\frac{\left(\frac{Th}{hr\ module}\right)\ x}{boiler\ efficiency}\ x\ 1\ modules\ x\ \$/\text{Th boiler gas rate}$

Maintenance

Follow manufacturers' recommendations for preventative maintenance.

Benefits

- The installation of a cogeneration unit will result in significant economic benefits to the overall ESIP program. These benefits include:
  - Up to 20-year financing term.
  - High efficiency generation of electricity and heating

Replace AC and Furnaces at the Board of Education Offices

ECM Summary

The furnaces and AC units at Board of Education Offices are nearing the end of their useful life. As existing both systems age, they typically experience a loss in efficiency as well as an increase in maintenance costs. This measure will include replacing these units with new, higher efficiency models.

The existing furnaces are standard efficiency models that operate at a nameplate value of around 80% thermal efficiency. This measure will include the installation of new units to replace these aging, lower efficiency ones. New furnaces are available that operate at efficiencies up to 90%.

The existing AC units serving the offices have a Seasonal Energy Efficiency Ratio (SEER) value of 10. This measure will include the installation of new units to replace the old. New AC systems can have a SEER value as high as 21.

Typical AC Units Outside of BOE Offices

Facilities Recommended for this Measure

- BOE Offices

Scope of Work

Demolition and Removal Work

- Drain, disconnect hot water piping, gas piping, and electrical and properly disposing of existing gas fired domestic hot water heater.

New Installation Work

• Furnish & Install (F&I) Qty. (4) DX horizontal cased cooling evaporator coils with TXV's.

• F&I Qty. (4) (2.5 Ton, R-410A, 16/17 SEER) high efficiency condenser units set on new concrete baes.

• F&I Qty. (4) high efficiency horizontal gas fired furnaces.

• F&I Qty. (4) New sets of insulated copper refrigerant lines to connect new outdoor to new indoor equipment. Install pipe covering on outside of building.

• F&I (1) Zone Damper

• F&I (4) Honeywell F50 (Pleated Media) high efficiency air filters.

• F&I new PVC combustion and intake vent piping up through roof according to manufacturer's instructions.

• F&I new concentric vent kits with new adjustable roof flashings.

• F&I new custom fabricated sheet metal supply duct transitions from existing supply and return ducting to new evaporator coil and furnace filter. New duct fittings will be sealed at all joints and internally lined with 1” duct liner to attenuate air velocity noise.

• F&I new low voltage control wiring from thermostat location and from furnace to condenser units.

• Reconnect high voltage wiring to new furnace and condenser unit disconnect switches.

• Reconnect gas lines to new furnaces with new shutoff valves.

• Provide Pre & Post air balance testing of systems.

• Start up and test all new systems.

Savings Methodology

Savings Calculation Methodology		
Existing DHWH Efficiency	=	Existing Heat Production/ Existing Fuel Input
Proposed DHWH Efficiency	=	Proposed Heat Production/ Proposed Fuel Input
Energy Savings	=	Heating Production (Proposed Efficiency – Existing Efficiency)

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Natural gas savings
- Electricity Savings

Replace Building Automation System

ECM Summary

The currently installed Building Management System (BMS) is an old Direct Digital Control (DDC) system. It has begun having serious issues where equipment is no longer communicating properly with equipment as well as other issues. In addition, the control BAS does not control all of the equipment in the district. Of the 4 buildings, only Frog Pond Elementary and George Mitchell Elementary are included leave both the BOE Offices and the Early Childhood Center without monitoring or remote control.

This ECM includes replacement of the District's current control system for the HVAC equipment with a new, state-of-the-art BAS. With the system, the District will be able to both monitor and control the HVAC equipment in all 4 of the buildings. The improvements will help conserve energy, reduce temperature complains, and aid in facility staff to maintain and troubleshoot future issues with HVAC equipment.

Facilities Recommended for this Measure

- BOE Offices
- Frog Pond Elementary
- George Mitchell Elementary
- Early Childhood Center

Scope of Work (General)

District BMS Infrastructure

1. ADX server
    a. Provide ADX5 server software for virtual server setup
        i. Virtual server, OS, anti-virus and SQL is by others
    b. Graphics and alarming and trending
    c. Provide 42" monitor
2. Training
    a. Provide 8 hours of staff training

Scope of Work (BOE Offices)

1. Network Engine
    a. Provide, mount and wire Network Engine with UPS
2. AC Split Systems (typ. 4)
    a. Provide, mount and wire TEC thermostat/controller
    b. Wire BACnet MSTP to router/NAE
3. Zone Damper
    a. Provide, mount and wire TEC thermostat/controller
    b. Wire BACnet MSTP to router/NAE
4. Building Utility Meter (typ. 2)
    a. Wire BACnet MSTP to router/NAE
    b. Meter and meter install is by others. Meter is to be BACnet MSTP capable

Scope of Work (Frog Pond Elementary)

1. Network Automation Engine
    a. Provide, mount and wire Network Engine with UPS
    b. Integrate existing network controllers
2. Building Utility Meter (typ. 2)
    a. Wire to new Network Automation Engine
    b. Meter and meter install is by others. Meter is to be BACnet MSTP capable

Scope of Work (George Mitchell Elementary)

1. Network Engine (typ. 2)
    a. Provide, mount and wire Network Engine with UPS
    b. Integrate existing controllers
2. Building Utility Meter (typ. 2)
    a. Wire to new Network Engine
    b. Meter and meter install is by others. Meter is to be BACnet MSTP capable
3. Ductless Mini Splits (typ. 7)
    a. Provide, mount and wire TEC thermostat/controller
    b. Wire to new Network Automation Engine

Scope of Work (Early Childhood Center)

1. BACnet Router
   a. Provide, mount and wire BACnet router to connect to new NAE bus
2. Heat Pumps (typ. 16)
   a. Provide, mount and wire TEC thermostat/controller
   b. Wire BACnet MSTP to router/NAE
3. Building Utility Meter (typ. 2)
   a. Wire BACnet MSTP to router/NAE
   b. Meter and meter install is by others. Meter is to be BACnet MSTP capable

Savings Methodology

See savings calculations provided in Appendix.

Maintenance

The maintenance staff should maintain the newly installed equipment per manufacturers' recommendations. The manufacturer specification sheets will be provided for exact maintenance requirements.

Benefits

- Electric and fuel energy savings

District Wide Water Fixture Tuning and Valve Upgrades

ECM Summary

Throughout the district, the primary consumption of water is from toilets and sinks used by students and staff. In order to reduce water use, two strategies will be employed. First, water hardware will be upgraded or replaced where applicable. For sinks, the installation of an aerator helps reduce the amount of water needed while still ensuring effectiveness by more efficiently dispersing the water. Sinks that don't currently have one will have an aerator installed, where applicable, and sinks with one already will be inspected for condition to determine if a replacement is warranted.

Sink Located in the George Mitchell Elementary School

For toilets, it is dependent on the type in use. For tank toilers, the fixture will be retrofitted such that each flush uses less water while still properly eliminating waste. For tank-less toilets, the measure is to replace the valve. Over time, the valve which is used to flush the toilet begins to wear out as the consumable diaphragm begins to degrade. This leads to more water than is required to be used until the diaphragm fails completely. Replacing the valve will bring each fixture back up to proper working condition. Additionally, water usage per flush changes based on the water pressure available. The rated water usage changes if the water pressure in the building is higher or lower than the default manufacturer specification. The new valves will be tuned based on the pressure to ensure the finished toilet flushes with the specified flow amount.

Facilities Recommended for this Measure

- BOE Offices
- Frog Pond Elementary
- George Mitchell Elementary
- Early Childhood Center

Scope of Work

- Toilets
  - Furnish and Install (144) new Toilet Valves
  - Furnish and Install (86) Spud and Flushtubes
  - Furnish and Install (36) Fill Valves and Flappers to retrofit Tank Toilets
- Sinks
  - Furnish and Install (251) Vandal Resistant Flow Controls Aerators
- Retro-commission existing fixtures and adjust flows rates based on water pressure to ensure proper water consumption

Savings Methodology

See savings calculations provided in Appendix.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Reduce water consumption

PC Power Management

ECM Summary

Computers are used throughout the district for both district and educational purposes. PCs consume power when in use but also when sitting idle. At the end of each day, most computer will be left on and for the rest of the day and overnight until school begins the next day, the computer will continue to consume electricity.

Working in conjunction with district IT, PC Power Management controls will be installed. These controls work by establishing a normal operating schedule that particular devices will be in use. After this period ends, software on each PC attempts to shut down the device in order to fully turn off the machine and stop consuming energy. If the computer is still in use, the user can easily stop the process. This ensures the user experience is not affected while still addressing the unwanted power use.

Facilities Recommended for this Measure

- BOE Offices
- Frog Pond Elementary
- George Mitchell Elementary
- Early Childhood Center

Scope of Work

- A total of (402) machines throughout the district will have PC Power Management software installed on them
- Schedules will be created with the assistance of both IT personnel and district staff to ensure the most accurate usage model is employed

Savings Methodology

See savings calculations provided in Appendix.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Reduce electricity consumption

Construction Contingency

ECM Summary

A construction contingency budget has been included in this project in order to account for any unforeseen costs or problems during the installation and commissioning phases. All efforts will be made to minimize this costs. At the end of the project, remaining funds will be used to complete additional work as agreed upon by the district.

Facilities Recommended for this Measure

- BOE Offices
- Frog Pond Elementary
- George Mitchell Elementary
- Early Childhood Center

Windows and Door Allowance

ECM Summary

As part of the project, an allowance has been made to replace windows and doors in the district. The work will be coordinated with district staff to allow them to prioritize which doors or/windows they would like to have replaced.

Facilities Recommended for this Measure

- BOE Offices
- Frog Pond Elementary
- George Mitchell Elementary
- Early Childhood Center

SECTION 5. MEASUREMENT AND VERIFICATION

Measurement & Verification (M&V) Methodologies

This section contains a description of the types of Measurement and Verification (M&V) methodologies that Energy Systems Group will use to guarantee the performance of this project.

They have been developed and defined by two independent authorities:

- International Performance Measurement and Verification Protocol (IPMVP)
- Federal Energy Management Program (FEMP)

There are four guarantee options that may be used to measure and verify the performance of a particular energy conservation measure. Each one is described below.

Option A – Retrofit Isolation: Key Parameter Measurement

Energy savings is determined by field measurement of the key parameters affecting the energy use of the system(s) to which an improvement measure was applied separate from the energy use of the rest of the facility. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period.

Measurement of key parameters means that those parameters not selected for field measurement will be estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter will be described in the M&V plan in the contract. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the combination of measured and estimated parameters, along with any routine adjustments.

Option B – Retrofit Isolation: All Parameter Measurement

Like Option A, energy savings is determined by field measurement of the energy use of the systems to which an improvement measure was applied separate from the energy use of the rest of the facility. However, all of the key parameters affecting energy use are measured; there are no estimated parameters used for Option B. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the measured parameters, along with any routine adjustments.

Option C – Whole Building Metering/Utility Bill Comparisons

Option C involves the use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of improvement measure, but not individually if more than one is applied to an energy meter. This option determines the collective savings of all improvement measures applied to the part of the facility monitored by the energy meter. In addition, since whole building meters are used, savings reported under Option C include the impact of any other change made in facility energy use (positive or negative).

Option C may be used in cases where there is a high degree of interaction between installed improvement measures or between improvement measures and the rest of the building or the isolation and measurement of individual improvement measures is difficult or too costly.

This Option is intended for projects where savings are expected to be large enough to be discernable from the random or unexplained energy variations that are normally found at the level of the whole facility meter. The larger the savings, or the smaller the unexplained variations in the baseline, the easier it will be to identify savings. In addition, the longer the period of savings analysis after installing the improvement measure, the less significant is the impact of short-term unexplained variations. Typically, savings should be more than 20% of the baseline energy use if they are to be separated from the noise in the baseline data.

Periodic inspections should be made of all equipment and operations in the facility after the improvement measure installation. These inspections will identify changes from baseline conditions or intended operations. Accounting for changes (other than those caused by the improvement measures) is the major challenge associated with Option C-particularly when savings are to be monitored for long periods.

Savings are calculated through analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.

Option D – Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use, most often in cases where baseline data does not exist. Such simulation models must be calibrated so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year.

Option D may be used to assess the performance of all improvement measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation in Option D allow estimates of the savings attributable to each improvement measure within a multiple improvement measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Option A and B. In this case, the system’s energy use must be isolated from that of the rest of the facility by appropriate meters.

Savings are calculated using energy use simulation models, calibrated with hourly or monthly utility billing data and/or end-use metering.

Selecting M&V Options for a Specific Project

The tailoring of your specific M&V option is based on the level of M&V precision required to obtain the desired accuracy level in the savings determination and is dependent on:

- The complexity of the Energy Conservation Measure
- The potential for changes in performance
- The measured savings value.

The challenge of the M&V plan is to balance three related elements:

- The cost of the M&V Plan
- Savings certainty
- The benefit of the particular conservation measure.

Savings can also be non-measured. If savings are non-measured, these savings are mutually agreed upon as achieved at substantial completion of the respective facility improvement measure and shall not be measured or monitored during the term of the performance contract. Non-measured energy savings are limited to no more than 10-15% of the overall project savings.

Recommended Performance Verification Methods

Energy Systems Group's performance verification methods are designed to provide the facility's administration with the level of M&V necessary to protect them from an under-performing ECM, yet have a minimal impact on the project's financial success.

The selection of the M&V methods to be used is based on the criteria as detailed by IPMVP and Energy Systems Group's experience with hundreds of successful performance contracts in the K-12, state, and local government sectors. Following is a table illustrating how the savings of the major energy conservation measures proposed for this project will be verified.

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
Comprehensive LED Lighting Upgrades	Option A: One-time pre and post-retrofit kW measurement. Burn hours agreed upon with school district.	Pre M&V: Lighting power readings will be taken on a sample of lighting fixtures. Lighting burn hours were estimated due to summer operating schedule. Post M&V: Lighting power readings will be taken on a sample of lighting fixtures. Measurements will occur once at the outset of the agreement. "Occupied" hours will be logged to account for controls implementation. Energy Savings: Energy savings will be calculated using the actual measured wattage reduction and measured burn-hours.
Kitchen Hood Control Upgrades	Non-measured: Savings are from the reduced operating hours and slower speed of the equipment.	Pre M&V: Quantity of motors and horsepower were determined in the field survey. Nameplate data was used to determine the total kW of related equipment. Post M&V: Once the installation is complete, the VFDs will be inspected to verify operation. Energy Savings: Savings are from the reduced kW load of the equipment at reduced speed.
Transformer Replacement	Non-Measured: Savings are from installing high efficiency transformers.	Pre M&V: Manufacturer's data and operating parameters will be collected on the existing transformers. The efficiency of the existing transformers will be determined through the test. Post M&V: Once the installation is completed, the new transformers will be inspected to verify if they are working properly. The efficiency of the new transformers will be determined through the test. Energy Savings: Savings are from reduced losses from installing high efficiency transformers.
HVAC Armor-Refurbish Condensing Units	Option A: Savings are from reduced electric consumption by improving efficiency of equipment.	Pre & Post M&V: Measure performance of the unit, with the following test points: • Compressor Inlet Pressure or Evaporator Reference Pressure (refrigerant)

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
		• Compressor Discharge Pressure (refrigerant) • Compressor Discharge Temperature (refrigerant). • Condenser Outlet Temperature (refrigerant) • Outdoor Air Temperature or Entering Cooling Water Temperature. Evaporator Water Inlet Temperature or Evaporator Air Return Temperature.
Replacement of Rooftop Units	Non-Measured: Savings are from installing new RTUs	Pre M&V: Manufacturer's data and operating parameters will be collected on the existing rooftop units (RTUs). The efficiency of the existing RTUs will be determined by a prior to removal. Post M&V: Once the installation is completed, the new RTUs will be inspected to verify if they are working properly. Energy Savings: Savings are from improved efficiency of the RTUs, particularly in cooling.
Convert Existing R22 RTUs Refrigerant	Non-Measured: Savings are from replacing the refrigerant	Pre M&V: Manufacturer's data and operating parameters will be collected on the existing rooftop units (RTUs). The efficiency of the existing RTUs will be determined by a prior to removal. Post M&V: Once the installation is completed, the new RTUs will be inspected to verify if they are working properly. Energy Savings: Savings are from improved efficiency of the RTUs, particularly in cooling.
Retro-Commissioning	Non-Measured: Savings are retro-commissioning the HVAC equipment to ensure they are working as expected.	Pre M&V: Accepted engineering practices / building simulations will be used to calculate energy consumption baselines. Operating parameters of the system will be verified through BAS system. Post M&V: Various control points within the building management system will be trended and/or totalized. This data will be used to verify that all control strategies are in place and functioning as intended. Energy Savings: Savings are retro-commissioning the HVAC equipment to ensure they are working as expected.
Building Envelope & Weatherization	Non-Measured: Existing envelope deficiencies will be documented based on collected field data to provide a baseline for evaluating the	Pre M&V: The magnitude of the air infiltration caused by cracks and joint deficiencies was determined by field surveys. Post M&V: The areas identified for weatherization improvements will be verified to be complete through visual inspections and as-built

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
	effectiveness of the air barrier system. Post-retrofit verifications of improvements will be documented.	documentation. A one-time infrared survey of the buildings, when seasonally appropriate, will be conducted for the M&V agreement. Energy Savings: Energy savings will be based on the ASHRAE crack method calculations. If the commissioning process reveals any variation in the as-built conditions, then savings will be adjusted accordingly.
Refrigerant Control Upgrades	Non-Measured: Savings are from the reduced electric consumption of freezers and coolers.	Pre M&V: Manufacturer's data and operating parameters will be collected on the freezer and refrigerator. Post M&V: Once the installation is completed, the walk-in box control system will be inspected to ensure proper operation. Energy Savings: Savings are from the reduced electric consumption of freezers and coolers.
Plug Load Controls	Non-Measured: Savings are from reduced electric consumption by controlling plugged equipment.	Pre M&V: Manufacturer's data of the plug load and the occupancy mode of the affected spaces will be collected during the field audit. Typical plug load is assumed to run 24 hours per day. Post M&V: The occupancy mode is assumed to be same pre and post, so the post retrofit operating hours are determined as the "occupied" hours from the pre- installation. Following the installation, a sample of sensors and correspondent equipment associated with them will be inspected to ensure the sensors are in place and operating. Energy Savings: Savings are from reduced electric consumption by controlling plugged equipment.
Combined Heat and Power	Option B: Savings are from the electric and heat provided by the cogeneration system.	Pre M&V: The baseline utility bills were analyzed to determine baseline heating and electric loads and the time that the cogeneration system is able to operate per year and the capacity of the cogeneration system. Post M&V: The electric generation output from the cogeneration system will be measured with an electric meter. The heat output from the cogeneration system will be determined by measuring the water inlet/outlet temperature and flow rate. The gas input to the cogeneration system will be measured with a gas meter. Combined, these data points will be used to verify the conversion efficiency of the cogeneration system.

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
		Energy Savings: Savings are from the electric and heat provided by the cogeneration system.
Upgrade Building Automation System	Option A: Savings are from implementing control strategies.	Pre M&V: Accepted engineering practices / building simulations will be used to calculate energy consumption baselines. Operating parameters of the system will be verified through BAS system. Post M&V: Various control points within the building management system will be trended and/or totalized. This data will be used to verify that all control strategies are in place and functioning as intended. Energy Savings: Savings are from implementing control strategies.
District Wide Water Fixture Tuning and Valves Upgrades	Option A: Savings are from implementing control strategies.	Pre M&V: Water use will be measured in sample water fixtures prior to work. Post M&V: Water use will be measured in sample water fixtures after completion of work. Water Savings: Savings are from tuning and retrofitting of water fixtures.
PC Power Management	Non-Measured: Savings are from reduced electric consumption by controlling computers.	Pre M&V: Manufacturer's data of the computer and the occupancy mode of the affected spaces will be collected during the field audit. Typical plug load is assumed to run 24 hours per day. Post M&V: The occupancy mode is assumed to be same pre and post, so the post retrofit operating hours are determined as the "occupied" hours from the pre- installation. Following the installation, a sample of sensors and correspondent equipment associated with them will be inspected to ensure the sensors are in place and operating. Energy Savings: Savings are from reduced electric consumption by controlling computers.

Measurement and Verification Services

Measurement and Verification Services will be provided in association with the guarantee provided by Energy Systems Group. The guarantee will be in effect for each year that the District elects to participate in the Measurement and Verification Services. The cost of the measurement and verification services is included in the business case in the "Annual Services" column as outlined in the table below:

Year	Annual Amount ($/Yr)
1	$87,849
Total	$87,849

ESG will provide the M&V Services set forth below in connection with the Assured Performance Guarantee.

- During the Installation Period, an ESG Performance Engineer will track Measured Project Benefits. ESG will report the Measured Project Benefits achieved during the Installation Period, as well as any Non-Measured Project Benefits applicable to the Installation Period, to Customer within 90 days of the commencement of the Guarantee Term.
- Within 90 days of each anniversary of the commencement of the Guarantee Term, ESG will provide Customer with an annual report containing:
    - An executive overview of the project's performance and Project Benefits achieved to date;
    - A summary analysis of the Measured Project Benefits accounting; and
    - Depending on the M&V Option, a detailed analysis of the Measured Project Benefits calculations.
- During the Guarantee Term, an ESG Performance Engineer will monitor the on-going performance of the Improvement Measures, as specified in this Agreement, to determine whether anticipated Measured Project Benefits are being achieved. The Performance Engineer will visit Customer regularly and assist Customer on-site or remotely, with respect to the following activities:
    - Review of information furnished by Customer from the facility management system to confirm that control strategies are in place and functioning;
    - Advise Customer's designated personnel of any performance deficiencies based on such information;
    - Coordinate with Customer's designated personnel to address any performance deficiencies that affect the realization of Measured Project Benefits; and
    - Inform Customer of opportunities to further enhance project performance and of opportunities for the implementation of additional Improvement Measures.
    - Track utility bills on a monthly basis to determine current utility rate costs and to identify any billing anomalies.
- For specified Improvement Measures, ESG will:
    - Conduct pre and post installation measurements required under this Agreement;
    - Confirm the building management system employs the control strategies and set points specified in this Agreement; and
    - Analyze actual as-built information and adjust the Baseline and/or Measured Project Benefits to conform to actual installation conditions (e.g., final lighting benefits calculations will be determined from the as-built information to reflect the actual mix of retrofits encountered during installation).
    - Confirm that the appropriate metering and data points required to track the variables associated with the applicable Improvement Measures' benefits calculation formulas are established; and

- Set up appropriate data capture systems (e.g., trend and totalization data on the facility management system) necessary to track and report Measured Project Benefits for the applicable Improvement Measure.

SECTION 6. CUSTOMER SUPPORT

Maintenance Impacts/ On-Going Service

New pieces of equipment that are installed as part of the ESIP project will be provided with the standard manufacturer warranty. Once installation of the equipment is complete, the remaining warranty period will be transferred to Little Egg Harbor School District; any warranty issues will be handled directly with the equipment manufacturer rather than with Energy Systems Group.

a) ESG subcontractors will warranty the installation for a period of 12 months, beginning at substantial completion.

b) In addition, ESG will facilitate warranty related issues for a period of 12 months, beginning at substantial completion. Extended manufacture warranties beyond the 12 month installation warranty period will be facilitated by the District.

The installation of the recommended measures will reduce the amount of emergency maintenance required by the district through the installation of new equipment; however, preventative maintenance is still required in order to ensure the correct operation of the equipment for the expected lifetime. A service agreement cannot be included as part of this project per the New Jersey Local Finance Notice 2009-11. Once the scope is finalized and bids are received, Energy Systems Group will assist the District in preparing bids for any preventative service agreement that is felt necessary for the new equipment. The service agreement will cover recommended maintenance per each equipment manufacturer. Training on the proper maintenance and operation of each piece of equipment has also been included as part of the ESIP project which will allow the District to complete the majority of maintenance and repair in-house in order to utilize District resources.

In order to ensure the District is fully capable of achieving the energy savings and fully utilizing the new HVAC and Building Automation Systems, Energy Systems Group has included training for district employees.

Energy Systems Group recommends the District go out to bid for the following 3rd party service contracts in order to achieve the continuous savings throughout the term of the Energy Savings Improvement Program:

- Cogeneration Service Agreement to allow for emergency service and preventative maintenance on the new cogeneration systems. In order to receive the incentives for the cogeneration system, a 10-year maintenance contract must be in place.

Services for Lighting, RTU replacements, RTU refrigerant conversions, AC units replacements, furnace replacements, Combined Heat and Power, Plug Load Management, PC Power Management, and walk-in freezer controller upgrades, such as filter changes and on-going maintenance can be completed by District staff.

Design and Compliance Issues

Little Egg Harbor School District will work closely with Energy Systems Group and CHA Consulting Inc. (CHA) to oversee and complete all design engineering for the purposes of public bidding of the work as well as completing construction drawings.

As part of the Energy Savings Plan development, Energy Systems Group completed a thorough analysis of the building electrical and mechanical systems including light level readings throughout the spaces. The existing light levels are typically within 10-20% of current Illumination Engineering Society (IES) recommendations, which is reasonable given the varying age of lamps throughout the District. The proposed lighting solution will continue to adhere to current IES and NJ Education Code guidelines for light levels, which in many cases may increase the current light levels to the spaces. At this time, Energy Systems Group did not observe any compliance issues in the development of this Energy Savings Plan.

Customer Risks

Asbestos reports were obtained and reviewed for all schools as part of Energy Systems Group's safety policy. If any asbestos is found during the installation of the measures, Energy Systems Group will stop work and notify the School District. Any work associated with testing or remediation of asbestos containing material will be the responsibility of Little Egg Harbor School District.

The NJ SmartStart Incentives outline the anticipated incentive amounts to Little Egg Harbor School District. Energy Systems Group does not guarantee the rebate or state incentive structure. If the programs change or the incentive amounts differ, Little Egg Harbor School District will be responsible to make up the difference in received incentives for the financing. The difference could result from over performance of energy conservation measures, other rebates/ incentives that may be available, restructuring the loan payment for years 1 and 2, or capital contributions by the District.

Public Engagement and Community Outreach

Student Engagement in ESIP Development: ESG has involved students at all levels in the energy related fields. At Little Egg Harbor Schools, we plan to expand on interests related to energy conservation throughout the district and would welcome and actively encourage student involvement in various phases of the proposed project. Furthermore, in line with our commitment, and with Little Egg Harbor's concurrence, we propose to offer presentations to Energy Clubs, including them in the process.

STEM EXPO Sponsorship: ESG has a history of sponsoring STEM programs for many school districts and Universities across the country.

Community Outreach Program: ESG is focused on creating a partnership with Little Egg Harbor School District that will extend beyond the scope of this project. Keeping the community informed and involved in the process is key to success. One way this can be achieved is thru a ***Community Scholarship Program.*** At Northern Illinois University (NIU), ESG established The **Energy Systems Group Scholarship Award in Engineering** to underscore our commitment. Established in 2001, ESG and NIU jointly select students for award of this scholarship. To date, we have awarded **$35,000** to NIU engineering students with superior academic excellence. ESG would like to establish a similar program for Little Egg Harbor School District.

ESG will seek to develop and build partnerships between The National Education Foundation (NEF) and the Little Egg Harbor School District. These partnerships were developed by ESG and the NEF, to bring engineering and engineering technology career opportunities to students through the educational programs offered by the University of Salt Lake City Utah. These programs help students who might not otherwise consider careers in these sciences or further expand the knowledge of the children who are participating in such class. In addition, this affords local colleges and Universities the opportunity to recruit future applicants from the local school boards. Some of these programs are listed below:

Student Engagement in ESIP Development: ESG has involved students at all levels in the energy related fields. At Little Egg Harbor School District, we plan to expand on interests related to energy conservation throughout the Little Egg Harbor School District campus and would welcome and actively encourage student involvement in various phases of the proposed project. Furthermore, in line with our commitment, and with Little Egg Harbor School District's concurrence, we propose to offer presentations to Energy Clubs, including them in the process.

Career Exploration, grades 11-12: Provides students with career related work experience while obtaining up to 40 hours of academic credit. The program allows students a superb opportunity to integrate classroom theory into the world of work, as well as providing career option exploration, skill development, work environment exposure, and professional contacts.

SECTION 7: IMPLEMENTATION SCHEDULE

A preliminary installation schedule for the measures implemented as part of the ESP is included below. Once final bids are received and financing of the project is complete, the installation will be finalized in much greater detail and reviewed with the team from the Little Egg Harbor School District to ensure agreement. A high-level review of the next steps in the process is shown below as well as the estimated time frame to complete each step:

- 3rd Party Engineering Approval: (Board Action) 10/14/2019
- Authorize ESP Submission to 3rd Party and BPU: (Board Action) 10/14/2019
- 3rd Party Engineering Review: 10/15/19 – 10/29/19
- Submit ESP to BPU for Review: 10/30/19 – 11/13/19
- Start Design: 10/15/19
- Financing: November 2019 – January 2020
- BOE Approval of Final BPU Approved ESP: (Board Action) 11/18/19
- Financing Authorization: (Board Action) 11/18/19
- Authorize Acceptance/Denial of M&V/Guarantee: (Board Action) 11/18/19
- Authorize Amendments to LRFP: (Board Action) 11/18/19

APPENDIX 1. ENERGY CONSERVATION MEASURES INVESTIGATED BUT NOT RECOMMENDED AT THIS TIME

ECM: Replacement of Media Center Rooftop Unit

ECM Summary

Media Center RTU at Frog Pond Elementary

As part of the rooftop replacements to be completed at Frog Pond Elementary School, a 3rd RTU was considered but ultimately rejected. The two Gym units being replaced have reached and exceeded end of life but the media center RTU is not old enough to be considered for replacement. The reason it was initially looked at was due to it using R22 refrigerant.

Instead of replacing the entire unit, along with two other RTUs, the refrigerant will instead be replaced. This achieves the desired goal of alleviating future maintenance costs as R22 becomes more difficult and more expensive to obtain.

Facilities Considered for this Measure

- Frog Pond Elementary School

APPENDIX 2. LIGHTING UPGRADES

BOE Offices

ECM No.	Quant.	Energy Conservation Measure
ID08	1	Re-Lamp 1-Lamp Incandescent or Compact Fluorescent Fixture with (1) 9 Watt Dimmable LED A Lamp.
T2UR2	2	Retrofit U-Lamp 2' Fixtures with (2) 7 Watt Line Voltage Type B LED T8 Tubes, New Socket Bar Kit and White Reflector.
T4L22	15	Retrofit 2-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L32	2	Retrofit 3-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L42	39	Retrofit 4-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L44	3	Retrofit 4-Lamp 4' Fixtures with (4) 10.5 Watt Line Voltage Type B LED T8 Tubes.
-	7	No Lighting Upgrade Specified
Total	**62**	

Frog Pond Elementary School

ECM No.	Quant.	Energy Conservation Measure
3NEL09	1	Replace Existing Fixture with New 1'x4' Strip Fixture containing (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
HE01	33	Retrofit 1-Lamp HID Fixture with (1) 16.5 Watt LED HID Lamp. Existing ballast will be disconnected.
HE03	1	Retrofit 1-Lamp HID Fixture with (1) 45 Watt LED HID Lamp. Existing ballast will be disconnected.
HE25	25	Retrofit 1-Lamp HID Fixture with (1) 45 Watt Medium E26 LED HID Lamp. Existing ballast will be disconnected.
HN115	1	Replace Existing Fixture with New 20 Watt LED Security Wallpack Fixture with 50,000 Hour L70 Rating. Includes Photocell.
HN207	1	Replace Existing Fixture with New 50 Watt LED Area-Barn Fixture with 100,000 Hour L70 Rating.
IRD24	1	Re-Lamp 1-Lamp Incandescent or Compact Fluorescent Fixture with (1) 13 Watt Wet Location LED Par38 Lamp.
ID08	2	Re-Lamp 1-Lamp Incandescent or Compact Fluorescent Fixture with (1) 9 Watt Dimmable LED A Lamp.
ID13	1	Re-Lamp 3-Lamp Incandescent or Compact Fluorescent Fixture with (3) 9 Watt Dimmable LED A Lamps.
IN18	2	Replace Existing Fixture with New 12 Watt 8-Inch LED Downlight Fixture with 40,000 Hour L70 Rating.
T211	1	Retrofit 1-Lamp 2' Fixtures with (1) 7 Watt Line Voltage Type B LED T8 Tube.
T4L22	1018	Retrofit 2-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L32	42	Retrofit 3-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L33	3	Retrofit 3-Lamp 4' Fixtures with (3) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L42	26	Retrofit 4-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L44	89	Retrofit 4-Lamp 4' Fixtures with (4) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4BL44	28	Retrofit 4-Lamp 4' Bi-Level Switched Fixtures with (4) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4EL22	28	Retrofit 2-Lamp 4' Emergency Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes and Emergency Battery Backup Kit.
T8L44	11	Retrofit 4-Lamp 8' Fixtures with (4) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T8CL22	2	Retrofit 2-Lamp 8' Fixtures (Existing 8' Fluorescent Lamp) with New Socket Bar Kit, Ballast Pan and (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
Total	**1316**	

George Mitchell Elementary School

ECM No.	Quant.	Energy Conservation Measure
9NE23	33	Provide Labor to Install 112 Watt Linear LED High Bay Fixture with 100,000 Hour L70 Rating. Includes Motion Sensor and Cage. Fixture supplied by customer.
HE01	1	Retrofit 1-Lamp HID Fixture with (1) 16.5 Watt LED HID Lamp. Existing ballast will be disconnected.
HE02	8	Retrofit 1-Lamp HID Fixture with (1) 25 Watt LED HID Lamp. Existing ballast will be disconnected.
HN72	13	Replace Existing Fixture with New 31 Watt LED Cutoff Wallpack Fixture with 100,000 Hour L70 Rating.
HN103	3	Replace Existing Fixture with New 78 Watt LED Flood Fixture with 100,000 Hour L80 Rating.
HN104	1	Replace Existing Fixture with New 129 Watt LED Flood Fixture with 100,000 Hour L84 Rating.
HN115	1	Replace Existing Fixture with New 20 Watt LED Security Wallpack Fixture with 50,000 Hour L70 Rating. Includes Photocell.
HN191	4	Replace Existing Fixture with New 23 Watt LED Canopy Fixture with 100,000 Hour L70 Rating. Includes Photocell.
HN207	1	Replace Existing Fixture with New 50 Watt LED Area-Barn Fixture with 100,000 Hour L70 Rating.
I43	24	Retrofit 2-Lamp Plug-In Compact Fluorescent Fixture with (2) 10.5 Watt Line Voltage Horizontal LED 4-Pin PL B Lamps.
I93	2	Retrofit 4-Lamp Plug-In Compact Fluorescent Fixture with (4) 17 Watt Line Voltage LED BX B Lamps.
IRD07	12	Re-Lamp 1-Lamp Incandescent or Compact Fluorescent Fixture with (1) 14 Watt Dimmable LED Par38 Lamp.
IRD22	1	Re-Lamp 1-Lamp Incandescent or Compact Fluorescent Fixture with (1) 10 Watt Dimmable LED Par30 Lamp.
ID08	20	Re-Lamp 1-Lamp Incandescent or Compact Fluorescent Fixture with (1) 9 Watt Dimmable LED A Lamp.
ID09	24	Re-Lamp 1-Lamp Incandescent or Compact Fluorescent Fixture with (1) 11 Watt Dimmable LED A Lamp.

ECM No.	Quant.	Energy Conservation Measure
ID11	5	Re-Lamp 2-Lamp Incandescent or Compact Fluorescent Fixture with (2) 9 Watt Dimmable LED A Lamps.
IN12	3	Replace Existing Fixture with New 27 Watt 8-Inch LED Downlight Fixture with 40,000 Hour L70 Rating.
IN20	11	Replace Existing Fixture with New 8.5 Watt 6-Inch LED Downlight Fixture with 40,000 Hour L70 Rating.
IRE02	10	Retrofit Existing Fixture with 17 Watt 3"x6" LED Surface-Mount Retrofit Kit with 93,000 Hour L70 Rating.
T2UR2	24	Retrofit U-Lamp 2' Fixtures with (2) 7 Watt Line Voltage Type B LED T8 Tubes, New Socket Bar Kit and White Reflector.
T4L22	822	Retrofit 2-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L32	6	Retrofit 3-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L42	38	Retrofit 4-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L44	2	Retrofit 4-Lamp 4' Fixtures with (4) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T8L44	116	Retrofit 4-Lamp 8' Fixtures with (4) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T8CL24	25	Retrofit 2-Lamp 8' Fixtures (Existing 8' Fluorescent Lamp) with New Socket Bar Kit, Ballast Pan and (4) 10.5 Watt Line Voltage Type B LED T8 Tubes.
Total	**1210**	

Early Childhood Center

ECM No.	Quant.	Energy Conservation Measure
T4L22	203	Retrofit 2-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
T4L32	1	Retrofit 3-Lamp 4' Fixtures with (2) 10.5 Watt Line Voltage Type B LED T8 Tubes.
Total	**204**	

APPENDIX 3. ENERGY SAVINGS CALCULATIONS

Energy Savings

Energy savings were calculated using an Excel based bin calculation workbook developed by Energy Systems Group; all savings calculations and field measurements will be provided electronically.

Operational Savings

New LED Fixtures

Annual operational savings are calculated based on the reduced amount of material needed for replacement of the lighting system. This is calculated by comparing the existing lifetime of the T8, HID and halogen lamps to the new lifetime of LED lighting. The calculations are based on replacements of T8 fixtures every three years, T8 ballasts every 5 years, HID lamps every 5 years and halogen lamps being replaced every 2 years. The table below highlights the various lamp types and associated replacement timing as well as total cost with replacement. These savings do not include any costs for labor to replace the bulbs or additional material needed for replacement such as lifts, replacement fixtures, new sockets, etc.

Material Type	Lifetime	Cost/ Unit
Linear fluorescent (T8)	3 years	$5
Electronic Ballast	5 years	$25
HID Lamp	5 years	$25
HID Ballast	5 years	$75
Halogen, PARs, BRs	2 years	$10
Incandescent, CFLs, MRs	2 years	$2

This methodology is used to determine the annual savings through the replacement of all lamp types with new LED lamps and fixtures. The fixture warranty associated with each of these replacements is 10 years. Operational savings have been claimed for a total of 5 years per the BPU regulations.

Mechanical Upgrades (BAS, RTU, Furnace, and AC Replacements and Retrofits)

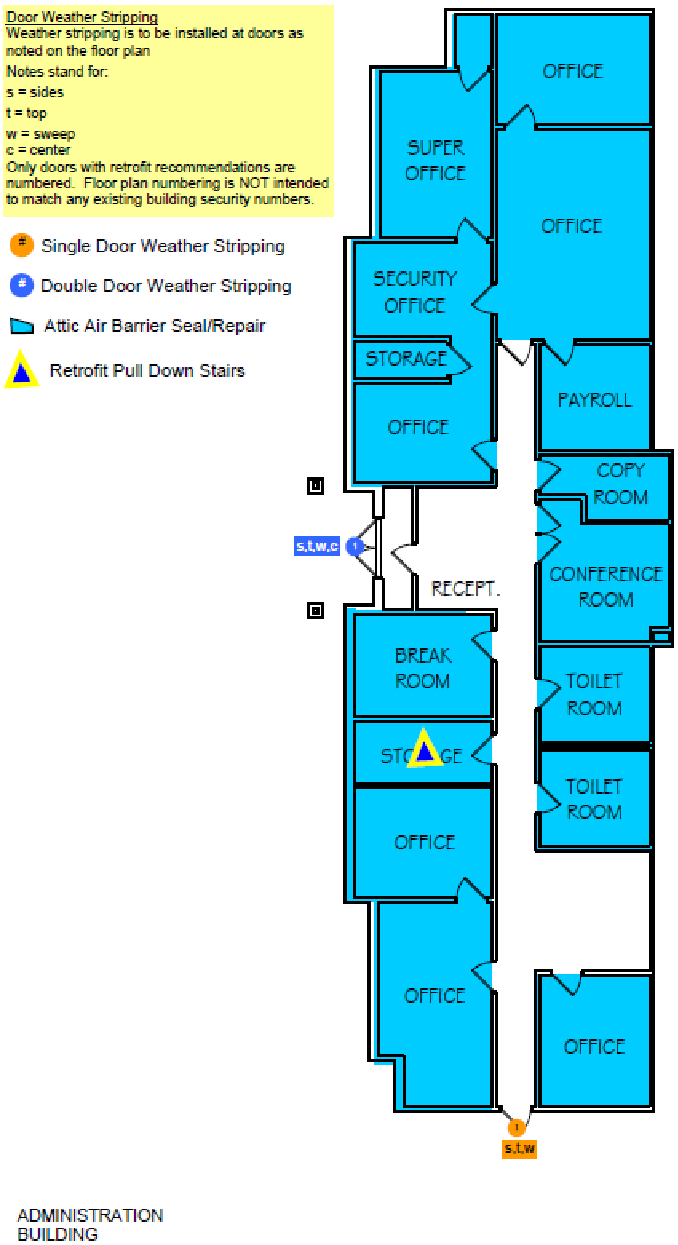
The annual operating expenses for Little Egg Harbor was provided to Energy Systems Group in order to determine the amount of emergency repair maintenance conducted annually at the District. The installation of new equipment along with manufacturers' warranties will effectively eliminate the need for these emergency repair costs. The operational savings for these measures have been claimed for 2 years per the BPU regulations.

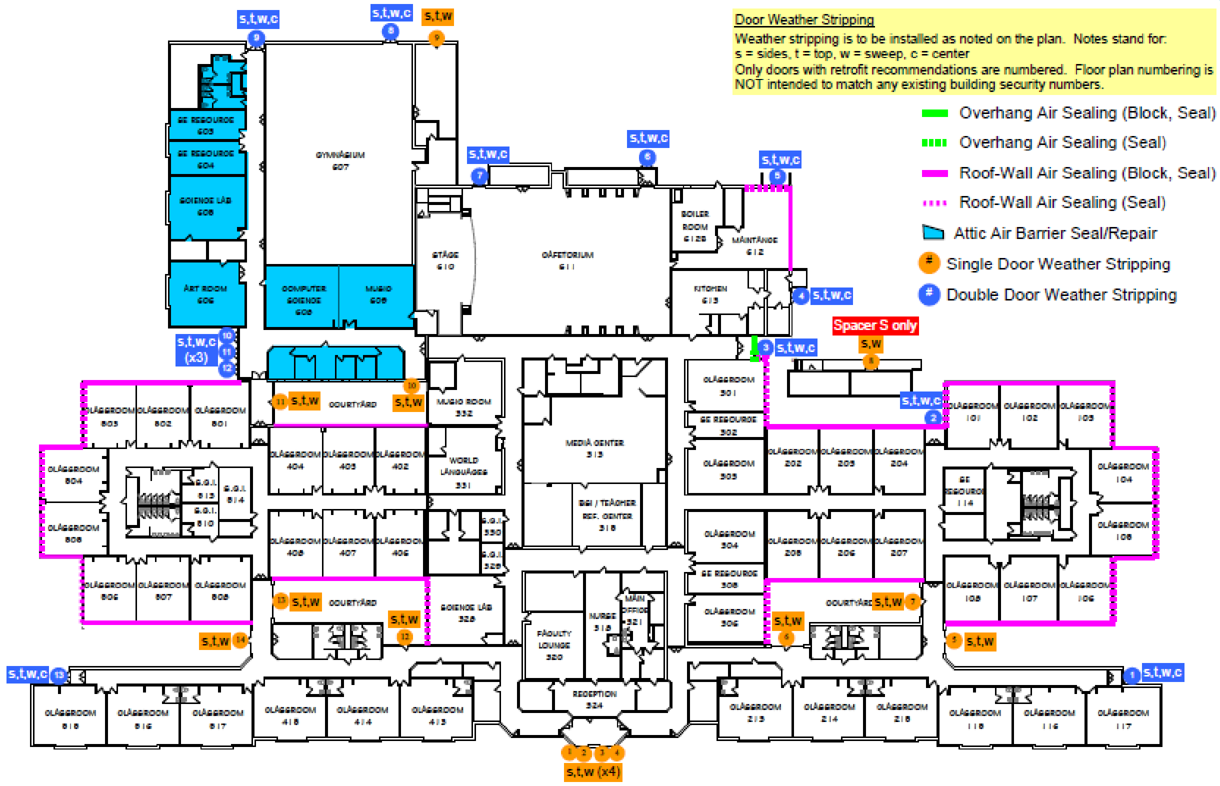
Operational Savings Summary

Energy Systems Group has worked with the District to quantify the exact sources of savings by going through past invoices and expenses. The table below summarizes the cost savings estimated from invoices provided by the District; these invoices are summarized only by the applicable ECMs and any non-recurring charge. Any preventative maintenance or service contracts that will remain were not factored into this analysis. The complete list of invoices is provided electronically. The operational savings will not be escalated.

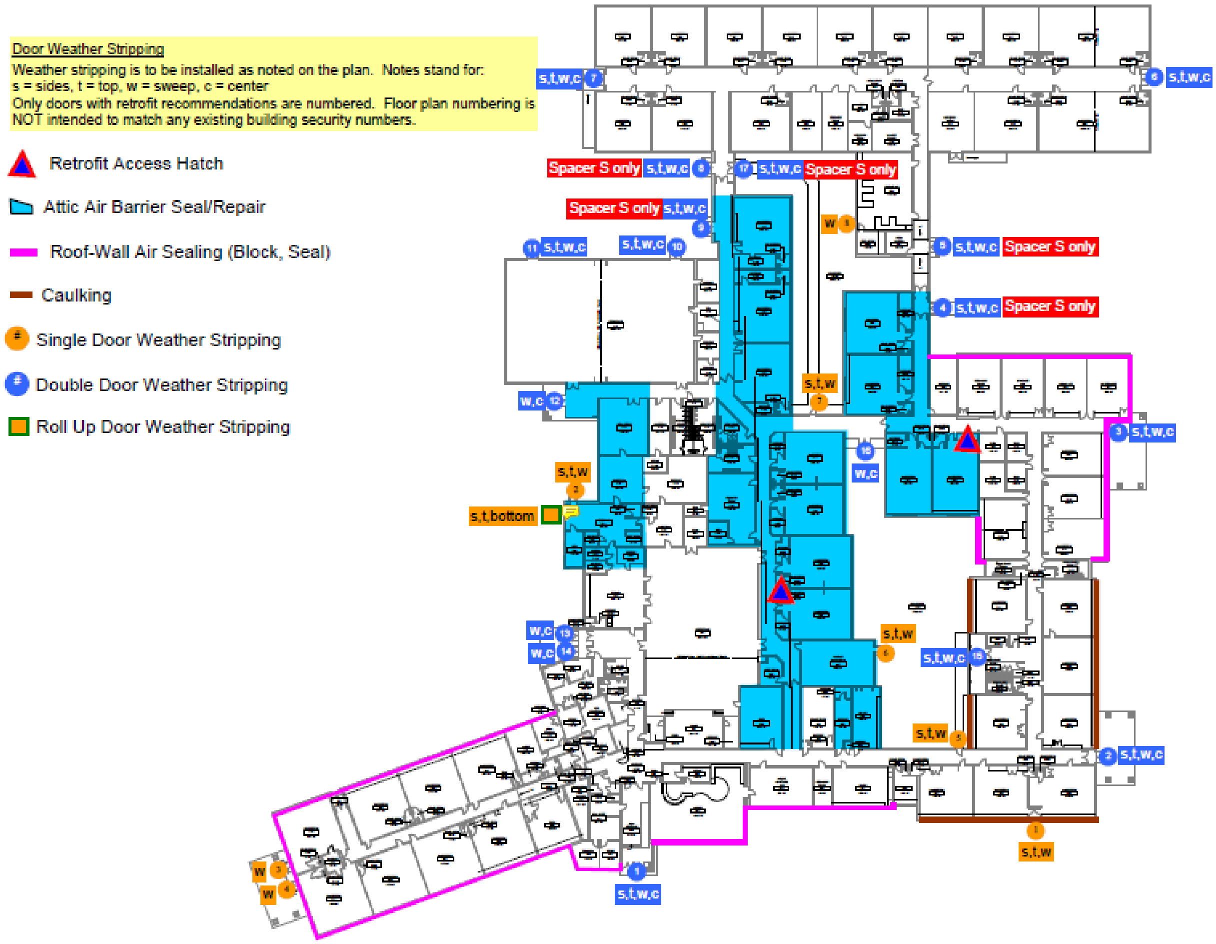
Operational Savings for Financial Model	
ECM Description	**Annual Savings**
LED Lighting Upgrades & Occupancy Sensors – District Wide	$5,660
HVAC Upgrades / Equipment Replacement	$5,617
Totals	$11,277

APPENDIX 4. BUILDING ENVELOPE SCOPE DRAWINGS

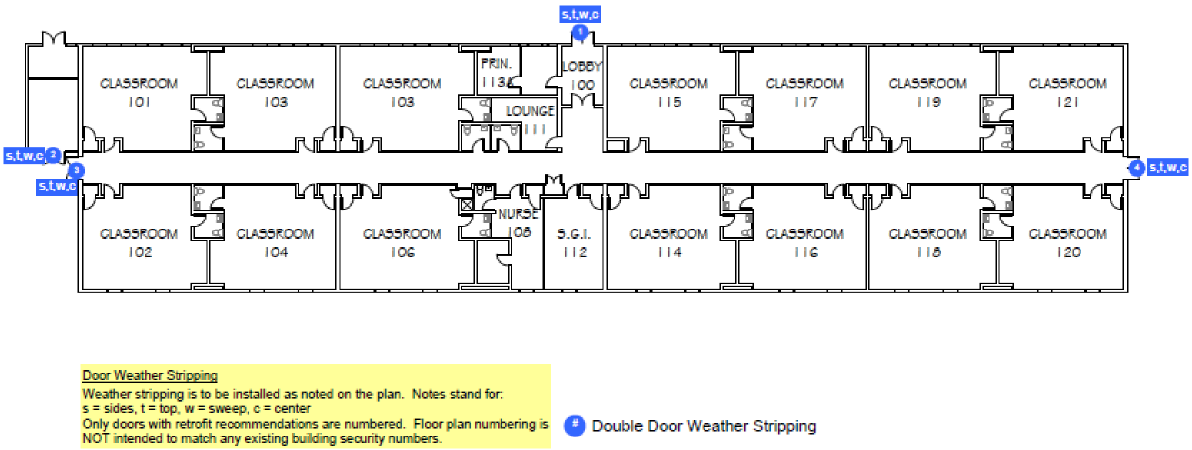




FROG POND ELEMENTARY



GEORGE MITCHELL ELEMENTARY



EARLY CHILDHOOD CENTER

APPENDIX 5. RECOMMENDED PROJECT – ESP

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
1	BOE Offices	LED Lighting Upgrade + Controls (Int. and Ex.)	$9,313	$1,348	6.9
2	Early Childhood Center	LED Lighting Upgrade + Controls (Int. and Ex.)	$35,708	$2,173	16.4
3	Frog Pond Elementary School	LED Lighting Upgrade + Controls (Int. and Ex.)	$214,449	$19,503	11.0
4	George Mitchell School	LED Lighting Upgrade + Controls (Int. and Ex.)	$204,892	$19,768	10.4
5	Frog Pond Elementary School	Building Envelope Repairs and Improvements	$49,419	$5,708	8.7
6	George Mitchell School	Building Envelope Repairs and Improvements	$90,210	$7,800	11.6
7	Early Childhood Center	Building Envelope Repairs and Improvements	$2,593	$335	7.7
8	BOE Offices	Building Envelope Repairs and Improvements	$8,220	$716	11.5
9	District Wide	District Wide Water Fixture Tuning and Diaphragm Valve Upgrade	$71,067	$8,399	8.5
10	District Wide	District Wide PC Power Management Controls	$16,000	$3,742	4.3
11	District Wide	Plug Load Controls	$27,228	$3,017	9.0
12	George Mitchell School	Single 35 kW CHP for DHW and HW	$242,000	$11,284	21.4
13	George Mitchell School Frog Pond Elementary	Kitchen Hood VFDs and Controls	$44,100	$2,329	18.9
14	District Wide	District Wide Retrocommissioning of Controls	$126,300	$27,094	4.7
15	Frog Pond Elementary School	Walk-In Cooler Improvements	$2,407	$1,446	1.7
16	George Mitchell School	Walk-In Cooler Improvements	$2,407	$1,532	1.6
17	Frog Pond Elementary School	Upgraded, High Efficiency Electrical Transformers	$91,624	$7,609	12.0
18	George Mitchell School	Upgraded, High Efficiency Electrical Transformers	$88,609	$6,814	13.0
19	Frog Pond Elementary School	Replace RTUs at Frog Pond Elementary School	$75,068	$1,932	38.9
20	BOE Offices	Replacing AC and Furnaces at BOE Offices	$73,950	$2,394	30.9
21	District Wide	Upgrade the Building Automation System	$196,400	$2,245	87.5
22	Frog Pond Elementary School	HVAC Coil Rejuvenation Protection (FP and GM)	$59,600	$8,715	6.8
23	George Mitchell School	HVAC Refrigerant Optimization (FP and GM)	$47,350	$6,657	7.1
24	Frog Pond Elementary School	Convert existing (3) R22 RTUs Refrigerant	$19,800	$110	180.0
25	District Wide	Construction Contingency	$235,000	$0	N/A

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
26	District Wide	Windows and Doors (Allowance)	$160,000	$274	583.9
		TOTALS	**$2,193,714**	**$152,944**	**14.3**

Operational Savings for Financial Model	
ECM Description	**Annual Savings**
LED Lighting Upgrades & Occupancy Sensors – District Wide	$5,660
HVAC Upgrades / Equipment Replacement	$5,617
Totals	$11,277

NJ Clean Energy Rebates	
Energy Conservation Measure	**Energy Rebate/ Incentives**
BOE Offices - Lighting Upgrades - LED	$1,203
Early Childhood Center - Lighting Upgrades - LED	$3,667
Frog Pond Elementary - Lighting Upgrades - LED	$26,087
George Mitchell Elementary - Lighting Upgrades - LED	$21,130
Frog Pond Elementary – RTU Replacements	$2,173
BOE Offices – AC Units and Furnace Replacements	$2,650
Totals	**$56,909**

Demand Response Energy – Emergency Capacity Credit	
PJM Payment Year	Annual Customer Capacity Benefit
2021/2022	$2,074
2022/2023	$2,684
2023/2024	$2,684
2024/2025	$2,684
Totals	$10,126

Building	Energy Conservation Measure "ECM" Description	Total Electric kW Savings	Electric kWh Savings	Natural Gas Therms Savings	Water kGal Savings	Electric Demand Savings $	Electric Savings $	Natural Gas Savings $	Water Savings $	Total Energy Savings $
BOE Offices	District Wide LED Lighting Upgrade + Controls (Int. and Ex.)	51	7,743	(0)	0	$567	$781	($0)	$0	$1,469
Early Childhood Center	District Wide LED Lighting Upgrade + Controls (Int. and Ex.)	85	12,248	(0)	0	$938	$1,236	($0)	$0	$2,502
Frog Pond Elementary School	District Wide LED Lighting Upgrade + Controls (Int. and Ex.)	686	118,021	(3)	0	$7,597	$11,909	($3)	$0	$22,095
George Mitchell School	District Wide LED Lighting Upgrade + Controls (Int. and Ex.)	640	125,686	(2)	0	$7,089	$12,682	($3)	$0	$22,386
Frog Pond Elementary School	Building envelope repairs and improvements	-	13,850	3,963	0		$1,397	$4,311	$0	$5,708
George Mitchell School	Building envelope repairs and improvements	-	19,269	5,383	0		$1,944	$5,856	$0	$7,800
Early Childhood Center	Building envelope repairs and improvements	-	828	232	0		$84	$252	$0	$335
BOE Offices	Building envelope repairs and improvements	-	1,767	494	0		$178	$537	$0	$716
District Wide	District Wide Water Fixture Refurbishment	-	-	1,017	618			$1,107	$7,292	$8,399
District Wide	District Wide PC Power Management Controls	-	37,087	-	0		$3,742		$0	$3,742
District Wide	Plug Load Controls	-	29,903	-	0		$3,017		$0	$3,017
George Mitchell School	Single 35 kW CHP for DHW and HW	391	201,862	(12,325)	0	$4,324	$20,368	($13,408)	$0	$11,284
George Mitchell School Frog Pond Elementary School	Kitchen Hood VFDs and Controls	-	14,680	779	0		$1,481	$848	$0	$2,329
District Wide	District Wide Retrocommissioning of Controls	-	221,550	4,356	0		$22,355	$4,739	$0	$27,093
Frog Pond Elementary School	Walk-In Cooler Improvements	-	14,331	-	0		$1,446		$0	$1,446
George Mitchell School	Walk-In Cooler Improvements	-	15,187	-	0		$1,532		$0	$1,532
Frog Pond Elementary School	Replace electrical transformers for improved efficiency	90	65,558	-	0	$995	$6,615		$0	$7,609

Building	Energy Conservation Measure "ECM" Description	Total Electric kW Savings	Electric kWh Savings	Natural Gas Therms Savings	Water kGal Savings	Electric Demand Savings $	Electric Savings $	Natural Gas Savings $	Water Savings $	Total Energy Savings $
George Mitchell School	Replace electrical transformers for improved efficiency	80	58,701	-	0	$891	$5,923		$0	$6,814
Frog Pond Elementary School	Replace RTUs at Frog Pond Elementary School	78	10,573	-	0	$865	$1,067		$0	$1,932
BOE Offices	Replacing AC and Furnaces at BOE Offices	78	15,160	-	0	$865	$1,530		$0	$2,394
District Wide	Upgrade the Building Automation System	-	5,830	1,523	0		$588	$1,657	$0	$2,245
Frog Pond Elementary School	HVAC Coil Rejuvenation Protection (FP and GM)	-	86,368	-	0		$8,715		$0	$8,715
George Mitchell School	HVAC Refrigerant Optimization (FP and GM)	-	65,973	-	0		$6,657		$0	$6,657
Frog Pond Elementary School	Convert existing (3) R22 RTUs to Bluon for improved efficiency and reduced long term maintenance costs	-	1,087	-	0		$110		$0	$110
District Wide	Construction Contingency	-	-	-	0				$0	
District Wide	Windows and Doors	-	485	207	0		$49	$225	$0	$274

Business Case for Recommended Project

FORM VI - ENERGY SAVINGS PLAN

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
Project Name
ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO Name: ENERGY SYSTEMS GROUP **Project Scenario 2**

Note: Respondents must use the following assumptions in all financial calculations

(a) The cost of all types of energy should be assumed to inflate at 2.2% gas, 2.4% electric per year; anc

1. Term of Agreement: 19 years
2. Construction period[2] (months): 12
3. Cash Flow Analysis Format:

Total Financed Amount[4]	$	2,808,367
ESP Development	$	9,900
ESIP Implementation	$	151,366
Construction Administration	$	39,487
BC/FA	$	30,000
Total ESG Project Cost [1]	$	2,577,614

Pass | **Project Status**

Interest Rate to be used for Proposal Purposes: 2.90%

	Annual Energy Savings	Annual Operational Savings	Energy Rebates/ Incentives	Solar PPA	Total Annual Savings	Annual Project Costs	Board Costs	Annual Service Costs	Net Cash-Flow to client	Cumulative Cash Flow
Installation[3]	$ 54,824	$ -	$ -	$ -	$ 54,824	$ -	$ -	$ -	$ 54,824	$ 54,824
1	$ 156,307	$ 11,277	$ 58,465	$ -	$ 226,049	$ 222,649	$ 222,649	$ -	$ 3,400	$ 58,224
2	$ 159,743	$ 11,277	$ 2,013	$ -	$ 173,033	$ 169,633	$ 169,633	$ -	$ 3,400	$ 61,624
3	$ 163,255	$ 5,660	$ 2,013	$ -	$ 170,928	$ 167,528	$ 167,528	$ -	$ 3,400	$ 65,024
4	$ 166,844	$ 5,660	$ 2,013	$ -	$ 174,518	$ 171,118	$ 171,118	$ -	$ 3,400	$ 68,424
5	$ 170,513	$ 5,660	$ -	$ -	$ 176,173	$ 172,773	$ 172,773	$ -	$ 3,400	$ 71,824
6	$ 174,262	$ -	$ -	$ -	$ 174,262	$ 170,862	$ 170,862	$ -	$ 3,400	$ 75,224
7	$ 178,093	$ -	$ -	$ -	$ 178,093	$ 174,693	$ 174,693	$ -	$ 3,400	$ 78,624
8	$ 182,009	$ -	$ -	$ -	$ 182,009	$ 178,609	$ 178,609	$ -	$ 3,400	$ 82,024
9	$ 186,011	$ -	$ -	$ -	$ 186,011	$ 182,611	$ 182,611	$ -	$ 3,400	$ 85,424
10	$ 190,101	$ -	$ -	$ -	$ 190,101	$ 186,701	$ 186,701	$ -	$ 3,400	$ 88,824
11	$ 194,281	$ -	$ -	$ -	$ 194,281	$ 190,881	$ 190,881	$ -	$ 3,400	$ 92,224
12	$ 198,553	$ -	$ -	$ -	$ 198,553	$ 195,153	$ 195,153	$ -	$ 3,400	$ 95,624
13	$ 202,918	$ -	$ -	$ -	$ 202,918	$ 199,518	$ 199,518	$ -	$ 3,400	$ 99,024
14	$ 207,380	$ -	$ -	$ -	$ 207,380	$ 203,980	$ 203,980	$ -	$ 3,400	$ 102,424
15	$ 211,941	$ -	$ -	$ -	$ 211,941	$ 208,541	$ 208,541	$ -	$ 3,400	$ 105,824
16	$ 216,601	$ -	$ -	$ -	$ 216,601	$ 213,201	$ 213,201	$ -	$ 3,400	$ 109,224
17	$ 221,364	$ -	$ -	$ -	$ 221,364	$ 217,964	$ 217,964	$ -	$ 3,400	$ 112,624
18	$ 226,232	$ -	$ -	$ -	$ 226,232	$ 222,832	$ 222,832	$ -	$ 3,400	$ 116,024
19	$ 231,207	$ -	$ -	$ -	$ 231,207	$ 211,071	$ 211,071	$ -	$ 20,136	$ 136,160
20	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
21	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
22	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
23	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
25	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Totals	$ 3,692,439	$ 39,535	$ 64,504	$ -	$ 3,796,477	$ 3,660,317	$ 3,660,317	$ -	$ 136,160	$ -

NOTES:

1 Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"
2 No payments are made by the Board during the construction period.
3 Installation period savings for Energy Savings and Operational Savings are guaranteed. These savings will be used in addition to the first loan payment.
4 Total Financed Cost includes all Fees and project costs.
5 Interest rate is indicative rate only. Final rate will vary with market conditions at time of closing
6 ESG is an energy services and engineering company, not a financial advisor.
7 ESG is not a financial advisor and the presented cash flow proforma is for information onl
8 The cash flow shown is for illustration purposes, and is not intended as financial advice
9 Loan repayment includes interest accumulation in the construction perioc
10 Loan repayment assumes that the 1st repayment starts immediately after construction
11 The annual energy escalation are in accordance with the BPU
12 The utility incentive amount shown is typical expected and is not indicative of the actual amount as project timing, changes to utility program and availability of funds affect the outcom
13 The consultant's fee is in accordance with input from the consultant
14 M&V service and associated costs have been excluded
15 Demand Response incentives have a 75% confidence factor applied in cash flow calculations

APPENDIX 6. 3RD PARTY REVIEW CORRESPONDANCE (DLB ASSOCIATE)