Energy Savings Plan (ESP)

Johnson Controls Inc.

Kittatinny Regional Board of Education

77 Halsey Road, Newton, NJ 07860 **Date: July 23, 2019**

KITTATINNY REGIONAL
EDUCATING THE FUTURE

Johnson Controls

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Section 1. Executive Summary

Various Energy Conservation Measures (ECMs) were evaluated in the development of this Energy Savings Plan (ESP). 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 Kittatinny Regional High School 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 Dome-Tech, Inc. 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 at the High School with LED retrofits, new fixtures in most classroom areas and Connected Lighting technology in Special Needs classrooms
- Conversion of the facility from #2 fuel oil to natural gas
- Replacement of three (3) oil-fired boilers with high-efficiency gas-fired condensing units
- Replacement of oil-fired/propane burners to gas-fired units
- New high-efficiency, condensing, gas-fired domestic water heaters
- Upgrades to the Building Automation System (BAS) in the E-Wing
- Installation of premium efficiency motors
- New thermally enhanced exterior main entrance doors at the A and D Wings
- Replacing older split air conditioning units (25 years old) with high-efficiency units
- Replacing original (1975) transformers with Energy Efficient Transformers
- A 35 kW Combined Heating & Power Plant (CHP) for pool water heating/electric generation

Energy saving calculations performed in the development of this ESP (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 **855,306 kWh** of electricity with a **1,752 kW** reduction and the facility will save a total of **47,073 gallons** of #2 fuel oil along with **2,657 gallons** of propane. The District would need to purchase approximately **47,000 therms** of natural gas due to the fuel conversion. The total net utility cost savings is **$4,187,134** over the life of the project (20 years) plus **$357,458** in operational savings and project incentives. Additionally, these energy savings will result in a net reduction of greenhouse gases and will reduce the High School's carbon footprint by **1,716,474 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 ESP addresses the following facilities:

Kittatinny Regional High School	
Kittatinny Regional High School	77 Halsey Road, Newton, NJ 07860

Facility Description

Kittatinny Regional High School

The Kittatinny Regional High School is located on 77 Halsey Road in Newton, New Jersey. The 213,705 SF school was built in 1975 with a new C-wing addition in 2000. The building is a single story facility except for the two-story E-Wing addition comprised of classrooms, gymnasiums, cafeteria, kitchen, media center, conference rooms, 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 10:00 P.M. Kittatinny Regional High School employs approximately 200 people with student enrollment estimated at 1,300.

Building Envelope

Exterior walls for the Kittatinny High School are masonry brick faced with a concrete block construction. The windows throughout the school are in good condition (installed in the summer of 2009) and appear to be well maintained. Typical windows are double pane, operable, 1/4" coated glass with aluminum frames and blinds. The roof (except the A-Wing) is a flat, metal deck with rubber membrane and in good condition. The roof supports existing PV panels, laid out on three wings of the school.

Major Mechanical Systems

Heating hot water for the original building (A thru D Wings) is generated by a single boiler plant fitted with three (3) Cleaver-Brooks Model 4 Packaged Steam Boilers. These boilers are oil-fired; built in 1986; rated at 6,000 MBH input and 4,800 MBH output (when new); and fitted with Cleaver-Brooks oil-fired burners/controls. The steam is converted to heating hot water in the same boiler plant by a steam-to-hot water heat exchanger outfitted with a condensate receiver and pumps. The primary hot water pumps are two (2) 20 horsepower pumps rated at 450 gallons per minute (gpm) with 115 feet of head pressure and the motors are 89.5% efficient

Heating hot water for the 2000 addition (E-Wing) is generated by a single boiler plant fitted with two (2) Peerless Model LC-10 hot water boilers. These boilers are oil-fired; built in 2006; rated at 1,511 MBH output (when new); and fitted with Riello RL Series oil burners. The primary hot water pumps are two (2) Bell & Gossett series 60, 5 HP in-line, ceiling-mounted pumps rated at 100 gallons per minute (gpm) and 50 feet of head pressure.

Chilled water for portions of the A thru D wings is provided by a new (2018) Daikin Model AWV012 air-cooled, variable speed, screw chiller with a rated capacity of 265 Tons. The chilled water is delivered to various chilled water coils by two (2) 20 horsepower variable speed pumps rated at 465 gallons per minute (gpm) and 105 feet of head pressure.

The main gym is conditioned by two (2) Daikin model MPS040FY cooling only rooftop units with a 15 HP supply air fan motor, two (2) 8 HP return/exhaust fans, and four (4) 1 HP condenser fans. These two (2) units are rated at 40 tons each and have an energy efficiency of 10.2 EER. This main gym is heated by hot water duct heating coils. The boys and girls locker rooms are conditioned by two (2) non gas-fired, make-up air units; a Greenheck model MSX-109-H12-DB rated at 2,245 CFM with a 2 HP supply fan and a model MSX-115-H22-DB rated at 4,950 CFM with a 5 HP supply fan.

The cafeteria is conditioned by a Carrier model 50HJ-017-521 cooling only rooftop unit rated at 110.3 MBH with a 10 HP supply air fan motor. The library computer labs are conditioned by two (2) Carrier model 50HJ-006-521HG units rated at 5-Tons of cooling and 11.5 kW of heating with an energy efficiency of 13.0 SEER.

The auxiliary gym, training rooms, etc. are heated and ventilated by various Nesbitt H&V units ranging in size from 2,800 CFM to 7,800 CFM with 1/6 HP freeze protection pumps.

The science rooms (B-Wing) are conditioned by six (6) Carrier model 50HJ-005-H-641 HY cooling only rooftop units rated at 4-Tons of cooling each. The school store is conditioned by a Trane model THC036E4 cooling only rooftop unit rated at 3-Tons. Numerous classrooms in the B and C-Wings are air-conditioned by split AC units with Sanyo 3 and 4 ton rooftop air-cooled condensers that feed split unit ventilators.

The various classrooms and labs (A to D Wings) are heated and cooled by vertical unit ventilators ranging in size from 500 to 1,250 CFM with heating capacities from 30.0 MBH to 64.0 MBH and some units have cooling with capacity of 16.9 MBH to 24.6 MBH. There are also numerous hot water duct heating coils that supplement/reheat ranging in size from 5 MBH to 124 MBH. The balance of the heating (A thru D Wings) is performed by hot water cabinet unit heaters ranging in size from 38.3 MBH to 43.2 MBH; unit heaters ranging in size 9.2 MBH to 21.1 MBH; and fin-tube radiation ranging in size from 480 BTUH/foot to 660 BTUH/foot.

The E-Wing HVAC is provided by the following units:

Unit	Make	Model	Cooling Capacity	Heating Capacity
AC-1, 2	Nesbitt	RSA-300	216.6 MBH	250.7 MBH *
AC-3	Carrier	50SX-024-31AA	18.3 MBH	No Heating
AC-4	Carrier	50HJ-017	112.9 MBH	55 kW
AC-5	Carrier	50HJ-015	90.6 MBH	55 kW
AC-6,8	Carrier	50HJ-009	70.9 MBH	No Heating
AC-7	Carrier	50HJ-008	56.7 MBH	No Heating
AC-9	Carrier	50HJ-004	33.4 MBH	6.0 kW
* Hot water Heat				

The various classrooms and labs are heated and cooled by fifteen (15) Nesbitt vertical & horizontal unit ventilators ranging in size from 500 to 1,500 CFM with heating capacities from 42.1 MBH to 129.6 MBH and cooling capacity of 35.1 MBH to 39.7 MBH. There are also numerous McQuay hot water duct heating coils that supplement/reheat. The balance of the heating is performed by hot water cabinet unit heaters ranging in size from 11.8 MBH to 42.4 MBH; unit heaters ranging in size 15.6 MBH to 35.9 MBH; Vulcan fully wall recessed convectors ranging in size from 1.5 MBH to 7.4 MBH; and Vulcan Fin-tube radiation ranging in size from 1,209 BTUH/foot to 1,510 BTUH/foot.

Kitchen Equipment

The walk-in refrigerator and freezer with two (2) and three (3) Bohn evaporators respectively are serviced by Heatcraft model HWN010X6C water-cooled indoor condensers rated at 11,200 BTU/Hour at 30° F suction temperature. The 4-foot by 25-foot kitchen exhaust hood is rated at 6,250 CFM and includes two (2) 5 HP rooftop exhaust fans. The balance of the equipment includes a Traulsen 4-door refrigerator, a two-door reach-in refrigerator, four (4) Blodgett warming cabinets, electric steamer, Imperial 6-burner electric range, and a Hobart dishwasher with a 45 kW electric water heater.

Exhaust System

Air is exhausted from various classrooms, restrooms, storage rooms, mechanical rooms, common areas etc. by over seventy (70) exhaust fans rated from 70 CFMs to 10,000 CFMs with fan motor sizes from 1/25 HP to 5 HP.

HVAC System Controls

The building has three separate control systems that monitor the boilers, rooftops, and pneumatic thermostats and control valves in the unit ventilators.

1. Wings A thru D have a Powers Controls Pneumatic system with twelve (12) zones, 3-way valves and a 7-day pneumatic timer.
2. The E-Wing and Music Suite has a Siemens Apogee (1999) DDC system.
3. The air-cooled chilled water system and two (2) air handlers are controlled by a Johnson Controls, Inc. Metasys 7.0 system.

Domestic Water

Domestic cold water is provided by a well system which feeds a 10,000 gallon tank. The two (2) 15 HP potable water pumps distribute the cold water to the domestic water heaters, toilets and sinks. The domestic water heaters include two (2) Bock model 73E oil-fired water heaters rated at 242 MBH and a storage capacity of 67 gallons and a Bock model 541 E rated at 623 MBH with 83 gallon storage capacity that feeds a Ruud 700 gallon storage tank with a heat exchanger.

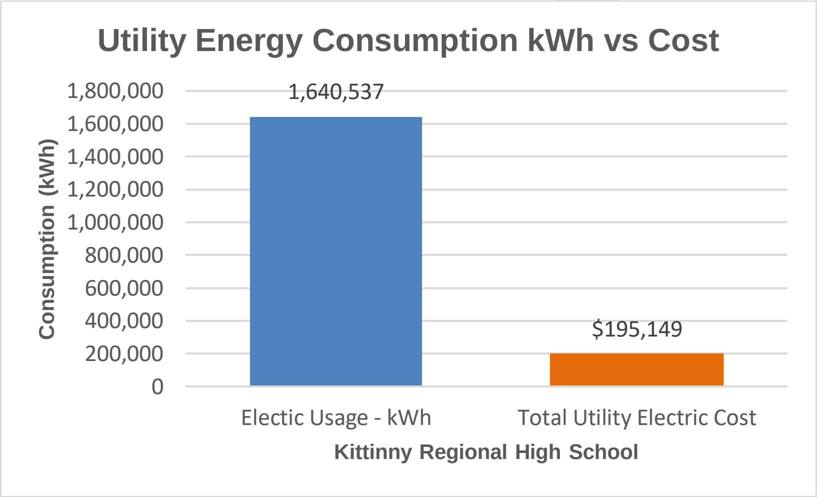
Lighting

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

Utility Baseline Analysis

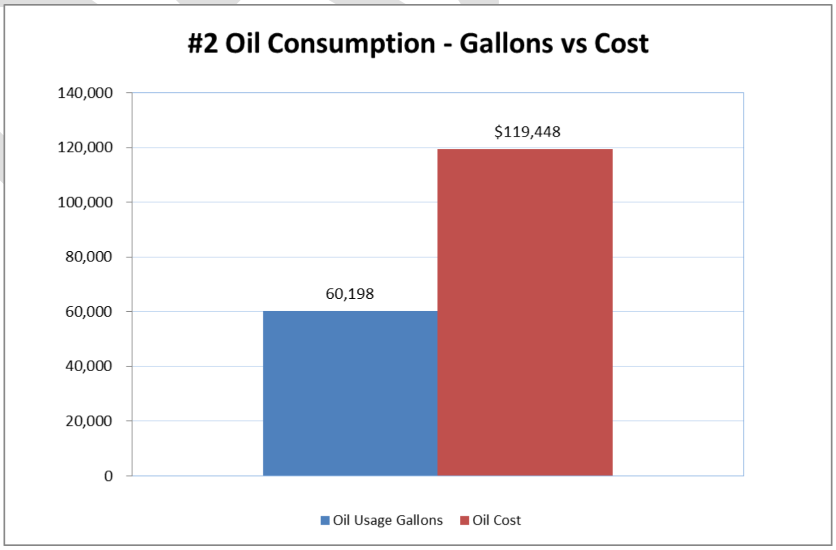
Electric Utility

Electrical energy is delivered to Kittatinny Regional High School through Jersey Central Power & Light. 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. There are three electric accounts and the accounts are under a rate structure named General Service Secondary 3 Phase (JC_GS3_01D).



#2 Fuel Oil

Kittatinny Regional High Schools acquires #2 Fuel Oil from Riggins Inc. The fuel oil utility company measures consumption in US gallons and converts the quantity into Btu of energy.



Propane

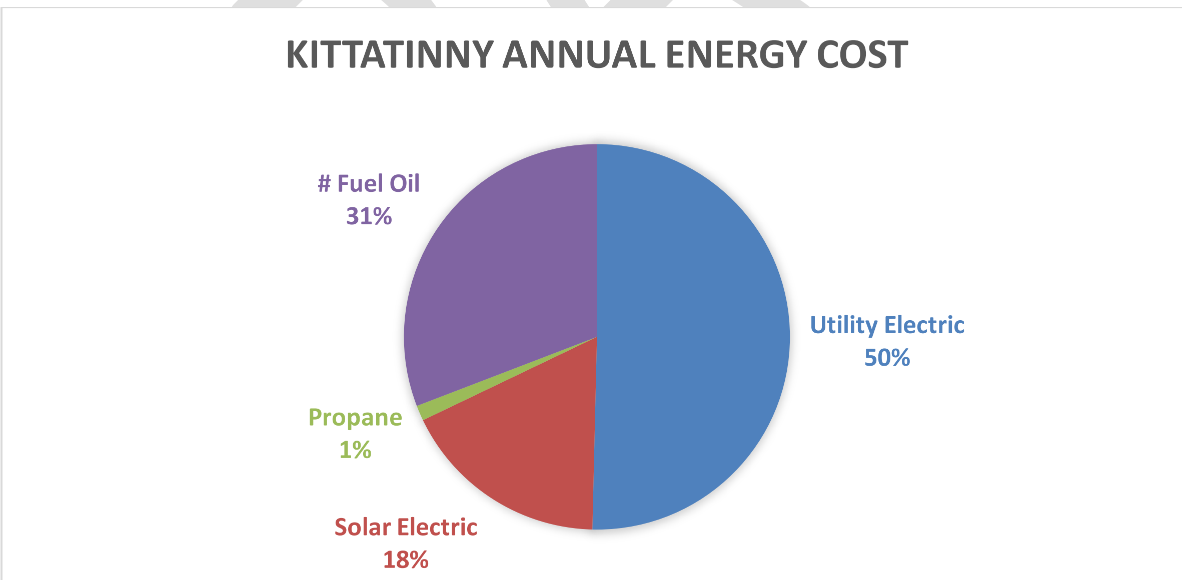
Kittatinny Regional High Schools acquires propane from Suburban Propane. The propane utility company measures consumption in US gallons and converts the quantity into Btu of energy. The account number for propane is 11-000-262-621-033.

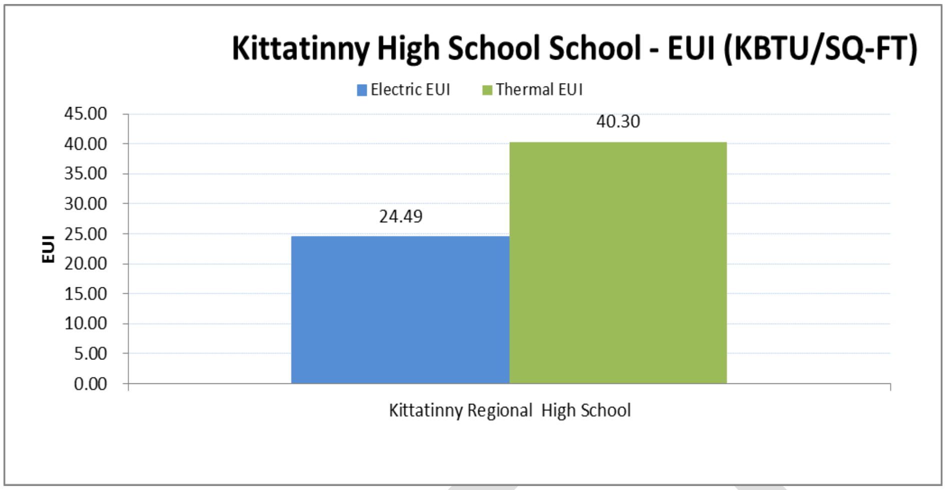
The following table shows the Schools' building names, addresses and utility account numbers.

Building Name	Address	Electric Account No.	#2 Fuel Oil Account No.
Kittatinny Regional High School	77 Halsey Road, Newton, NJ 07860	100 002 130 803	11-000-262-624-033
		100 002 099 958	
		100 002 639 175	

Energy Usage Summary

Utility Electricity			Solar Electricity		Total Electricity		#2 Fuel Oil		Propane		Total Annual Energy Cost	
Annual Consumption (KWH)	Monthly Average Utility Demand (KW)	Annual Cost ($)	Annual Consumption (KWH)	Annual Cost ($)	Annual Consumption (KWH)	Annual Cost ($)	Annual Consumption (Gallons)	Annual Cost ($)	Annual Consumption (Gallons)	Annual Cost ($)	Total Annual Energy Cost ($)	Total Annual Energy Cost (less solar) ($)
1,640,537	527	$195,149	689,324	$67,809	2,329,861	$262,958	60,198	$119,448	2,759	$4,965	$387,371	$319,562





Energy Use Index (EUI)

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		#2 Oil Rates	Propane Rates	Estimated Natural Gas
	$/kWh	$/kW	$/Gal	$/Gal	$/ THERM
Kittatinny Regional High School	$0.101	$6.44	$1.98	$1.80	$0.95

*The natural gas rate shown in the above table is an estimate based on the current rate tariff. This rate will be confirmed once the gas line is installed and meter and account is set up.

Utility Breakdown by Building

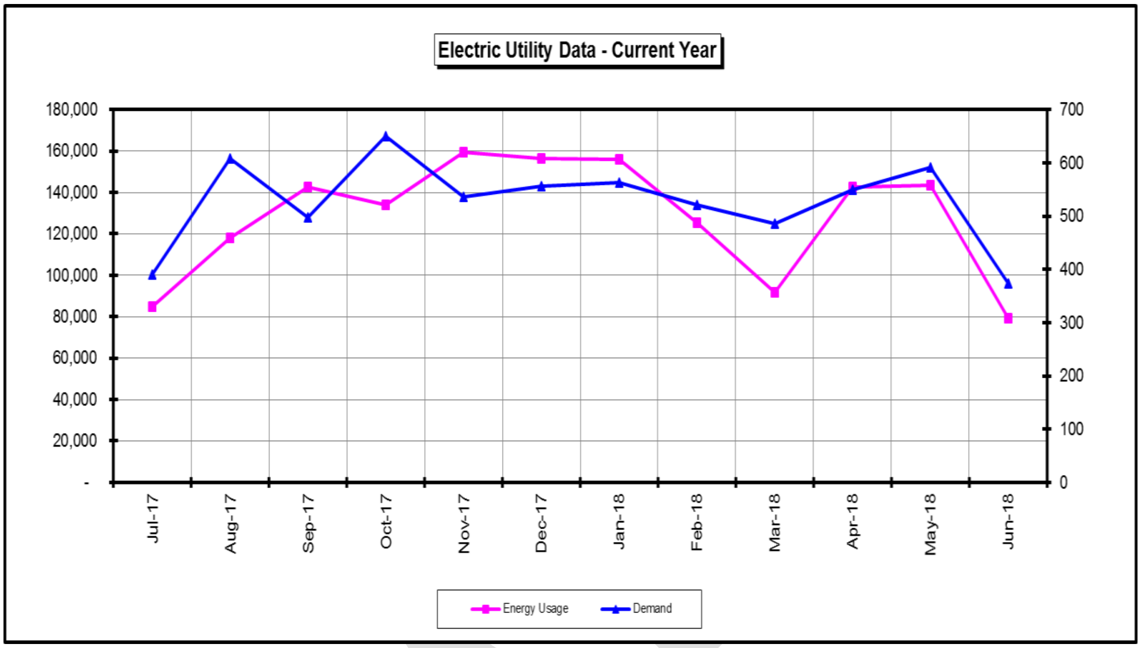
Kittatinny Regional High School

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-17	101,947	390.2	49,616	151,563	$11,871
Aug-17	132,416	609.0	44,928	177,344	$16,752
Sep-17	144,003	498.3	34,858	178,861	$18,020
Oct-17	143,683	650.7	27,600	171,283	$18,189
Nov-17	159,910	536.2	206,699	366,609	$19,868
Dec-17	157,281	556.2	15,497	172,778	$19,127
Jan-18	157,385	563.0	23,722	181,107	$18,635
Feb-18	134,573	521.8	27,572	162,145	$15,465
Mar-18	111,027	485.5	47,366	158,393	$11,893
Apr-18	147,239	550.2	73,704	220,943	$17,009
May-18	151,377	591.8	53,571	204,948	$17,917
Jun-18	99,696	373.0	84,191	183,887	$10,402
TOTAL/ MAX	**1,640,537**	**527.2**	**689,324**	**2,329,861**	**$195,149**

Based on the last year of utility bill information – July 2017 to June 2018, the figure below shows the demand (kW-secondary axis) and electricity usage (kWh-primary axis) over the baseline period.

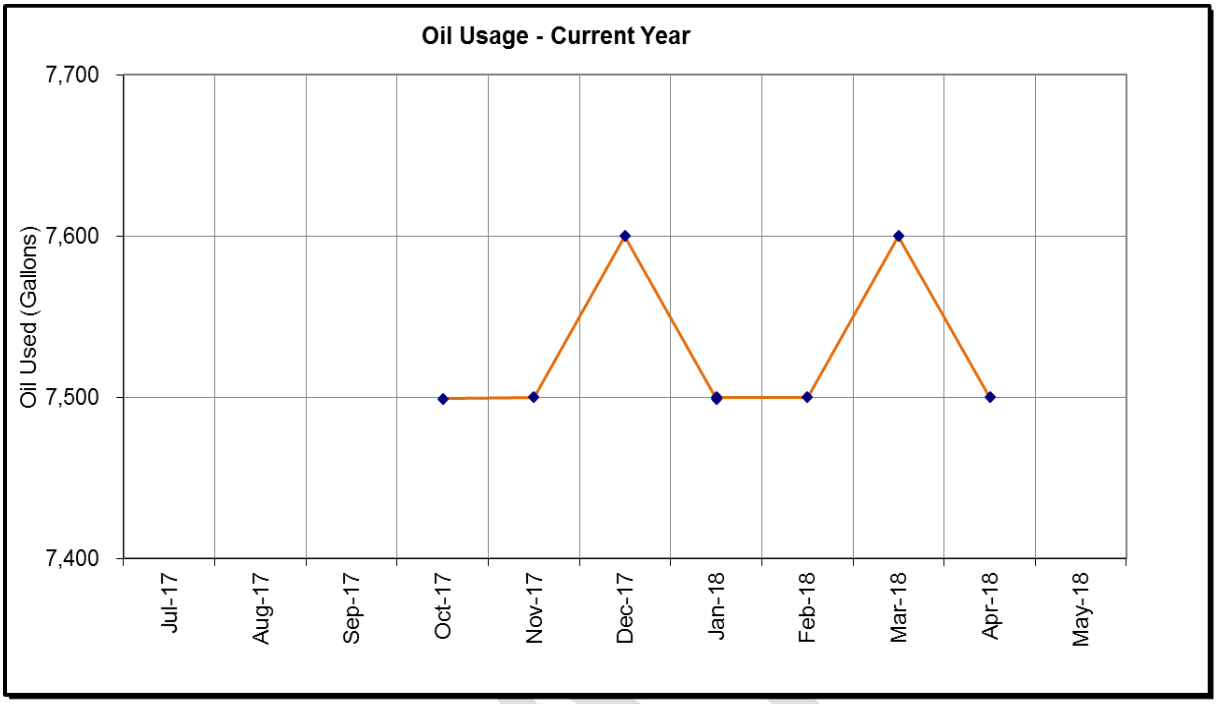


#2 Oil Usage

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

MONTH	CONSUMPTION (GALLONS)	#2 OIL COST ($)
Jul-17	--	--
Aug-17	--	--
Sep-17	--	--
Oct-17	7,499	$13,818
Nov-17	7,500	$14,710
Dec-17	7,600	$14,906
Jan-18	7,499	$16,000
Feb-18	7,500	$16,091
Mar-18	7,500	$13,988
Apr-18	7,600	$14,511
May-18	7,500	$15,425
Jun-18	--	--
TOTAL	**60,198**	**$119,448**

Based on the last year of utility bill information – July 2017 to June 2018, the figure below shows the Gallons and cost of #2 fuel oil for the baseline period.

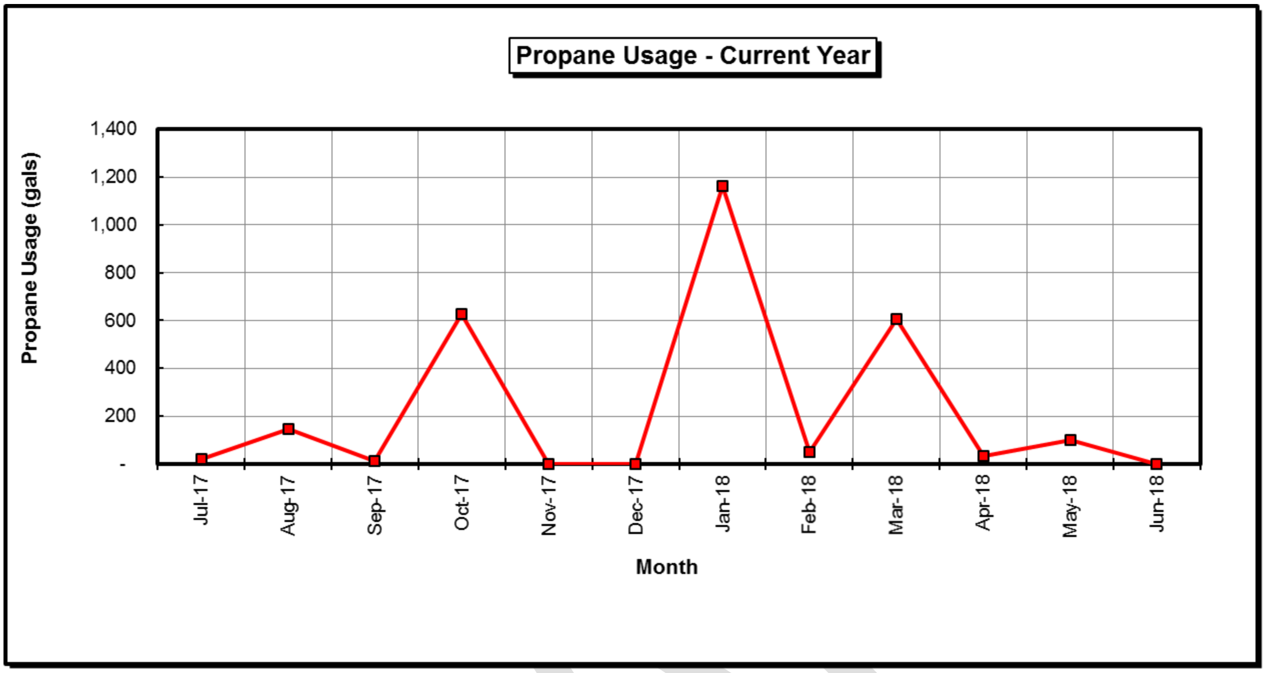


Propane Usage

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

MONTH	CONSUMPTION (GALLONS)	PROPANE COST ($)
Jul-17	22	$40
Aug-17	145	$348
Sep-17	13	$32
Oct-17	626	$1,136
Nov-17	-	$0
Dec-17	-	$0
Jan-18	1,161	$2,168
Feb-18	49	$102
Mar-18	607	$908
Apr-18	34	$59
May-18	102	$172
Jun-18	-	$0
TOTAL	**2,759**	**$4,965**

Based on the last year of utility bill information – July 2017 to June 2018, the figure below shows the Gallons and cost propane 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		Propane & #2 Fuel Oil	
Escalation Rate	Start Year of Escalation	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	3.0%	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
1A	Advanced Interior Lighting/Exterior Lighting Upgrades	$610,000	$49,492	12.3
1B	Connected Lighting – (6) Special Needs Rooms	$30,000	$694	43.2
2	Energy Efficient Motor Replacement	$24,490	$3,666	6.7
3	Building Envelope - Weatherization	$64,601	$9,139	7.1
4	DDC Controls Upgrade and DCV - E-Wing	$356,971	$8,737	40.9
4A	Exhaust Fan Controls	Incl. in DDC upgrade	$8,852	0
5	Mechanical Insulation	$770	$2,043	0.4
6	Kitchen Exhaust Hood Controls	$22,749	$2,381	9.6
7	VFD on Heating Hot Water Pumps	$20,885	$1,308	16
8	Change Oil-Fired Burners to Natural Gas Burners	$170,000	$9,913	17.1
8A	Install (3) New Hi-Eff. Gas Fired DHW Heaters	$45,000	$0	N/A
9	High-Efficiency Gas-Fired Condensing Boilers/Eliminate Steam to Hot Water HX	$700,000	$31,994	21.9
10	Energy Efficient Transformers	$103,467	$8,010	12.9
11	Combined Heat and Power Plant (35 kW)	$270,000	$15,991	16.9
12	Replace Older Split Units - Sanyo Units	$77,300	$4,580	16.9
12A	Replace Older Split Units - Computer Room Units	$18,670	$1,524	12.3
13A	New Exterior Door - A Wing	$45,680	$205	223
13B	New Exterior Door - D Wing	$45,680	$205	223
14	Aris Wind Turbine	$18,350	$0	N/A
15	Install Gas Piping & Pressure Regulators	$27,000	$0	N/A
16	Demand Response – Energy Efficiency Credit	$0	$0	N/A
17	SmartStart rebates	$10,000	$0	N/A
	Totals	**$2,661,613**	**$158,734**	**16.9**

***Year 1 Utility Savings in the above table include a 2.2% escalation on Electric, 2.4% escalation on Natural Gas and 3.0% escalation for Fuel Oil and Propane 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 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 – Kittatinny Regional High School	5	$22,286
DDC Controls Expansion/Upgrade and DCV - E-Wing	2	$7,500
Change Oil-Fired Burners to Natural Gas - (2) Boilers & (3) DHW	2	$2,500
High-Efficiency Gas-Fired Condensing Boilers/Eliminate Steam to Hot Water HX	2	$9,000

Potential Revenue Generation Estimates

Rebates

As part of the ESP for the Kittatinny Regional High School, several avenues for obtaining rebates and incentives have been investigated which include:

- SmartStart
- NJ Combined Heat and Power Incentives
- Demand Response – Energy Efficiency Credit

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 K12 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
Smart Start (LED OHLC)	$99,000
Smart Start (Lighting Fixture)	$78,512
Smart Start (Unitary HVAC)	$6,808
Smart Start (Gas Water Heating)	$1,223
Smart Start (Gas Heating)	$37,200
Smart Start (DHW Pipe Insulation)	$56
Smart Start (VFDs)	$5,000
Estimated Total Incentive	**$ 227,799**

Cogeneration Incentives

Incentives are available for Combined Heat and Power (CHP)/ Cogeneration systems with heat recovery and productive use of waste heat that are located on-site. Cogeneration units that are powered by natural gas and under 500kW, as in the case of the system recommended for Kittatinny High School, are eligible for an incentive of $2.00/ watt.

The CHP incentive is paid in three increments as outlined below:

- Thirty percent (30%) of the incentive upon proof of equipment purchase
- Fifty (50%) percent upon project completion and verification of installation
- Remainder twenty percent (20%) upon acceptance and confirmation the project is achieving the required performance thresholds based on twelve (12) months of operating data. proposed and/or minimum efficiency threshold

Building	Estimated Incentive #1	Estimated Incentive #2	Estimated Incentive #3	Estimated Total
Kittatinny Regional High School	$21,000	$35,000	$14,000	$70,000

Demand Response 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 table summarizes the available Demand Response credits available for 4 years.

Demand Response Energy – Emergency Capacity Credit		
Payment Year	**Approximate Load Reduction (kW)**	**Annual Customer Capacity Benefit**
2020/2021	110 kW	$5,000

Business Case for Recommended Project

FORM VI

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
KITTATINNY REGIONAL 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): **10 months**
3. Cash Flow Analysis Format:

Project Cost [(1)]: $3,403,138

Interest Rate to Be Used for Proposal Purposes: 2.9%

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
Installlation	$43,265	$0	$21,000	$64,265	$0	$0	$0	$0	$64,265
1	$158,733	$41,286	$267,999	$468,018	$516,047	$530,220	$14,173	$2,064	$2,064
2	$162,961	$41,286	$19,000	$223,247	$206,530	$221,128	$14,598	$2,118	$4,182
3	$167,304	$22,286	$5,000	$194,590	$177,379	$192,415	$15,036	$2,175	$6,357
4	$171,767	$22,286	$5,000	$199,053	$196,820	$196,820	$0	$2,233	$8,590
5	$176,351	$22,286	$0	$198,637	$196,344	$196,344	$0	$2,293	$10,883
6	$181,061	$0	$0	$181,061	$178,707	$178,707	$0	$2,354	$13,236
7	$185,900	$0	$0	$185,900	$183,483	$183,483	$0	$2,417	$15,653
8	$190,871	$0	$0	$190,871	$188,390	$188,390	$0	$2,481	$18,134
9	$195,979	$0	$0	$195,979	$193,431	$193,431	$0	$2,548	$20,682
10	$201,227	$0	$0	$201,227	$198,611	$198,611	$0	$2,616	$23,298
11	$206,620	$0	$0	$206,620	$203,934	$203,934	$0	$2,686	$25,984
12	$212,160	$0	$0	$212,160	$209,402	$209,402	$0	$2,758	$28,742
13	$217,853	$0	$0	$217,853	$215,021	$215,021	$0	$2,832	$31,574
14	$223,702	$0	$0	$223,702	$220,794	$220,794	$0	$2,908	$34,482
15	$229,713	$0	$0	$229,713	$226,726	$226,726	$0	$2,986	$37,469
16	$235,889	$0	$0	$235,889	$232,822	$232,822	$0	$3,067	$40,535
17	$242,235	$0	$0	$242,235	$239,086	$239,086	$0	$3,149	$43,684
18	$248,756	$0	$0	$248,756	$245,522	$245,522	$0	$3,234	$46,918
19	$255,457	$0	$0	$255,457	$252,136	$252,136	$0	$3,321	$50,239
20	$262,343	$0	$0	$262,343	$260,167	$260,167	$0	$2,176	$52,415
Totals	**$4,170,145**	**$149,430**	**$317,999**	**$4,637,574**	**$4,541,352**	**$4,585,159**	**$43,807**	**$52,415**	

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 #2 Oil Savings	Total Annual Avoided Emissions
Annual Unit Savings	855,306 kWh	65,432 Therms	
NO_X, , lbs	812 lbs	602 lbs	1,414 bs
SO_2 , lbs	1,890 lbs	0 lbs	1,890 lbs
CO_2 , lbs	950,920 lbs	765,554 lbs	1,716,474 lbs

Factors Used In Calculations:

CO_2 Electric Emissions:	1,111.79 lbs. per MWh saved
CO_2 Gas Emissions:	11.7 lbs. per therm saved
NO_X Electric Emissions:	0.95 lbs. per MWh saved
NO_X Gas Emissions:	0.0092 lbs. per therm saved
SO_2 Electric Emissions:	2.21 lbs. per MWh saved

Section 4. Potential ECMs

ECM #1A: Advanced Interior Lighting Upgrades/Exterior Lighting Upgrades

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 the Kittatinny High School utilize 32-watt T8 lamps operating on electronic ballasts. Several 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 drive ways 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 detail 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.

Scope of Work

Kittatinny High School – Summary

Johnson Controls is proposing to retrofit existing fluorescent T8 and HID fixtures with a combination of the latest LED technology fixtures, tubular lamps and retrofit kits. Existing incandescent and compact fluorescent lamps will be replaced with high efficiency LED technology.

Our recommendations are based on guidelines established by the IES of North America and commonly accepted lighting practices. We believe we captured the majority of energy and dollar savings, while improving the quality of illumination in the building.

Proposed LED lamps

Proposed Exterior Fixtures

Proposed LED High Bays

Proposed Troffers & LED Kits

Proposed ULB – TLED (direct wire)

Fixture Replacement with Advanced Controls:

Classrooms:

The lighting in these spaces are primarily comprised of 32W T8 linear fluorescent fixtures in a variety of styles, 2x4 recessed, 2x4 surface, 2x2 surface mount, and recessed cans. The existing troffer fixtures will be replaced with a new LED fixture.

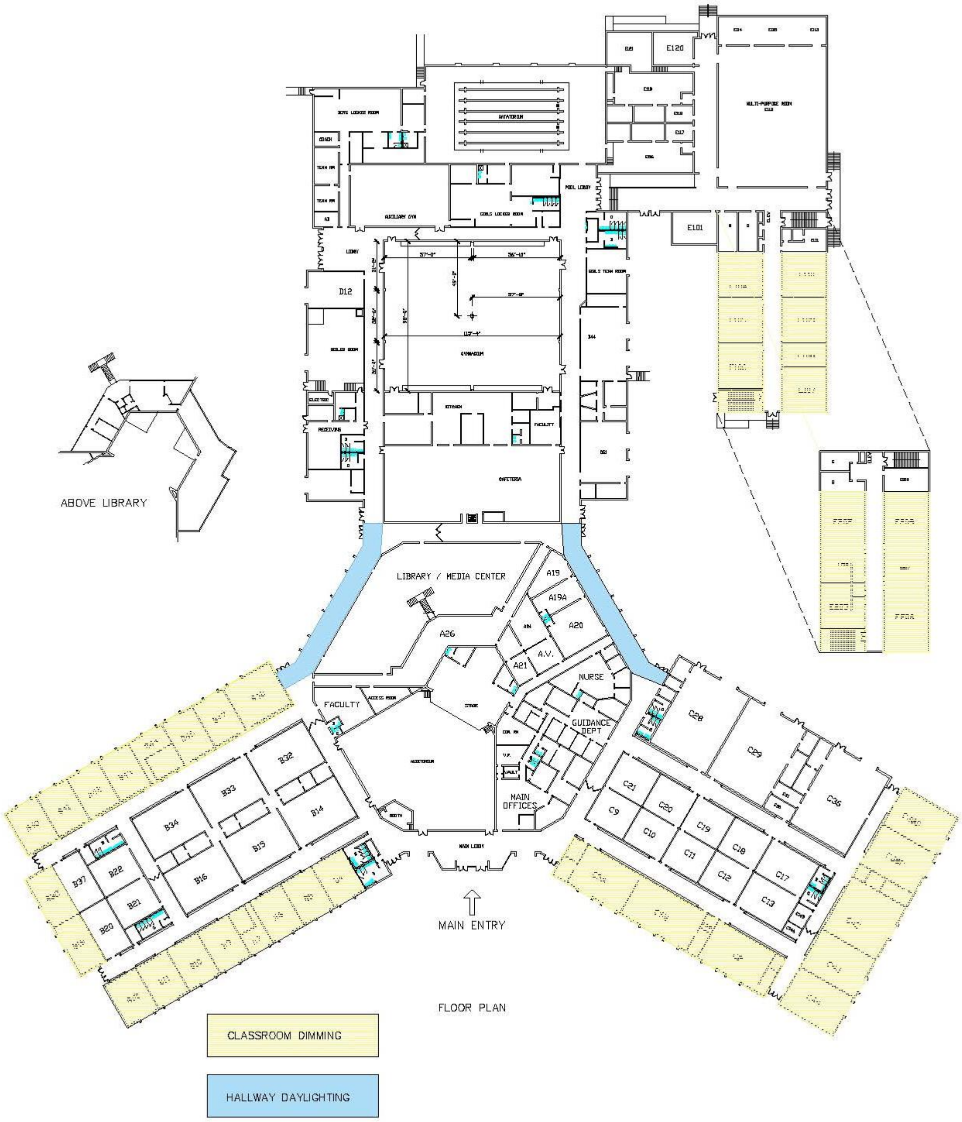
The new fixtures will be installed along with an advanced control system. The new controls will provide the opportunity to dim the spaces to optimal levels of lighting and provide further control to the occupants. This approach also ensures capturing additional energy savings and extends the life of the lamps.

Retrofits and Daylight Harvesting Controls:

Hallways/Stairwells/Common Areas:

The lighting in hallways, stairwells, and common spaces throughout the building are primarily comprised of 32W T8 linear fluorescent fixtures. There are also a variety of fixtures types including wraps and troffer fixtures. The existing linear fluorescent fixtures will be re-lamped. During the final lighting design, replacement fixtures or new LED retrofit kits will be evaluated for economic feasibility.

Daylight Harvesting is also part of the advanced lighting solution for the hallways with access to sunlight. Where adequate daylight is detected, the system will adjust interior light levels and/or shut down any applicable light fixtures.



Offices/ Mechanical/ Storage Areas/ Rest Rooms and other areas:

The lighting in these spaces are primarily comprised of 32W T8 linear fluorescent fixtures in a variety of styles, 1x4 wraps, 1x4 strips, and industrial. The existing linear fluorescent fixtures will be re-lamped with new UL type B TLED tubes, removing the existing ballast to extend life and removing an added point of failure.

If existing fixtures are in good shape, LED retrofit kits shall be used. Utilizing the retrofit kits will limit labor costs and provide the exact same aesthetic look as a new LED fixture would. This project approach will make the classrooms future ready inclusive of wireless sensors that can be added to a fully networked lighting control system in subsequent years.

Savings Methodology

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

Demand (kW)

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

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)

$$kWh\ Savings_{Lighting} = \sum_u [\ Connected\ kW\ Savings_u \times Hours\ of\ Operation]_{t,u}$$

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*

Watt readings of existing lamp/ballast combinations were taken during the audit phase. Hours of operation were taken from the results of data logging a sample of spaces throughout each facility. The loggers collected data over a period during early June, 2019 while the school was in session. In addition to logging the hours of operation, the data loggers also recorded how long areas were occupied.

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
- Occupancy data and daylight harvesting increase savings

ECM #1B: Connected Lighting – (6) Special Needs Classroom

Research supports that lighting can have a positive effect on learning and attention. Connected Lighting Controls bring lighting adaptability in an easy-to-use plug & play platform. With simple elegance, the system delivers dimming and color tuning effects at the touch of a button. Tunable White is perfect in classrooms and educational settings as it allows the light color temperature to be adjusted to the optimal light level for student tasks such as reading or test taking.

SCOPE OF WORK (CLASSROOMS)

Simple plug & play installation by utilizing the connected lighting network

- Provide new LED Series lighting fixtures that are pre-programmed to be integrated to the WAC Tunable White Controller (available in three sizes).
- Provide pre-set and engraved wallpods available with 4 default settings (General, Reading, Testing and Energy)
- The following rooms will be retrofit with Connected Lighting:
    - A19
    - A20 – Classroom selected as demo room
    - B7
    - B44
    - D10
    - E108

LED Luminaire

Tunable White Wallstation


General Lighting


Reading


Testing


Energy

BENEFITS

- Improved reading fluency and comprehension
- Higher school scorecard ratings
- Safety and Security
- Energy Savings

ECM #2: Energy Efficient Motor Replacement

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 School as candidates for replacement with premium efficiency equivalents.

Scope of Work

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

The scope of work will be as follows:

1. Remove and dispose of the old standard efficiency motors.
2. Inspect all belt sheaves and replace belts as needed.
3. Align the sheaves/couplings to EASA standards.
4. Install new motors on the existing pumps and fans designated.
5. Measure and verify both the pre and post-retrofit voltage, amperage, and fan RPM.

Building	Location	Equipment Type	Horsepower
High School	Special Aid	Unit Ventilator	7.5
High School	Pool	Pool Pump	15
High School	Cafeteria	Unit Ventilator	10
High School	Auditorium	Unit Ventilator	10
High School	Well Pit	Sewage Pump	15
High School	Sewage Plant	Sewage Pump	15
High School	Sewage Plant	Sewage Pump	15
High School	MER 1	Potable Water Pump	15
High School	MER 1	Potable Water Pump	15
High School	MER 1	Irrigation Pump	10
High School	Boiler Rm-1	HWP-1	20
High School	Boiler Rm-1	HWP-2	20

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance.

Benefits

- Electrical energy savings

ECM #3: Building Envelope - Weatherization /Infiltration Reduction

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;
- Sealant is recommended around the perimeter of several windows;
- 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 at Charles Lewis MS and Union Valley ES. 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 school.
- 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 School leads 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 School. 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 at Chews ES create bypasses for air leakage and heat loss that force the heating and cooling systems to work harder than necessary.

Door Weather Stripping – daylight visible at the center of the door is a clear indicator of an unwanted air leakage pathway due to missing weather stripping materials.

Caulking – weather stripping installed to the snap trim is useless when air is allowed to bypass snap trim into the building. Caulking the snap trim in place eliminates air leakage pathways around the door in turn allowing weather stripping to create an effective air barrier.

Roof-Wall Intersection Air Sealing – the exterior flashing and finishes at the roof-wall intersection are not constructed to stop air leakage.

Roof-Wall Intersection Air Sealing – gaps at the interior of the roof-wall intersection combine with the unsealed exterior flashing and finish details to allow unwanted infiltration/ exfiltration; excessive debris and cobwebs collecting at the roof-wall are clear indicators of air leakage.

Roof-Wall Intersection Air Sealing – the exterior flashing and finishes at the roof-wall intersection are not constructed to stop air leakage; the elevation change at the Library/Media Center, Auditorium, and adjoining offices creates a construction detail susceptible to large amounts of air leakage.

Roof-Wall Intersection Air Sealing – gaps at the roof and unsealed gaps around framing components create pathways for unwanted infiltration/ exfiltration; bypasses in the masonry components are allowing infiltration/ exfiltration.

Scope of Work

A building envelope audit was performed for the entire School. 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).

Attic Insulation – under-insulated attics are large surface areas for unnecessary heat loss leading to wasted energy and stress on mechanical equipment.

Attic Flat Insulation –attic insulation is crucial for controlling conductive heat loss in a building. After air gaps are sealed and convective air loss is reduced the biggest remaining form of heat loss becomes conduction. Damaged, discolored, inconsistent, or no insulation in an attic will result in excessive energy loss due to the lack of a properly insulated thermal barrier.

Attic Insulation Baffles – when adding insulation to an attic with active soffit venting attic baffles need to be installed. Often times there will be no baffles in place because the inadequate levels of insulation did not pose a risk of covering the ventilation. The attic baffles make sure the attic has the same ventilation after insulation is added.

Attic Air Barrier Retrofit- select areas in the attics do not have a proper air barrier in place for controlling air leakage. These level changes and large attic bypasses are gaps that expose walls in conditioned spaces to the unconditioned attic air. Interior walls are not treated to stop conductive or convective heat losses resulting in a weakness in the thermal envelope in each school with recommended attic improvements.

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.

Building/ Measure	Location	Sum of Crack Size	Sum of Crack Length (LF)	Sum of Leakage Area (SF)	Sum of Savings (CFM)	Sum of Starting R-Value	Sum of Ending R-Value
⊟Kittatinny Regional High School							
⊟Caulking							
⊟Interior Seal (LF)	See Floor Plan	1/64 In.	531 LF	0.7 SF	84 CFM	---	---
	See Floor Plan - Alternate Scope	1/64 In.	114 LF	0.1 SF	18 CFM	---	---
⊟Door Weather Stripping							
⊟Double Door - Sides, Top, Sweep, Center (UT)	See Floor Plan	1/10 In.	528 LF	4.4 SF	537 CFM	---	---
⊟Single Door - Sides, Top, Sweep (UT)	See Floor Plan	1/10 In.	680 LF	5.7 SF	691 CFM	---	---
	See Floor Plan - Alternate Scope	1/10 In.	320 LF	2.7 SF	325 CFM	---	---
⊟Overhang Air Sealing							
⊟Seal (LF)	See Floor Plan	1/6 In.	80 LF	1.1 SF	136 CFM	---	---
⊟Roof-Wall Intersection Air Sealing							
⊟Block, Seal Paint (LF)	See Floor Plan	1/8 In.	161 LF	1.7 SF	205 CFM	---	---
⊟Seal (LF)	See Floor Plan	1/4 In.	1,062 LF	11.1 SF	1,350 CFM	---	---
⊟Seal Exposed (LF)	See Floor Plan	1/16 In.	238 LF	1.2 SF	151 CFM	---	---
⊟Seal Exposed (UT)	See Floor Plan	1/12 In.	32 LF	0.2 SF	27 CFM	---	---
⊟Seal Paint (LF)	See Floor Plan	1/4 In.	455 LF	4.7 SF	578 CFM	---	---
Kittatinny Regional High School Total				33.6 SF	4,102 CFM	---	---
Grand Total				33.6 SF	4,102 CFM	---	---

KITTATINNY REGIONAL HIGH SCHOOL, NJ BUILDING ENVELOPE WORK SUMMARY		
Task	Kittatinny Regional High School	Total Quantity
Caulking (LF)	645	645
Door Weather Striping - Doubles (Units)	16	16
Door Weather Stripping - Singles (Units)	50	50
Overhang Air Sealing (LF)	80	80
Roof-Wall Intersection Air Sealing (LF)	1,916	1,916
Roof-Wall Intersection Air Sealing (Units)	32	32

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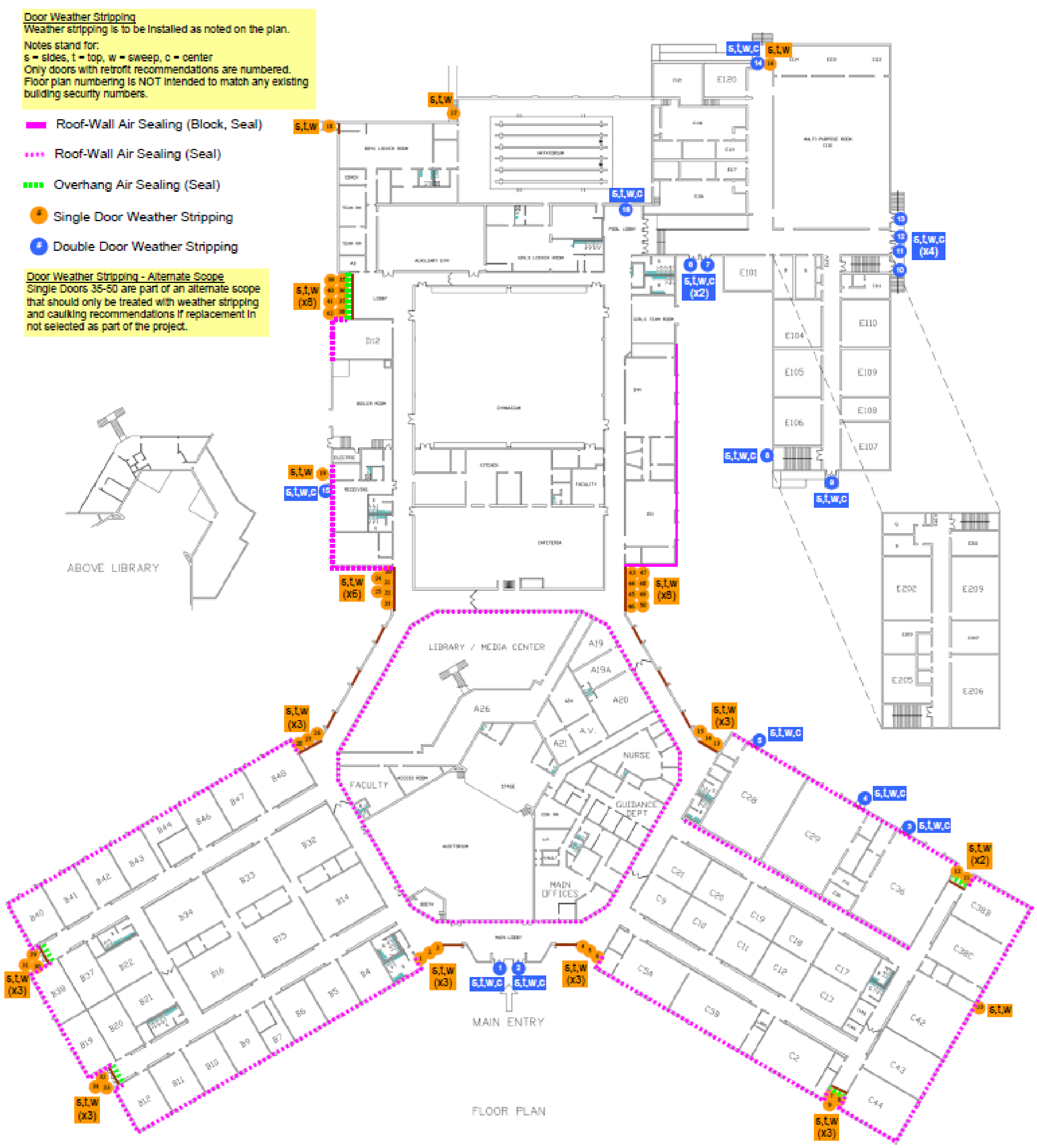
Kittatinny Regional High School



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

Savings due to Attic Insulation:

Existing Clg. Gain (In mmBtu's) = (Avg. OA Temp. - Summer Inside Setpoint) x Attic SqFt. x Existing U Value of Attic x Total Bin Hours/1,000,000
Proposed Clg. Gain (In mmBtu's) = (Avg. OA Temp. - Summer Inside Setpoint) x Attic SqFt. x Proposed U Value of Attic x Total Bin Hours/1,000,000

Existing Htg. Loss (In mmBtu's) = (Avg. OA Temp. - Winter Inside Setpoint) x Attic SqFt. x Existing U Value of Attic x Total Bin Hours/1,000,000

Proposed Htg. Loss (In mmBtu's) = (Avg. OA Temp. - Winter Inside Setpoint) x Attic SqFt. x Proposed U Value of Attic x Total Bin Hours/1,000,000

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

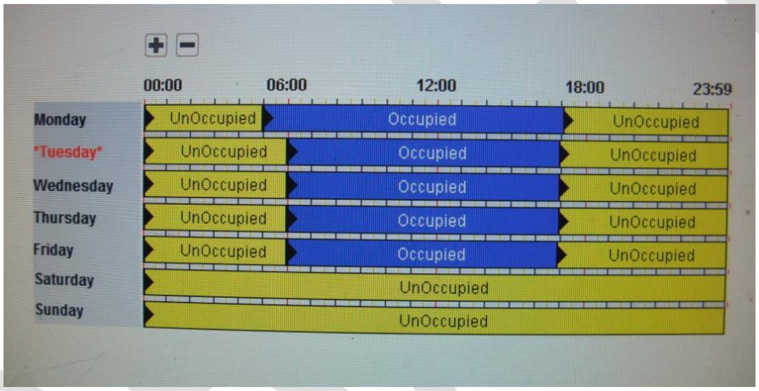
ECM #4: Building Automation Controls Upgrades – E Wing

ECM Summary

The central plant of each building at the Kittatinny High School consists of all heating and cooling equipment, associated pumps, and typically represents the largest energy consumption used in the course of heating/cooling the building. The rooftop units (RTUs), air-handling units and terminal units in the buildings are also part of the controls to reduce the energy foot print of the buildings. Therefore, good calibrated controls have a great potential for energy savings through upgraded building automation controls.

Existing System at the Kittatinny High School

The HVAC controls are a combination of pneumatic controls and Direct Digital Control systems with electronically controlled field devices on a Johnson Controls front end for monitoring and controlling the HVAC systems in the E-Wing. The control system seems to only have some of the HVAC equipment mapped into the system with graphic capabilities. It was brought to our attention that facility management only has limited scheduling, monitoring and controls capabilities. A typical schedule obtained from the existing DDC is shown below.



Johnson Controls proposes a comprehensive controls upgrade to a Metasys system to enable the School to have superior scheduling, monitoring and controls capabilities. Existing Direct Digital Control and pneumatic controls for equipment shall be upgraded with Johnson Controls.

Scope of Work

Johnson Controls shall provide and install new BAS controls and integrate to existing digital controls where indicated. In instances where an existing BAS system is in place, Johnson Controls shall provide labor and material to modify the existing system or replace where indicated. In instances where pneumatic controls, electronic controls, time-clocks or other non-digital controls are in place, JCI shall provide BAS upgrades for major HVAC equipment and air-handling units as described below with new Johnson Controls Metasys Extended Architecture Direct Digital Controls. New controls shall have an open protocol utilizing BACnet-based controllers. Scale and scope of each upgrade are included in the implementation of the following measure.

Mechanical Room

- Demolition
  - Remove existing end devices and control panel

- New Work
  - Provide, mount, and wire
    - (1) NCE Controller/Panel
    - (6) Boiler command/status
    - (2) HW pump command/status
    - (1) Outside air temperature sensor
    - (2) Occupancy E/P relays
    - (1) Room vent damper electric actuator

  - Provide, and wire (mounted by mechanical contractor)
    - (2) Control valves (3" 3-way)
    - (2) Control valves (2" 2-way)
    - (6) Well temperature sensors
  - Wire
    - (2) VFDs – BACnet MS/TP
- Clarifications
  - Control valves to be mounted by mechanical contractor
  - Power to panels to be provided by prime electrician

CoGen Room

- New Work
  - Provide, mount, and wire
    - (1) FEC Controller
  - Provide, and wire
    - (1) Control valves (6" 2-way)
    - (1) Flow meter
    - (2) Pipe mounted temperature sensors

- Clarifications
- Control valves to be mounted by mechanical contractor
- Power to panels to be provided by prime electrician

E-Wing Work:

Network Communication
  - Johnson Controls' Metasys temperature control system
  - Provide, mount and wire the following devices:
  - (1) Network Application Engine's (NAE's)
  - Clarifications
  - All IP drops to be provided by local IT department

Mechanical Room
  - Demolition

- Remove existing end devices and control panel

- New Work
  - Provide, mount, and wire
    - (1) NCE Controller/Panel
    - (2) Boiler command/status
    - (3) HW pump command/status
    - (1) Outside air temperature sensor
    - (2) Zone temperature sensors
    - (2) Occupancy E/P relays
    - (1) Room vent damper electric actuator

  - Provide, and wire (mounted by mechanical contractor)
    - (2) Control valves (3” 3-way)
    - (2) Control valves (2” 2-way)
    - (6) Well temperature sensors

- Clarifications
- Control valves to be mounted by mechanical contractor
- Power to panels to be provided by prime electrician

Daikin Rooftop Units w/ Exhaust Fans (GYM) – Typical for 2

- Demolition
- Remove existing BAS controller
- Remove existing wiring and end devices
- New Work
  - Provide, mount, and wire
    - (1) FEC controller/panel
    - (3) Temperature sensors
    - (1) Zone temperature sensor
    - (4) Exhaust fan command/status
    - (4) Electric damper actuators
    - (1) Low limit freeze-stat
    - Provide, and wire (mounted by mechanical contractor)
    - (2) Control valves
- Clarifications
- Smoke detectors to be existing

Nesbitt Rooftop Units w/ Exhaust Fans (GYM) – Typical for 2

- Demolition
- Remove existing BAS controller
- Remove existing wiring and end devices

- New Work
  - Provide, mount, and wire
    - (1) FEC controller/panel

- (3) Temperature sensors
- (1) Zone temperature sensor
- (2) Exhaust fan command/status
- (2) Electric damper actuators
- (1) Low limit freeze-stat
- (3) Stages DX Cooling
- (3) Stages electric heat
- Wire
- Interlock to DX unit

- Clarifications
- Smoke detectors to be existing
- Any rewiring of smoke detectors to be by an FAS contractor

Carrier AC Units w/ Exhaust Fans (GYM) – Typical for 11

- Demolition
- Remove existing BAS controller
- Remove existing wiring and end devices

New Work
- Provide, mount, and wire
    - (1) FEC controller/panel
    - (3) Temperature sensors

    (1) Zone temperature sensor
    - (2) Exhaust fan command/status
    - (1) Electric damper actuators
    - (1) Low limit freeze-stat
    - (3) Stages DX Cooling
    - (3) Stages electric heat
    - Wire
    - Interlock to DX unit
- Clarifications
- Smoke detectors to be existing
- Any rewiring of smoke detectors to be by an FAS contractor

Hot Water Duct Heaters – typical for 4

- Demolition
- Remove existing BAS controller
- Remove existing wiring and end devices

- New Work
    - Provide, mount, and wire
    - FEC Controller
    - (1) Duct mounted temperature sensor
    - Provide, and wire (mounted by mechanical contractor)

- (1) Control valves

Exhaust Fans – typical for 8

- Provide, mount and wire
- (1) FEC controller
- (1) Command/status
- Clarifications
- Power to unit to be provided by prime electrician

Unit Ventilators – typical for 8

- Demolition
- Remove all existing end devices and wiring
- Provide, mount, and wire
- (1) FEC controller
- Command/status
- (1) Freeze stat
- (1) Zone temperature sensor
- (1) Discharge air temperature sensor
- (1) Damper actuator
- Provide, and wire (mounted by mechanical contractor)
- (2) Control valves
- Clarifications
- Power to units to be provided by prime electrician

Unit Ventilators w/ DX Cooling – typical for 8

- Demolition
- Remove all existing end devices and wiring
- Provide, mount, and wire
- (1) FEC controller
- Command/status
- (1) Freeze stat
- (1) Zone temperature sensor

(1) Discharge air temperature sensor
- (1) Damper actuator
- (3) DX cooling stages
- Clarifications
- Power to units to be provided by prime electrician

Demand Control
- Provide, mount, and wire
- (4) CO2 sensors
- Clarifications
- CO2 sensors to be tied back to existing units (gym/all-purpose)
- Johnson Controls to provide demand control ventilation

Training
- Provide hands-on on-site operator instruction
- Training to be done during normal business hours

Warranty
- Provide (1) year warranty on all material and workmanship from date of completion of the above referenced project

Clarification and Exclusions
- Control wiring located in concealed space shall be run in plenum rated cable
- Control wiring located in mechanical rooms to be run in EMT/Raceways
- Excluding any and all mechanical project demolition
- Entire system to be DDC (no pneumatic components)
- Excluding installation of valves, sensor wells and dampers

- Fire, smoke and combination fire/smoke dampers provided and installed by others
- Smoke detectors to be hard-wire interlocked with unit fan starter (no status into BMS)
- Fire alarm interlock wiring by division 16
- Excluding pump/fan motor starters (motor starters and power by division 16)
- JCI assumes all motor starters are located adjacent to associated equipment
- JCI assumes all ceilings are accessible
- JCI assumes all ceiling heights are less than 20 feet AFF and accessible by ladder
- JCI assumes all walls are hollow core partitions
- Excluding any sheet-metal work or furnishing ductwork access doors
- Cutting, patching, and painting are by others

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 #5: 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.

KITTATINNY REGIONAL HIGH SCHOOL, NJ
MECHANICAL INSULATION WORK SUMMARY

Task	Kittatinny Regional High School	Total Quantity
Butterfly Valve Insulation (Units)	6	6
Control Valve Insulation (Units)	1	1
Flange Insulation (Units)	48	48
Gate Valve Insulation (Units)	5	5
Pipe Fitting Insulation (Units)	5	5
Pump Insulation (Units)	7	7
Straight Pipe Insulation (LF)	19	19
Strainer Insulation (Units)	8	8
Tank Inuslation (Units)	1	1

Pipe Insulation – boiler room #1 is proposed to undergo a full heating distribution retrofit. There are no recommendations to complete pipe insulation measures in this room with the exception of a small amount of work in the domestic hot water system.

Pipe Insulation – chilled water pipe insulation was properly installed, there are no recommendations to wrap chilled water distribution pipes.

Valve & Fitting Insulation – the inline pump needs to be insulated in order to avoid unnecessary domestic hot water distribution losses.

Valve & Fitting Insulation – butterfly valves, strainers, and pumps pictured above require insulation to avoid distribution losses.

Pipe Insulation – heating distribution pipes are mostly insulated. Select flanges, valves, and fittings that were left bare need to be insulated.

Pipe Insulation – heating distribution pipes are mostly insulated. Select flanges, valves, and fittings that were left bare need to be insulated.

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.

The following tables indicate the detailed scope of work for the building:

Building	Fluid Type	Pipe Dia (") or Tank Surface Area(SF)*	Component	Insulation Thickness (")	Proposed Insulation Type	Quantity or Length	Total Eq Length(LF) or Total Area(SF)*
Kittatinny Regional Higl	MTHW	2	In-Line Pump	1.5	Removable Blanket	1	5
	MTHW	3	Butterfly Valve	1.5	Removable Blanket	4	16.4
	MTHW	3	Control Valve	1.5	Removable Blanket	1	4.1
	MTHW	3	Flange	1.5	Removable Blanket	2	3.6
	MTHW	3	Flange	1.5	Removable Blanket	15	27
	MTHW	3	In-Line Pump	1.5	Removable Blanket	2	10
	MTHW	3	Straight Pipe	2	Cellular Glass	4	4
	MTHW	3	Strainer	1.5	Removable Blanket	2	10
	MTHW	3	Strainer	1.5	Removable Blanket	4	20
	MTHW	3	T Intersection	2	Cellular Glass	2	2.4
	MTHW	4	Butterfly Valve	1.5	Removable Blanket	1	4.1
	MTHW	4	Flange	1.5	Removable Blanket	6	10.8
	MTHW	4	Flange	1.5	Removable Blanket	2	3.6
	MTHW	4	Flange	1.5	Removable Blanket	12	21.6
	MTHW	4	Flange	1.5	Removable Blanket	9	16.2
	MTHW	4	Gate Valve	1.5	Removable Blanket	2	10
	MTHW	4	Straight Pipe	2	Cellular Glass	3	3
	MTHW	4	Strainer	1.5	Removable Blanket	2	10
	MTHW	6	Flange	2	Cellular Glass	2	3.6
	MTHW	6	Gate Valve	1.5	Removable Blanket	1	5
	MTHW	37.68	Air Seperator Tank	2	Cellular Glass	1	37.68
	MTHW Total						
	DHW	1.5	In-Line Pump	1.5	Removable Blanket	2	10
	DHW	1.5	Straight Pipe	1.5	Cellular Glass	6	6
	DHW	2	90 Degree Elbow	1.5	Cellular Glass	1	1.8
	DHW	2	Straight Pipe	1.5	Cellular Glass	4	4
	DHW	3	90 Degree Elbow	1.5	Cellular Glass	2	3.6
	DHW	3	Straight Pipe	1.5	Cellular Glass	2	2
	DHW Total						

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 #6: Kitchen Exhaust Hood Fan Controls

ECM Summary

Kitchen fume hoods are usually operated from the time the first kitchen employee enters the kitchen to the time the last kitchen employee leaves the kitchen. Operating the fume hoods at full power all the time wastes electrical fan energy and the fume hood also draws conditioned air out of the space causing the heating and cooling systems to over work. There is significant energy to be saved by controlling the fume hood fans based on the cooking load directly below. The fan will be modulated based on monitoring of the exhaust air temperature and smoke load inside the hood.

Existing System

The kitchen equipment includes reach-in refrigerators, reach-in freezers, and walk-in freezer. The kitchen also has ovens, stoves and a 2' by 10' kitchen hood. The kitchen equipment appears to be in good condition.

Scope of Work

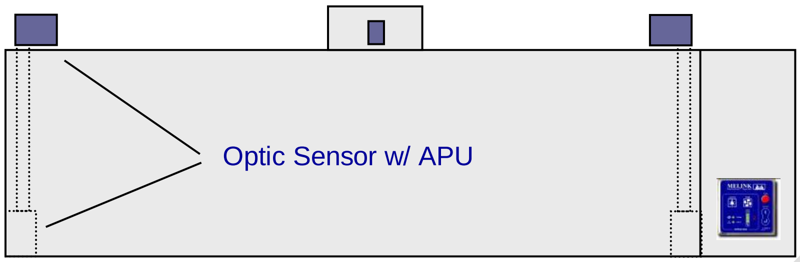
Provide Melink Kitchen Hood System for the facilities shown in the table below:

Building	Quantity of Hoods
Kittatinny High School	1

- The Melink Hood System will automatically control the speed of the exhaust and make-up fans above to ensure optimal hood performance. The system includes the following components:
  - I / O Processor
  - Keypad
  - Temperature Sensors
  - Optic Sensors
  - Variable Frequency Drives (VFDs), which replace magnetic starters for 3-phase motors, and cables.
- The I/O processor shall be mounted above the hood closest to the keypad and the keypad shall be mounted next to the existing hood switch.
- The temperature sensors shall be mounted in each exhaust collar while the optic sensors shall be mounted inside the ends of each Type 1 hood with air purge units (APU) mounted on top.
- The VFDs shall replace the existing magnetic starters for each fan.

System

- The specified system will be as follows:
  - I/O Processor (120/1, 20A) - Sends RS-485 signals to the VFDs for up to four (4) independent exhaust fans and one (1) make-up air unit (multiple VFDs can be controlled with each signal).
  - Keypad - Controls lights and fans for up to four (4) hoods (one (1) keypad per I/O Processor).
  - Temperature Sensor - Monitors exhaust air temperature at duct (one (1) sensor per exhaust duct).
  - Optic Sensor with APU - Monitors smoke load inside hood (one (1) sensor set per Type 1 hood).
  - Variable Frequency Drive(s) - Varies fan speed (one (1) VFD per fan).
  - Cables - Links I/O Processor to keypad, sensors, and VFDs.



Kitchen Hood Controls Diagram

Savings Methodology

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

Existing Energy Used	= (Full load CFM * BTU/CFM) + Fan energy at full load
Proposed Energy Used	= (CFM at reduced fan speed * BTU/CFM) + Fan energy at low speed
Energy Savings $	= (CFM Existing- CFM Proposed)*BTU/CFM + Reduced fan energy

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance.

Benefits

- Cost & Electrical energy savings

ECM #7: VFD on Heating Hot Water Pumps

ECM Summary

This measure proposes to install variable frequency drive (VFD) controls on the hot water pumps to reduce electric costs. This control will allow for a more efficient operation of the heating system and reduce electric consumption. New differential pressure sensors will be installed and tied into the controls system to regulate the speed of the pump according to load requirements. JCI will provide computer operating displays for new control points, to include pump status, on/off command, speed command, supply/return pressure and temperatures.

<u>Existing System</u>

Presently the building is served with two (2) 20-hp hot water pumps located in the boiler room. The pumps deliver constant volume hot water at 450 GPM @ 115 feet of dynamic head. The pumps are not equipped with inverter duty motors.

Figure 7.1: HW Pumps

Facilities Recommended for this Measure

- Kittatinny High School

Scope of Work

JCI proposes to replace two (2) 20-hp hot water pump motors, located in the boiler room, with new premium efficiency, inverter duty units. The pump motors will also be retrofitted with variable frequency drives.

The scope of work will be as follows:

1. Remove and dispose of the old standard efficiency motors.
2. Furnish and Install two (2) 20-hp premium efficiency, inverter duty motors and VFDs.
3. Connect the VFD to the existing differential pressure sensor.
4. Inspect all belt sheaves and replace belts as needed.
5. Align the sheaves/couplings to EASA standards.
6. Measure and verify both the pre and post-retrofit voltage, amperage, and motor RPM.
7. Install controls and power wiring for the VFD's.
8. Provide status and command feedback from VFD to the BMS.
9. Start-up and commission VFD to ensure proper operation.

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 = [(Pump kW) x (Reduced Flow/Orig. Flow)^2] x EFLH Where EFLH = Effective Full Load Hours

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance on motors.

Benefits

- Electricity savings
- Reduced HVAC operation due to reduction in full load pumping cycles.

ECM #8: Replace Oil-Fired Burners to Gas Burners

ECM Summary

JCI proposes to replace the burners at Kittatinny High School with new Riello gas fired burners and associated controls. This measure will improve the efficiency of the heating plant by installing replacement burners with a more intelligent burner control system that will cycle boiler firing based on the supply hot water tempetature.

Existing System

Heating hot water for the 2000 addition (E-Wing) is generated by a single boiler plant fitted with two (2) Peerless Model LC-10 hot water boilers. These boilers are oil-fired; built in 2006; rated at 1,511 MBH output (when new); and fitted with Riello RL Series oil burners. The primary hot water pumps are two (2) Bell & Gossett series 60, 5 HP in-line, ceiling-mounted pumps rated at 100 gallons per minute (gpm) and 50 feet of head pressure.

	Manufacturer	Model	Input (MBH)	Output (MBH)
Boiler #1	PeerLess Boiler	LC-10-WP	1,510	1,314
Boiler #2	PeerLess Boiler	LC-10-WP	1,510	1,314

Figure 9.1 – Existing Boiler for E-Wing

Scope of Work

General

The following general requirements are associated with HVAC / Mechanical / Electrical upgrades to the facilities. All work to be in accordance with prevailing industry practice, state and local codes.

- Remove the existing two (2) #2 Oil fired burners including the combustion air damper controls, on each of the boilers. Based on time of year, one boiler will be retrofitted and started prior to proceeding to the next unit. JCI will provide the schedule before starting the installation.
- Reconnect gas lines from existing to new burners.
- Inspect the each boiler. The front wall of the boiler will be demolished and the refractory rubble will be properly disposed of.
    - Provide and install Qty. (2) two new Riello (Model # RS50E) natural gas burners. The burners shall be equipped with automatic Air/Fuel ratio adjustment controls.
- Reconnect power and control wiring to new burners.
- Each new gas gun power burner will consist of a minimum of the following components: A wind box, an integral fan, an air register, a spark ignited natural gas pilot and natural gas built in accordance with the recommendations of factory mutual and in accordance with NFPA 85 standards.
- Includes a factory-authorized agent to provide burner light off and adjustment. The start-up agent shall provide a burner light-off report as written proof that the burner was adjusted to optimum performance.
- The authorized agent shall provide a one-year service warranty after start-up.

Exclusions:

- Asbestos abatement: If any hazardous material is discovered at the time of this work the customer shall be notified immediately, work will be stopped and a plan for proceeding further will be determined with the Customer's environmental department.
- Costs due to delays and work stoppages beyond the control of Johnson Controls.

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 (Proposed Efficiency – Existing Efficiency)

Efficiency Table

EXCESS AIR	O2 (%)	CO2 (%)	Net Stack Temperature (ºF)							
			280	**290**	**300**	**310**	**320**	**330**	**340**	**350**
9.5	2	10.7	83.6	83.3	83.1	82.9	82.6	82.4	82.2	82.9
12.1	2.5	10.4	83.4	83.2	83	82.7	82.5	82.3	82	81.8
15	*3*	*10.1*	*83.3*	*83*	*82.5*	*82.1*	*81.6*	*81.1*	*80.8*	*80.4*
18	3.5	9.8	83.1	82.9	82.6	82.4	82.2	81.9	81.7	81.4

Maintenance Requirements

Annual maintenance procedures should be followed as recommended by the boiler manufacturer.

Benefits

- Operational savings based on new equipment requiring less maintenance
- Capital improvements of heating plant

ECM #8A: Install High Efficiency Gas Fired DHW Heaters

ECM Summary

New gas fired, domestic hot water heaters will be installed to replace the existing units at Kittatinny High school. A minimum water temperature of 130ºF must be maintained in order to prevent the growth of bacteria in the piping and hot water tanks.

Existing System

The domestic water heaters include two (2) Bock model 73E oil-fired water heaters rated at 242 MBH and a storage capacity of 67 gallons and a Bock model 541 E rated at 623 MBH with 83 gallon storage capacity that feeds a Ruud 700 gallon storage tank with a heat exchanger.

Unit	Manufacturer	Type	Model	Input (MBH)	Output (MBH)	Area Served
DHW-1	Bock	#Oil Fired Water Heater	Model 73E	242	194	E Wing
DHW-2,3	Bock	#Oil Fired Water Heater	Model 541E	623	498	A-D Wing

Figure 9A.1 – Existing DHW Heater

Figure 9A.2 – Existing DHW Heater tank

Scope of Work

General

The following general requirements are associated with HVAC/Mechanical/Electrical upgrades to the facilities. All work to be in accordance with prevailing industry practice, state and local codes.

Demolition and Removal Work

- Disconnect, remove and properly dispose of existing unit.
- Disconnect, remove and properly dispose of HW piping to nearest isolation valves or as required for new installation.
- Disconnect, remove and properly dispose of gas flue as required.
- Disconnect, remove and properly dispose of all other materials or debris related to this project.

New Installation Work

Furnish and Install Qty. (1) new AO Smith Model BTH-199(A) and two (2) AO Smith Model BTH-500(A) new commercial flue damper, gas fired hot water heater will with electronic ignition to replace the existing system. A minimum water temperature of 120°F must be maintained in order to prevent the growth of bacteria in the piping and hot water tanks.

Installation to consist of the following:

- Disconnect, remove and properly dispose of existing domestic hot water heater.
- Disconnect, remove and properly dispose of HW piping to nearest isolation valves or as required for new installation.
- Disconnect, remove and properly dispose of gas flue as required.
- Disconnect, remove and properly dispose of all other materials or debris related to this project.
- F& I Qty. (1) new AO Smith Model BTH-199(A) and two (2) AO Smith Model BTH-500(A) commercial DHW heater with flue damper and electronic ignition, to include all piping modifications as required.
- Furnish and install gas piping to new burners.
- Furnish and install pipe supports, hangers and brackets as required.
- Provide all electrical control wiring.
- Provide authorized start-up with written combustion report.
- Provide training for operating personnel.
- All existing piping, supply pumps and check valve to remain.
- Provide (1) one year-warranty on all material and labor provided.

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 (Proposed Efficiency – Existing Efficiency)

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance.

Benefits

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

ECM #9: High-Efficiency Gas Fired Condensing Boilers

Executive Summary

Kittatinny High School was surveyed for the application of this measure. The boilers that operate at lower than acceptable efficiencies and are at the end of their life should be replaced. The new boilers will help the School achieve future energy savings and lower the amount of maintenance cost during the contract period.

Existing Systems

Heating hot water for the original building (A thru D Wings) is generated by a single boiler plant fitted with three (3) Cleaver-Brooks Model 4 Packaged Steam Boilers. These boilers are oil-fired; built in 1986; rated at 6,000 MBH input and 4,800 MBH output (when new); and fitted with Cleaver-Brooks oil-fired burners/controls. The steam is converted to heating hot water in the same boiler plant by a steam-to-hot water heat exchanger outfitted with a condensate receiver and pumps. The primary hot water pumps are two (2) 20 horsepower pumps rated at 450 gallons per minute (gpm) with 115 feet of head pressure and the motors are 89.5% efficient

Location	Name	Manufacturer	Model Number	Heating Input (MBH)
Boiler Room (A-D Wings)	Boiler 1	Cleaver Brooks	87-374-H	6,000
Boiler Room (A-D Wings)	Boiler 2	Cleaver Brooks	87-374-H	6,000
Boiler Room (A-D Wings)	Boiler 3	Cleaver Brooks	87-374-H	6,000

Figure 10.1 – Existing Cleaver Brooks Boiler

Figure 10.2 – Existing HHW Pumps

Proposed Systems

New Hot Water Boiler Installation

Provide and install four (4) new AERCO, Model No: Benchmark BMK3000, or Johnson Controls approved equal condensing HW Boiler. The new boiler shall have an input rating of 3,000 MBH at full load. The output of the boiler is a function of the unit's firing rate (valve position) and return water temperature.

a. The condensing boilers to have an output capacity of 2,790 MBH each.
b. Modulating forced draft burner with a turndown ratio of 15:1 or higher.
c. System Efficiency >=91% at 120ºF EWT (50% firing rate).
d. Provide 6" main header for the condensing boiler and connect the main header to the supply side of the existing pumps via a 4" steel pipe.
e. Provide (3) three 2-way electronic isolation valve for the new boiler, on the supply side piping.
f. Connect the hot water return to the main header via 4" steel pipe and further connect the boiler return water from the main header.
g. New boiler to have Boiler Management System that communicates via BACnet open protocol (BACnet card for seamless interfacing to BMS).
h. New boiler to have controls that should be capable of integrating with the existing building management system.
i. Boiler (s) and controls to comply with applicable regulations.
j. Provide U.L. labeled burner(s).
k. Burners to have stack O_2 sensor based optimal A/F ratio controls.
a. The boilers shall be located in the existing location, on the existing concrete pad, to be field verified.
b. Insulate new piping, valves and fittings as required.
l. Provide boiler pad if use of existing is inadequate (field verify w/ Johnson Controls to include new pad in scope of work).
m. Install boilers based on manufacturer's installation procedures.
n. Provide and install new flue as required.
o. Patch and repair all penetrations.
p. Provide Valve Tags and ID Chart.
q. Provide new stainless steel vent piping off boilers to connect to single wall SS flue vented out through wall and run up side of building to above roof line.
r. Provide new PVC intake air vent piping off boilers to connect to single Z-Flex single wall SS flue vented out through wall and run up side of building to above roof line.
s. Provide Pipe Labeling and Directional Arrows.
t. Connect the boilers to the building management system via new supervisory/field controller (controller and wiring to be provided by controls installer).
u. Condensate Neutralization Kits for boilers.
v. Start-up, checkout and verify all modes (stages) of operation (by factory authorized rep.) including measurement and verification of "part load" and "full load" efficiencies, combustion gas analysis and ALL Unit control features per manufacturers' start-up and checkout procedures.
w. Reuse existing piping, pipe fittings, pipe hangers, isolation valves, strainers, check valves, thermal wells, and pressure sensor wells where feasible and equipment serviceable.
x. Asbestos removal is not responsibility of JCI.

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 (Proposed Efficiency – Existing Efficiency)

Equipment Information

Manufacturer and Type	Several quality and cost-effective manufacturers are available. Johnson Controls and the customer will determine final selections.
Equipment Identification	As part of the ECM design and approval process, specific product selection will be provided for your review and approval.

Warranty

All installed equipment and workmanship will be warranted for a period of one year after customer acceptance. All parts, labor and costs will be covered by Johnson Controls during this period.

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.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods. Continuity of service must be maintained for the customer. All interruptions will be coordinated and scheduled with the staff in advance.

Environmental Issues

Resource Use	Energy savings will result from greater plant efficiency, and reduced maintenance costs.
Waste Production	This measure will produce waste by products. Existing burners will be removed and demolished according to proper guidelines by contractor.
Environmental Regulations	Environmental impact is expected; all regulations will be adhered to in accordance with federal and local code requirements.

ECM #10: Energy Efficient Transformer Replacements

ECM Summary

The E-Saver-C3 transformer is the ideal transformer for institutional and commercial environments where energy efficiency is a priority. Optimized for lowest life cycle cost, the E-Saver-C3 reduces waste by as much as 74%. The E-Saver-C3 is a practical and affordable solution for K-12 schools and commercial buildings where lowest life cycle cost and energy savings are a priority.

Powersmiths E-Saver-C3 is a 3-phase common-core, ventilated, dry type isolation transformer, built in an ISO 9001 and ISO14001 environment to NEMA ST-20 and other applicable ANSI and IEEE standards. Primary and secondary terminals and voltage taps are readily accessible by removing the front cover plate; 10kV BIL. The E-Saver-C3 has a 220°C class insulation, is rated for 60Hz, and comes in a NEMA 1 ventilated indoor enclosure. It exceeds the efficiency requirements of DOE candidate Standard Level 3 (CSL 3). The E-Saver-C3L comes in two models optimized for light loading: copper-wound k-7 listed, and aluminum-wound k-4 listed. Both have a 130°C temperature rise. The E-Saver-C3H is optimized for heavy loading, is copper-wound, has a UL listed k-13 rating, and a 105°C temperature rise. The C3H model has an 80°C option with k-20 rating.

<u>Existing System</u>

The 208V (Primary) -120V (Secondary) D-Y transformers that were found in the locations were operating with evidence of harmonic disturbance thus generating heat and noise. There were twelve (12) step down transformers found in different locations throughout the building.

Scope of Work

Johnson Controls proposes to install nine (9) new energy efficient transformers (Powersmith E-Saver-C3 or equal) at the locations specified in the table below. These transformers will match the capacity of the existing units.

Building	Location	Transformer Designation	Existing kVA	Replacement kVA
Kittatinny High School	Main Electrical room	TX1	300	300
Kittatinny High School	Roof Over Front Entrance	PNL 1LA1	75	75
Kittatinny High School	Electrical room / Backstage	TX1	75	75
Kittatinny High School	Elec Rm by C44	TX1	150	150
Kittatinny High School	Storage Room in C28	PNL LC	225	225
Kittatinny High School	Boiler Rm 2	TPC/2	15	15
Kittatinny High School	Boiler Rm 2	TP1-A	75	75
Kittatinny High School	Boiler Rm 2	TPC-3	15	15
Kittatinny High School	Elec. Room	PNL LC	15	15

- Clean-up of area
- Training for facility staff on proper maintenance

Savings Methodology

Savings from the transformer replacement is a result of the improved efficiency of the proposed transformers. In general, the following methods are used to calculate savings:

The following calculations were conducted for both the existing transformers and the recommended transformers. The difference represents the energy savings.

Existing Transformers:

kW Losses (Occupied) [EKWO] = (Existing kVA x % Loading Occ. x Load Power Factor / Efficiency) –

(Existing kVA x % Loading Occ. x Load Power Factor)

kW Losses (Unoccupied) [EKWU] = (Existing kVA x % Loading Un-occ. x Load Power Factor / Efficiency) –

(Existing kVA x % Loading Un-occ. x Load Power Factor)

Annual Additional kWh use due to Transformers [EKWH] = Existing kW Losses Occupied x Annual Occupied Hours + Existing kW Losses Unoccupied x Annual Unoccupied Hours

Proposed Transformers:

kW Losses (Occupied) [PKWO]	=	(Proposed kVA x % Loading Occ. x Load Power Factor / Efficiency) – (Proposed kVA x % Loading Occ. x Load Power Factor)
kW Losses (Unoccupied) [PKWU]	=	(Proposed kVA x % Loading Un-occ. x Load Power Factor /Efficiency) – (Proposed kVA x % Loading Un-occ. x Load Power Factor)
Annual Additional kWh use due to Transformers [PKWH]	=	Proposed kW Losses Occupied x Annual Occupied Hours + Proposed kW Losses Unoccupied x Annual Unoccupied Hours

Electrical Savings

kW Savings	=	EKWO – PKWO
Annual kWh Savings	=	EKWH – PKWH

Maintenance Requirements

There are no additional maintenance requirements for this product.

Benefits

- Reduces electricity waste to help you meet your sustainability goals
- Optimized to provide quiet, efficient electrical power for improved productivity
- Significantly exceeds NEMA TP-1 efficiency for low operating cost over life of transformer
- Provides the lowest life cycle cost of any transformer on the market
- Produced in an ISO 9001 and ISO 14001 certified facility to ensure high quality and low environmental impact

The E-Saver-C3's long life and dependable performance is backed up by Powersmiths' industry leading 25 year pro-rated warranty.

ECM #11: Combined Heat and Power – Reciprocating Engine

ECM Summary

Johnson Controls proposes to install one (1) 35 kW cogeneration machine at the Kittatinny High School to supply electricity to the building, which will offset a portion of the boiler load and pool load. The recovered heat will be rejected into the boiler hot water heating system.

Location: There is ample space in the boiler room next to the Peerless boilers after the HB Smith boiler is removed. The radiator, which will reject the excess heat, will be installed on the roof or outside the boiler room (final location will be determined during the design phase). The radiator location must be verified and agreed upon with the Board of Education.

Scope of Work

The systems will include:

- One (1) 35 kW Johnson Controls approved, low emissions cogeneration module.
- One (1) pump and valve module station complete with circulating pump and thermostatic mixing valve to be located in the boiler room.
- 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. BAS package for Combined Heat and Power plant control panel.
- Provide electric meter, natural gas meter and Btu meter (flow & temperature) measurements in the heat recovery loop and interface these control points to the central BAS for trending.
- Glycol based modulating heat dissipation system located on outdoor pad next to boiler room to keep system operational during varying periods with limited or no thermal load.
- 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

Power	Output	Rated Output	35 kW
		Voltage	208V, 60Hz
		Phases/Wires	Three phase, 3 wire
Fuel	Gas type		Natural gas
	Pressure	Standard	9 in WC (2.25 kPa)
		Range	8 -10 in WC (2 - 2.5 kPa)
	Consumption (LHV)		367,487 BTU (107.7 kW)
			3.67 therms/hr
	Consumption (HHV) (*1)		407,114 BTU (119.3 kW)
			4.07 therms/hr
Heat output	Rated recovered heat		204,040 BTU/h (59.8 kW)
	Rated hot water temp.	Inlet	167°F (75°C)
		Outlet	176°F (80°C)
	Rated hot water flow rate		43 GPM (164 L/min)
	Maximum hot water temp. (Outlet)		190°F (88°C)

Savings Methodology

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

Energy: 35 kW/module x 1 module(s) x 1 net after "parasitic loads"

= 35 net kW output x $/kWh avg. displaced energy

Demand : 35 kW/module x 1 module(s) available x 1 net after "parasitic loads"

When Heat Used to Displace Boiler Gas Use:

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

Maintenance 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 during heating.

ECM #12: Replace Older Split Units – Sanyo Units

ECM Summary

JCI proposes to install new direct expansion split cooling system that will meet the cooling needs for the classrooms at Kittatinny High school.

Existing System

Presently the classrooms in the B and C-Wings at the high school are air-conditioned by split AC units with Sanyo 3 and 4 ton rooftop air-cooled condensers that feed split unit ventilators. The Sanyo condensers are over the useful life of the equipment and should be considered for replacement. The name plate data for most of condensers were not available during the time of the audit and hence they were estimated based on the evaporator size.

Figure 13.1


Figure 13.2

Scope of Work

JCI proposes to replace direct expansion split systems for the units mentioned below at Kittatinny High school.

- Furnish and install the following:
- Install condensers and evaporators for the classrooms mentioned below. The capacities of the condensers shall not exceed the capacities mentioned in the table below, without written approval of Johnson Controls.

Location	Area-System Served	Manufacturer	Model Number	Cooling Capacity (Ton)
C Wing Roof	Classroom	SANYO	C4822	4
C Wing Roof	Classroom	SANYO	C2422	2
C Wing Roof	Classroom	SANYO	C3622	3
C Wing Roof	Classroom	SANYO	C4822	4
C Wing Roof	Classroom	SANYO	Not Available	3
C Wing Roof	Classroom	SANYO	Not Available	3
C Wing Roof	Classroom	SANYO	Not Available	3
C Wing Roof	Classroom	SANYO	Not Available	3
C Wing Roof	Classroom	SANYO	Not Available	3
C Wing Roof	Classroom	SANYO	Not Available	3
C Wing Roof	Classroom	SANYO	Not Available	3
C Wing Roof	Classroom	SANYO	Not Available	3

- Provide power wiring to the condenser (65 Amps each).
- Reuse curb adapters for the condensers where applicable.
- Install all applicable refrigerant piping.
- Insulate all piping and conceal refrigerant piping in conditioned space.
- Leak check piping.
- Electrical power and control wiring to new unit(s).
- Coordinate with new DDC controls.
- Provide new unit start-up and commissioning

Savings Methodology

In general, consumption is calculated using Excel-based Bincalc and effective full load hours. There will be negative energy savings for running the unit in cooling mode as extra cooling load is added to the building. Appropriate baseline adjustment will be made while calculating guaranteed energy savings.

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance.

Benefits

- Negetive Energy savings.
- Increased occupant comfort during cooling season.

ECM #12A: Replace Older Roof Top Units – Computer Room Units

Scope of Work

JCI proposes to replace 5 Ton, Single Stage Cooling, Johnson Controls Series 12R Single Packaged R-410A Air Conditioner, 14.1 SEER / 12.1 EER.

- Furnish and install the following:
- Install condensers for the Computer room mentioned below. The capacities of the condensers shall not exceed the capacities mentioned in the table below, without written approval of Johnson Controls.

Location	Unit Name	Qty.	Ton	Model #
Computer Room	RTU	2	5	ZQG06E4B1AA1A323A2

- Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors.
- Microchannel All Aluminum Condenser Coil, Copper tube/Aluminum fin Evaporator Coil
- Provide power wiring to the condenser (60 Amps each).
- Insulate all piping and conceal refrigerant piping in conditioned space.
- Leak check piping.
- Electrical power and control wiring to new unit(s).
- Coordinate with new DDC controls.
- Provide new unit start-up and commissioning

ECM #13: New Exterior Door Installation – A & D Wings

ECM Summary

All locations within the School were surveyed for the application of this measure. Locations where doors are new or are in good condition this measure does not apply. The heat loss and heat gains that occur due to low R-value of the doors, will be improved through the replacement of old doors with new energy efficient doors. Additionally, the rate of infiltration that occurs due to the leakage around the frames is also a major cause of energy loss. The upgrade will result in substantial savings and improved comfort to those affected spaces. Johnson Controls proposes the installation of new energy efficient, FRP doors to reduce infiltration, infrared and conductive losses. Overall, through the implementation of this measure the School will reduce its heating fuel usage and air conditioning costs each year.

Detailed Description of FIM

Existing System

Kittatinny High School

The doors that are installed are standard metal frame doors shown in Figure 1. There are two sets of doors that are located in the A and D wings that are old and needs to be replaced.

Figure 1

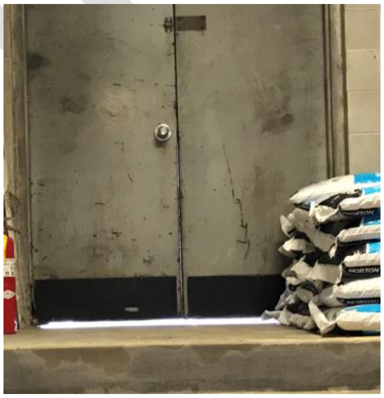


Figure 2

Proposed System

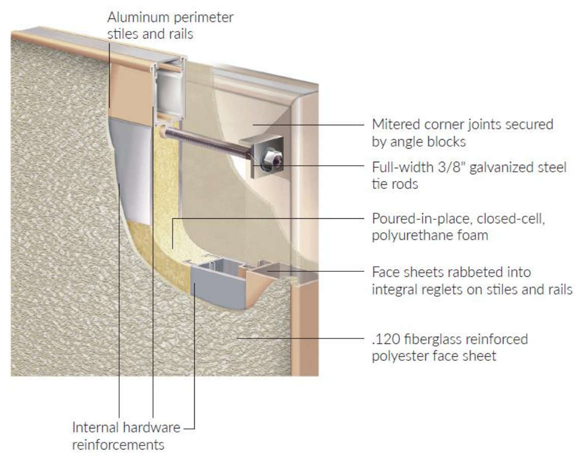
The upgrade will result in substantial savings and improved comfort to those affected spaces. Johnson Controls proposes the installation of new energy efficient, FRP doors to reduce infiltration, infrared and conductive losses. Overall, through the implementation of this measure the School will reduce its heating fuel usage and air conditioning costs each year.

Scope of Work

JCI proposes to install two (2) Sets of Doors & Frames at A-Wing and two (2) Sets of Doors & Frames at D-Wing located in the high school.

- Demo (4) Bays of Existing Doors at A-Wing & D-Wing.
- Install New FRP Doors, Aluminum Frames, & Hardware.
- Four (4) Special-Lite SL260 Complicated Aluminum Tube Frame x Thermally Broken x Top Transom x Clear Aluminum Finish (138" x 100")
- Special-Lite SL17 FRP Doors x Standard Finish x Narrow Lites x SL484 Flush Pulls x Clear Trim x Prepared & Reinforced For Hardware (32" x 84")
- Insulated Glass
- Select SL18HD-83" Continuous Hinge x AL
- Aluminum Capping & Material
- Provide complete set of shop drawings for review by Architect and Engineer.

SL-17 Door Construction



Energy Savings Methodology

Energy savings results from significantly reducing the heat losses. In general, JCI uses the following approach to determine savings for this specific measure:

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

Existing Window Efficiency	= Existing U + Existing Infiltration Rate
Proposed Window Efficiency	= Proposed U + Proposed Infiltration Rate
Energy Savings $	= U x A x dt x Hours/Boiler Efficiency +((Existing Airflow – proposed airflow) x 1.08 (OA Avg. Temp – Inside Avg. Temp)/ (Boiler efficiency) x (fuel cost)

Benefits

- Electrical energy savings
- Capital improvements of HVAC systems
- Improved indoor air quality
- Improved occupant comfort

ECM #14: Aris Wind Turbine

Executive Summary

The High school was surveyed for the application of this measure. The high school building is located in an area where wind power would be beneficial to the school. Wind power reduces the quantity of purchased power from the local utility resulting in good financial benefits for both electric and fossil fuels; and provides an excellent platform for education.

Detailed Description of Measure

Scope of Work

Johnson Controls proposes to install one (1) Aris Remote Power Unit (RPU) that will include a 300-Watt wind turbine for electrical generation, a 250-watt polycrystalline solar panel, two LED lights and a 24V battery storage system. The physical location and system variation must be agreed upon with the District. The specifications of the unit is mentioned in the table below.

- 80 Watt LED Hybrid Streetlight (RPU) with single lamp arm
- Kittatinny School District banner print both sides and tailfin
- Data Monitoring and Maintenance of the RPU
- USB Charging station at the RPU
- Installation, foundation, cleanup and haul away (Prevailing Wages)

By installing a RPU system, you will receive the following benefits.

- LED lighting and enhanced security
- Save money on your system purchase with state rebates
- Utilize free energy from the wind and sun
- Provide a valuable teaching program to instill environmental awareness and responsibility

Wind Power (Permanent Magnetic Generator)	
Rated Power Output	300w
Rated Wind Speed	9 m/s (20 mph)
Cut in Wind Speed	2 m/s (4.5 mph)
Solar Power	
Number of Panels	1 Polycrystalline Panel
Rated Power Output	250w - 500w
LED Lighting	
Number of Lights	1 or 2 lamp arms/fixtures
Wattage/Fixture	60w, 80w, 100w Dimmable
Control System	
Charge Controller	Airsynergy Hybrid Controller
Voltage To Battery	24v
Batteries	
Type	Absorbent Glass Mat (AGM)
Number	(2) 12v Batteries for 24v Storage
Capacity (amp-hrs)	230 amp hour
Tower	
Material	Hot Dipped Galvanized Steel
Powder Coat Paint	White (std), Green/Brown (opt)

Energy Savings Methodology

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

> Cost per kWh = Average Site Data Package $/kWh
>
> Developed kWh = As calculated by e2systems with the location average annual wind speed
>
> Energy Savings $ = kWh x Average Site Data Package $/kWh

Changes in Infrastructure

New equipment will be installed and electric tie in required.

Support and Coordination with Utilities

Coordination of the electrical tie in to the main electric panels will be required as well as with local rebates associated with the installation.

Proposed Location of the Remote Power Unit

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. Non-measured energy savings are limited to no more than 10-15% of the overall project savings.

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:** 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:** 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 Energy Recovery Desiccant Wheel)	**Option A:** Baseline consumption and demand determined through computer simulation and verified using utility data. Post retrofit consumption and demand taken from computer simulation calibrated with actual operating conditions from the BAS.	**Pre M&V**: Accepted engineering practices/building simulations will be used to calculate energy consumption baselines. Pre-installation measurements will be taken, including temperature and occupancy hours. All calculations will be calibrated. **Post M&V**: Various control points within the BAS will be trended and/or totalized. This data will be used to verify that all control strategies are in place and functioning as intended. If differences are found due to the fault of Johnson Controls, 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	**Option B:** Savings are verified using metered data for fuel input and electrical and heat recovery output.	**Pre M&V**: The baseline utility bills will be analyzed to determine baseline heating and electric loads and the time that the cogeneration system is able to operate per year and the capacity of the cogeneration system. **Post M&V**: The electric generation output from the cogeneration system will be measured with a permanent electric meter. The heat output from the cogeneration system will be determined by measuring the water inlet/outlet temperature and flow rate. The gas input to the cogeneration system will be measured with a permanent gas meter. Combined, these data points will be used to verify the conversion efficiency of the cogeneration system. **Energy Savings**: Savings are from the electric and heat provided by the cogeneration system.

ECM Description	M&V Method - Summary	Detail of M&V Methodology
Infiltration Reduction	**Non-Measured:** Existing envelope deficiencies will be documented based on collected field data to provide a baseline for evaluating 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 based on the ASHRAE crack method calculations.
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	**Non-Measured:** Savings are from installing pipe insulation and insulation blankets.	**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. **Energy Savings:** Savings are from a reduction in heat loss through uninsulated pipes and valves.

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	$14,173
2	$14,598
3	$15,036
Total	$43,807

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 and water 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, Year 1 and Year 2 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 ESP project will be provided with the standard manufacturer warranty. Once installation of the equipment is complete, the remaining warranty period will be transferred to Kittatinny Regional High School; 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.

In order to ensure the School is fully capable of achieving the energy savings and fully utilizing the new HVAC and BAS, Johnson Controls has included 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. In order to receive the incentives for the cogeneration system, a 10-year maintenance contract must be in place.

Services for lighting upgrades and standard HVAC maintenance, such as filter changes, can be completed by School staff.

Design and Compliance Issues

Johnson Controls will enlist Barnickel Engineering Corporation (BEC) 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 ESP 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 ESP.

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 Kittatinny Regional High School.

Johnson Controls does not guarantee the rebate or state incentive structure. If the programs change or the incentive amounts differ, Kittatinny Regional High School 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

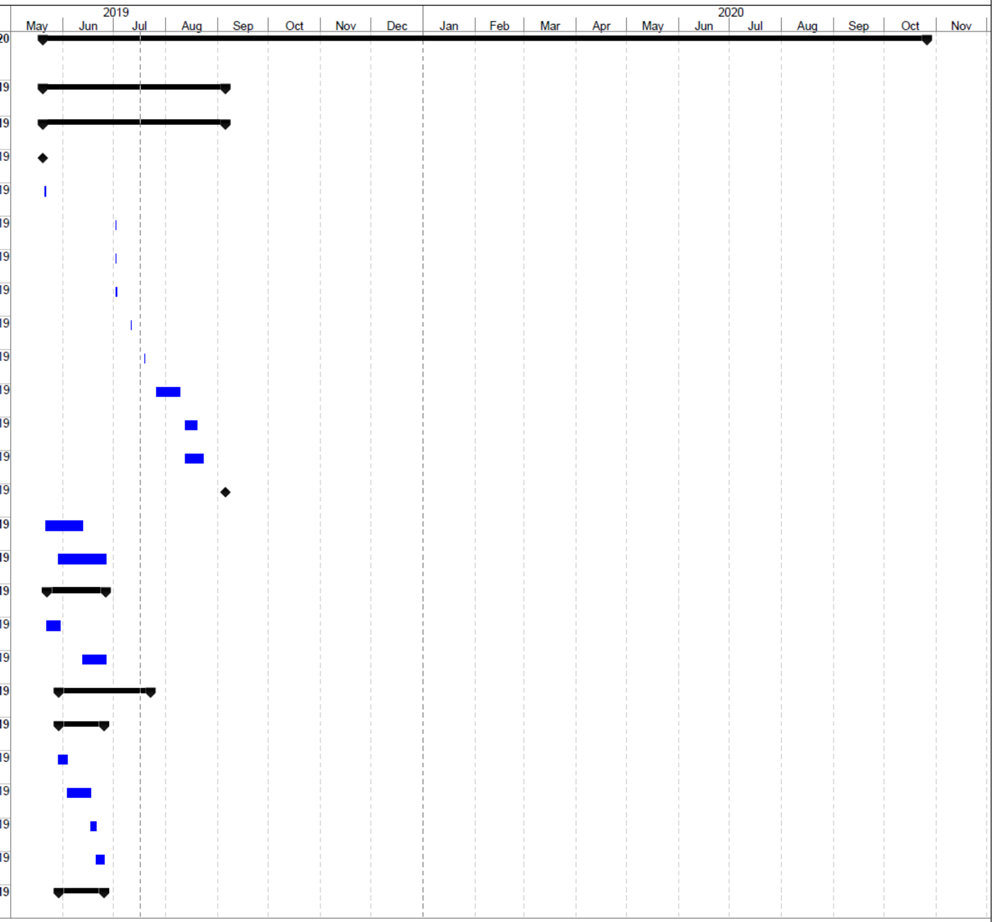
A preliminary installation schedule for the measures implemented as part of the ESP is included below to provide a reasonable expectation for the timeline of construction. Once final bids are received and financing of the project is complete, the installation will be finalized in much greater detail and reviewed with the team from Kittatinny Regional High School 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 ESP Pending necessary Reviews – July 25, 2019
- Complete Third Party Engineering Review of ESP – July 26, 2019 – August 9, 2019
- Complete Board of Public Utilities Review of ESP – August 12, 2019 – August 19, 2019
- Approval resolution to contract with Johnson Controls: September 5, 2019
- Complete 100% design drawings and bid specifications – October 28, 2019
- Expected Finance Close: October 2019
- Lighting Installation to Begin: January 2019
- Public bidding for Non-Mechanical Work: November – December 2019
- Non-Lighting Installation to Begin: March 2020
- Project Installation: January – September 2020

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

Kittatinny Regional Board of Education
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
1	**Kittatinny Regional BOE ESIP**	373.5 days	Mon 5/20/19	Mon 10/26/20
2	**Phase 1: Investment Grade Audit/ Energy Savings Plan**	76.5 days	Mon 5/20/19	Thu 9/5/19
3	Major Milestone	76.5 days	Mon 5/20/19	Thu 9/5/19
4	Signed Investment Grade Audit Agreement	0 days	Mon 5/20/19	Mon 5/20/19
5	Customer Kick-off Workshop	2 hrs	Tue 5/21/19	Tue 5/21/19
6	ECM Verification Workshop	3 hrs	Tue 7/2/19	Tue 7/2/19
7	Baseline Utility Workshop	3 hrs	Tue 7/2/19	Tue 7/2/19
8	Measurement & Verification Workshop	3 hrs	Tue 7/2/19	Tue 7/2/19
9	Business Case Workshop	2 hrs	Thu 7/11/19	Thu 7/11/19
10	IGEA Results Presented to Customer	2 hrs	Fri 7/19/19	Fri 7/19/19
11	3rd Party Engineering Review/Approval	2 wks	Fri 7/26/19	Fri 8/9/19
12	Submit Energy Savings Plan to BPU for Review/Approval	5 days	Mon 8/12/19	Mon 8/19/19
13	Submit PC Contract (ESIP) to Board Attorney for Review/Approval	9 days	Mon 8/12/19	Fri 8/23/19
14	Customer Approval & Acceptance of ESP & JCI Contract	0 days	Thu 9/5/19	Thu 9/5/19
15	**Detailed Site Visits**	3 wks	Tue 5/21/19	Wed 6/12/19
16	**Scope Design & Construction Cost Estimating**	4 wks	Wed 5/29/19	Wed 6/26/19
17	**Detailed Energy Analysis**	24 days	Wed 5/22/19	Wed 6/26/19
18	Update Utility Bills	1 wk	Wed 5/22/19	Thu 5/30/19
19	Energy Saving Calculations	2 wks	Wed 6/12/19	Wed 6/26/19
20	**Data Logging**	37.75 days	Wed 5/29/19	Mon 7/22/19
21	**Lighting Loggers**	19 days	Wed 5/29/19	Tue 6/25/19
22	Deploy Loggers	3 days	Wed 5/29/19	Mon 6/3/19
23	Logging Time	10 days	Mon 6/3/19	Mon 6/17/19
24	Retrieve Loggers	3 days	Mon 6/17/19	Thu 6/20/19
25	Analyze Data	3 days	Thu 6/20/19	Tue 6/25/19
26	**Temperature/ Motor Loggers**	19 days	Wed 5/29/19	Tue 6/25/19



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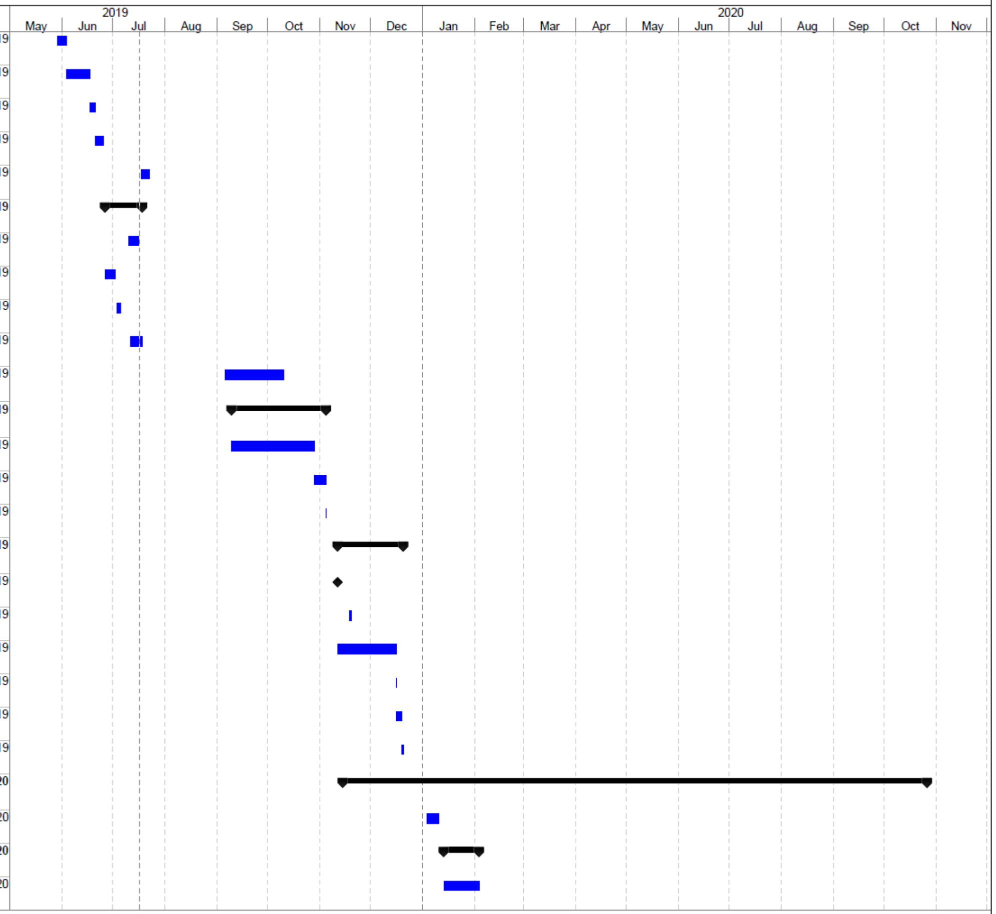
Kittatinny Regional Board of Education
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
27	Deploy Loggers	3 days	Wed 5/29/19	Mon 6/3/19
28	Logging Time	10 days	Mon 6/3/19	Mon 6/17/19
29	Retrieve Loggers	3 days	Mon 6/17/19	Thu 6/20/19
30	Analyze Data	3 days	Thu 6/20/19	Tue 6/25/19
31	Field Measurements	3 days	Thu 7/18/19	Mon 7/22/19
32	**ESP Report Development**	**15.25 days**	**Wed 6/26/19**	**Thu 7/18/19**
33	Detailed Scope Write-up	4 days	Wed 7/10/19	Tue 7/16/19
34	Detailed Energy Savings Analysis	4 days	Wed 6/26/19	Tue 7/2/19
35	Develop Business Case	1 day	Wed 7/3/19	Fri 7/5/19
36	Energy Savings Plan Appendix	1 wk	Thu 7/11/19	Thu 7/18/19
37	**Project Financing**	5 wks	Thu 9/5/19	Thu 10/10/19
38	**Phase 2: Design**	**40.25 days**	**Mon 9/9/19**	**Mon 11/4/19**
39	Final Design Engineering	7 wks	Mon 9/9/19	Mon 10/28/19
40	Bid Specification Development	1 wk	Mon 10/28/19	Mon 11/4/19
41	Final Design Review Workshop	2 hrs	Mon 11/4/19	Mon 11/4/19
42	**Phase 3: Procurement**	**29 days**	**Mon 11/11/19**	**Fri 12/20/19**
43	Advertise Bids	0 days	Mon 11/11/19	Mon 11/11/19
44	Pre-Proposal Conference & Site Visits	1 day	Mon 11/18/19	Tue 11/19/19
45	Bid Duration for Subcontractors	5 wks	Mon 11/11/19	Mon 12/16/19
46	Opening of Bids	1 hr	Mon 12/16/19	Mon 12/16/19
47	Evaluation of Bids and Confer on Selection of Sub-Contractors	3 days	Mon 12/16/19	Thu 12/19/19
48	Subcontractor Selection	1 day	Thu 12/19/19	Fri 12/20/19
49	**Phase 4: Construction**	**247 days**	**Thu 11/14/19**	**Mon 10/26/20**
50	Issue Subcontracts	1 wk	Fri 1/3/20	Fri 1/10/20
51	**Pre- Construction Activities**	**15 days**	**Mon 1/13/20**	**Mon 2/3/20**
52	Mobilization / Planning / Engineering	3 wks	Mon 1/13/20	Mon 2/3/20



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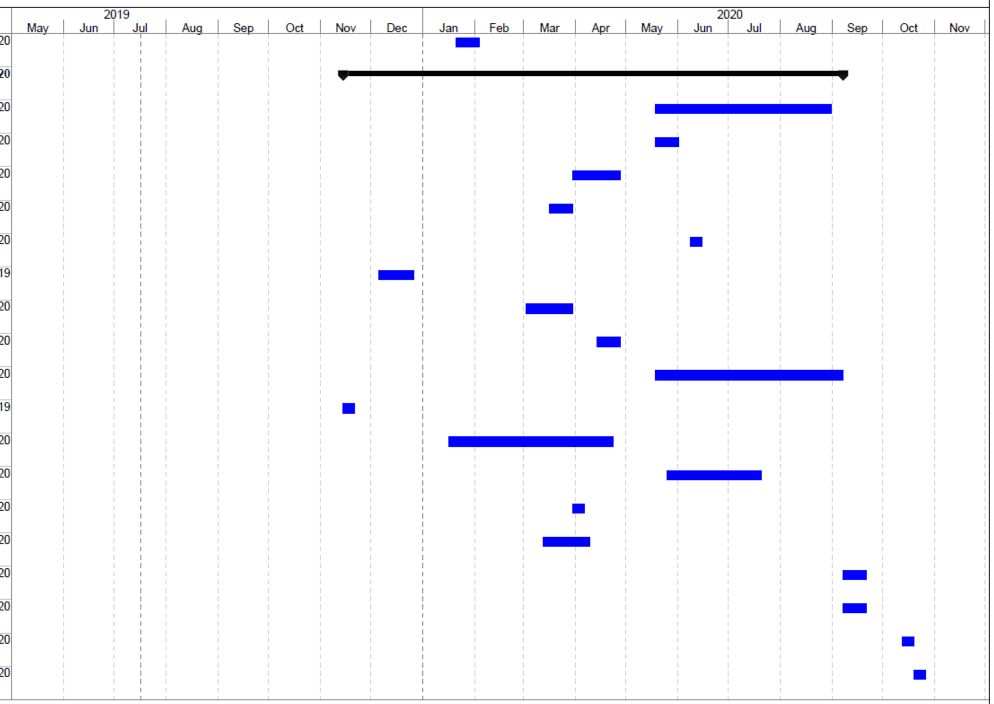
Kittatinny Regional Board of Education
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
53	Shop Drawing Approval	2 wks	Mon 1/20/20	Mon 2/3/20
54	**Installation of Recommended ECMs**	**212 days**	**Thu 11/14/19**	**Mon 9/7/20**
55	Boiler/DHW Replacements/Gas Conversion	15 wks	Mon 5/18/20	Mon 8/31/20
56	Boiler Burner Replacements/Gas Conversion	2 wks	Mon 5/18/20	Mon 6/1/20
57	Replace Older Split Units	4 wks	Mon 3/30/20	Mon 4/27/20
58	Premium Efficiency Motors	2 wks	Mon 3/16/20	Mon 3/30/20
59	VFDs on Hot Water Pumps	1 wk	Mon 6/8/20	Mon 6/15/20
60	Building Envelope/Mechanical Insulation Upgrades	3 wks	Thu 12/5/19	Thu 12/26/19
61	Plug Load Controls	4 wks	Mon 3/2/20	Mon 3/30/20
62	Energy Efficient Transformers	2 wks	Mon 4/13/20	Mon 4/27/20
63	DDC Controls Expansion/Upgrade - E-Wing	16 wks	Mon 5/18/20	Mon 9/7/20
64	Kitchen Exhaust Hood Controls	1 wk	Thu 11/14/19	Thu 11/21/19
65	Interior Lighting/Exterior Lighting Upgrades	14 wks	Thu 1/16/20	Thu 4/23/20
66	Combined Heat and Power	8 wks	Mon 5/25/20	Mon 7/20/20
67	New Exterior Doors for A and D Wings	1 wk	Mon 3/30/20	Mon 4/6/20
68	Aris Wind/Solar/Battery Storage/USB Charging System	4 wks	Thu 3/12/20	Thu 4/9/20
69	Punch List Items	2 wks	Mon 9/7/20	Mon 9/21/20
70	Equipment Initial Training	2 wks	Mon 9/7/20	Mon 9/21/20
71	System Commissioning	1 wk	Mon 10/12/20	Mon 10/19/20
72	Project Close Out	1 wk	Mon 10/19/20	Mon 10/26/20



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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.

Operational Savings

New LED Fixtures

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

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

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

Mechanical Upgrades

The operational savings for these measures have been claimed for 2 years per the BPU regulations. A complete breakdown of the operational analysis for the School is included on the following pages.

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 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 – Kittatinny Regional High School	5	$22,286
DDC Controls Expansion/Upgrade and DCV - E-Wing	2	$7,500
Change Oil-Fired Burners to Natural Gas - (2) Boilers & (3) DHW	2	$2,500
High-Efficiency Gas-Fired Condensing Boilers/Eliminate Steam to Hot Water HX	2	$9,000

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 – ESP

ID #	Energy Conservation Measure	ECM Hard Cost	Year 1 Utility Savings*	Simple Payback
1A	Advanced Interior Lighting/Exterior Lighting Upgrades	$610,000	$49,492	12.3
1B	Connected Lighting – (6) Special Needs Rooms	$30,000	$694	43.2
2	Energy Efficient Motor Replacement	$24,490	$3,666	6.7
3	Building Envelope - Weatherization	$64,601	$9,139	7.1
4	DDC Controls Upgrade and DCV - E-Wing	$356,971	$8,737	40.9
4A	Exhaust Fan Controls	Incl. in DDC upgrade	$8,852	0
5	Mechanical Insulation	$770	$2,043	0.4
6	Kitchen Exhaust Hood Controls	$22,749	$2,381	9.6
7	VFD on Heating Hot Water Pumps	$20,885	$1,308	16
8	Change Oil-Fired Burners to Natural Gas Burners	$170,000	$9,913	17.1
8A	Install (3) New Hi-Eff. Gas Fired DHW Heaters	$45,000	$0	N/A
9	High-Efficiency Gas-Fired Condensing Boilers/Eliminate Steam to Hot Water HX	$700,000	$31,994	21.9
10	Energy Efficient Transformers	$103,467	$8,010	12.9
11	Combined Heat and Power Plant (35 kW)	$270,000	$15,991	16.9
12	Replace Older Split Units - Sanyo Units	$77,300	$4,580	16.9
12A	Replace Older Split Units - Computer Room Units	$18,670	$1,524	12.3
13A	New Exterior Door - A Wing	$45,680	$205	223
13B	New Exterior Door - D Wing	$45,680	$205	223
14	Aris Wind Turbine	$18,350	$0	N/A
15	Install Gas Piping & Pressure Regulators	$27,000	$0	N/A
16	Demand Response – Energy Efficiency Credit	$0	$0	N/A
17	SmartStart rebates	$10,000	$0	N/A
	Totals	**$2,661,613**	**$158,734**	**16.9**

***Year 1 Utility Savings in the above table include a 2.2% escalation on electric, 2.4% escalation on Natural Gas and 3.0% escalation for Fuel Oil and Propane guaranteed savings.**

Rebates

As part of the ESP for the Kittatinny Regional High School, several avenues for obtaining rebates and incentives have been investigated which include:

- Pay for Performance
- NJ Combined Heat and Power Incentives
- Demand Response – Energy Efficiency Credit

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 K12 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
Smart Start (LED OHLC)	$99,000
Smart Start (Lighting Fixture)	$78,512
Smart Start (Unitary HVAC)	$6,808
Smart Start (Gas Water Heating)	$1,223
Smart Start (Gas Heating)	$37,200
Smart Start (DHW Pipe Insulation)	$56
Smart Start (VFDs)	$5,000
Estimated Total Incentive	**$ 227,799**

Cogeneration Incentives

Incentives are available for Combined Heat and Power (CHP)/ Cogeneration systems with heat recovery and productive use of waste heat that are located on-site. Cogeneration units that are powered by natural gas and under 500kW, as in the case of the system recommended for Kittatinny High School, are eligible for an incentive of $2.00/ watt.

The CHP incentive is paid in three increments as outlined below:

- Thirty percent (30%) of the incentive upon proof of equipment purchase
- Fifty (50%) percent upon project completion and verification of installation
- Remainder twenty percent (20%) upon acceptance and confirmation the project is achieving the required performance thresholds based on twelve (12) months of operating data. proposed and/or minimum efficiency threshold

Building	Estimated Incentive #1	Estimated Incentive #2	Estimated Incentive #3	Estimated Total
Kittatinny Regional High School	$21,000	$35,000	$14,000	$70,000

Demand Response 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 table summarizes the available Demand Response credits available for 4 years.

Demand Response Energy – Emergency Capacity Credit		
Payment Year	**Approximate Load Reduction (kW)**	**Annual Customer Capacity Benefit**
2020/2021	110 kW	$5,000

Baseline Utility Savings

ID #	Energy Conservation Measure	Electric Consumption		Electric Demand		Natural Gas		Propane		#2 Oil		Total Annual Utility Savings
		$$	Units	$$	Units	$$	Units	$$	Units	$$	Units	$$
1A	Advanced Interior Lighting/Exterior Lighting Upgrades	$38,321	413,212	$10,106	1,584							$48,427
1B	Connected Lighting – (6) Special Needs Rooms	$679	6,788									$679
2	Premium Efficiency Motors	$2,753	28,086	$834	129	$-	-					$3,587
3	Replace Older Split Units - Computer Room Units	$1,491	15,211									$1,491
4	Replace Older Split Units - Sanyo Units	$4,481	45,717									$4,481
5	DDC Controls Expansion/Upgrade and DCV - E-Wing	$2,546	25,935			$5,991	6,306					$8,537
6	Kitchen Exhaust Hood Controls	$316	3,221			$2,010	2,115					$2,326
7	Exhaust Fan Controls	$1,338	13,648			$7,309	7,693					$8,647
8	VFD on Heating Hot Water Pumps	$1,280	13,056									$1,280
9	Change Oil-Fired Burners to Natural Gas	$-	-			$(12,511)	(13,170)			$22,062	11,035	$9,551
10	High-Efficiency Gas-Fired Condensing Boilers/Eliminate Steam to Hot Water HX	$-	-			$(30,419)	(32,020)			$61,304	30,886	$30,885
11	Install (3) New Hi-Eff. Gas Fired DHW Heaters											$-
12	Building Envelope - Weatherization	$1,042	10,633			$7,885	8,300					$8,927
13	Energy Efficient Transformers	$7,355	75,033	$482	6	$-	-					$7,837
14	New Exterior Door - A Wing					$200	210					$200
15	New Exterior Door - D Wing					$200	210					$200
16	Plug Load Controllers	$668	6,819									$668
17	Mechanical Insulation					$1,995	2,100					$1,995
18	Combined Heat and Power Plant (35 kW)	$19,404	197,946	$1,698	33	$(20,989)	(22,093)	$4,793	2,657	$10,660	5,374	$15,567
19	Aris Wind Turbine											
20	Install Gas Piping & Pressure Regulators											

Business Case for Recommended Project

FORM VI

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
KITTATINNY REGIONAL 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): **10 months**
3. Cash Flow Analysis Format:

Project Cost (1): $3,403,138

Interest Rate to Be Used for Proposal Purposes: 2.9%

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
Installlation	$43,265	$0	$21,000	$64,265	$0	$0	$0	$0	$64,265
1	$158,733	$41,286	$267,999	$468,018	$516,047	$530,220	$14,173	$2,064	$2,064
2	$162,961	$41,286	$19,000	$223,247	$206,530	$221,128	$14,598	$2,118	$4,182
3	$167,304	$22,286	$5,000	$194,590	$177,379	$192,415	$15,036	$2,175	$6,357
4	$171,767	$22,286	$5,000	$199,053	$196,820	$196,820	$0	$2,233	$8,590
5	$176,351	$22,286	$0	$198,637	$196,344	$196,344	$0	$2,293	$10,883
6	$181,061	$0	$0	$181,061	$178,707	$178,707	$0	$2,354	$13,236
7	$185,900	$0	$0	$185,900	$183,483	$183,483	$0	$2,417	$15,653
8	$190,871	$0	$0	$190,871	$188,390	$188,390	$0	$2,481	$18,134
9	$195,979	$0	$0	$195,979	$193,431	$193,431	$0	$2,548	$20,682
10	$201,227	$0	$0	$201,227	$198,611	$198,611	$0	$2,616	$23,298
11	$206,620	$0	$0	$206,620	$203,934	$203,934	$0	$2,686	$25,984
12	$212,160	$0	$0	$212,160	$209,402	$209,402	$0	$2,758	$28,742
13	$217,853	$0	$0	$217,853	$215,021	$215,021	$0	$2,832	$31,574
14	$223,702	$0	$0	$223,702	$220,794	$220,794	$0	$2,908	$34,482
15	$229,713	$0	$0	$229,713	$226,726	$226,726	$0	$2,986	$37,469
16	$235,889	$0	$0	$235,889	$232,822	$232,822	$0	$3,067	$40,535
17	$242,235	$0	$0	$242,235	$239,086	$239,086	$0	$3,149	$43,684
18	$248,756	$0	$0	$248,756	$245,522	$245,522	$0	$3,234	$46,918
19	$255,457	$0	$0	$255,457	$252,136	$252,136	$0	$3,321	$50,239
20	$262,343	$0	$0	$262,343	$260,167	$260,167	$0	$2,176	$52,415
Totals	**$4,170,145**	**$149,430**	**$317,999**	**$4,637,574**	**$4,541,352**	**$4,585,159**	**$43,807**	**$52,415**	

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 ESP Review Comments & Correspondence

Kittatinny Regional Board of Education **August 22, 2019**
Energy Savings Plan – Independent Third Party Review

Prepared for:

Kathy Kane, SFO
Business Administrator / Board Secretary

77 Halsey Road
Newton, NJ 07860
(973) 383-1800

Prepared By:

David B. Strunk, PE, CPD, CEM
NJ PE License No. 24GE03336800

Strunk-Albert Engineering
804 Seven Bridge Road
East Stroudsburg, PA 18301
(570) 421-2025

ECM #1A: Advanced Interior Lighting Upgrades/Exterior Lighting Upgrades

Strunk-Albert Comment

None.

ECM #1B: Connected Lighting – (6) Special Needs Classroom

Strunk-Albert Comment

None.

ECM #2: Energy Efficient Motor Replacement

Strunk-Albert Comment

Provide explanation detailing demand KW summation for baseline and proposed cases.

JCI Response:

Since most of the motors cycle based on the load, demand savings are revised and not claimed for most motors. However the classroom unit-ventilator motors runs continuously during peak hours to provide ventilation, and the heating hot water pumps are most likely to run during peak hours and contribute to the electric demand. Hence only ten (10) and seven (7) months of demand savings respectively are claimed for those units. Please refer to revised calculations.

ECM #3: Building Envelope - Weatherization /Infiltration Reduction

Strunk-Albert Comment

Provide infiltration/exfiltration pressure change for verification of values.

JCI Response:

Energy Savings calculations are based on infiltration Air Changes per Hour (ACH). Under normal/tight conditions the value ranges from 0.3 to 0.5 ACH, and JCI will restore these normal operating conditions by implementing this measure. We also believe that weatherization of the building will restore designed static pressure in most areas of the building.

ECM #4: Building Automation Controls Upgrades – E Wing

Strunk-Albert Comment

None.

ECM #5: Mechanical Insulation

Strunk-Albert Comment

1. While the heat transfer formulas are provided in the report, it is unclear what the tabulated heat loss per item is in order to verify subsequent fuel savings.

JCI Response:

Please refer to calculations shown below. The tabulated heat loss are itemized values for different un-insulated equipment type. For example the second line item is the annual MMBtu heat loss for all 3" butterfly valves, and the total loss includes conductive, convective and radiative losses. Values used in the calculations are industry standards.

EXISTING ENERGY USE									PROPOSED ENERGY USE						
Eq Length / Unit	Total Eq Length(LF) or Total Area(SF)	Ambient Temp	Pipe Material	Bare Pipe emittance	Bare Heat Loss Btu/h/lin.ft.	Existing Heat Loss Btu/h	Heating or Cooling Hrs/Yr	Existing Fuel Loss MMBTU/yr	Proposed Insul Type	Proposed Insul Jacket	Proposed Insul Thickness (")	Proposed Insul %	Insulated Heat Loss Btu/h/lin.ft.	Insulated Heat Loss Btu/h	Insulated Fuel Loss MMBTU/yr
1	6	85	Copper - polished	0.03	18	106	8,760	1.1	Cellular Glass	ASJ	1.50	100%	6.79	40.7	0.4
1.8	1.8	85	Copper - polished	0.03	21	38	8,760	0.4	Cellular Glass	PVC	1.50	100%	7.87	14.2	0.1
5	10	85	Iron	0.80	37	366	8,760	3.9	Removable Blanket	Fiberglass Fabric	1.50	100%	7.57	75.7	0.8
1	4	85	Copper - polished	0.03	21	84	8,760	0.9	Cellular Glass	ASJ	1.50	100%	7.87	31.5	0.3
1	2	85	Copper - polished	0.03	28	56	8,760	0.6	Cellular Glass	ASJ	1.50	100%	10.38	20.8	0.2
1.8	3.6	85	Copper - polished	0.03	28	101	8,760	1.1	Cellular Glass	PVC	1.50	100%	10.38	37.4	0.4
1.8	3.6	85	Iron	0.80	238	858	5,110	5.3	Removable Blanket	Fiberglass Fabric	1.50	100%	35.06	126.2	0.8

2. Additional comments may apply pending review of additional information.

JCI Response:
Duly Noted.

ECM #6: Kitchen Exhaust Hood Fan Controls

Strunk-Albert Comment

1. Energy Savings does not appear to include a time component. Temperature/smoke-based controls would theoretically reduce exhaust fan runtime during inactive periods.

JCI Response:

Please refer to revised and complete calculations. The existing and the proposed runtime are the same, however in the proposed scenario the fan ramps up or down as needed based on a signal from a smoke detector that identifies the level of cooking. The calculation conservatively estimates that 30% of the time the fans run at a slower speed and it goes to a minimum of 30% speed.

2. Calculations are not complete. It appears that only baseline fan data is filled. Proposed fan data with reduced CFM, time component, and fuel savings based on BTU load shed are not indicated.

JCI Response:

Please refer to revised and complete calculations.

ECM #7: VFD on Heating Hot Water Pumps

Strunk-Albert Comment

1. ESIP description indicates replacement of (2) 20 HP motors. Field survey data in calculations indicate 10 HP motor. Please clarify.

JCI Response:

Please refer to revised calculations. Savings updated for (1) 20 HP pump only, since the other pump is a back-up unit.

2. Calculations appear to be for a single 10 HP motor versus (2) 20 HP motors.

JCI Response:

Please refer to previous response.

ECM #8: Replace Oil-Fired Burners to Gas Burners

Strunk-Albert Comment

1. Description of scope notes connection of Natural Gas-fired burners to existing oil lines. Is the intent to connect to natural gas at the site, or to replace the oil burners with a higher efficiency oil burner?

JCI Response:

Yes, the intent of the ECM is to convert the oil fired burners to natural gas fired burners of higher efficiency and the new burners will provide high turndown, linkageless combustion fuel/air control that will result in substantial fuel savings over the existing burners.

2. If this is a fuel oil to natural gas conversion (see comments under item A), the proposed fuel usage should utilize natural gas pricing rates.

JCI Response:

Proposed energy cost savings are based on a conservative estimate of natural gas pricing of $9.5/MMBtu and the rate is agreed upon with the school district. Cost savings are based on the equation below.

$ Annual Savings = Existing MMBtu/yr. x $/MMBtu (Oil Rate) - Proposed MMBtu/yr. x $/MMBtu (Gas Rate)

3. Fuel efficiency savings (228 MMBtu) and utility Rate/Units (14.28$/MMBtu) do not appear to equate to projected savings ($9,544) by a multiplier of 3.

$ Annual Savings = Existing MMBtu/yr. x $/MMBtu (Oil Rate) - Proposed MMBtu/yr. x $/MMBtu (Gas Rate)

=1,545.8 x $14.28 – 1,317.6 x $9.5

= $9,544

ECM #8A: Install High Efficiency Gas Fired DHW Heaters

Strunk-Albert Comment

1. If this is a fuel oil to natural gas conversion, the proposed fuel usage should utilize natural gas pricing rates.

JCI Response:

Proposed energy cost savings are based on a conservative estimate of natural gas pricing of $9.5/MMBtu and the rate is agreed upon with the school district. Cost savings are based on the equation below.

$ Annual Savings = Existing MMBtu/yr. x $/MMBtu (Oil Rate) - Proposed MMBtu/yr. x $/MMBtu (Gas Rate)

Please Note that the energy savings calculations for ECM 8A is combined with ECM 8 since the DHW fuel consumption was low compared to boiler fuel consumption and the difference in efficiencies between the two type of burners were insignificant.

2. Additional comments may apply pending review of additional information.

JCI Response:
Duly Noted.

ECM #9: High-Efficiency Gas Fired Condensing Boilers

Strunk-Albert Comment

1. If this is a fuel oil to natural gas conversion, the proposed fuel usage should utilize natural gas pricing rates.

JCI Response:

Proposed energy cost savings are based on a conservative estimate of natural gas pricing of $9.5/MMBtu and the rate is agreed upon with the school district. Cost savings are based on the equation below.

$ Annual Savings = Existing MMBtu/yr. x $/MMBtu (Oil Rate) - Proposed MMBtu/yr. x $/MMBtu (Gas Rate)

2. Estimated non-boiler gas consumption for DHW does not appear to include ECM8A natural gas conversion. Additionally, fuel efficiency savings and utility rate/units do not appear to equate to projected savings by a multiplier of 2.

JCI Response:

DHW fuel usage interaction is considered in ECM 9 because the DHW system efficiency is significantly different form a condensing boiler system efficiency.

JCI is replacing the boiler burners (in the E wing) as well as the DHW burners. Hence energy savings calculations for ECM 8A is combined with ECM 8 since the difference in efficiencies between the two type of burners were insignificant.

ECM #10: Energy Efficient Transformer Replacements

Strunk-Albert Comment

None.

ECM #11: Combined Heat and Power – Reciprocating Engine

Strunk-Albert Comment

None.

ECM #12: Replace Older Split Units – Sanyo Units

Strunk-Albert Comment

No calculations provided

JCI Response:

Please refer to new calculation.

Note: Energy Savings for ECM 12 and ECM 12A are shown in the same spreadsheet.

ECM #12A: Replace Older Roof Top Units – Computer Room Units

Strunk-Albert Comment

No calculations provided

JCI Response:

Please refer to new calculation.

Note: Energy Savings for ECM 12 and ECM 12A are shown in the same spreadsheet.

ECM #13: New Exterior Door Installation – A & D Wings

Strunk-Albert Comment

None.

ECM #14: Aris Wind Turbine

Strunk-Albert Comment

1. Section 3 energy savings and cost summary indicate no utility savings for ECM.

JCI Response:

This is a stand-alone system and not connected to the grid, hence there are no energy savings calculations. This ECM was mainly implemented for educational purpose.

2. No calculations provided.

JCI Response:

Please refer to previous response.

ECM #15: Install Gas Piping and Pressure Regulators

Strunk-Albert Comment

No information provided. It is assumed that this is a line item in the cost summary to account for natural gas conversions.

JCI Response:

Yes, this is a line item to carry cost of installing gas pipeline.

ECM #16: Demand Response

Strunk-Albert Comment

No information provided. Cost/Savings fields in the cost summary are zero.

JCI Response:

Cost and savings based on "Demand Response – Energy Efficiency Credit" as the school will receive incentive from PJM for a permanent load reduction resulting from the newly installed LED lighting system.

ECM #17: SmartStart Rebates

Strunk-Albert Comment

None.

Calculations

Below are the list of ECM's with new or revised calculations.

ECM #	Calculation Status
ECM #2: Energy Efficient Motor Replacement	Revised
ECM #6: Kitchen Exhaust Hood Fan Controls	Revised and Complete
ECM #7: VFD on Heating Hot Water Pumps	Revised
ECM #12: Replace Older Split Units – Sanyo Units	New
ECM #12A: Replace Older Roof Top Units – Computer Room Units	

Appendix 5. O&M Savings

Kittatinny Operations and Maintenance (O&M) Savings

1. DDC Controls O&M savings

Operational Savings	ESIP Annual Savings	Siemens Service Agreement	Excess
DDC Controls Expansion/Upgrade and DCV	**$7,500**	**$20,756**	**$13,256**

Please see attached: Siemens Service Agreement for operations and maintenance savings claimed for DDC Controls Upgrades ECM. Once the new controls system (Metasys) will be installed, most of the DDC equipment will be under warranty for one year. JCI is conservatively claiming only a portion of the savings from the service contract only for 2 years.

2. Heating System Upgrades O&M savings

Operational Savings	ESIP Annual Savings	Annual Maintenance	Excess
Change Oil-Fired Burners to Natural Gas - (2) Boilers & (3) DHW	**$2,500**		
High-Efficiency Gas-Fired Condensing Boilers/Eliminate Steam to Hot Water HX	**$9,000**		
Total	**$11,500**	**$10,883.90**	**-$616**

Please see attached: boiler maintenance bills for the school district. Also presented below are the summary of all the maintenance bills, provided for your reference. JCI is conservatively claiming only a portion of the heating system maintenance savings for 2 years.

Date	Description	Amount	Bill pdf
8/15/2019	Annual Boiler Cleaning	$6,800.0	Annual Boiler Cleaning
3/1/2019	Flame Failure	$517.0	Boiler Repairs 1
2/13/2019	Boiler Test and Wiring	$1,209.0	Boiler Repairs 2
1/14/2019	Boiler Test and Pump Service	$2,357.8	Boiler Repairs 3
	Total	**$10,883.9**	

Date	Description	Amount	Bill pdf
7/26/2018	Annual Boiler Cleaning	$6,800.0	Annual Boiler Cleaning
3/1/2019	Burner Service and Oil Pump	$844.4	Boiler Repairs 1
2/13/2019	Burner Service and Sensor Replace	$505.0	Boiler Repairs 2
1/14/2019	Refractory Repair	$1,020.0	Boiler Repairs 3
	Total	**$9,169.5**	

Appendix 6. BPU Approval

Subject: Energy Savings Plan (Kittatinny) - APPROVED

Good afternoon,

The bills that were submitted that reflect 2019 maintenance costs will suffice. Generally, this number is not averaged, it is a combined total of the previous two years.

We are approving your Energy Savings Plan with the revisions sent on 9/11/19.
I have also reviewed other emails sent by Johnson Controls Inc. (JCI), showing the expected incentives from the Clean Energy Program.
There is no guarantee that all of these incentives will be paid, however there would be certain expectations they would be successful, because of their experience in the industry.
I would highly recommend receiving a guarantee from JCI for all the savings related to the Proforma.

Please send a copy of all the bids for the project; Forms II, V and VI are required for each bidder.

Also a flash drive copy of the final (approved) Energy Savings Plan, including the third party audit, is required for our records.

Sincerely,
Michelle Rossi

N J B P U
State Energy Office
44 South Clinton Avenue
Trenton, NJ 08625
609.633.9641 (o)

-----Original Message-----
From: Subhasis Bhadra [mailto:Subhasis.Bhadra@jci.com]

Sent: Wednesday, September 11, 2019 7:17 PM
To: Rossi, Michelle; Paul Napoli; ESIP; kkane@krhs.net
Cc: Samuel Doria; Timothy J Barnish; Lawrence Irvine; Casey Murrah; Hirav Joshi
Subject: [EXTERNAL] RE: Energy Savings Plan (Kittatinny)

Hello Michelle,

My apologies for sending the email this late, but really wanted to get this to you ASAP.

We verified the lighting O&M numbers at our end and found that the numbers in form VI was in fact correct. So we revised the table on page 13. Please see attached revised page 13.

Also we received HVAC bills for 2019 only. Please let us know if you need bills for 2018 and we will put in a request ASAP. Just curious, are you looking for an average number for the past two years?

Thank you for your assistance,
Sincerely,
Subs.

-----Original Message-----
From: Rossi, Michelle [mailto:Michelle.Rossi@bpu.nj.gov]

Sent: Wednesday, September 11, 2019 5:25 PM
To: Subhasis Bhadra <Subhasis.Bhadra@jci.com>; Paul Napoli <paul.napoli@jci.com>; ESIP <ESIP@bpu.nj.gov>; kkane@krhs.net
Cc: Samuel Doria <samuel.doria@jci.com>; Timothy J Barnish <Timothy.J.Barnish@jci.com>; Lawrence Irvine <lawrence.irvine@jci.com>; Casey Murrah <Casey.L.Murrah@jci.com>; Hirav Joshi <hirav.joshi@jci.com>
Subject: RE: Energy Savings Plan (Kittatinny)

Good afternoon, Subhasis.

I have received the supporting HVAC bills justifying the Operational/Maintenance savings however the bills captured were only from January through August of 2019. Can you provide me with 2018's records as well?

Lastly, annual savings on page 13 - under Lighting Upgrades - says $22,268. Form VI - page 16 - under Annual Operational Savings - Years 3,4 and 5 read $22,286. Although most likely a minor typo, can you clarify and make revisions and resubmit Form VI?
This change would also affect Years 1 and 2. Current total in Year One and Year Two is $41, 286. Should it be $41, 268?

Thank you,

Michelle Rossi

N J B P U
State Energy Office
44 South Clinton Avenue
Trenton, NJ 08625
609.633.9641 (o)

-----Original Message-----
From: Subhasis Bhadra [mailto:Subhasis.Bhadra@jci.com]

Sent: Wednesday, September 11, 2019 2:27 PM
To: Rossi, Michelle; Paul Napoli; ESIP; kkane@krhs.net
Cc: Samuel Doria; Timothy J Barnish; Lawrence Irvine; Casey Murrah; Hirav Joshi
Subject: [EXTERNAL] RE: Energy Savings Plan (Kittatinny)

Hello Michelle,

Please see attached, our response to the Operation and Maintenance savings, and the supporting HVAC bills that you have requested.

Please let me know if you need anything else from us.
Thank You,
Sincerely
Subs

-----Original Message-----
From: Rossi, Michelle [mailto:Michelle.Rossi@bpu.nj.gov]

Sent: Wednesday, September 11, 2019 2:03 PM
To: Paul Napoli <paul.napoli@jci.com>; Subhasis Bhadra <Subhasis.Bhadra@jci.com>; ESIP <ESIP@bpu.nj.gov>; kkane@krhs.net
Cc: Samuel Doria <samuel.doria@jci.com>; Timothy J Barnish <Timothy.J.Barnish@jci.com>; Lawrence Irvine <lawrence.irvine@jci.com>; Casey Murrah <Casey.L.Murrah@jci.com>; Hirav Joshi <hirav.joshi@jci.com>
Subject: RE: Energy Savings Plan (Kittatinny)

Great, thank you Paul.

Michelle Rossi

Michelle Rossi
N J B P U
State Energy Office
44 South Clinton Avenue
Trenton, NJ 08625
609.633.9641 (o)

-----Original Message-----
From: Paul Napoli [mailto:paul.napoli@jci.com]

Sent: Wednesday, September 11, 2019 1:02 PM
To: Rossi, Michelle; Subhasis Bhadra; ESIP; kkane@krhs.net
Cc: Samuel Doria; Timothy J Barnish; Lawrence Irvine; Casey Murrah; Hirav Joshi
Subject: [EXTERNAL] RE: Energy Savings Plan (Kittatinny)

Good Afternoon Michelle,
We will sending you the supporting HVAC bills shortly. They will be sent to you via email by mid-afternoon from Subhasis Bhadra.

Thanks again,
Paul

Paul Napoli
Johnson Controls, Performance Infrastructure
609-410-8419
paul.napoli@jci.com
http://www.johnsoncontrols.com===

-----Original Message-----
From: Rossi, Michelle [mailto:Michelle.Rossi@bpu.nj.gov]

Sent: Tuesday, September 10, 2019 10:43 PM
To: Subhasis Bhadra <Subhasis.Bhadra@jci.com>; ESIP <ESIP@bpu.nj.gov>; kkane@krhs.net
Cc: Paul Napoli <paul.napoli@jci.com>; Samuel Doria <samuel.doria@jci.com>; Timothy J Barnish <Timothy.J.Barnish@jci.com>; Lawrence Irvine <lawrence.irvine@jci.com>; Casey Murrah <Casey.L.Murrah@jci.com>; Hirav Joshi <hirav.joshi@jci.com>
Subject: Energy Savings Plan (Kittatinny)

Good afternoon,

Although your plan mentions that JCI has worked with the school to quantify exact sources of savings through invoices and expenses, we need to review those items as well.

Back up for the operational savings is required. Your data sheets show the calculations for lighting but I do not see any prior bills for HVAC for the first two-three years.

Please provide these to me soon as possible so a full approval can be sent out.

Thank you,
Michelle Rossi

Michelle Rossi

Michelle Rossi
N J B P U
State Energy Office
44 South Clinton Avenue
Trenton, NJ 08625
609.633.9641 (o)
[cid:image001.png@01D567EE.FFCEFBD0]

From: Subhasis Bhadra [mailto:Subhasis.Bhadra@jci.com]

Sent: Wednesday, August 28, 2019 12:20 PM
To: ESIP; Thulen, Michael; Mercer, Ed; kkane@krhs.net
Cc: Paul Napoli; Samuel Doria; Timothy J Barnish; Lawrence Irvine; Casey Murrah; Hirav Joshi
Subject: [EXTERNAL] Kittatinny Board of Education - Energy Savings Plan for BPU Approval

Hello Mike/Ed,

We've attached the final revision of Energy Savings Plan for Kittatinny Board of Education for your review and approval. The 3rd party review was completed by Strunk-Albert Engineering (SAE). We've completed the 3rd party review and have incorporated the responses in Appendix 4 of the document. I will be sending the Appendix 1 and Appendix in a separate email due to the size of the pdf.

Please review and let me know if there are any questions or comments that you have.

Can you please confirm receipt of this email?

Thank you very much.
Sincerely,
Subs.

Subs Bhadra, P.E, C.E.M
100 Lighting Way, Suite 402
Secaucus, NJ 07094
Work Ph (201) 325-4168