Energy Savings Improvement Plan (ESIP)

Pittsgrove Township School District

1076 Almond Road, Pittsgrove, NJ 08318 **Date: November 20th, 2019**

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Section 1. Executive Summary

Various Energy Conservation Measures (ECMs) were evaluated in the development of this Energy Savings Improvement Plan (ESIP). Johnson Controls 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 ECMs that allow Pittsgrove Township 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 CHA. The original audit was used for building descriptions as well as an overall indication of the District needs.

Priority items include:

- Upgrade interior/exterior lighting LED retrofits
- Lighting occupancy controls
- Building Envelope Improvements – Weatherization
- Water Source Heat Pump Replacement at Middle School
- Roof Top Units Replacement at Middle School
- Controls Integration at Middle School on New Equipment
- Cooling Tower Replacement at Middle School
- Boiler Replacement at High School
- Fan Coil Unit Replacement with Cooling and Ductsox at Norma Elementary School
- Installation of premium efficiency motors and pumps
- Mechanical insulation
- Micro Combined Heat and Power (CHP) at Middle School

Energy saving calculations performed in the development of this ESIP (Energy Calculation Workbook) were 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. Energy savings have been provided in the Appendix for ease of review.

Benefits

The measures investigated in this ESP would result in an annual utility savings of **467,331 kWh** of electricity with a **2,267 kW** reduction and the facility will save a total of **25,652 therms** of natural gas. The natural gas savings include the purchase of approximately **34 therms** of natural gas due to the micro CHP usage. The total net utility cost savings are **$2,626,032** over the life of the project (20 years) plus **$26,096** in operational savings and **$74,685** in project incentives. Additionally, the project also leverages $50,000 in solar PPA savings with approval from Board of Public Utilities. These energy savings will result in a net reduction of greenhouse gases and will reduce the Pittsgrove Schools' carbon footprint by **819,714 lbs.** of CO_2 annually. All these savings are achieved while improving the classroom environment and replacing many items that have been in service beyond their useful life expectancy.

Section 2. Project Description

This ESIP addresses the following facilities:

Building	Address	Square Feet	Construction Date
Administration Building	1083 Almond Road, Pittsgrove, NJ 08318	5,000	1989
Norma Elementary School	873 Gershal Avenue, Pittsgrove, NJ 08318	22,110	1953,1994
Elmer Elementary School	207 Front Street, Elmer, NJ 08318	21,240	1956
Olivet Elementary School	235 Sheep Pen Road, Pittsgrove, NJ 08318	56,359	1930, 1957, 1966 and 1992
Pittsgrove Middle School	1082 Almond Road, Pittsgrove, NJ 08318	88,479	1989, 1999
Arthur P. Schalick High School	718 Centerton Road, Pittsgrove, NJ 08318	112,000	1976

Facility Description

Arthur P. Schalick High School

Arthur P. Schalick High School is located on 718 Centerton Road, Pittsgrove, New Jersey. The 112,000 SF school was built in 1976. The building is a single story facility comprised of classrooms, auditorium, gymnasium, dance studio, cafeteria, kitchen, computer labs, library, music rooms, mechanical rooms and offices.

Occupancy Profile

The typical hours of operation for the High School are Monday through Friday between 6:00 A.M. and 11:00 P.M. Arthur P. Schalick High School employs approximately 70 people with student enrollment estimated at 628.

Building Envelope

Exterior walls for Arthur P. Schalick High School are masonry brick faced with a concrete block construction and structural steel framing. The windows throughout the school are in good condition and appear to be well maintained. Typical windows are double pane, with aluminum frames and exterior doors are steel doors with safety glass. The roof is flat, with white rubber membrane and in good condition.

Major Mechanical Systems

Heating of this building is achieved by two methods. The gymnasium, auditorium, cafeteria, library, which are large rooms are heated by rooftop units (RTU) equipped with gas fired furnaces. Classrooms, offices, hallways are heated using water source heat pumps, with heating boosted by a Bryan boiler rated at 2,160 MBH. The hot water in the heat pump loop is circulated by three (3) pumps driven by motors with 15 HP. The heating capacities for the RTUs are shown below:

Manufacturer	Heating Capacity	Efficiency	Location	Serving Area
Carrier	350 MBH heat input 283.5 MBH heat output	81% Eff.	Roof	Auditorium
Carrier	72MBH heat input and 59.04MBH heat output	82% Eff.	Roof	Auditorium/Stage
Carrier	72MBH heat input and 59.04MBH heat output	82% Eff.	Roof	Auditorium/Stage
Carrier	275MBH heat input and 223 MBH heat output.	81% Eff.	Roof	Gym
Carrier	275MBH heat input and 223 MBH heat output	81% Eff.	Roof	Gym
Carrier	72MBH heat input and 59.04 MBH heat output	81% Eff.	Roof	Café
Carrier	125MBH heat input and 102.5 MBH heat output	82% Eff.	Roof	Café
AAON	Heat Capacity is unknown due to fade name tag	Unknown	Roof	Café
Carrier	125MBH heat input and 102.5 MBH heat output	82% Eff.	Roof	Library

Cooling is achieved by the two methods and enabling the building to have 100% cooling. The RTUs equipped with DX cooling coils provide cooling for the auditorium, gymnasium, cafeteria and library. While the water source heat pumps provide cooling for the classrooms, offices and hallways. The heat absorbed by the water loop of the heat pump is dissipated in two (2) blow-through type Baltimore Air Coil (BAC) cooling towers. The cooling capacities for the RTUs are shown below:

Manufacturer	Heating Capacity	Location	Serving Area
Carrier	30 ton Cooling	Roof	Auditorium
Carrier	5 ton Cooling	Roof	Auditorium/Stage
Carrier	5 ton Cooling	Roof	Auditorium/Stage
Carrier	15 ton Cooling	Roof	Gym
Carrier	15 ton Cooling	Roof	Gym

Manufacturer	Heating Capacity	Location	Serving Area
Carrier	4 ton Cooling	Roof	Café
Carrier	8 ton Cooling	Roof	Café
AAON	25 ton Cooling	Roof	Café
Carrier	15 ton Cooling	Roof	Library

The building is ventilated by seven (7) designated outdoor air intake fans that are part of the heat pump loop. These bring fresh air into the classrooms, offices and hallways. The RTUs each have outdoor air intake that have dampers controlled by the central DDC system. This enables them to be able to use economizer mode when the outdoor air temperatures are favorable.

Kitchen Equipment

Kitchen equipment includes two (2) reach-in refrigerators, one (1) reach-in freezer, one walk-in refrigerator and two walk-in freezers, but no dishwasher. The kitchen also has ovens, deep fryers and a 2' by 10' kitchen hood. Most of the kitchen equipment have Energy Star labels.

Exhaust System

Air is exhausted from the gymnasium, auditorium, cafeteria and library by the RTUs and the exhaust air amount is interlocked with the outdoor air intake. Restrooms, locker rooms, science lab rooms, art rooms and general exhaust occurs with exhaust fans. The Kitchen hood is manually turned on by a switch and is operated from 7am to 12:30pm each school day when cooking is done.

HVAC System Controls

CM3 direct digital control is used on most of the HVAC equipment which also control the RTUs. Some energy savings strategies have been implemented in the control systems, such as temperature setback during when rooms are unoccupied, and economizer mode strategy that controls the RTUs outdoor air intake and exhaust. The control system appears to be working efficiently.

Domestic Water

The school has four domestic hot water heaters distributed throughout the building. Two (2) Bradford White electric DHW heaters serve the majority of the restrooms. They each have a rated heating capacity of 3.5 kW and 50 gallons of storage capacity. The kitchen, cafeteria and locker rooms are served by a gas fired DHW heater with 98 gallon capacity and 199.999 MBH heating capacity. Lastly the science labs, art rooms and restrooms nearby received domestic hot water from a Bradford White electric DHW heater, rated at 4.5 kW for heating capacity and 80 gallons for storage.

Lighting

Please refer to the Appendix Line by Line for a detailed list of the lighting throughout the facility and operating hours per space.

Pittsgrove Middle School

Pittsgrove Middle School is located on 1082 Almond Road, Pittsgrove, New Jersey. The 88,479 SF school was built in 1989 and new sections added in 1999. The building is a single-story facility comprised of classrooms, gymnasium, auditorium, cafeteria, kitchen, computer lab, music rooms, mechanical rooms and offices.

Occupancy Profile

The typical hours of operation for the Middle School are Monday through Friday between 7:00 A.M. and 11:00 P.M. Pittsgrove Middle School employs approximately 50 people with student enrollment estimated at 441.

Building Envelope

Exterior walls for Pittsgrove Middle School are masonry brick faced with a concrete block construction and structural steel framing. The windows throughout the school are in good condition and appear to be well maintained. Typical windows are double pane, with aluminum frames and exterior doors are steel doors with safety glass. The roof is flat, with grey rubber membrane and in good condition.

Major Mechanical Systems

Heating for the original building (1989) is provided by a water source heat pump loop that is tempered by two Weil-McLain boilers. The boilers each have a rated heat capacity of 610 MBH. The new sections (1999) of the building are heated by hot water baseboard heaters and Trane RTUs with hot water heating coils. The heating hot water for this section is provided by a Weil-McLain boiler with a rated heating capacity of 1,632 MBH. This HHW is circulated by two (2) 7.5 HP motor driven inline pumps.

The water source heat pump loop provides cooling for the original building. The heat absorbed by the cooling loop is dissipated in the blow-through type Evapco cooling tower, equipped with a 25 HP blow fan.

The Trane RTUs provide cooling for the new sections using the DX cooling coils and have cooling capacities ranging from 3 to 5 Tons.

The water source heat pump loop has 7 outdoor air intake fans to bring outdoor air into the heat pump ductwork systems. In addition, each RTU has an outdoor air intake and the dampers for these vents are controlled by the central DDC system for the economizer mode when applicable.

Newer section of the building is served by thirty-two (32) Trane roof top units (RTUs) of sizes ranging between 2.5 tons to 6 tons. The units have reheat coils in the duct work served by an independent boiler.

Kitchen Equipment

The kitchen equipment in middle school includes two (2) reach-in refrigerators, one (1) reach-in freezer, one walk-in refrigerator and one walk-in freezer. Most kitchen equipment has energy star labels. There is a dishwashing room next to the kitchen which has a Champion commercial dishwasher having an electric booster heater rated at 22 kW.

Exhaust System

Air is exhausted from various classrooms, restrooms, storage rooms, mechanical rooms, common areas etc. mainly by eight (8) exhaust fans. In addition, the RTUs have air intake and exhaust and are able to balance the pressure during ventilation.

The kitchen has a 2’ by 10’ exhaust hood that is manually operated and runs from 7:00AM to at 12:30PM each school day. The kitchen exhaust is interlocked with a make-up air (MAU) unit.

HVAC System Controls

CM3 direct digital control is used on most of the HVAC equipment, while a Trane control system is designated to control the RTUs.

Some energy savings strategies have been implemented in the control systems, such as temperature setback during when rooms are unoccupied, and economizer mode strategy that controls the RTUs outdoor air intake and exhaust. Both control systems are in communication with one another and appear to be working efficiently.

Domestic Water

The school has two domestic hot water (DHW) heaters serving in the building. This includes a gas-fired A.O. Smith water heater rated at 400 MBH and a storage capacity of 200 gallons and a small Bradford White electric water heater rated at 1.5 kW with 19 gallon storage capacity.

Lighting

Please refer to the Appendix Line by Line for a detailed list of the lighting throughout the facility and operating hours per space.

Norma Elementary School

Norma Elementary School is located on 873 Gershal Avenue, Pittsgrove, New Jersey. The 22,110 SF school was built in 1953 and renovated in 1994. The building is a two-story facility except comprised of classrooms, cafeteria, media center, music rooms, mechanical room and offices.

Occupancy Profile

The typical hours of operation for the Elementary School are Monday through Friday between 6:00 A.M. and 9:00 P.M. Norma Elementary School employs approximately 40 people with student enrollment estimated at 180.

Building Envelope

Exterior walls for the Norma Elementary School are masonry brick faced with a concrete block construction and structural steel framing. The windows throughout the school are in good condition and appear to be well maintained. Typical windows are double pane, with aluminum frames and exterior doors are steel doors with safety glass. The roof is a flat, metal deck with rubber membrane and in good condition.

Major Mechanical Systems

This building is conditioned with both steam and hot water. Heating hot water for the original building (1953 section) is generated by a single H. B. Smith Boiler. The boiler is gas-fired; built in 1953; rated at 1,854 MBH); and fitted with a new Power Flame Burner. For heating the 1994 building addition, the steam is converted to heating hot water by a steam-to-hot water heat exchanger. The primary hot water pumps are two (2) in-line ITT Bell & Gossett pumps.

Chilled water for most of the building is provided by an air cooled Trane chiller with a rated capacity of 20 Tons. The chilled water is delivered to various chilled water coils by a Bell & Gossett pump driven by a 2 HP electric motor.

Steam circulates through FCUs equipped with steam radiators and steam coils in the 1953 section of the building. While heating hot water circulates through FCUs with HHW coil and HHW baseboard heaters. The classrooms are cooled by the same fan coil units equipped with chilled water (CHW) coils.

The Nurse’s office is heated and cooled by a packaged terminal heat pump (PTHP) with a heating capacity of 12.15 MBH and cooling capacity of 0.8 ton with an efficiency of 11.2 SEER.

Ventilation of the building is provided by fan coil units (FCU) with a vent opening louver.

Kitchen Equipment

This school does not have a kitchen, all the meals are prepared elsewhere. Powers cooler and a regular household refrigerator are used for food storage in the cafeteria.

Exhaust System

Air is exhausted from restrooms by two (2) exhaust fans rated with unknown ratings due to inaccessibility.

HVAC System Controls

CM3 direct digital control is used on only the chiller equipment. Fan coils are controlled by manually adjusted thermostat. Steam radiators and baseboard heaters are not controlled.

Domestic Hot Water

Domestic cold water is provided by a Bradford White natural gas DHW heater, rated at 50 MBH and a storage capacity of 50 gallons.

Lighting

Please refer to the Appendix Line by Line for a detailed list of the lighting throughout the facility and operating hours per space.

Elmer Elementary School

Elmer Elementary School is located on 207 Front Street, Elmer, New Jersey. The 21,240 SF school was built in 1956. The building is a single story facility comprised of classrooms, multipurpose room, computer lab, storage rooms, offices and a mechanical room.

Occupancy Profile

The typical hours of operation for the Elementary School are Monday through Friday between 7:00 A.M. and 7:00 P.M. Elmer Elementary School employs approximately 23 faculty and staff with student enrollment estimated at 200.

Building Envelope

Exterior walls for Elmer Elementary School are masonry brick faced with a concrete block construction, structural steel framing and fiberglass panels above the windows. The windows throughout the school are in good condition, double pane and aluminum framed and exterior doors are steel doors with safety glass. One section of the roof is flat with white rubber membrane. The other section is pitched and covered with shingles. Both sides of the roof are in good condition.

Major Mechanical Systems

Heating hot water is generated by a gas-fired H. B. Smith boiler; rated at 1,773 MBH. There are two hot water pumps driven by 2 HP Marathon Electric motors. Hot water circulates through the baseboard heaters of classrooms and the two heating ventilating (HV) units of the multipurpose room.

Cooling is provided for the school building by eighteen (18) Mitsubishi or Fujitsu ductless split units, each with a capacity ranging between 1 to 1.5 Tons.

Ventilation in the classrooms are provided by Nesbit unit ventilators (UV) in each room. The multipurpose room has two heating ventilating (HV) units.

Kitchen Equipment

This building does not have a kitchen. All food preparation is done elsewhere.

Exhaust System

Air is exhausted by few exhaust fans rated with unknown ratings due to inaccessibility.

HVAC System Controls

CM3 direct digital control is used on most of the heating equipment. The split units for cooling are controlled locally, some by programmable thermostats. Some split units are manually controlled and non-programmable.

Domestic Water

The domestic water heaters include two electric domestic hot water (DHW) heaters. One Bradford White heaters rated at 3.5 kW with a storage capacity of 40 gallons. And another water heater will likely similar specs, though not visible during the inspection.

Lighting

Please refer to the Appendix Line by Line for a detailed list of the lighting throughout the facility and operating hours per space.

Olivet Elementary School

Olivet Elementary School is located on 235 Sheep Pen Road, Pittsgrove, New Jersey. The 56,359 SF school was built in 1930 and renovated times in 1957, 1966 and 1992. The building is a two-story facility comprised of classrooms, cafeteria, kitchen, media center, multipurpose room, mechanical rooms and offices.

Occupancy Profile

The typical hours of operation for the Elementary School are Monday through Friday between 8:00 A.M. and 7:00 P.M. Olivet Elementary School employs approximately 35 people with student enrollment estimated at 362.

Building Envelope

Exterior walls for the Olivet Elementary School are masonry brick faced with a concrete block construction and structural steel framing. The windows throughout the school are in good condition and appear to be well maintained. Typical windows are double pane, with aluminum frames and exterior doors are steel doors with safety glass. The roof is flat, with grey rubber membrane and in good condition.

Major Mechanical Systems

This building is conditioned primarily by circulation of refrigerant using six (6) Mitsubishi Variable Refrigerant Volume (VRV) systems. The rated heating capacity is 240 MBH each for five (5) of the VRV systems and 120 MBH for one VRV system. This totals to 1320 MBH of heating capacity. Supplemental heating is by Hot Water circulation. Heating hot water for the building is generated by two H. B. Smith Boilers. The boilers are gas-fired, each rated at 2499 MBH and are fitted with Power Flame Burners. Hot water circulates through the baseboard heaters, cabinet heaters and heat coils in the building, by two lead/lag pumps driven by a 5 HP and 1.5 HP motor respectively.

Cooling is provided primarily by the 6 VRV systems. The cafeteria cooled by two (2) Carrier split units during normal operation with a rated cooling capacity of 7.5 Ton. During maximum occupation of the cafeteria there is also a Carrier roof top unit (RTU) with DX cooling with a rated cooling capacity of 15 Ton. The teachers' lounge has its own dedicated cooling provided by a 2 Ton packaged air conditioning (PTAC) unit.

Ventilation for this building is provided by six (6) Ruskin heat recovery ventilation (HRU) units that supply fresh air to the VRV units. Each HRU unit is equipped with a heat wheel to exchange energy with the incoming flow of fresh air, a supply fan, exhaust fan and a desiccant wheel. The details of the HRU units are as follows:

Supply Total CFM	Exhaust Total CFM	Supply Air Fan Motor (HP)	Exhaust Air Fan Motor (HP)
2340	1905	1.5	1
1950	2340	1	1.5
1400	1400	1	0.75
1905	1945	0.75	1
1720	765	0.75	0.75
2900	2900	2	2

The Carrier roof top unit (RTU) provides additional ventilation during maximum occupation of the cafeteria and has a rated total supply air capacity of 6,000 CFM and outdoor air capacity of 1,800 CFM.

Kitchen Equipment

This school has a kitchen and a dishwashing room, however mostly disposable dishes and trays are used.

Kitchen equipment includes one (1) Energy Star Rated Blodgett ovens with two doors, one (1) Vulcan convection oven, One (1) kettle and one (1) stove. There are two (2) reach-in coolers, one (1) reach-in freezer and one old walk-in refrigerator with no nameplate information. In the dishwashing room, there is an Energy Star Rating Hobart dishwasher with an electric Hatco booster heater which has a rated heating capacity of 36kW.

Exhaust System

Air is exhausted from majority of the building by the heat recovery units. Additionally, restrooms and Hallways are exhausted by exhaust fans located on the roof.

HVAC System Controls

CM3 direct digital control is used on most of the HVAC equipment. Temperature reset schedule has been programmed into the boiler controls, to reduce the hot water temperature from 180 ^{o}F to 120 ^{o}F, when the outdoor temperature is warm enough. Similarly, the VRV controls are programmed with a temperature setback schedule based on occupancy of the rooms. In general, the DDC system for this school is comprehensive.

Domestic Water

The school has four electric domestic hot water heaters. Two (2) Bradford White electric DHW heaters serve the majority of the building. They each have a rated heating capacity of 4.5 kW and 80 gallons of storage capacity. The kitchen and cafeteria are served by a DHW heater with 180 gallon capacity and 15 kW heating capacity. Lastly the teachers' lounge has its own DHW heater rated at 1.5 kW for heating capacity and 6 gallons for storage.

Lighting

Please refer to the Appendix Line by Line for a detailed list of the lighting throughout the facility and operating hours per space.

BOE Administration Building

The BOE Administration Building is located on 1083 Almond Road, Pittsgrove, New Jersey. The 5,000 SF building is a two-story facility and built in 1989. The building is comprised of offices, a conference room, restrooms and a mechanical room.

Occupancy Profile

The typical hours of operation for the Admin Building are Monday through Friday between 9:00 A.M. and 5 P.M. The building serves about 15 employees.

Building Envelope

Exterior walls for the BOE Administration Building are constructed of wood structure with bricks façade. The windows throughout the building are double pane and in good condition. Exterior doors are steel doors with a single pane safety glass. The roof is pitched shingle and in good condition.

Major Mechanical Systems

Heating of this building is all electrically generated. Packaged terminal Heat Pump (PTHP) units equipped with direct vent gas fired heat exchangers provide heating for most of the 1st floor. Specifically, the 1st floor offices use 15 Islandaire packaged units with a rated heating capacity of 12.15 MBH with 81% efficiency. While, the hallway, lobby and room 10 are heated with wall mounted electric heaters, with heating capacities that are unknown due to wear and tear. All the 2nd floor offices use Fujitsu heat pumps with a rated heating capacity of 17.20 MBH

PTAC units and split units are used to provide cooling for the building. Office and conference rooms use 15 Islandaire PTAC units with rated cooling capacities of 0.8 ton and EER of 11.2. Sanyo split unit is used to cool the Room #10 with a rated capacity of 0.96 ton and SEER of 10. The 1st floor interior rooms and hallway and the 2nd floor hallway are cooled by a Carrier split unit rated at 2.5 to and a Sanyo split unit rated at 2.8 ton. The offices on the 2nd floor are cooled by two Fujitsu heat pumps, each with a rated capacity of 1.5 ton. Ventilation of this building is provided by the PTACs.

Kitchen Equipment

The building has a kitchenette with a household microwave and refrigerator.

Exhaust System

Air is exhausted from the building from 2 exhaust fans in the bathroom.

HVAC System Controls

HVAC equipment controlled by manual switches or thermostats.

Remote non-programmable thermostats are used to control the PTAC units and split systems. The unit heaters are controlled by manual switches.

Domestic Water

One 40 gallon domestic hot water heater rated for 3.5 kW services the building with hot water.

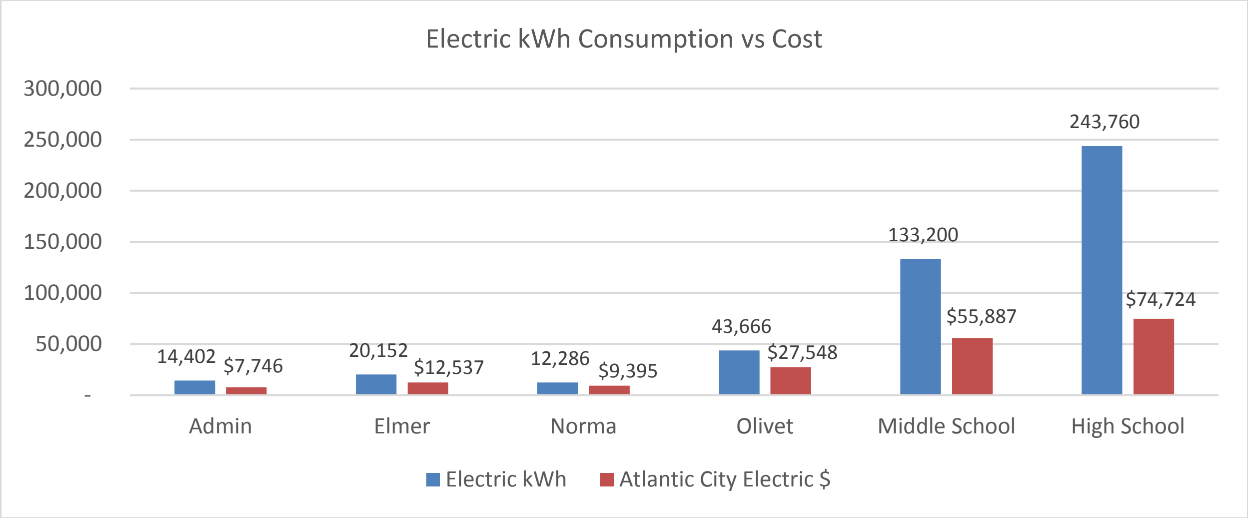
Lighting

Please refer to the Appendix Line by Line for a detailed list of the lighting throughout the facility and operating hours per space.

Utility Baseline Analysis

Electric Utility

Electrical energy is delivered to Pittsgrove Township School District through Atlantic City Electric. The electric utility measures consumption in kilowatt-hours (kWh) and maximum demand in kilowatts (kW). One kWh usage is equivalent to 1000 watts running for one hour. One kW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. The Baseline period for Electric utility is July 2018 to June 2019.

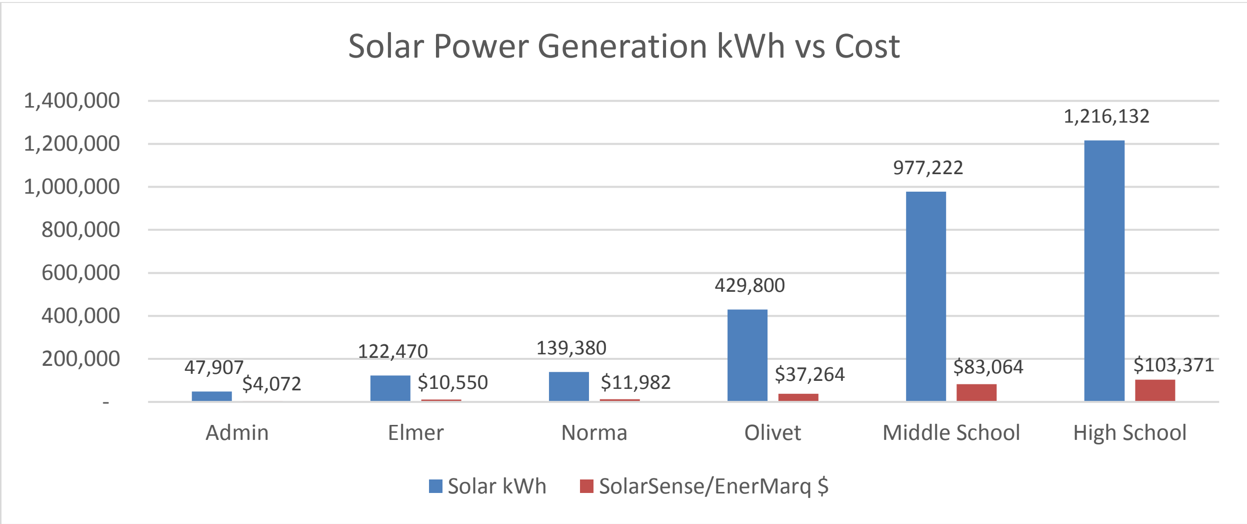


Building Name	Utility Electricity			Solar Electricity		Total Electricity	
	Annual Consumption (kWh)	**Monthly Average Utility Demand (kW)**	**Annual Cost ($)**	**Annual Consumption (kWh)**	**Annual Cost ($)**	**Annual Consumption (kWh)**	**Annual Cost ($)**
Admin	14,402	15	$7,746	47,907	$4,072	62,309	$11,818
Norma School	12,286	39	$7,926	139,380	$11,982	151,666	$19,907
Elmer Elementary School	20,152	42	$12,537	122,470	$10,550	142,622	$23,087
Olivet Elementary School	43,666	70	$27,548	429,800	$37,264	473,466	$64,812
Pittsgrove Middle School	133,200	221	$56,185	977,222	$83,064	1,110,422	$139,249
Arthur P. Schalick High School	243,760	272	$74,723	1,216,132	$103,371	1,459,892	$178,094

Solar Electricity

Pittsgrove Township School District generates electricity on-site using solar panels based on a PPA agreement. The High School, Middle School and Admin are being provided by a consolidated PPA agreement and the rest of the Elementary Schools are on a single agreement.

The PPA generation for the baseline year was accounted in energy savings plan and scope development.

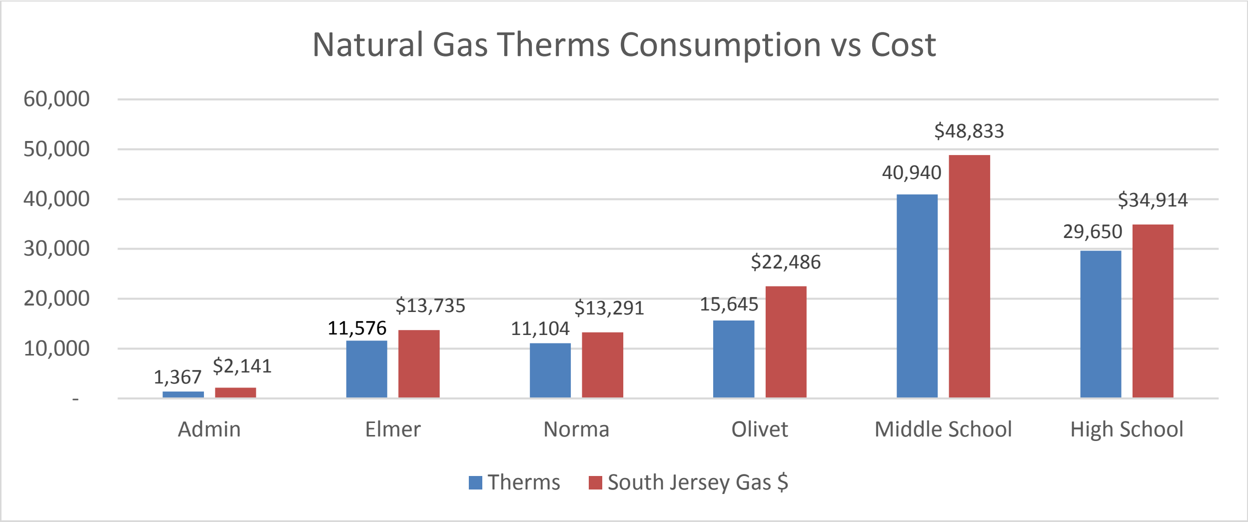


Pittsgrove Township School District with the written consent from Board of Public utilities has allowed Johnson Controls to carry $50,000 in energy savings towards the ESIP.

Natural Gas

Pittsgrove Township School District acquires Natural Gas from South Jersey Gas. The natural gas utility company measures consumption in CCF and converts the quantity into Therms, using the factor of 1.0370. The Baseline period for Natural Gas utility is July 2018 to June 2019.

Building Name	Natural Gas		
	Annual Consumption (Therms)	Annual Cost ($)	Natural Gas Rate ($/Therms)
Admin	1,367	$2,137	$1.56
Norma School	11,128	$13,313	$1.20
Elmer Elementary School	11,576	$13,733	$1.19
Olivet Elementary School	19,025	$22,509	$1.18
Pittsgrove Middle School	40,840	$48,801	$1.19
Arthur P. Schalick High School	29,204	$34,365	$1.18
Total	**113,140**	**134,858**	

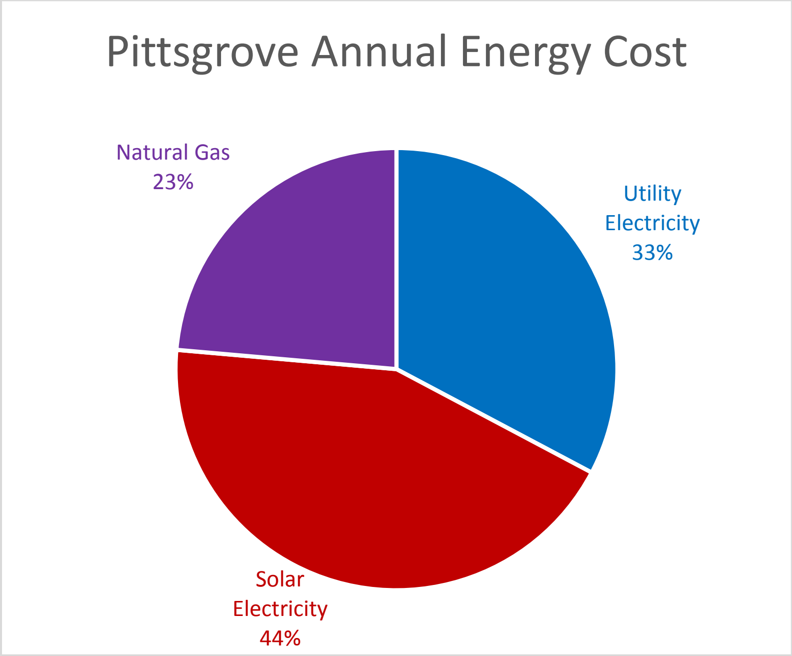


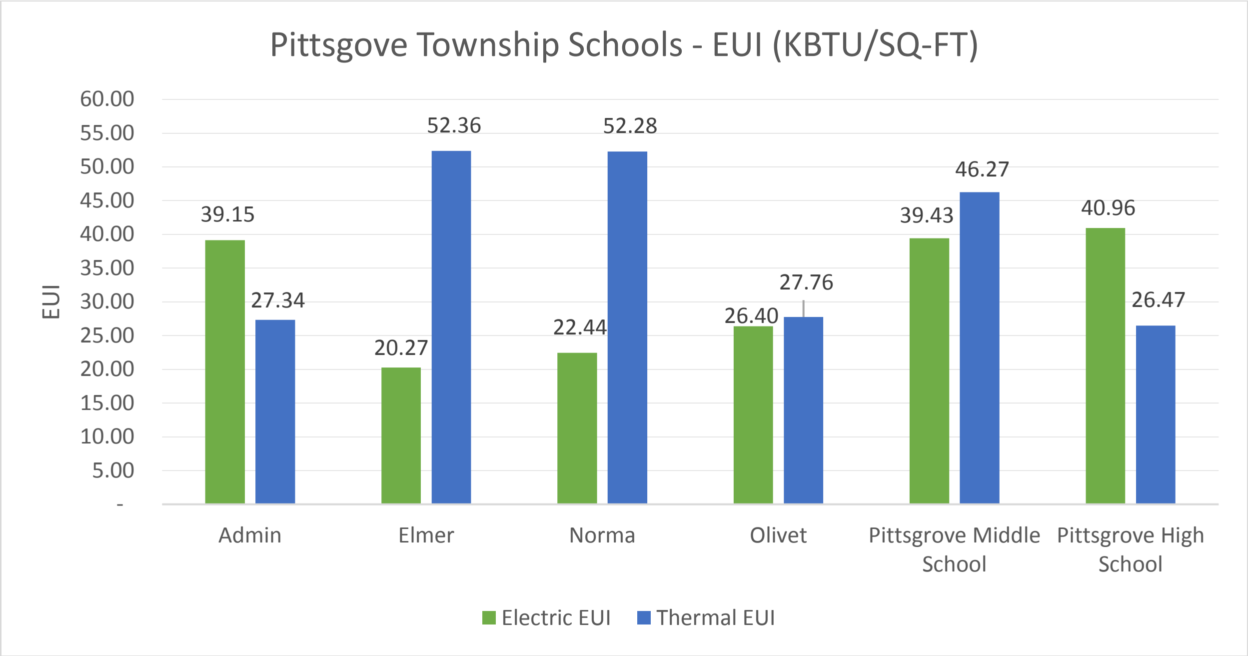
The following table shows the Schools' building names, addresses and utility account numbers.

Building	Address	ACE Electric Account No.	SJG Natural Gas Account No.
Admin	1083 Almond Road, Pittsgrove, NJ 08318	5500 0963 276	3458430000
Norma School	873 Gershal Avenue, Pittsgrove, NJ 08318	5501 0491 292	4883330000
Elmer Elementary School	207 Front Street, Elmer, NJ 08318	5500 3288 283 5500 0561 963	2811320000
Olivet Elementary School	235 Sheep Pen Road, Pittsgrove, NJ 08318	5501 2895 136 5501 1972 357 5501 0039 695 5501 1971 904 5501 1478 967	2439430000
Pittsgrove Middle School	1082 Almond Road, Pittsgrove, NJ 08318	5500 1626 625	3358430000
Arthur P. Schalick High School	718 Centerton Road, Pittsgrove, NJ 08318	5500 0326 441 5500 9652 524	4358430000

Energy Usage Summary

Building Name	Total Annual Energy Cost	
	Total Annual Cost ($)	**Total Annual Cost (less solar) ($)**
Admin	$13,955	$9,883
Norma School	$33,221	$21,239
Elmer Elementary School	$36,821	$26,270
Olivet Elementary School	$87,321	$50,057
Pittsgrove Middle School	$188,050	$104,986
Arthur P. Schalick High School	$212,459	$109,088
Total	**$571,826**	**$321,523**





*The electric EUI per school includes the electric generated from the solar system.

The Combined EUI for Electric and Thermal is shown below for each school. The EUI per school is higher compared to the national benchmark of 48.6 for the K-12 schools, for Norma the national benchmark is 64.8, and for the Admin building it is 52.9.

Combined EUI	EUI (KBTU/SQ-FT)
Admin	66.50
Norma School	74.83
Elmer Elementary School	72.63
Olivet Elementary School	60.15
Pittsgrove Middle School	85.59

Marginal Rates

The utility rates identified below were used for purposes of calculating the dollar effect of the energy savings for the schools. These rates were determined based on data from tariff data and utility data.

BUILDING	Utility Electric Rates		Natural Gas
	$/kWh	$/kW	$/ THERM
Admin	$0.0907	$13.15	$1.57
Norma School	$0.0900*	$9.88*	$1.20
Elmer Elementary School	$0.0904	$13.67	$1.19
Olivet Elementary School	$0.0913	$13.62	$1.44
Pittsgrove Middle School	$0.0905	$13.57	$1.19
Arthur P. Schalick High School	$0.0915	$13.70	$1.18

*Norma School electric unit rate is estimated based on utility rate structure.

Utility Breakdown by Building

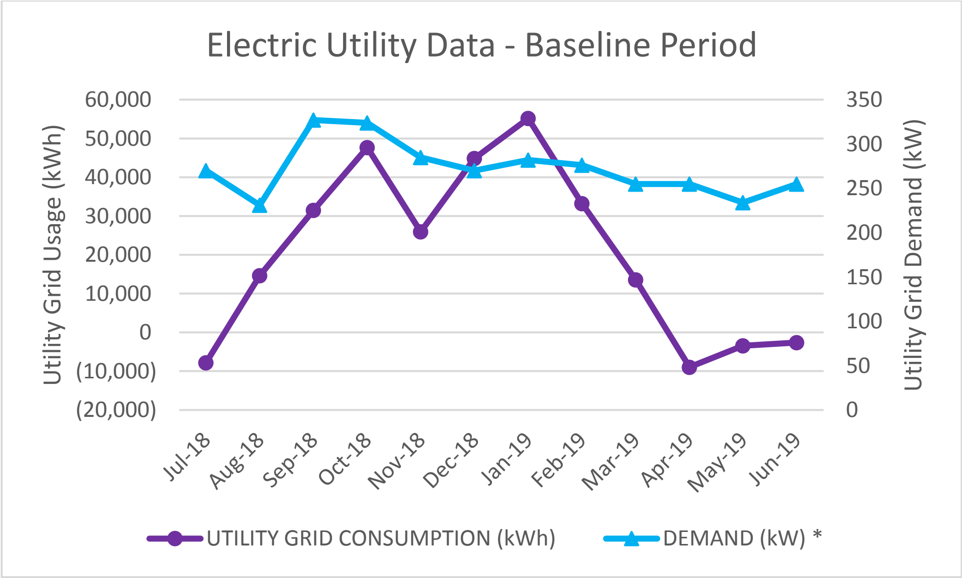
Arthur P. Schalick High School

Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost by month is shown below in table format.

MONTH	UTILITY GRID CONSUMPTION (kWh)	DEMAND (kW)	SOLAR PPA CONSUMPTION (kWh)	TOTAL CONSUMPTION (kWh)	TOTAL UTILITY GRID ELECTRIC COST
Jul-18	(7,800)	270	138,308	130,508	$4,735
Aug-18	14,640	231	132,374	147,014	$4,557
Sep-18	31,500	327	78,353	109,853	$7,730
Oct-18	47,660	324	91,427	139,087	$8,746
Nov-18	25,980	285	73,231	99,211	$6,648
Dec-18	44,820	270	60,901	105,721	$8,135
Jan-19	55,140	282	63,507	118,647	$9,541
Feb-19	33,200	276	77,952	111,152	$6,571
Mar-19	13,600	255	116,842	130,442	$4,766
Apr-19	(8,940)	255	124,689	115,749	$3,960
May-19	(3,400)	234	125,407	122,007	$4,563
Jun-19	(2,640)	255	133,140	130,500	$4,772
Total/Max	**243,760**	**327**	**1,216,132**	**1,459,892**	**$74,723**

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the demand (kW-secondary axis) and electricity usage (kWh-primary axis) over the baseline period.

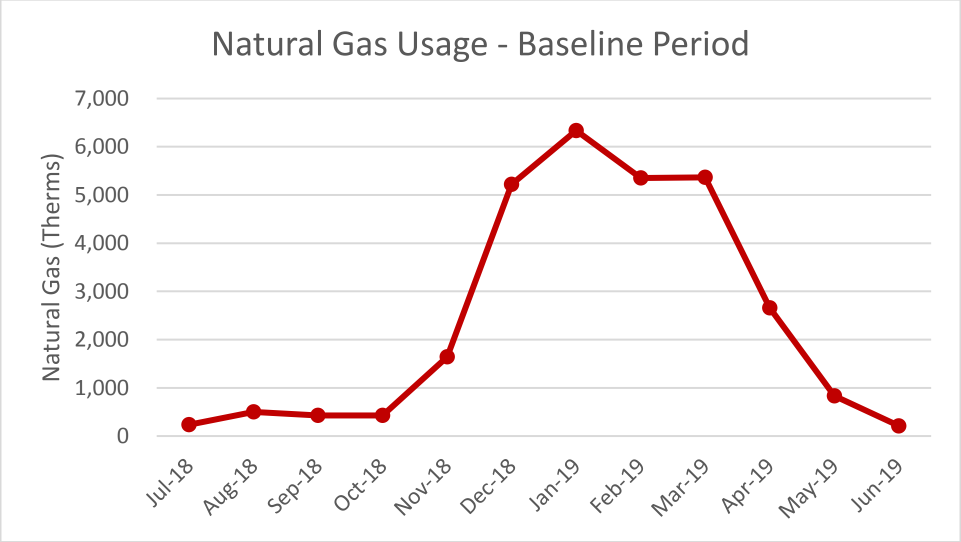


Natural Gas Usage

A detailed look at the monthly consumption (Therms) in a typical year is shown below in table format.

MONTH	CONSUMPTION (THERMS)	NATURAL GAS COST ($)
Jul-18	233	$315
Aug-18	501	$630
Sep-18	430	$548
Oct-18	428	$309
Nov-18	1,640	$1,925
Dec-18	5,220	$6,606
Jan-19	6,337	$7,370
Feb-19	5,352	$6,212
Mar-19	5,363	$6,222
Apr-19	2,657	$3,000
May-19	832	$962
Jun-19	211	$267
Total/Max	**29,204**	**$34,365**

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the Therms and natural gas cost for the baseline period.



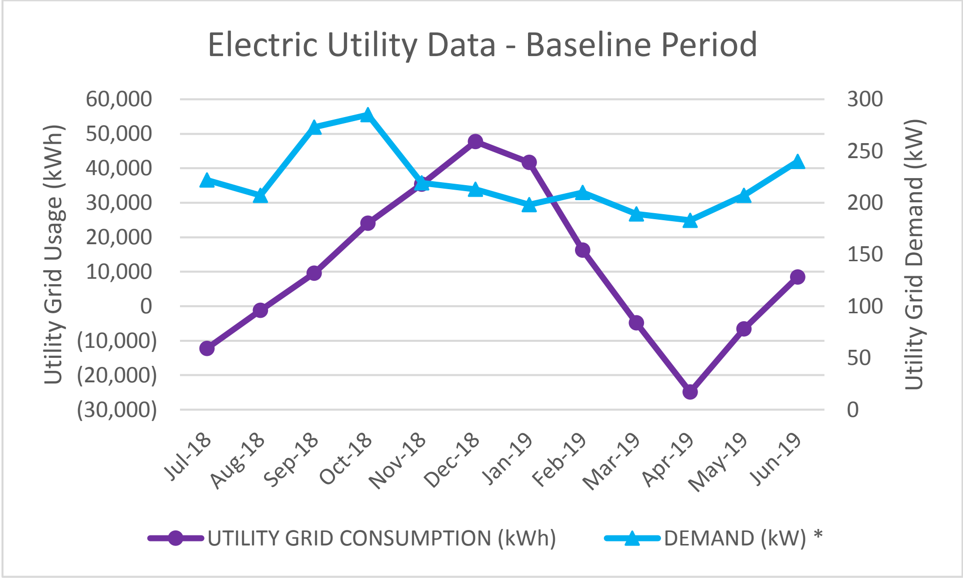
Pittsgrove Middle School

Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost by month is shown below in table format.

MONTH	UTILITY GRID CONSUMPTION (kWh)	DEMAND (kW)	SOLAR PPA CONSUMPTION (kWh)	TOTAL CONSUMPTION (kWh)	TOTAL UTILITY GRID ELECTRIC COST
Jul-18	(12,300)	222	110,920	98,620	$3,354
Aug-18	(1,200)	207	106,635	105,435	$3,816
Sep-18	9,600	273	63,035	72,635	$4,609
Oct-18	24,000	285	73,386	97,386	$5,806
Nov-18	35,400	219	58,962	94,362	$6,537
Dec-18	47,700	213	49,588	97,288	$7,412
Jan-19	41,700	198	51,390	93,090	$6,969
Feb-19	16,200	210	62,942	79,142	$4,275
Mar-19	(4,800)	189	93,345	88,545	$2,816
Apr-19	(24,900)	183	100,427	75,527	$3,466
May-19	(6,600)	207	100,981	94,381	$3,761
Jun-19	8,400	240	105,613	114,013	$3,364
Total/Max	**133,200**	**285**	**977,222**	**1,110,422**	**$56,185**

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the demand (kW-secondary axis) and electricity usage (kWh-primary axis) over the baseline period.

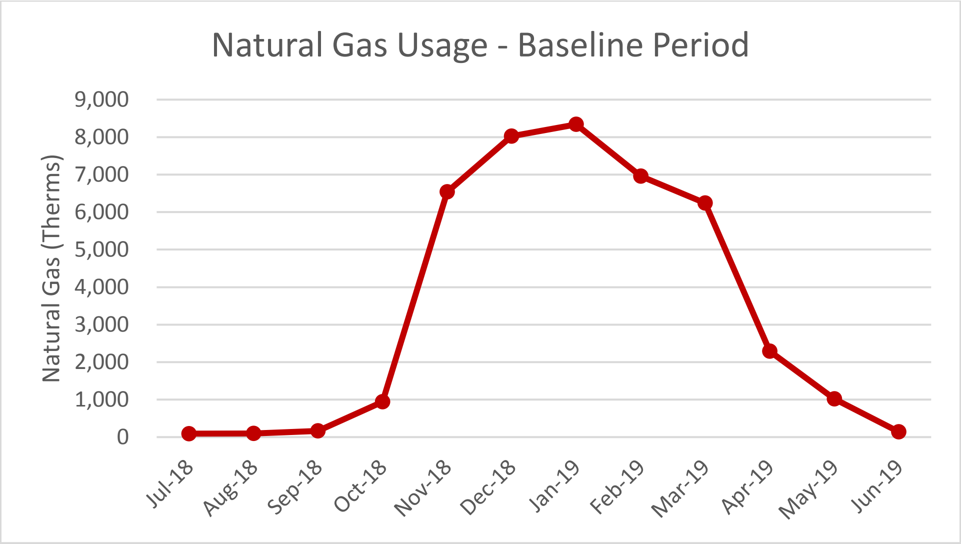


Natural Gas Usage

A detailed look at the monthly consumption (Therms) in a typical year is shown below in table format.

MONTH	CONSUMPTION (THERMS)	NATURAL GAS COST ($)
Jul-18	92	$102
Aug-18	95	$150
Sep-18	163	$228
Oct-18	942	$891
Nov-18	6,538	$7,619
Dec-18	8,027	$10,796
Jan-19	8,338	$9,718
Feb-19	6,956	$8,090
Mar-19	6,243	$7,263
Apr-19	2,292	$2,594
May-19	1,020	$1,171
Jun-19	135	$178
Total/Max	**40,840**	**$48,801**

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the Therms and natural gas cost for the baseline period.



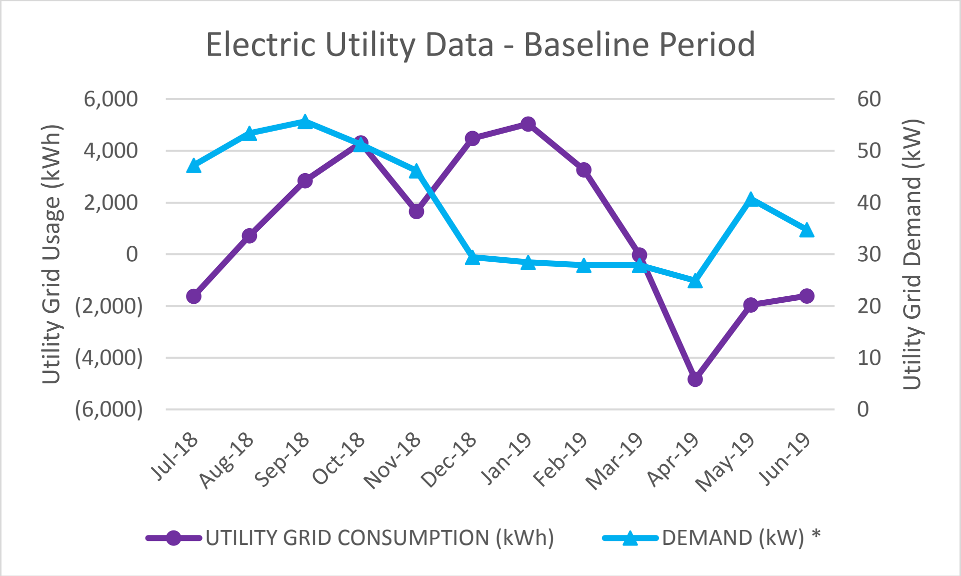
Norma Elementary School

Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost by month is shown below in table format. Actual demand shown here is lower than minimum demand (44.5 kW) for billing.

MONTH	UTILITY GRID CONSUMPTION (kWh)	DEMAND (kW)	SOLAR PPA CONSUMPTION (kWh)	TOTAL CONSUMPTION (kWh)	TOTAL UTILITY GRID ELECTRIC COST
Jul-18	(1,619)	47	16,400	14,781	$608
Aug-18	716	53	15,200	15,916	$710
Sep-18	2,846	56	8,970	11,816	$665
Oct-18	4,314	51	9,960	14,274	$681
Nov-18	1,655	46	7,740	9,395	$660
Dec-18	4,483	29	5,890	10,373	$670
Jan-19	5,041	28	6,380	11,421	$717
Feb-19	3,275	28	8,540	11,815	$631
Mar-19	(20)	28	13,600	13,580	$521
Apr-19	(4,835)	25	14,900	10,065	$599
May-19	(1,958)	41	15,200	13,242	$732
Jun-19	(1,612)	35	16,600	14,988	$732
Total/Max	**12,286**	**56**	**139,380**	**151,666**	**$7,926**

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the demand (kW-secondary axis) and electricity usage (kWh-primary axis) over the baseline period.

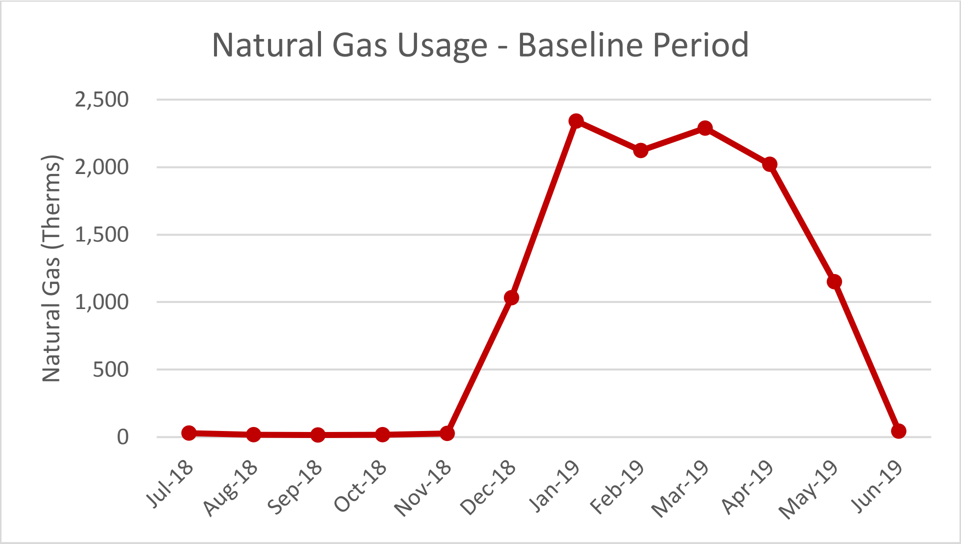


Natural Gas Usage

A detailed look at the monthly consumption (Therms) in a typical year is shown below in table format.

MONTH	CONSUMPTION (THERMS)	NATURAL GAS COST ($)
Jul-18	30	$71
Aug-18	18	$55
Sep-18	16	$55
Oct-18	17	$52
Nov-18	27	$62
Dec-18	1,032	$1,002
Jan-19	2,341	$2,920
Feb-19	2,123	$2,652
Mar-19	2,287	$2,669
Apr-19	2,020	$2,354
May-19	1,150	$1,316
Jun-19	44	$83
Total/Max	**11,104**	**$13,291**

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the Therms and natural gas cost for the baseline period.



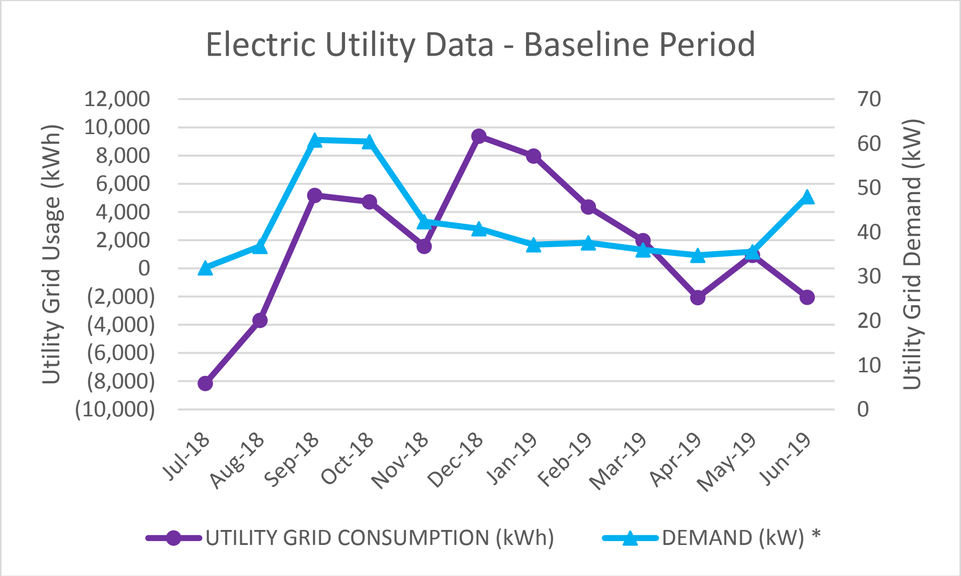
Elmer Elementary School

Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost by month is shown below in table format. Actual demand shown here is lower than minimum demand (48.6 kW) for billing.

MONTH	UTILITY GRID CONSUMPTION (kWh)	DEMAND (kW)	SOLAR PPA CONSUMPTION (kWh)	TOTAL CONSUMPTION (kWh)	TOTAL UTILITY GRID ELECTRIC COST
Jul-18	(8,150)	32	15,500	7,350	$805
Aug-18	(3,670)	37	13,700	10,030	$686
Sep-18	5,169	61	8,130	13,299	$1,030
Oct-18	4,728	60	8,350	13,078	$832
Nov-18	1,571	42	6,310	7,881	$1,135
Dec-18	9,368	41	2,800	12,168	$1,515
Jan-19	7,970	37	5,320	13,290	$1,657
Feb-19	4,369	38	7,260	11,629	$1,119
Mar-19	1,969	36	12,200	14,169	$956
Apr-19	(2,070)	35	13,900	11,830	$951
May-19	929	36	13,700	14,629	$926
Jun-19	(2,031)	48	15,300	13,269	$923
Total/Max	**20,152**	**61**	**122,470**	**142,622**	**$12,537**

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the demand (kW-secondary axis) and electricity usage (kWh-primary axis) over the baseline period.



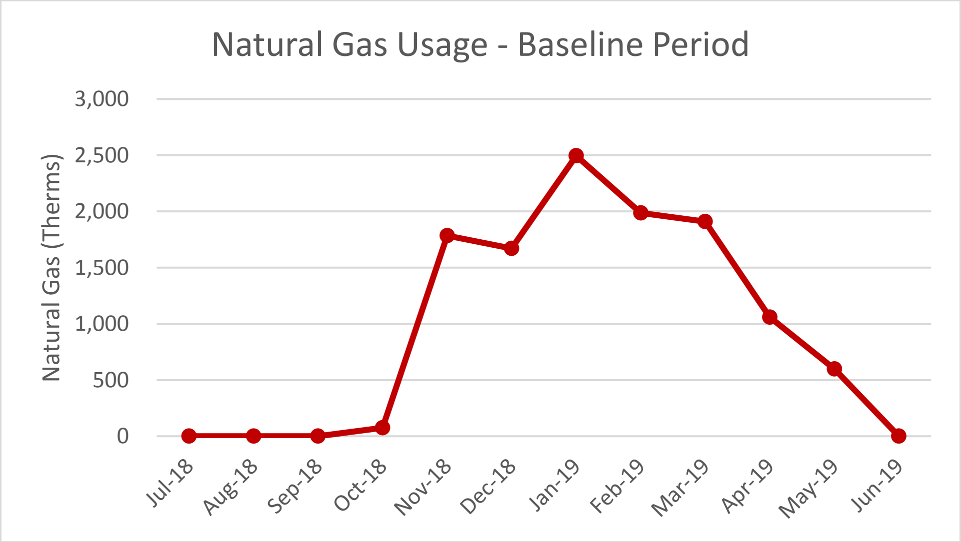
Natural Gas Usage

A detailed look at the monthly consumption (Therms) in a typical year is shown below in table format.

MONTH	CONSUMPTION (THERMS)	NATURAL GAS COST ($)
Jul-18	0	$38
Aug-18	0	$33
Sep-18	0	$36
Oct-18	75	($102)*
Nov-18	1,784	$2,102
Dec-18	1,670	$2,199
Jan-19	2,495	$2,927
Feb-19	1,986	$2,325
Mar-19	1,909	$2,237
Apr-19	1,058	$1,210
May-19	599	$696
Jun-19	0	$32
Total/Max	**11,576**	**$13,733**

*Refunded/Credited amount

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the Therms and natural gas cost for the baseline period.



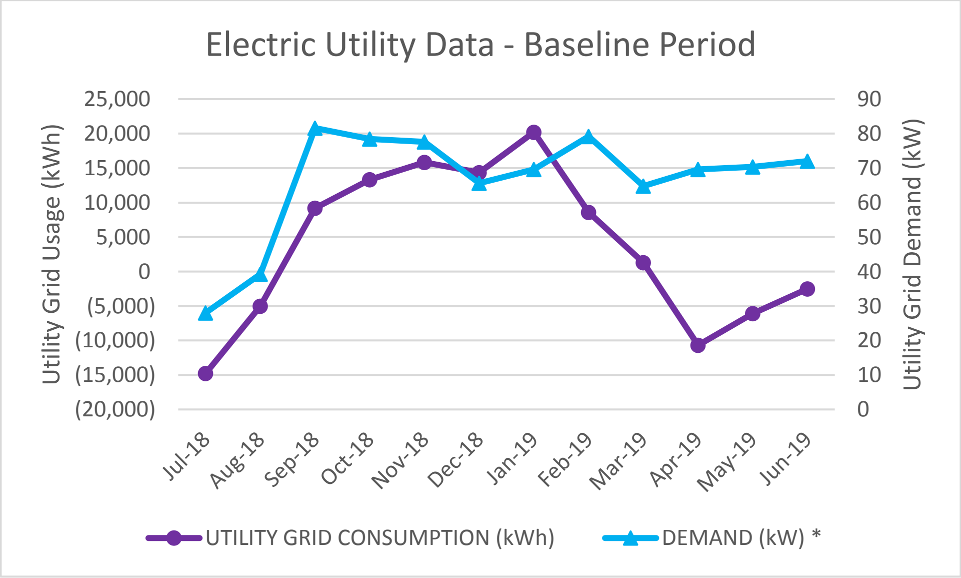
Olivet Elementary School

Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost by month is shown below in table format. Actual demand shown here is lower than minimum demand (65.3 kW) for billing.

MONTH	UTILITY GRID CONSUMPTION (kWh)	DEMAND (kW)	SOLAR PPA CONSUMPTION (kWh)	TOTAL CONSUMPTION (kWh)	TOTAL UTILITY GRID ELECTRIC COST
Jul-18	(14,793)	28	52,300	37,507	$630
Aug-18	(5,034)	39	48,000	42,966	$602
Sep-18	9,191	82	27,500	36,691	$2,745
Oct-18	13,324	78	28,900	42,224	$2,623
Nov-18	15,820	78	22,700	38,520	$2,995
Dec-18	14,350	66	18,400	32,750	$2,637
Jan-19	20,215	70	18,400	38,615	$3,321
Feb-19	8,595	79	25,200	33,795	$2,619
Mar-19	1,305	65	41,700	43,005	$2,532
Apr-19	(10,706)	70	46,500	35,794	$2,040
May-19	(6,071)	70	47,500	41,429	$2,228
Jun-19	(2,530)	72	52,700	50,170	$2,575
Total/Max	**43,666**	**82**	**429,800**	**473,466**	**$27,548**

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the demand (kW-secondary axis) and electricity usage (kWh-primary axis) over the baseline period.



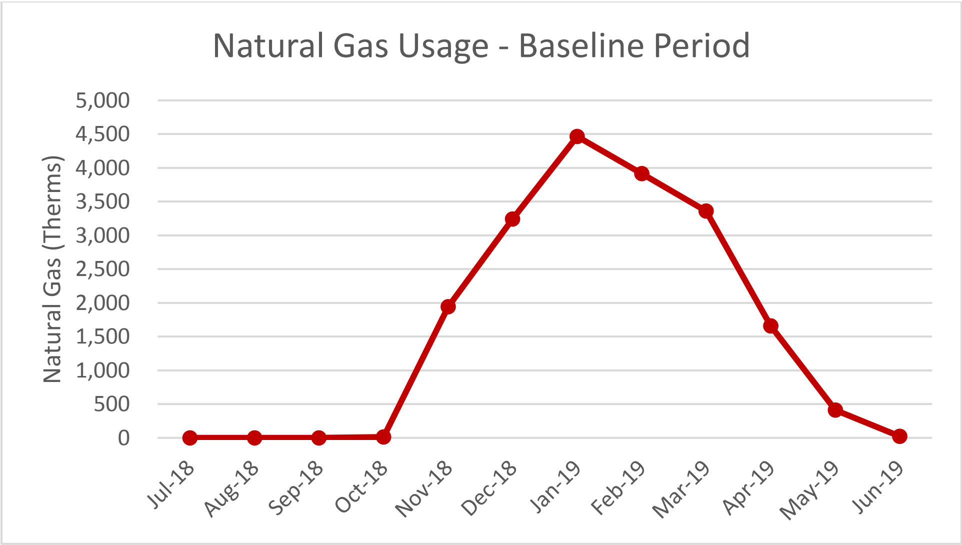
Natural Gas Usage

A detailed look at the monthly consumption (Therms) in a typical year is shown below in table format.

MONTH	CONSUMPTION (THERMS)	NATURAL GAS COST ($)
Jul-18	0	$37
Aug-18	0	$28
Sep-18	0	$38
Oct-18	10	($175)*
Nov-18	1,942	$2,277
Dec-18	3,240	$4,142
Jan-19	4,465	$5,205
Feb-19	3,916	$4,555
Mar-19	3,360	$3,910
Apr-19	1,659	$1,947
May-19	412	$487
Jun-19	21	$57
Total/Max	**19,025**	**$22,509**

*Refunded/Credited amount

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the Therms and natural gas cost for the baseline period.



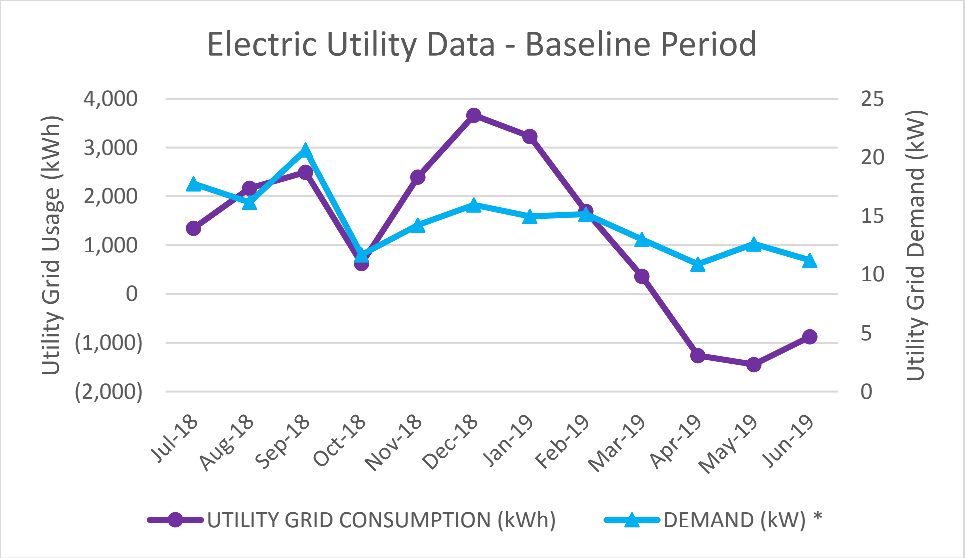
BOE Administration Building

Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost by month is shown below in table format. Actual demand shown here is lower than minimum demand (25 kW) for billing.

MONTH	UTILITY GRID CONSUMPTION (kWh)	DEMAND (kW)	SOLAR PPA CONSUMPTION (kWh)	TOTAL CONSUMPTION (kWh)	TOTAL UTILITY GRID ELECTRIC COST
Jul-18	1,345	18	5,617	6,962	$594
Aug-18	2,166	16	5,418	7,584	$734
Sep-18	2,493	21	3,366	5,859	$717
Oct-18	625	12	3,641	4,266	$512
Nov-18	2,398	14	1,815	4,213	$754
Dec-18	3,663	16	1,815	5,478	$834
Jan-19	3,229	15	2,576	5,805	$811
Feb-19	1,698	15	3,192	4,890	$608
Mar-19	364	13	4,739	5,103	$488
Apr-19	(1,261)	11	5,062	3,801	$569
May-19	(1,445)	13	5,090	3,645	$619
Jun-19	(873)	11	5,575	4,702	$506
Total/Max	**14,402**	**21**	**47,907**	**62,309**	**$7,746**

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the demand (kW-secondary axis) and electricity usage (kWh-primary axis) over the baseline period.



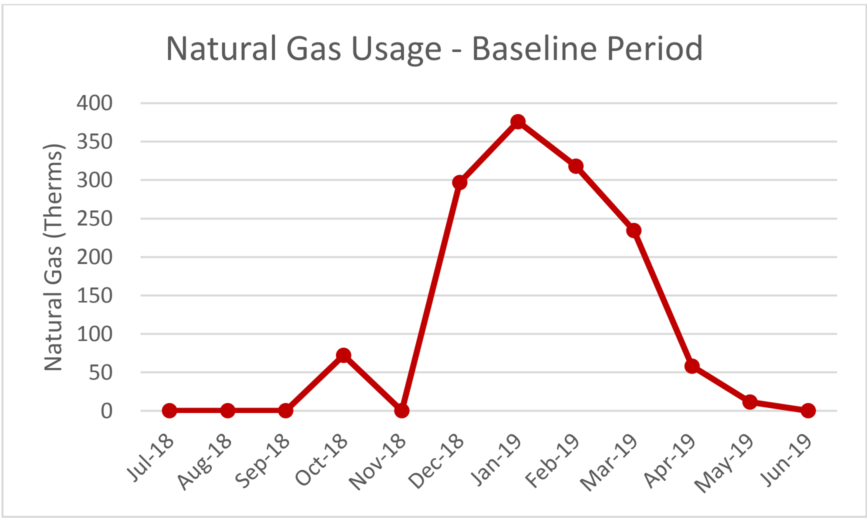
Natural Gas Usage

A detailed look at the monthly consumption (Therms) in a typical year is shown below in table format.

MONTH	CONSUMPTION (THERMS)	NATURAL GAS COST ($)
Jul-18	0	$33
Aug-18	0	$37
Sep-18	0	$34
Oct-18	72	$37
Nov-18	0	$277
Dec-18	297	$408
Jan-19	376	$508
Feb-19	318	$453
Mar-19	234	$343
Apr-19	58	$111
May-19	11	($131)*
Jun-19	0	$29
Total/Max	**1,367**	**$2,137**

*Refunded/Credited amount

Based on the last year of utility bill information – July 2018 to June 2019, the figure below shows the Therms and natural gas cost for the baseline period.



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.

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
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 ESP. 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.

ID #	Energy Conservation Measure	ECM Hard Cost	Year 1 Utility Savings*	Simple Payback
1,2	Upgrade Interior and Exterior Lighting LED Retrofits, Lighting Occupancy Controls	$ 483,098	$ 72,502	6.5
3	Building Envelope - Weatherization	$ 173,733	$ 13,516	12.9
4	Water Source Heat Pump Replacement at Middle School	$ 300,000	$ 324	925.9
5	Roof Top Units Replacement at Middle School	$ 498,000	$ -	
6	Controls Integration at Middle School on New Equipment	$ 90,000	$ 7,174	12.5
7	Cooling Tower Replacement at Middle School	$ 165,000	$ 159	1036.8
8	Boiler Replacement at High School	$ 150,000	$ 5,434	27.6
9	Installation of Premium Efficiency Motors and Pumps	$ 67,900	$ 722	94.0
10	Mechanical Insulation	$ 36,152	$ 4,673	7.7
11	Micro Combined Heat and Power (CHP) at Middle School	$ 80,000	$ 197	406.9
12	Solar PPA Savings	$ -	$51,100	
	Totals	$ 2,043,883	$155,801	13.5

***Year 1 Utility Savings in the above table include a 2.2% escalation on Electric and 2.4% escalation on Natural Gas for guaranteed savings.**

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 lighting and will generate material cost savings.

A brief description of the operational savings estimated for this project is included below. Johnson Controls has worked with the School 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	**Years to Carry**	**Annual Savings**
Lighting Upgrades	5	**$13,896**
Roof Top Units Replacement at Middle School	2	**$6,200**
Cooling Tower Replacement at Middle School	2	**$4,000**
Boiler Replacement at High School	2	**$2,000**

Potential Revenue Generation Estimates

Rebates

As part of the ESP for the Pittsgrove Township School District, several avenues for obtaining rebates and incentives have been investigated which include:

- Smart Start Incentives

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.

SmartStart Incentives

New Jersey SmartStart Buildings is a statewide energy efficiency program available to qualified K-12 customers planning to construct, expand, renovate, or remodel a facility, or to replace electric or gas equipment. Incentives are available for prescriptive measures or for custom measures that are selected and incorporated into the project to help offset the added cost to purchase qualifying energy-efficient equipment.

Inventive Type	Estimated Amount
Lighting (Smart Start) - HS and MS	$71,685
Boiler Replacement (Smart Start) - HS	$3,000
Total	$74,685

Elementary schools do not qualify for Smart Start rebates as Direct Install is used for the implementation of the scope. Rebates are indicative of existing programs & subject to change based on future programs (changes in 2020). Johnson Controls does not guaranteed any rebates carried in this project.

Demand Response Energy Efficiency Credit

The LED Lighting and facility upgrades will qualify the school will be eligible for the Energy Efficiency Credit and the Energy Efficiency Credit pays consumers based on the permanent load reduction through the installation of energy efficiency measures. The following Energy Efficiency Credits are estimated for the demand reduction from lighting upgrades.

Year	Estimated Amount
Year 1	$3,536
Year 2	$3,120
Year 3	$2,288
Year 4	$2,288
Total	$11,232

Johnson Controls does not guaranteed any rebates carried in this project.

Business Case for Recommended Project

FORM VI

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
PITTSGROVE TOWNSHIP BOARD OF EDUCATION - ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO NAME: **Johnson Controls**

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 **2.4% gas, 2.2% electric per year**; and

1. Term of Agreement: 20 **years (240 Months)**
2. Construction Period (2) (months): **12 months**
3. Cash Flow Analysis Format:

Project Cost (1): **$2,725,926**
Bond Issuance Cost : **$35,000**
Project Finance Amount: **$2,760,926**

Interest Rate to Be Used for Proposal Purposes: 2.5%

Year	Annual Energy Savings	Annual Operational Savings	Energy Rebates/ Incentives	Total Annual Savings	Annual Project Costs	Board Costs	Annual Service Costs (3)	Net Cash Flow to Client	Cumulative Cash Flow
Installation	$43,591			$43,591	$0	$0			
1	$155,801	$26,096	$78,221	$260,118	$273,194	$287,088	$13,894	$2,727	$2,727
2	$159,289	$26,096	$3,120	$188,505	$157,096	$171,407	$14,311	$2,788	$5,514
3	$162,856	$13,896	$2,288	$179,040	$146,709	$161,449	$14,740	$2,850	$8,364
4	$166,502	$13,896	$2,288	$182,686	$181,437	$179,772		$2,914	$11,278
5	$170,230	$13,896		$184,126	$182,850	$181,147		$2,979	$14,257
6	$174,042			$174,042	$172,737	$170,997		$3,046	$17,303
7	$177,940			$177,940	$176,605	$174,826		$3,114	$20,417
8	$181,924			$181,924	$180,560	$178,741		$3,184	$23,600
9	$185,998			$185,998	$184,603	$182,743		$3,255	$26,855
10	$190,164			$190,164	$188,738	$186,836		$3,328	$30,183
11	$194,423			$194,423	$192,965	$191,020		$3,402	$33,585
12	$198,777			$198,777	$197,286	$195,298		$3,479	$37,064
13	$203,229			$203,229	$201,705	$199,673		$3,557	$40,621
14	$139,973			$139,973	$138,923	$137,523		$2,450	$43,070
15	$143,135			$143,135	$142,061	$140,630		$2,505	$45,575
16	$146,368			$146,368	$143,573	$143,807		$2,561	$48,136
17	$149,675			$149,675	$143,573	$147,056		$2,619	$50,756
18	$153,057			$153,057	$143,573	$150,378		$2,679	$53,434
19	$156,515			$156,515	$143,573	$153,776		$2,739	$56,173
20	$160,052			$160,052	$143,573	$157,086		$2,966	$59,139
Totals	**$3,413,541**	**$93,880**	**$85,917**	**$3,593,338**	**$3,435,332**	**$3,491,254**	**$42,945**	**$59,139**	

NOTES:
(1) Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"
(2) No payments are made by Board during the construction period
(3) This figure should equal the value indicated on the ESCOs PROPOSED "FORM V". DO NOT include in the Financed Project Costs.

Greenhouse Gas Reductions

Avoided Emissions	Total Electric Savings	Total Natural Savings	Total Annual Avoided Emissions
Annual Unit Savings	467,331 kWh	25,653 Therms	
NOX, , lbs	519 lbs	236 lbs	755 lbs
SO2 , lbs	458 lbs		458 lbs
CO2 , lbs	642,113 lbs	300,140	942,253 lbs

Factors Used In Calculations:

- 1,374 lbs. CO2 per MWh saved
- 1.11 lbs. NOx per MWh saved
- 0.98 lbs. SO2 per MWh saved
- 11.7 lbs. CO2 per therm saved
- 0.0092 lbs. NOx per therm saved

Section 4. Energy Conservation Measures

- Upgrade Interior and Exterior Lighting LED Retrofits
- Lighting Occupancy Controls
- Building Envelope Improvements – Weatherization
- Water Source Heat Pump Replacement at Middle School
- Roof Top Units Replacement at Middle School
- Controls Integration at Middle School on New Equipment
- Cooling Tower Replacement at Middle School
- Boiler Replacement at High School
- Fan Coil Unit Replacement with Cooling and Ductsox at Norma Elementary School
- Installation of Premium Efficiency Motors
- Mechanical Insulation
- Micro Combined Heat and Power (CHP) at Middle School

ECM #1: Upgrade Interior and Exterior Lighting LED Retrofits

ECM #2: Lighting Occupancy Controls

ECM Summary

Since the advent of energy efficient T8 lighting (with electronic ballast), there have been several generations of improvements to interior lighting. Today, a 10.5-watt LED lamp offers an opportunity to lower energy consumption in areas lit by the standard 32 or 28-watt T8 lamp.

The large majority of lighting fixtures throughout Pittsgrove Township Schools utilize 32-watt T8 lamps operating on electronic ballasts. Several areas of the older buildings have 2F96T12 pendant-mounted fixtures that use T-12 technology with magnetic ballasts.

Light levels vary from school to school, and in some instances from classroom to classroom within a school. In general, light levels are typically within 10-15% of current IES and Department of Education recommendations and this is likely due the variation of fixture types, as well as the lamps that are at different stages of their life cycles. During the lighting survey, most of the lamps were found towards the lower end of the depreciation curve. There are also a small number of failed lamps in each building.

For exterior lighting, existing 70-watt and 100-watt wall-pack and 250 watt metal halide exterior fixtures installed in various locations in the School will be replaced with newer technology LED type fixtures. The newer technology fixtures have a much longer life and improved light quality throughout the entire life of the lamp than the existing lamps. This will provide energy savings as well as provide a safe environment around the exterior of the buildings. Pole-mounted lighting owned by the School can be found in some of the parking lots and driveways at these facilities. Any of the pole-mounted fixtures used by the School but owned and maintained by the electric utility company are not included in the project. A detailed room-by-room description of the existing and proposed fixture type, fixture count and lamp wattage are presented in the Appendix.

The standardization to LED lighting in all areas of the School will allow for reduced lighting operational expenses.

Lighting Controls

Most spaces are switch controlled, with many fixtures having bi-level control. Where economically feasible, we recommend installing lighting controls to maximize savings and functionality of each space. We are proposing to install wireless occupancy control sensors within spaces that would benefit from their inclusion based on usage/energy savings. These sensors will be used in areas to monitor occupancy and turn off lights when areas are not in use, which can generate energy savings. Although lowering kWh will always lower the electric bill, not every location is a good candidate for occupancy sensor use. JCI has reviewed the occupancy and use of each room using an occupancy sensor. Areas that have relatively low operating hours and would only save an hour or two per day are usually not good candidates for sensors from a cost perspective.

New sensors will not be proposed in areas that have existing sensors.

Scope of Work

Arthur P. Schalick High School

Interior

- All 60-watt incandescent bulbs, as listed, will be relamped with new 9 watt A Lamp LED bulbs.
- All 75-watt incandescent floods, as listed, will be replaced with new 15-watt PAR38 LED bulbs.
- All two 2' F17 T8lamps with normal powered electronic ballast, as listed, will be retrofitted with new two 2' LED self-ballasted tubes.
- All one, two, three and four 4' F32 T8lamps with normal powered electronic ballast, as listed, will be retrofitted with new one, two, three and four foot (4')LED self-ballasted tubes.
- All 2x4 four lamp TS high bays, as listed, will be retrofitted with new four 4' T5 high output LED self-ballasted tubes.
- All two 8' F96 T8 lamps with normal powered electronic ballast, as listed, will be retrofitted with new two 4' LED self-ballasted strip kits
- As listed, sensors will be added for additional savings.

Exterior

- All 70-watt metal halide high hats, as listed, will be retrofitted with new 10-inch 12- watt LED high hats.
- All 250-watt metal halide wall packs, as listed, will be replaced with new 50-watt LED wall packs.
- All 400-watt metal halide floods, as listed, will be replaced with new 100-watt LED adjustable floods.
- All 1,000-watt metal halide floods, as listed, will be replaced with new 270-watt high output LED floods.

Pittsgrove Middle School

Interior

- All 60-watt incandescent bulbs, and 13-watt compact fluorescent screw-ins, as listed, will be relamped with new 9 watt A Lamp LED bulbs.
- All 65 and 75-watt incandescent floods, as listed, will be replaced with new 15-watt PAR38 LED bulbs.
- All two 2' F17 T8 lamps and two 4' F32 u-tubes with normal powered electronic ballast, as listed, will be retrofitted with a new two 2' LED self-ballasted tubes.
- All one 4' F40 Tl2 lamps with standard magnetic ballast, as listed, will be retrofitted with new one 4' LED self-ballasted tubes.
- All two, three and four 4' F32 T8 lamps with normal powered electronic ballast, as listed, will be retrofitted with new two, three and four 4 'LED self-ballasted tubes.
- All 2x4 four lamp TS high bays, as listed, will be retrofitted with new four lamp TS high output LED self-ballasted tubes.
- All (2) 13-watt compact fluorescent hard wired fixtures, as listed, will be retrofitted with new 6-inch 12-watt LED high hats.
- As listed, sensors will be added for additional savings.

Exterior

- All (2) 23-watt compact fluorescent hard wired fixtures, as listed, will be retrofitted with new I0-inch 12-watt LED high hats.
- All 70-watt high pressure sodium wallpacks, as listed, will be replaced with new 26- watt LED wallpacks.
- All 250-watt metal halide floods, as listed, will be replaced with new 50-watt LED floods.
- All 400-watt metal halide shoebox fixtures, as listed, will be replaced with new 140- watt LED shoebox fixtures with arms.

Olivet School

Interior

- All 60-watt incandescent bulbs, as listed, will be relamped with new 9 watt A Lamp LED bulbs.
- All two 2' F17 T8lamps with normal powered electronic ballast, as listed, will be retrofitted with new two 2' LED self-ballasted tubes.
- All one, two, three and four 4' F32 T8 lamps with normal powered electronic ballast, as listed, will be retrofitted with new one, two, three and four 4 ' LED self-ballasted tubes.
- All 2x4 four lamp TS high bays, as listed, will be retrofitted with new four lamp TS high output LED self-ballasted tubes.
- All 13-watt compact fluorescent hard wired fixtures will be retrofitted with new 6-inch 12-watt LED high hats.
- As listed, sensors will be added for additional savings.

Exterior

- All two 8' F96 T8 lamps with normal powered electronic ballast, as listed, will be retrofitted with new two 4' LED self-ballasted strip kits

- All 60-watt incandescent jelly jars, as listed, will be relamped with new 9 watt A Lamp LED bulbs.
- All 2S0-watt high pressure cobraheads, as listed, will be replaced with new 100-watt LED cobraheads.
- All 2S0-watt high pressure sodium shoebox fixtures, as listed, will be replaced with new 100-watt LED shoebox fixtures with arms.

Norma School

Interior

- All 13-watt compact fluorescent bulbs, as listed, will be relamped with new 9 watt A iii9.
- All two 2' F17 TS lamps and two 4' F32 u-tubes with normal powered electronic ballast, as listed, will be retrofitted with a new two 2' LED self-ballasted tubes.
- All two 3' F25 TS lamps with normal powered electronic ballast, as listed, will be retrofitted with a new two 3' LED self-ballasted tubes.
- All two, three and four 4' F32 T8 lamps with normal powered electronic ballast, as listed, will be retrofitted with new two, three and four 4' LED self-ballasted tubes.
- As listed, sensors will be added for additional savings.

Exterior

- All two 8' F96 TS lamps with normal powered electronic ballast, as listed, will be retrofitted with new two 4' LED self-ballasted strip kits
- All 250-watt high pressure cobraheads, as listed, will be replaced with new 100-watt LED cobraheads.
- All 250-watt metal halide wallpacks, as listed, will be replaced with new 50-watt LED wallpacks.

Elmer School

Interior

- All 60-watt incandescent bulbs, as listed, will be relamped with new 9 watt A Lamp LED bulbs.
- All 75-watt incandescent floods, as listed, will be relamped with new 15-watt PAR38 LED bulbs.
- All two 2' F17 T8lamps with normal powered electronic ballast, as listed, will be retrofitted with new two 2' LED self-ballasted tubes.
- All one, two, and four 4' F32 T8 lamps with normal powered electronic ballast, as listed, will be retrofitted with new one, two, and four 4' LED self-ballasted tubes.

Exterior

- All 70-watt high pressure sodium wallpacks, as listed, will be replaced with new 21- watt LED wallpacks.
- All 70-watt metal halide wallpacks, as listed, will be replaced with new 26-watt LED wallpacks.
- All 250-watt metal halide shoebox fixtures, as listed, will be replaced with new 70-watt LED shoebox with arms.
- All 400-watt metal halide floods and 500-watt incandescent quartz, as listed, will be replaced with new 100-watt LED floods with adjustable arms.

Administration Building

Interior

- All 60-watt incandescent bulbs and 13-watt compact fluorescents, as listed, will be relamped with new 9 watt A Lamp LED bulbs.
- All 65-watt incandescent floods, as listed, will be relamped with new 15-watt PAR38 LED bulbs.
- All 13-watt compact fluorescent hardwired fixtures, as listed, will be retrofitted with new 12 watt 6-inch-high hats.
- All two 4' F32 u-tubes with normal powered electronic ballast, as listed, will be retrofitted with a new two 2' LED self-ballasted tubes.
- All two and four 4' F32 T8 lamps with normal powered electronic ballast, as listed, will be retrofitted with new two and four 4' LED self-ballasted tubes.

Exterior

- All 70-watt metal halide high hats, as listed, will be retrofitted with new 12 -watt LED 10-inch-high hats.
- All 400-watt metal halide shoebox fixtures, as listed, will be replace with new 140-watt LED shoebox fixtures with arms.

Lighting Controls

Refer to the line by line for location of lighting occupancy sensors by building.

Proposed LED lamps

Proposed Exterior Fixtures

Proposed LED High Bays

Proposed Troffers & LED Kits

Proposed ULB – TLED (direct wire)

Savings Methodology

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

Demand (kW)

$\textit{Connected kW Savings} = \sum_u [\ (kW/Fixture_{baseline} \times Quantity_{baseline} - kW/Fixture_{post} \times Quantity_{post})]_{t,u}$
where:

$kW/fixture_{baseline}$ = lighting baseline demand per fixture for usage group *u*
$kW/fixture_{post}$ = lighting demand per fixture during post-installation period for usage group
$Quantity_{baseline}$ = quantity of affected fixtures before the lighting retrofit for usage group *u*
$Quantity_{post}$ = quantity of affected fixtures after the lighting retrofit for usage group *u*

Energy (kWh)

$\textit{kWh Savings}_{Lighting} = \sum_u [\ \textit{Connected kW Savings}_u \times \textit{Hours of Operation}]_{t,u}$
$\textit{kWh Savings}_{Lighting\ controls} = \sum_u [kW/Fixture_{post} \times Quantity_{post} \times (\textit{Hours of Operation}_{pre} - \textit{House of Operation}_{post}]_{t,u}$

where:

Connected kW Savings= total connected fixture demand reduction for usage group *u*
Hours of Operation = number of operating hours during the time period *t* for the usage group *u*

Hours of operation and watt readings of existing lamp/ballast combinations will be taken before and after installation.

Benefits

- Electrical energy savings
- Improved exterior light quality
- Reduction in maintenance of exterior lighting system
- Improved safety around school perimeter
- 10 year warranty by lamp manufacturer
- Reduced lamp replacement for 10 to 15 years for LEDs

ECM #3: Building Envelope - Weatherization

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. A detailed building envelope survey was conducted throughout the School. The 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;
- Penetrations were observed that need to be sealed.

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.

Findings and Observations:

- Caulking – there are gaps between the door frame and the door jamb. These gaps allow direct infiltration/ exfiltration; clear daylight is showing at select joints of both buildings which is a clear indicator of air leakage.
- Door Weather Stripping – deteriorated weather stripping materials, ineffective weather stripping installation and daylight showing at the perimeter of door systems create direct pathways for unwanted infiltration/ exfiltration at all of the buildings throughout the schools.
- Overhang Air Sealing – overhangs are roofs, floor systems or areas above entryways that extend beyond the plane of the exterior wall system. These areas of construction are often misunderstood by builders and the cavity that extends beyond the plane of the exterior wall system is often incorrectly “connected” to the interior heated spaces of the building. Overhangs that are not properly sealed at the plane of the surface that should separate the conditioned space from the outdoors throughout the schools lead to excessive air leakage and heat loss at these vulnerable areas in the building envelope.
- Roof-Wall Intersection Air Sealing – the roof-wall intersection is regularly an area that allows unwanted air leakage through the building shell. The roof-wall intersection is the largest area of unwanted air losses throughout the schools. Exterior flashing and finish details at this area are not constructed to stop air leakage (exterior flashings are for water control, not air control); unsealed exterior flashing details combine with interior gaps in the framing between the roof and wall assembly to allow infiltration/ exfiltration.
- Wall Air Sealing/ Insulation – a wall assembly that does not have an effective air barrier in place allows unnecessary air leakage losses. Areas of poorly insulated and sealed wall assemblies create bypasses for air leakage and heat loss that force the heating and cooling systems to work harder than necessary.

Scope of Work

A building envelope audit was performed for all schools. The results of the audit were the identification of several areas of envelope deficiency. The deficient areas were tabulated and their savings potential calculated.

Roof-Wall Intersection Air Sealing – the roof-wall intersection is a construction area that often allows unwanted air leakage through the building shell. Exterior flashing and finish details at this area are not constructed to stop air leakage (exterior flashings are for water control, not air control); unsealed exterior flashing details combine with interior gaps in the framing between the roof and wall assembly to allow infiltration/ exfiltration. Most of the buildings in the School have weaknesses that allow excessive infiltration/ exfiltration at the roof-wall intersection. In select buildings, clear daylight shining from outside-to-inside is an obvious indicator of a major building envelope weakness.

Overhang Air Sealing – overhangs are roofs, floor systems or areas above entryways that extend beyond the plane of the exterior wall system. These areas of construction are often misunderstood by builders and the cavity that extends beyond the plane of the exterior wall system is often incorrectly "connected" to the interior heated spaces of the building. Overhangs that are not properly sealed at the plane of the surface that should separate the conditioned space from the outdoors lead to excessive air leakage and heat loss at these vulnerable areas in the building envelope. The exterior finishes of many overhangs at the Schools include exterior recessed lights and other pathways where outside air can easily leak through the exterior surfaces and reach the interior spaces of the building.

Caulking – door and window installers often do not caulk the joints of the interior finish casing and trim. Failing to seal these joints results in unwanted air infiltration / exfiltration. Surface sealing at doors and windows by using interior casings or snap trim as part of the interior surface air barrier reduces air infiltration and exfiltration.

Attic Bypass Air Sealing – the primary surface that separates the conditioned spaces from the unconditioned attic is used as the air barrier in a building where insulating the flat attic surface is optimal. Bypasses that connect the conditioned space and unconditioned attic need to be blocked and sealed to create an effective air barrier and prevent unnecessary air leakage losses. The "cap" at the ceiling surface stops air leakage loss and ensures peak performance of fibrous insulation materials (cellulose and/ or fiberglass).

Door Weather Stripping – deteriorated weather stripping materials, ineffective weather stripping installation and daylight showing at the perimeter of door systems create direct pathways for unwanted infiltration/ exfiltration.

Task	High School	Admin Building	Elmer ES	Norma School	Olivet ES	Middle School	Total Quantity
Attic Bypass Air Sealing (SF)					5300		5300
Attic Flat Insulation (SF)					5300		5300
Buck Frame Air Sealing (LF)	106			223	408		737
Caulking (LF)	338					40	378
Door - Install Jamb Spacer (Units)	15						15
Door Weather Striping - Doubles (Units)	20		1	1	6	10	38
Door Weather Stripping - Singles (Units)	9	3	6	2	17	13	50
Insulation Soffit Baffles (UT)					229.5		229.5
Overhang Air Sealing (LF)			18			8	26
Overhang Air Sealing (SF)	455				80	112	647
Overhead Door Weather Stripping (Units)	3						3
Retrofit Attic Hatch (Units)					1		1
Roof-Wall Intersection Air Sealing (LF)	1776			399	605	413	3193
Window Weatherization (Units)				39			39

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 setpoint
- Average seasonal ambient temperatures

Savings due to infiltration reduction:

The following equation is based on the ASHRAE crack method:

CFM = (Area (sq.in.) x ((Stack Coeff. x Avg. Temp. Diff) + (Wind Coeff. x Wind Speed^2))$^{1/2}$)x Correction Factor
Average Temperature differential is calculated by taking the average of the occupied and unoccupied setpoints
Sensible Heat Gain
Heating: Q (Btu/hr): Qsens = 1.08 x CFM x delta T x Bin Hours x 1/Boiler Eff
Cooling: Q (Btu/hr): Qsens = 1.08 x CFM x delta T x Bin Hours x 1 ton/12,000 Btu/hr x Cooling Efficiency kW/ton x % of Space Cooled
Proposed:
85% Reduction in CFM
Savings:
(Existing - Proposed) x Correction Factor
Correction Factor is used to provide a conservative approach to savings estimation. Based on previous experience on similar projects

Maintenance

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

Benefits

- Electrical energy savings
- Fuel energy savings
- Increased thermal comfort

ECM #4: Water Source Heat Pump Replacement at Middle School

ECM Summary

Water source heat pumps (WSHPs) are used throughout the 5th and 6th grade classrooms at Pittsgrove Middle School to provide heating and cooling to the spaces. Pittsgrove School District has already replaced two (2) units so far. Johnson Controls proposes to replace the remaining ten (10) water source heat pumps. Dehumidification controls sequence will be added to all the WSHP units replaced by Johnson Controls as part of this project.

Water Source Heat Pump Unit

Scope of Work

The following general requirements are associated with this scope.

- Johnson Controls shall furnish and install ten (10) new WSHPs.
- Wiring material and new shut off switches for the new units will be provided
- The heating (MBH) and ventilation (CFM) specifications of the new units shall match the capacities of the existing units.
- The unit shall have a programable unitary controller capable of interfacing with the existing building management system. Sequence of operations shall be programmed for the new units.
- New units will be connected to the exisiting Building Management system.
- Insulation will be provided where necessary.
- Manufacturer start-up for each new WSHP, commission and test of new units will be performed.
- Controls associated with the new units will include a dehumidification sequence using the electric reheat coils and the WSHP distribution system
- Ventilation humid summer months will engage the system in dehumidification sequence in cooling mode.

Johnson Controls does not guarantee operational performance of dehumidification of the proposed units and specific relative humidity conditions of the space.

Savings Methodology

Energy savings were estimated using existing conditions and proposed conditions. Energy savings are estimated using FIMCalcs, a Johnson Controls proprietary calculation tool. The tool uses local weather data to perform an hourly simulation of facility energy use, as well as occupancy and operating schedules.

Data collected for baseline models include on-site audit observations and equipment nameplate data, collected during site audits. Data sources also include inspection of building mechanical drawings and schedules, and inspection of the existing BAS set points, strategies and operating schedules.

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance.

Benefits

- Reduced annual energy cost.
- Improved temperature control, consistency.
- Reduced annual operational and maintenance costs.

ECM #5: Roof Top Units Replacement at Middle School

ECM Summary

This measure proposes to replace the existing rooftop/condensing units at Pittsgrove Middle School with units that will have increased efficiency and reliability.

7th and 8th Grade Arial Image of RTUs

Existing System

The following table lists the units that are proposed to be replaced:

Quantity and Location		Cooling Capacity MBH	CFM	ESP.	HP	O.A. CFM (MIN)	Exisitng Trane Model	V/ Hz/Ph
7th Wing	8th Wing							
3	3	60	2000	0.75	1	390	TCD060C400BD	460/60/3
8	7	48	1600	0.75	3/4	390	TCD048C400BD	460/60/3
3	1	36	1200	0.75	1/2	210	TCD036C400BC	460/60/3
1	1	24	800	0.75	1/3	195		208/230/60/1
1	0	72	2400	0.75	1	780	TCD075C400BD	460/60/3
1	0	120	4000	0.75	2	1845		
0	3	30	1000	0.75	1/2		TCC030F100BE	208/230/60/1

Proposed System

All units are to be replaced with YORK MagnaDRY or equivalent units with dehumidification capability using hot gas reheat. The new units operate at higher efficiency and provide cooling to the space as per the system design. During high humidity space conditions, the unit will operate in dehumidification mode using hot gas reheat system when in cooling mode. The existing hot water reheat coils in the duct work, served by an independent boiler, will work in combination with the new RTUs to provide reheat during normal operation. Johnson Controls does not guarantee the operational performance of dehumidification of the proposed units and specific relative humidity conditions of the space.

Scope of Work

- Johnson Controls shall furnish and install new high efficiency York MagnaDRY or equivalent units with dehumidification capability
- Equipment will be reconnected to existing electrical power wiring, equipment starter.
- Equipment will be reconnected to the BAS.
- Commission and test the new dehumidification sequence will be performed.
- Installation to be performed in accordance with mechanical, electrical, fire, local, state and national installation and operational codes
- Manufacturer start-up of each new unit and air balance of new units will be performed.

Energy Savings Methodology

No energy savings are carried for this scop.

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance.

Benefits

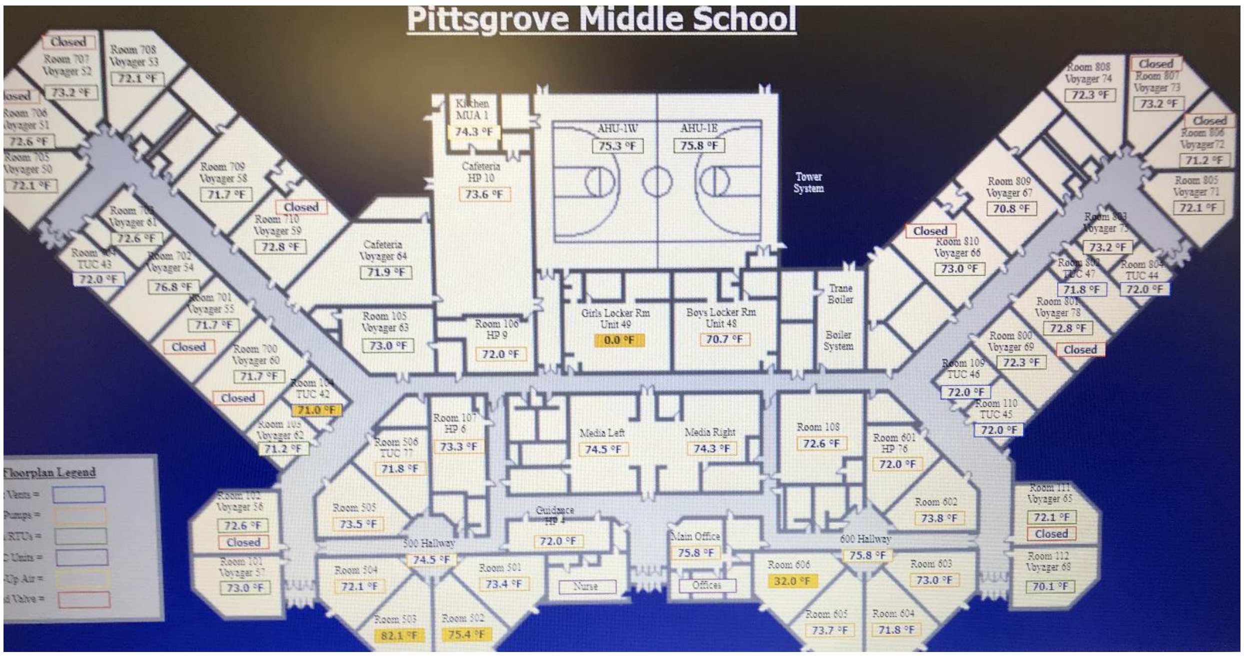
- Reduced annual energy cost.
- Improved temperature control, consistency.
- Reduced annual operational and maintenance costs.

ECM #6: Controls Integration at Middle School on New Equipment

ECM Summary

The heating and cooling equipment, associated pumps and terminal units typically represents the largest energy consumption used at Pittsgrove Middle School building. The rooftop units (RTUs) and water source heat pumps in the buildings are also part of the Trane controls to give the ability to schedule, operate and monitor the units. Good calibrated controls have a great potential for energy savings through upgraded building automation controls.

As part of the ESIP, Johnson Controls is replacing existing water source heat pumps and RTUs. The new units will be tied into the existing Trane Tracer front end to provide the School District with interface and controllability of the new units. Sequence of operation of the new controls will include dehumidification sequence for the new water source heat pumps and RTUs.



Middle School Front End

Scope of Work

The following scope of work for the Pittsgrove Middle school ATC shall include the following;

- Remove, edit or otherwise delete all associated control points, systems and control logic from the existing rooftop A/C Units, duct mounted hot water reheats and water source heat pumps from the existing Trane building automation system.
- Ensure all remaining systems maintain communication integrity and continue to operate as designed.
- Install a parallel BACNet MSTP communication bus, which shall be in daisy chain fashion to each new piece of equipment.
- Provide any communication interface extension module on existing JACE supervisory controller to handle the new units.
- Provide any software/hardware updates required to integrate all new equipment points into the existing Niagara based building automation and control system.

- Provide all required programming to functionally display the new equipment systems, points and graphics on the Pittsgrove BMS in a similar look and feel to the existing BMS.
- Provide customer training to all staff having direct responsibilities of maintaining and operating the new system.

Savings Methodology

Savings were calculated from the Excel-based bin temperature calculations. Savings result from implementing night setback temperatures, adjusting occupied heating and cooling setpoints.

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance. It is recommended that the School continue with the planned service agreement for an additional year in order to keep the BMS in proper working order.

Benefits

- Fuel energy savings.
- Improved occupant comfort
- Capital improvement of the BAS

ECM #7: Cooling Tower Replacement at Middle School

ECM Summary

Johnson Controls proposes the installation of new cooling tower for a water source heat pump at Pittsgrove Middle School. The new tower will be a high-performance, closed circuit, forced draft, and counter-flow cooling tower with variable speed drive (VSD). The proposed tower will have improved performance with lower approach temperatures, and with the VSD, will result in cooling tower fan energy savings. The existing tower is at the end of its service life and is at risk of failure.

Cooling Tower

Scope of Work

It is our recommendation that the existing cooling tower be replaced with a new EVAPCO or equal cooling tower with variable speed fan drive. Johnson Controls

Mechanical

- EVAPCO or equal closed circuit, forced draft, evaporative cooling tower to match capacity of existing unit will be installed
- New Cooling Tower will have:
  - BACnet capability for operation verification by building management system.
  - Factory installed VSD on fan motor that is totally enclosed, ball bearing type.
- New cooling tower and controls to comply with applicable regulations.
- Reconnect condenser water piping to the new cooling tower. Match the existing pipe size.
- Insulate new piping, valves and fittings as required.

- Start-up, checkout and verify all modes (stages) of tower operation (by factory authorized representative).
- Reuse existing piping, pipe fittings, pipe hangers, isolation valves, strainers, check valves, thermal wells, and pressure sensor wells where feasible and serviceable.
- Connect factory-mounted and wired controls.
- Provide new control valves if necessary, and size the valves to match the flow for designed pressure drop.
- Provide interface with existing building automation system as necessary.
- Flush all new piping and bleed air from the system.

Electrical

- Modify electrical power wiring distribution panel as needed.
- Extend communication bus to/from each new cooling tower VSD to/from existing Energy Management System.

Energy Savings Methodology

In general, Johnson Controls uses the following approach to determine savings for this specific measure:

Motor Savings, kWh	kWh reduced = [(kW) x (Reduced Flow/Orig. Flow)^2] x EFLH Where EFLH = Effective Full Load Hours

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance.

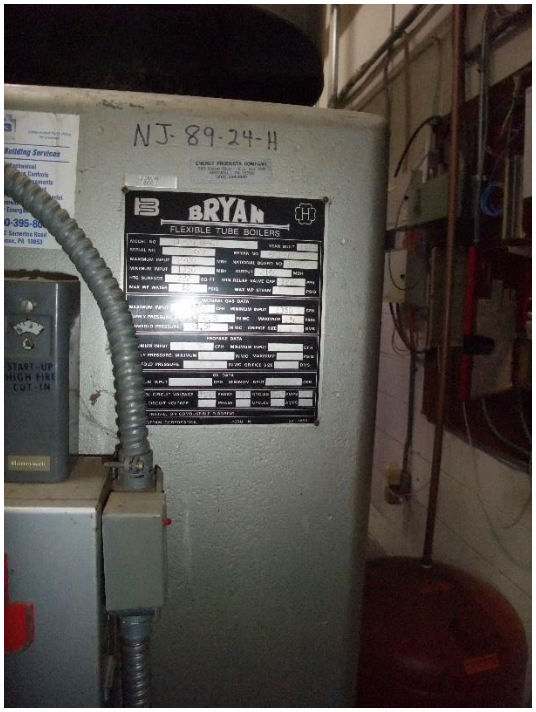
Benefits

- Electric Savings through improved efficiency.
- Operational savings through new equipment and preventative maintenance plan.

ECM #8: Boiler Replacement at High School

ECM Summary

Arthur P. Schalick High School was surveyed for the application of this measure. The High School water source heat pump loop hot water boiler that operates at lower than acceptable efficiencies and is at the end of its life should be replaced. The new boiler will help the School achieve energy savings and lower the amount of maintenance cost during the contract period.



Hot Water Boiler

Proposed Systems

New Installation Work

- Johnson Controls shall furnish, install, and commission (1) new 2,500 MBH gas-fired modular boiler to service existing Water Source Heat Pump (WSHP) system in accordance with code requirements, manufacturer's installation, operating and startup manual
    - Modulating burner
    - High Efficiency >88%
    - New boiler to have BACnet capability for operation verification only by building management system.
    - Boilers and controls to comply with applicable regulations
    - Provide U.L. labeled burner.
- The boiler shall be located in the existing location with gas piping, hot water piping and all other piping extended as required for connection
- Reconnect HW piping from new boiler into existing building WSHP loop with new piping.
- Reconnect natural gas piping to the new boiler with the manufacturer's required gas train and regulator.
- New piping, valves and fittings will be insulated as required.

- Patch and repair all penetrations with fire-rated caulking
- Start-up, checkout and verify all modes (stages) of operation (by factory authorized rep.).
- Reuse existing piping, pipe fittings, pipe hangers, isolation valves, strainers, check valves, thermal wells, and pressure sensor wells where feasible and equipment serviceable.
- Factory-mounted and wired controls.
- Disconnect and reconnect to existing controls and control valves. Replace “failed” valves as needed.
- Disconnect and reconnect to existing controls and control valves.
- Provide interface with existing building automation system as necessary
- Flush all new hot water pipe and bleed air from the system.

Electrical

- Reuse existing electrical devices and wiring. If devices and wiring are found to be of insufficient size, insufficient length, or in poor condition, then replace.
- Connect power to new boiler. Reuse existing electrical devices and wiring. If devices and wiring are found to be of insufficient size, insufficient length, or in poor condition, then replace.
- **Johnson Controls is not responsible for any asbestos removal.**

Energy Savings Methodology

In general, Johnson Controls uses the following approach to determine savings for this specific measure:

Existing Heating Efficiency = Existing Heat Production/ Existing Fuel Input

Proposed Heating Efficiency = Proposed Heat Production/ Proposed Fuel Input

Energy Savings $= Heating Production x (Proposed Efficiency – Existing Efficiency) x Natural Gas Rate

Changes in Infrastructure

New boilers will be installed in itemized locations. For most of the boiler replacements, no architectural or structural changes to the facility are anticipated with the implementation of this measure.

Benefits

- Fuel energy savings.
- Improved occupant comfort
- Capital improvement of the equipment

ECM #9: Installation of Premium Efficiency Motors and Pumps

Premium Efficiency Motors

ECM Summary

Energy savings can be achieved by replacing the standard efficiency motors that are installed throughout the facility with premium efficiency motors. Johnson Controls has identified motors in the below school as candidates for replacement with premium efficiency equivalents.

Facilities to be Included:

- High School
- Middle School
- Olivet Elementary School
- Norma School

Scope of Work

Johnson Controls proposes to replace all motors listed in the table below with new premium efficiency units.

Building	Location	Manufacturer	Rating (HP)
High School	Boiler Room	Marathon Electric	15
High School	Boiler Room	Marathon Electric	15
High School	Boiler Room	US Electric	15
Middle School	Boiler Room	Baldor Reliance	10
Middle School	Boiler Room	Marathon Electric	7.5
Middle School	Boiler Room	Marathon Electric	7.5
Middle School	Boiler Room	Marathon Electric	10
Olivet ES	Boiler Room	Delco	5
Olivet ES	Boiler Room	Magne Tek	5
Olivet ES	Boiler Room	Century	1.5
Olivet ES	Boiler Room	Century	1.5
Norma ES	Boiler Room	Weg Motor	2
Norma ES	Boiler Room	Bell and Gossett	0.75

- Installation to include leveling and alignment
- Install coupling

- Reconnect motor to existing electrical power wiring, reusing motor starter
- Verify new motor rotation
- Perform Start-up and Testing to manufacturer supplied specifications
- Provide conduit, fittings, gauges, insulation, etc.

Savings Methodology

In general, savings are calculated using Excel-based Bincalc. The equation presented below is used along with bin temperatures to equate building load and calculate pump savings. :

Motor Savings, kWh	kWh reduced = [(Motor kW/Proposed efficiency – Pump kW/existing efficiency) x EFLH Where EFLH = Effective Full Load Hours

Pump Replacement

ECM Summary

Energy savings can be achieved by replacing the existing standard efficiency pumps with premium efficiency pumps at Olivet Elementary School. The existing pumps are at the end of their useful life.

Scope of Work

Johnson Controls proposes to replace pump along with the motor replacement at Olivet ES.

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance.

Benefits

- Electrical energy savings

ECM #10: Mechanical Insulation

ECM Summary

Non-insulated pipelines and associated valves and fittings carrying thermal fluids because heat loss where not intended and result in excess fuel consumption. Valves and fittings without insulation were observed throughout the buildings and installation of new insulation is recommended. Installation of the proper amount of insulation will not only conserve energy but will also improve safety by reducing the chance for burns on hot piping or slipping due to condensate on a pipe.

Findings and Observations:

- Pipe Insulation – un-insulated pipes in the heating, cooling and domestic hot water systems are leading to unnecessary distribution losses and wasted energy.
- Valve & Fitting Insulation – valves and fittings are difficult components of a distribution system to insulate and as a result are frequently left un-insulated. These un-insulated or poorly insulated components have the same temperature fluids passing through them as the pipes that are more likely to be insulated; un-insulated components of the distribution system lead to unnecessary distribution losses and wasted energy.
- Tank Insulation – tanks are difficult components of a distribution system to insulate and as a result are frequently left un-insulated. Un-insulated or poorly insulated tanks or equipment have the same temperature fluids passing through them as the pipes that are more likely to be insulated; un-insulated components of the distribution system lead to unnecessary distribution losses and wasted energy.

Scope of Work

Piping insulation thickness will be added based on the following table as applicable:

Piping	Type	Pipe size	Type A insulation thickness
Domestic Hot water	A	All	1”
Hot/Dual Temp Water	A	½” – 1 ¼”	1.5”
Hot/Dual Temp Water	A	1½” – 10”	2”
Steam	A	½” – 3 ½”	2.5”
Steam	A	4” – 10”	3”
Steam Condensate	A	½” – 1 ¼”	1.5”
Steam Condensate	A	1 ½” – 10”	2”

- Insulation type:
  - Type A: Knauf 1000° Pipe Insulation, ASTM C547, Class 1, k value of 0.23 at 75 degrees F, with All Service Jacketing (ASJ) or equal.
  - Fittings: All fittings with Type A Pipe Insulation will be Proto Fitting Covers manufactured from 20-mil thick high-impact, ultra-violet-resistant PVC, or equal.
  - Jacket: All type A Pipe insulation includes a Foil and Paper Jacket: Laminated glass fiber-reinforced, flame retardant kraft paper and aluminum foil – white exterior, Kraft reinforce foil vapor barrier with self-sealing adhesive joints.
    - Accessories: All Type A Pipe Insulation terminations will be neatly finished with Childers Vi-Cryl CP-11 Mastic, or equal

- A detailed line-by-line scope of work has been included in the Appendix with the associated energy savings calculations for the insulation.

- Equipment insulation
  - Equipment: interior exposed above ambient temperature pumps, air separator, expansion tank.
  - Insulation type: Fiberglass/ w ASJ jacketing, 2" thickness.
- Insulation type:
  - Type A: Knauf Fiberglass, Kwikflex Pipe & Tank Insulation, ASTM C 1393, Types I,II, IIIA, IIIB Category 2, ASTM , flame spread rating is <25 and smoke developed rating is <50 as tested by ASTM E84,k value of 0.24 at 75 degrees F, with all service jacketing, or equal.

Task	High School	Elmer ES	Norma School	Olivet ES	Middle School	Total Quantity
3-Way Valve Insulation (Units)				1	1	2
Ball Valve Insulation (Units)	6	6			2	14
Bonnet Insulation (Units)				7		7
Butterfly Valve Insulation (Units)	1		1	2	6	10
Check Valve Insulation (Units)				5	2	7
Control Valve Insulation (Units)		1		2		3
End Cap Insulation (Units)	1		1	1		3
Flange Insulation (Units)		4	7	24	28	63
Flex Fitting Insulation (UT)		4	5		4	13
Flo-Check Insulation (Units)		2				2
Gate Valve Insulation (Units)			2	9	6	17
Pipe Fitting Insulation (Units)	15	69	37	13	15	149
Pump Insulation (Units)	1	2	5	3	2	13
Steam Trap Insulation (Units)			2			2
Straight Pipe Insulation (LF)	72	212	145	26	32	487
Strainer Insulation (Units)	3		1	3	2	9
Suction Diffuser Insulation (Units)			1	1		2
Tank Insulation (Units)			2		1	3
Triple Duty Valve Insulation (Units)			1			1

Savings Methodology

Mechanical Insulation Savings Calculations
This section describes our methodology for calculating energy savings. We use standard heat transfer methods to compute heat loss from bare and insulated mechanical systems (piping, valves, fittings, tanks, and ductwork). The difference in heat loss is the energy savings, as follows:

Energy Savings = [Existing Heat Loss] – [Insulated Heat Loss]

Methodology
We use standard heat transfer methods to compute radiation, convection, and conduction heat loss from (or gain to, for cold systems) bare and insulated systems. Key parameters that affect the heat transfer rate include: temperature of fluid (e.g. steam, hot water, chilled water, etc.); surface temperature of the component (e.g. pipe, fitting, tank, ductwork); temperature of environment; emissivity of surface; average wind speed where applicable; percentage of existing component covered with insulation; and condition of existing insulation, where applicable.

Energy Use
Existing and proposed energy use are computed as follows:

Pipes & Fittings
Heat Loss (Btu/h) = (Heat Loss / lin.ft. bare pipe) * (lin.ft. of pipe) * [1 – (%insulated)] +

(Heat Loss / lin.ft. insulated pipe) * (lin.ft. of pipe) * (%insulated)

Fuel Loss (MMBtu/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)

Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Tanks, Plates, & Ductwork
Existing and proposed heat loss for tanks, plates, and ductwork are calculated as follows:

Heat Loss (Btu/h) = (Heat Loss / sq.ft.) * (sq.ft. of component) * (qty) * [1 – (%insulated)] +

(Heat Loss / sq.ft. insulated) * (qty) * (sq.ft. of component) * (%insulated)

Fuel Loss (MMBtu/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)

Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Energy Savings

Energy savings are the difference between existing and proposed heat loss:

Fuel Savings (MMBtu/yr) = (Existing Fuel Loss) – (Proposed Fuel Loss)

Electric Savings (MMBtu/yr) = (Existing Electric Loss) – (Proposed Electric Loss)

Cost Savings ($/yr) = (Fuel Savings MMBtu/yr) * (Fuel Rate $/MMBtu) +

(Electric Savings kWh/yr) * (Electric Rate $/kWh)

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance.

Benefits

- Thermal energy savings
- Capital improvements of HVAC systems

ECM #11: Micro Combined Heat and Power (CHP) at Middle School

ECM Summary

Johnson Controls proposes to install one (1) 4.4 kW cogeneration machine at the Pittsgrove Middle School to supply electricity to the building, and the recovered heat will offset the domestic hot water boiler load at the Middle School. The CHP unit will be located in the boiler room.

Scope of Work

The systems will include:

- One (1) 4.4 kW Johnson Controls approved, low emissions cogeneration module with all appropriate appurtenances as required to tie into the existing domestic hot water system.
- Load modules for interfacing with the boiler plant, building space heating and other thermal loads encompassing pumps, heat exchangers, control values, and sensors for system monitoring and remote operation.
- Hydronic piping distribution from cogeneration unit to interface with building thermal loads.
- Natural gas piping from the existing service location to the cogeneration unit.
- Engine exhaust piping including silencer.
- One (1) electrical system including all necessary wiring, conduit, and fuse disconnect or circuit breaker with adequate fault duty utilizing the standard electrical interface and a utility grade relay for interconnection and parallel operation with utility. The electrical interconnection points will be in the boiler room, including conduit, wiring, and related electrical devices.
- MCC panel with all control circuit protection, circuit protection for all pumps and other electric devices, variable speed drives, and devices for data communication for live monitoring and operating control of the entire system.
- Customer to provide an IT network drop so that data and other operational information from the cogeneration unit can be collected remotely.
- Piping insulation and all required insignia to identify flow direction, valves and system components.
- Other appurtenances to make the system operational.
- Provide all Rigging and shipping.
- Proper ventilation for the cogeneration system and required ductwork from the unit's exhaust to outside.
- System startup with factory authorized technicians.
- Professional engineered drawing package including as-built drawings.

Proposed Specifications of unit

SYSTEM SPECIFICATIONS

ecopower microCHP Specifications	
Operating Voltage (single phase)	240 VAC / 208 VAC (207 - 253V)
Frequency	60 Hz
Dimensions (L x W x H)	54" x 30.375" x 43"
Power Factor	0.98 - 1
Exhaust Gas Temperature	< 180° F
Certified Test Data	
Electrical Output Range	1.2 - 4.4 kW
Thermal Output Range	NG 13,000 - 42,000 BTU/hr LPG 15,000 - 47,000 BTU/hr
Gas Consumption Range	NG 0.21 - 0.65 therms/hr LPG 0.26 - 0.78 gal/hr
Overall Efficiency	93%
Average Sound Level @ 1m	55 dB (A)
Average NOx Emissions	0.005 lb/MWh
Approvals	
UL Standards	UL 1741, UL 2200
CSA Standards	CSA C22.2 No. 14-10, 100-04, 107.1-01
Emissions Compliance	EPA Certified

Savings Methodology

Savings for cogeneration will be estimated using a custom spreadsheet using the following methodology:

Energy: 4.4 kW/module x 1 module(s) x 1 net after "parasitic loads"

= 4.4 net kW output x $/kWh avg. displaced energy

When Heat Used to Displace DHW Boiler Gas Use:

$$\frac{\left(\frac{Th}{hr\ module}\right)\ x}{boiler\ efficiency}\ x\ 1\ modules\ x\ \$/\text{Th boiler gas rate}$$

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance. Johnson Controls recommends the School to be contracted for an extended maintenance agreement to service the cogeneration units. This maintenance agreement needs to be conducted outside of the Energy Savings Improvement Program.

Benefits

- The installation of a cogeneration unit will result in significant economic benefits to the overall ESP program by extending the project financing term up to 20-years.
- Electric generation while making domestic hot water.

Section 5. Measurement and Verification

Measurement & Verification Methodologies

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

They have been developed and defined by the following independent authority:

- International Performance Measurement and Verification Protocol (IPMVP)

There are four guarantee options that may be used to measure and verify the performance of a particular ECM. 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. Also, 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. Also, 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.

Recommended Performance Verification Methods

Johnson Controls 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 Johnson Controls 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	M&V Method - Summary	Detail of M&V Methodology
Boiler Replacements	**Option A:** Baseline energy consumption based on collected field data and boiler logs of existing boilers. Post installation energy consumption based on combustion efficiency of new boilers.	**Pre M&V:** If weather allows, Johnson Controls will take a combustion efficiency test to verify the efficiency of existing boilers and estimate the fuel consumption of existing boilers based on collected field data and utility bills. **Post M&V:** If weather allows, Johnson Controls will take a combustion efficiency test to verify the efficiency of new boilers. **Energy Savings:** Savings for the new boilers will be determined using the base heating load and the difference in efficiencies between the existing boilers and new boilers.
Building Automation System Upgrades (including integration of Rooftop Units and Water Source Heat Pumps)	**Option A:** Baseline consumption determined through computer simulation and verified using utility data. Post retrofit consumption taken from computer simulation calibrated with actual operating conditions from the Building Automation System (BAS).	**Pre M&V**: Accepted engineering practices/building simulations were used to calculate energy consumption baselines. Pre-installation measurements will be taken where applicable. All calculations will be calibrated. **Post M&V**: Various control points within the BAS will be trended and/or totalized. The data will be used to verify if the proposed control strategies are in place and functioning as intended. If differences are found, savings will be adjusted accordingly. **Energy Savings**: The savings generated by the building model will be used for calculations. If differences occur between the as-built condition and the original design, the as-built conditions will be input into the model and savings will be re-calculated.
Combined Heat and Power	**Non-Measured:** Savings are from recovering the heat to domestic hot water loop and electric generation from the Combined Heat and Power system.	**Pre M&V**: The baseline utility bills were analyzed to determine natural gas consumption used for domestic hot water heating, electric loads, the time that the cogeneration system is able to operate per year and the capacity of the cogeneration system. **Post M&V**: Once the installation is completed, the system will be inspected to ensure it functions as intended. **Energy Savings**: Savings are from recovering the heat and electric generation from the Combined Heat and Power system.

ECM Description	M&V Method - Summary	Detail of M&V Methodology
Energy Efficient Pumps and Motors Replacement	**Non-Measured:** Savings are from the improved efficiency from the replacement of new motors and pumps.	**Pre M&V:** The HP and the efficiency of the existing motors and pumps will be determined through the nameplate data. **Post M&V:** The efficiency of the new motors and pumps will be determined from the manufacturer specification. **Energy Savings:** Energy savings will be calculated from the improved efficiency of the new motors and pumps.
Door Weatherstrip and Infiltration Reduction	**Option A:** A field audit will be implemented to identify existing envelope deficiencies, which will be used as the baseline to evaluate the effectiveness of the air barrier system. Post-retrofit verifications of improvements will be documented.	**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 documentation. **Energy Savings:** Energy savings will be determined using the ASHRAE crack method calculations.
Replace Cooling Tower	**Non-Measured:** Savings are from the improved efficiency from the replacement of cooling tower.	**Pre M&V:** The efficiency of the existing cooling tower was determined through the nameplate data. Bin data was used to determine the energy consumption of existing cooling tower. **Post M&V:** The efficiency of the new cooling tower will be determined from the manufacturer specification. **Energy Savings:** Energy savings will be calculated from the improved efficiency of cooling tower.
Interior & Exterior LED Lighting (including lighting occupancy sensors)	**Option A:** One-time pre and post-retrofit kW measurement. Burn hours determined using logger data collected in the field.	**Pre M&V**: Lighting power readings will be taken on a sample of lighting fixtures. Lighting burn hours were measured through the use of light loggers. **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 logged during the baseline data collection will be used as the post-installation burn hours. **Energy Savings**: Energy savings will be calculated using the actual measured wattage reduction and measured burn-hours.
Pipe Insulation and Blankets	**Option A:** Savings are from reduced heat loss through insulation installed on bare pipes and valves.	**Pre M&V:** The surface temperature and the size of the space requiring insulation installation were determined by field surveys. **Post M&V:** Following installation, the size and the surface temperature of the space where the insulation is installed will be verified using as-built document and infrared camera. **Energy Savings:** Savings are from a reduction in heat loss through installing insulation on bare pipes and valves.
Replace Water Source Heat Pumps	**Non-Measured:** Savings are from the improved efficiency from the replacement of water source heat pumps.	**Pre M&V:** The efficiency of the existing water source heat pumps was determined through the nameplate data. **Post M&V:** The efficiency of the new water source heat pumps will be determined from the manufacturer specification. **Energy Savings:** Energy savings will be calculated from the improved efficiency of new water source heat pumps.

ECM Description	M&V Method - Summary	Detail of M&V Methodology
Rooftop Units Replacement	**Non-Measured:** Savings are from the improved efficiency of new rooftop units.	**Pre M&V:** The HP and efficiency of the existing rooftop units were determined through the nameplate data. **Post M&V:** The efficiency of the new rooftop units will be determined from the manufacturer specification. **Energy Savings:** Energy savings will be calculated from the improved efficiency of new rooftop units.

Measurement and Verification Services

M&V Services will be provided in association with the guarantee provided by Johnson Controls. The guarantee will be in effect for each year that the School elects to participate in the M&V Services. The cost of the M&V services is included in the business case in the “Annual Services” column as outlined in the table below:

Year	Annual Amount ($/yr)
1	**$13,894**
2	**$14,311**
3	**$14,740**
Total	**$42,945**

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

1. During the Installation Period, a Johnson Controls Performance Engineer will track Measured Project Benefits. Johnson Controls 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 60 days of the commencement of the Guarantee Term.
2. For specified Improvement Measures, Johnson Controls will:
   A. conduct pre and post installation measurements required under this Agreement;
   B. confirm the BAS employs the control strategies and setpoints specified in this Agreement;
   C. 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);
   D. 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
   E. 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. Trend data records maintained in the ordinary course of system operation shall be used and relied upon by Johnson Controls in connection with Project Benefit calculations. Johnson Controls will use commercially reasonable efforts to ensure the integrity of the data collected to calculate the required metrics. In the event data are lost due to equipment failure, power failure or other interruption in data collection, transmission or storage, Johnson Controls will use reasonable engineering methods to estimate or replace the lost data.
3. During the Guarantee Term, a Johnson Controls 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. In this regard, the Performance Engineer will periodically assist Customer, on-site or remotely, with respect to the following activities:
   A. review of information furnished by Customer from the facility management system to confirm that control strategies are in place and functioning;
   B. advise Customer’s designated personnel of any performance deficiencies based on such information;
   C. coordinate with Customer’s designated personnel to address any performance deficiencies that affect the realization of Measured Project Benefits; and
   D. inform Customer of opportunities to further enhance project performance and of opportunities for the implementation of additional Improvement Measures.
4. Within 60 days of each anniversary of the commencement of the Guarantee Term, Johnson Controls will provide Customer with an annual report containing:

   A. an executive overview of the project's performance and Project Benefits achieved to date;
   B. a summary analysis of the Measured Project Benefits accounting; and
   C. Depending on the M&V Option, a detailed analysis of the Measured Project Benefits calculations.

5. Johnson Controls will assist the School in applying for rebate incentives. This includes submitting application forms and data on behalf of the School and following up with the program administrators to answer any questions or provide additional information. Work is expected to take place during the Construction period and Year 1 only. **Note: Rebates are not guaranteed.**

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 Pittsgrove Township School District; any warranty issues will be handled directly with the equipment manufacturer rather than with Johnson Controls.

The installation of the recommended measures will reduce the amount of emergency maintenance required by the School 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, Johnson Controls will assist the School 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 ESP project which will allow the School to complete the majority of maintenance and repair in-house in order to utilize School resources.

To ensure the School is fully capable of achieving its energy savings and utilize the new HVAC and BAS, Johnson Controls is including training for School employees.

Johnson Controls recommends the School 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:

- BAS Agreement including updates to subscription services
- Cogeneration Service Agreement to allow for emergency service and preventative maintenance on the new cogeneration systems.

Design and Compliance Issues

Johnson Controls will enlist a design engineering firm 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 ESIP development, Johnson Controls 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 School. 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, Johnson Controls did not observe any compliance issues in the development of this ESIP.

Customer Risks

Asbestos reports will be obtained for all schools as part of Johnson Controls safety policy. Based on the reports, asbestos materials will have to be abated prior to any work being performed. If any additional asbestos is found during the installation of the measures, Johnson Controls will stop work and notify the School. Any work associated with testing or remediation of asbestos containing material will be the responsibility of Pittsgrove Township School District.

Johnson Controls does not guarantee the rebate or state incentive structure. If the programs change or the incentive amounts differ, Pittsgrove Township School District will be responsible to make up the difference in received incentives for the financing. The difference could result from over performance of ECMs, other rebates/ incentives that may be available, restructuring the loan payment for years 1 and 2, or capital contributions by the School.

Section 7: Implementation Schedule

A preliminary installation schedule for the measures implemented as part of the ESIP is included below to provide a reasonable expectation for the timeline of construction. 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 Pittsgrove Township 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:

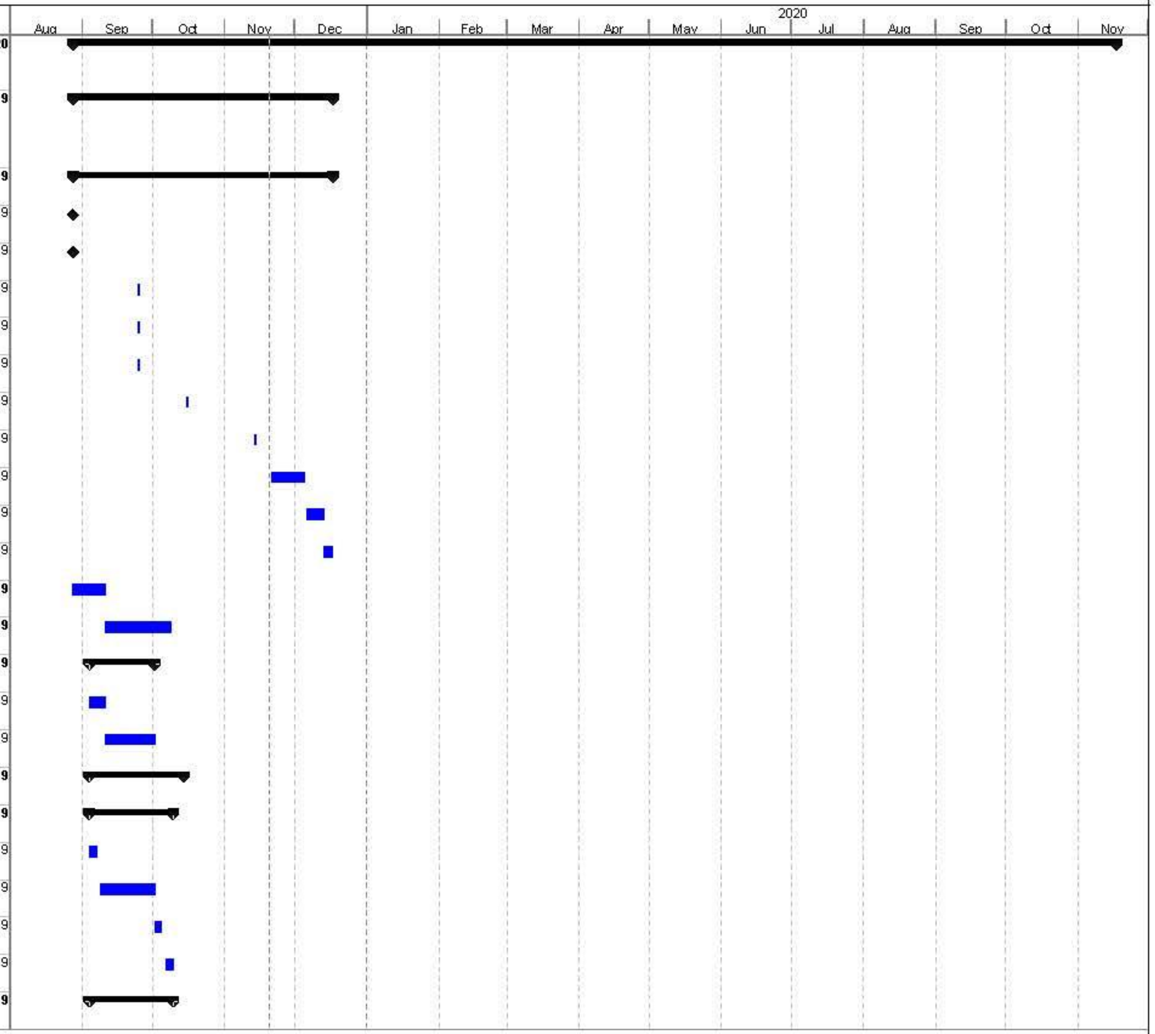
- Accept ESIP Pending necessary Reviews – November 21, 2019
- Complete Third Party Engineering Review of ESIP – December 5, 2019
- Complete Board of Public Utilities Review of ESIP – December 13, 2019
- Approval resolution to contract with Johnson Controls – December 17, 2019
- Complete 100% design drawings and bid specifications – March 2, 2020
- Expected Finance Close – January 14, 2020
- Lighting Installation to Begin – March 10, 2020
- Public bidding for Non-Lighting Work – March 9, 2020
- Non-Lighting Installation to Begin – May 2020
- Project Installation: March 2020 – November 2020

The project plan on the following page details the Installation Phase schedule.

Johnson Controls

Pittsgrove Township Board of Education
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
1	**Pittsgrove Township BOE ESIP**	**319.25 days**	**Wed 8/28/19**	**Tue 11/17/20**
2	**Phase 1: Investment Grade Audit/ Energy Savings Plan**	**79.25 days**	**Wed 8/28/19**	**Tue 12/17/19**
3	**Major Milestone**	**79.25 days**	**Wed 8/28/19**	**Tue 12/17/19**
4	Signed Investment Grade Audit Agreement	0 days	Wed 8/28/19	Wed 8/28/19
5	Customer Kick-off Workshop	0 hrs	Wed 8/28/19	Wed 8/28/19
6	ECM Verification Workshop	3 hrs	Wed 9/25/19	Wed 9/25/19
7	Baseline Utility Workshop	3 hrs	Wed 9/25/19	Wed 9/25/19
8	Measurement & Verification Workshop	3 hrs	Wed 9/25/19	Wed 9/25/19
9	Business Case Workshop	2 hrs	Wed 10/16/19	Wed 10/16/19
10	IGEA Results Presented to Customer	2 hrs	Thu 11/14/19	Thu 11/14/19
11	3rd Party Engineering Review	2 wks	Thu 11/21/19	Thu 12/5/19
12	Submit Energy Savings Plan to BPU for Review	1 wk	Fri 12/6/19	Fri 12/13/19
13	Customer Approval & Acceptance of ESP & JCI Contract	2 days	Fri 12/13/19	Tue 12/17/19
14	**Detailed Site Visits**	**2 wks**	**Wed 8/28/19**	**Tue 9/10/19**
15	**Scope Design & Construction Cost Estimating**	**4 wks**	**Wed 9/11/19**	**Tue 10/8/19**
16	**Detailed Energy Analysis**	**20 days**	**Wed 9/4/19**	**Tue 10/1/19**
17	Update Utility Bills	1 wk	Wed 9/4/19	Tue 9/10/19
18	Energy Saving Calculations	3 wks	Wed 9/11/19	Tue 10/1/19
19	**Data Logging**	**28.38 days**	**Wed 9/4/19**	**Mon 10/14/19**
20	**Lighting Loggers**	**26 days**	**Wed 9/4/19**	**Wed 10/9/19**
21	Deploy Loggers	3 days	Wed 9/4/19	Fri 9/6/19
22	Logging Time	17 days	Mon 9/9/19	Tue 10/1/19
23	Retrieve Loggers	3 days	Wed 10/2/19	Fri 10/4/19
24	Analyze Data	3 days	Mon 10/7/19	Wed 10/9/19
25	**Temperature/ Motor Loggers**	**26 days**	**Wed 9/4/19**	**Wed 10/9/19**



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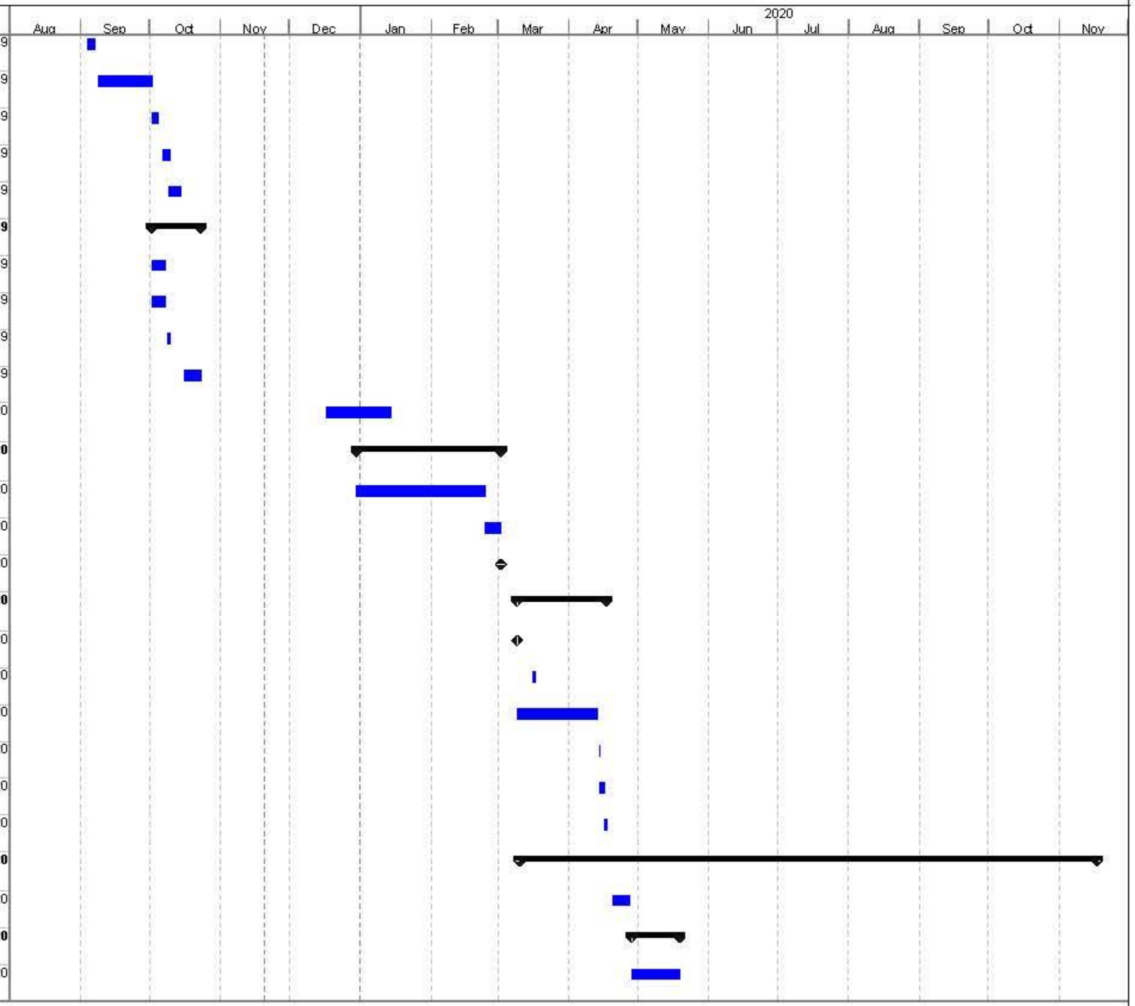
Johnson Controls

Pittsgrove Township Board of Education
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
26	Deploy Loggers	3 days	Wed 9/4/19	Fri 9/6/19
27	Logging Time	17 days	Mon 9/9/19	Tue 10/1/19
28	Retrieve Loggers	3 days	Wed 10/2/19	Fri 10/4/19
29	Analyze Data	3 days	Mon 10/7/19	Wed 10/9/19
30	Field Measurements	3 days	Wed 10/9/19	Mon 10/14/19
31	**ESP Report Development**	**15.25 days**	**Wed 10/2/19**	**Wed 10/23/19**
32	Detailed Scope Write-up	4 days	Wed 10/2/19	Mon 10/7/19
33	Detailed Energy Savings Analysis	4 days	Wed 10/2/19	Mon 10/7/19
34	Develop Business Case	1 day	Wed 10/9/19	Wed 10/9/19
35	Energy Savings Plan Appendix	1 wk	Wed 10/16/19	Wed 10/23/19
36	**Project Financing**	4 wks	Tue 12/17/19	Tue 1/14/20
37	**Phase 2: Design**	**45 days**	**Mon 12/30/19**	**Mon 3/2/20**
38	Final Design Engineering	8 wks	Mon 12/30/19	Mon 2/24/20
39	Bid Specification Development	1 wk	Mon 2/24/20	Mon 3/2/20
40	Final Design Review Workshop	0 days	Mon 3/2/20	Mon 3/2/20
41	**Phase 3: Procurement**	**29 days**	**Mon 3/9/20**	**Fri 4/17/20**
42	Advertise Bids	0 days	Mon 3/9/20	Mon 3/9/20
43	Pre-Proposal Conference & Site Visits	1 day	Mon 3/16/20	Tue 3/17/20
44	Bid Duration for Subcontractors	5 wks	Mon 3/9/20	Mon 4/13/20
45	Opening of Bids	1 hr	Tue 4/14/20	Tue 4/14/20
46	Evaluation of Bids and Confer on Selection of Sub-Contractors	2 days	Tue 4/14/20	Thu 4/16/20
47	Subcontractor Selection	1 day	Thu 4/16/20	Fri 4/17/20
48	**Phase 4: Construction**	**180 days**	**Tue 3/10/20**	**Tue 11/17/20**
49	Issue Subcontracts	1 wk	Mon 4/20/20	Mon 4/27/20
50	**Pre- Construction Activities**	**15 days**	**Tue 4/28/20**	**Tue 5/19/20**
51	Mobilization / Planning / Engineering	3 wks	Tue 4/28/20	Tue 5/19/20



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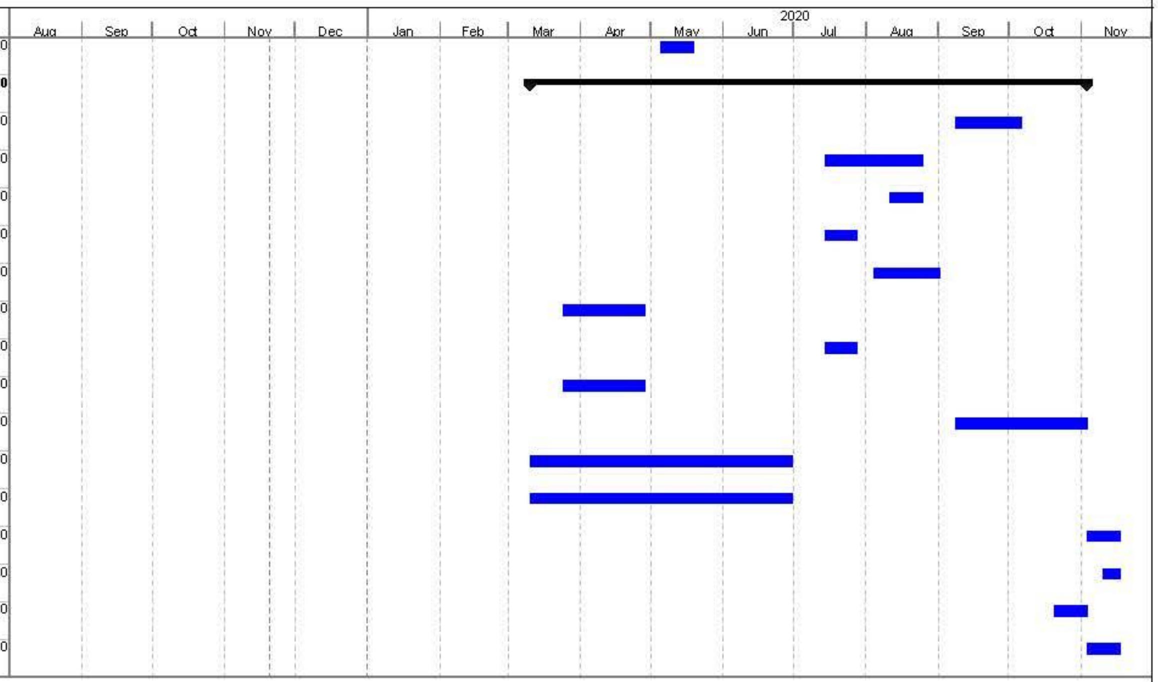
Pittsgrove Township Board of Education
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
52	Shop Drawing Approval	2 wks	Tue 5/5/20	Tue 5/19/20
53	**Installation of Recommended ECMs**	**170 days**	**Tue 3/10/20**	**Tue 11/3/20**
54	Combined Heat & Power	4 wks	Tue 9/8/20	Tue 10/6/20
55	High School Boiler Replacement	6 wks	Tue 7/14/20	Tue 8/25/20
56	Water Source Heat Pump Replacement	2 wks	Tue 8/11/20	Tue 8/25/20
57	Replace Cooling Tower	2 wks	Tue 7/14/20	Tue 7/28/20
58	Rooftop Unit Replacements	4 wks	Tue 8/4/20	Tue 9/1/20
59	Pipe and Valve Insulation	5 wks	Tue 3/24/20	Tue 4/28/20
60	Premium Efficiency Motors and Pumps	2 wks	Tue 7/14/20	Tue 7/28/20
61	Building Envelope Upgrades	5 wks	Tue 3/24/20	Tue 4/28/20
62	Middle School Controls Integration	8 wks	Tue 9/8/20	Tue 11/3/20
63	Interior/Exterior Lighting Upgrades	16 wks	Tue 3/10/20	Tue 6/30/20
64	Lighting Occupancy Sensors	16 wks	Tue 3/10/20	Tue 6/30/20
65	Punch List Items	2 wks	Tue 11/3/20	Tue 11/17/20
66	Equipment Initial Training	1 wk	Tue 11/10/20	Tue 11/17/20
67	System Commissioning	2 wks	Tue 10/20/20	Tue 11/3/20
68	Project Close Out	2 wks	Tue 11/3/20	Tue 11/17/20



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Section 8. Sample Energy Performance Contract

A sample Energy Performance Contract has been provided electronically to the School for review.

Appendix 1. Energy Savings Calculations

Energy Savings

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

Appendix 2. Detailed Scope Descriptions

Detailed scopes of work will be defined by full drawings and specifications during the design phase of this project.

Construction documents for bidding purposes will be available electronically.

Appendix 3. Recommended Project – ESIP

Business Case for Recommended Project

Energy Savings and Cost Summary

The table below provides a summary of the costs and savings associated with the measures recommended in the ESP. 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.

ID #	Energy Conservation Measure	ECM Hard Cost	Year 1 Utility Savings*	Simple Payback
1,2	Upgrade Interior and Exterior Lighting LED Retrofits, Lighting Occupancy Controls	$ 483,098	$ 72,502	6.5
3	Building Envelope - Weatherization	$ 173,733	$ 13,516	12.9
4	Water Source Heat Pump Replacement at Middle School	$ 300,000	$ 324	925.9
5	Roof Top Units Replacement at Middle School	$ 498,000	$ -	
6	Controls Integration at Middle School on New Equipment	$ 90,000	$ 7,174	12.5
7	Cooling Tower Replacement at Middle School	$ 165,000	$ 159	1036.8
8	Boiler Replacement at High School	$ 150,000	$ 5,434	27.6
9	Installation of Premium Efficiency Motors and Pumps	$ 67,900	$ 722	94.0
10	Mechanical Insulation	$ 36,152	$ 4,673	7.7
11	Micro Combined Heat and Power (CHP) at Middle School	$ 80,000	$ 197	406.9
12	Solar PPA Savings	$ -	$ 51,100	
	Totals	$ 2,043,883	$155,801	13.5

***Year 1 Utility Savings in the above table include a 2.2% escalation on Electric and 2.4% escalation on Natural Gas for guaranteed savings.**

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 lighting and will generate material cost savings.

A brief description of the operational savings estimated for this project is included below. Johnson Controls has worked with the School 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	Years to Carry	Annual Savings
Lighting Upgrades	5	**$13,896**
Roof Top Units Replacement at Middle School	2	**$6,200**
Cooling Tower Replacement at Middle School	2	**$4,000**
Boiler Replacement at High School	2	**$2,000**

Potential Revenue Generation Estimates

Rebates

As part of the ESP for the Pittsgrove Township School District, several avenues for obtaining rebates and incentives have been investigated which include:

- Smart Start Incentives

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.

SmartStart Incentives

New Jersey SmartStart Buildings is a statewide energy efficiency program available to qualified K-12 customers planning to construct, expand, renovate, or remodel a facility, or to replace electric or gas equipment. Incentives are available for prescriptive measures or for custom measures that are selected and incorporated into the project to help offset the added cost to purchase qualifying energy-efficient equipment.

Inventive Type	Estimated Amount
Lighting (Smart Start) – HS and MS	$71,685
Boiler Replacement (Smart Start) – HS	$3,000
Total	$74,685

Elementary schools do not qualify for Smart Start rebates as Direct Install is used for the implementation of the scope. Rebates are indicative of existing programs & subject to change based on future programs (changes in 2020). Johnson Controls does not guaranteed any rebates carried in this project.

Demand Response Energy Efficiency Credit

The LED Lighting and facility upgrades will qualify the school will be eligible for the Energy Efficiency Credit and the Energy Efficiency Credit pays consumers based on the permanent load reduction through the installation of energy efficiency measures. The following Energy Efficiency Credits are estimated for the demand reduction from lighting upgrades.

Year	Estimated Amount
Year 1	$3,536
Year 2	$3,120
Year 3	$2,288
Year 4	$2,288
Total	$11,232

Johnson Controls does not guaranteed any rebates carried in this project.

Greenhouse Gas Reductions

Avoided Emissions	Total Electric Savings	Total Natural Savings	Total Annual Avoided Emissions
Annual Unit Savings	467,331 kWh	25,653 Therms	
NOX, , lbs	519 lbs	236 lbs	755 lbs
SO2 , lbs	458 lbs		458 lbs
CO2 , lbs	642,113 lbs	300,140	942,253 lbs

Factors Used In Calculations:

- 1,374 lbs. CO_2 per MWh saved
- 1.11 lbs. NO_x per MWh saved
- 0.98 lbs. SO_2 per MWh saved
- 11.7 lbs. CO_2 per therm saved
- 0.0092 lbs. NO_x per therm saved

Baseline Utility Savings

ID #	Energy Conservation Measure	Electric Consumption		Electric Demand		Natural Gas		Total Annual Utility Savings
1,2	Upgrade Interior and Exterior Lighting LED Retrofits, Lighting Occupancy Controls	$42,095	452,699	$30,407	2,312	$-	-	$72,502
3	Building Envelope - Weatherization	$-	-	$-	-	$13,516	11,462	$13,516
4	Water Source Heat Pump Replacement at Middle School	$324	3,504	$-	-	$-	-	$324
5	Roof Top Units Replacement at Middle School	$-	-	$-	-	$-	-	$-
6	Controls Integration at Middle School on New Equipment	$-	-	$-	-	$7,174	5,874	$7,174
7	Cooling Tower Replacement at Middle School	$159	1,721	$-	-	$-	-	$159
8	Boiler Replacement at High School	$-	-	$-	-	$5,434	4,507	$5,434
9	Installation of Premium Efficiency Motors and Pumps	$722	7,753	$-	-	$-	-	$722
10	Mechanical Insulation	$-	-	$-	-	$4,673	3,844	$4,673
11	Micro Combined Heat and Power (CHP) at Middle School	$607	6,566	$-	-	$(411)	(34)	$197

Business Case for Recommended Project

FORM VI

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
PITTSGROVE TOWNSHIP BOARD OF EDUCATION - ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO NAME: **Johnson Controls**

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 **2.4% gas, 2.2% electric per year**; and

1. Term of Agreement: 20 **years (240 Months)**
2. Construction Period [2] (months): **12 months**
3. Cash Flow Analysis Format:

Project Cost [1]: **$2,725,926**
Bond Issuance Cost : **$35,000**
Project Finance Amount: **$2,760,926**

Interest Rate to Be Used for Proposal Purposes: 2.5%

Year	Annual Energy Savings	Annual Operational Savings	Energy Rebates/ Incentives	Total Annual Savings	Annual Project Costs	Board Costs	Annual Service Costs [3]	Net Cash Flow to Client	Cumulative Cash Flow
Installation	$43,591			$43,591	$0	$0			
1	$155,801	$26,096	$78,221	$260,118	$273,194	$287,088	$13,894	$2,727	$2,727
2	$159,289	$26,096	$3,120	$188,505	$157,096	$171,407	$14,311	$2,788	$5,514
3	$162,856	$13,896	$2,288	$179,040	$146,709	$161,449	$14,740	$2,850	$8,364
4	$166,502	$13,896	$2,288	$182,686	$181,437	$179,772		$2,914	$11,278
5	$170,230	$13,896		$184,126	$182,850	$181,147		$2,979	$14,257
6	$174,042			$174,042	$172,737	$170,997		$3,046	$17,303
7	$177,940			$177,940	$176,605	$174,826		$3,114	$20,417
8	$181,924			$181,924	$180,560	$178,741		$3,184	$23,600
9	$185,998			$185,998	$184,603	$182,743		$3,255	$26,855
10	$190,164			$190,164	$188,738	$186,836		$3,328	$30,183
11	$194,423			$194,423	$192,965	$191,020		$3,402	$33,585
12	$198,777			$198,777	$197,286	$195,298		$3,479	$37,064
13	$203,229			$203,229	$201,705	$199,673		$3,557	$40,621
14	$139,973			$139,973	$138,923	$137,523		$2,450	$43,070
15	$143,135			$143,135	$142,061	$140,630		$2,505	$45,575
16	$146,368			$146,368	$143,573	$143,807		$2,561	$48,136
17	$149,675			$149,675	$143,573	$147,056		$2,619	$50,756
18	$153,057			$153,057	$143,573	$150,378		$2,679	$53,434
19	$156,515			$156,515	$143,573	$153,776		$2,739	$56,173
20	$160,052			$160,052	$143,573	$157,086		$2,966	$59,139
Totals	**$3,413,541**	**$93,880**	**$85,917**	**$3,593,338**	**$3,435,332**	**$3,491,254**	**$42,945**	**$59,139**	

NOTES:

(1) Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"

(2) No payments are made by Board during the construction period

(3) This figure should equal the value indicated on the ESCOs PROPOSED "FORM V". DO NOT include in the Financed Project Costs.

Appendix 4. Third Party ESIP Review Comments & Correspondence