CONTRACT AMENDMENT

This Amendment (the "Amendment") is made this _____ day of _____2022 by and between:

JOHNSON CONTROLS, INC. ("JCI")
6 AERIAL WAY
SYOSSET, NY 11791

and
BOARD OF EDUCATION OF THE
PLAINEDGE SCHOOL DISTRICT
("Customer" or the "District")
241 WYNGATE DRIVE
BOX 1669
NO. MASSAPEQUA, NY 11758

RECITALS

WHEREAS, JCI and Customer are parties to a Performance Contract, dated May 11, 2021 (the "Agreement"); and

WHEREAS, JCI and Customer desire to amend the terms of the Agreement as set forth below;

NOW, THEREFORE, in consideration of the mutual covenants and conditions contained herein, the parties agree as follows:

1. The Agreement shall be amended in accordance with the following:

a. **On Page 2 of the Agreement, under 3. Architect of Record replace "384,641" with "377,449".**

b. **On Page 19 of the Agreement, remove the ECM Matrix table and replace with the following:**

ECM #	Proposed Measures	Plainedge High School	Plainedge Middle School	Eastplain Elementary School	John H. West Elementary School	Charles E. Schwarting Elementary School	Plainedge Athletic Center
ECM 1	Lighting - Interior Retrofit	x	x	x	x	x	x
ECM 2	Lighting - Exterior Retrofit	x		x	x	x	
ECM 3	Building Envelope - Weatherization	x		x	x	x	
ECM 4	Building Envelope - Window Replacement	x					
ECM 5.1	Energy Management System - Temperature Setback	x		x	x	x	
ECM 5.2	Energy Management System - Demand Controlled Ventilation	x	x				
ECM 5.3	Energy Management System - Relief Damper Control	x					
ECM 6	Heating System - Furnace Controllers			x		x	x
ECM 7	Heating System - Pipe and Valve Insulation	x	x	x	x	x	
ECM 8	Energy Efficient Transformers		x				
ECM 9	Renewable Energy- Photovoltaic Generation	x	x	x	x	x	
ECM 10	Plug Load Controllers	x	x	x	x	x	x
ECM 11	Heating System - DHW Replacement		x				
ECM 12	AC Compressor Controllers	x		x		x	x

c. **On Page 22 of the agreement, under "ECM 4: Building Envelope – Window Replacement", remove the scope in its entirety and replace with the following:**

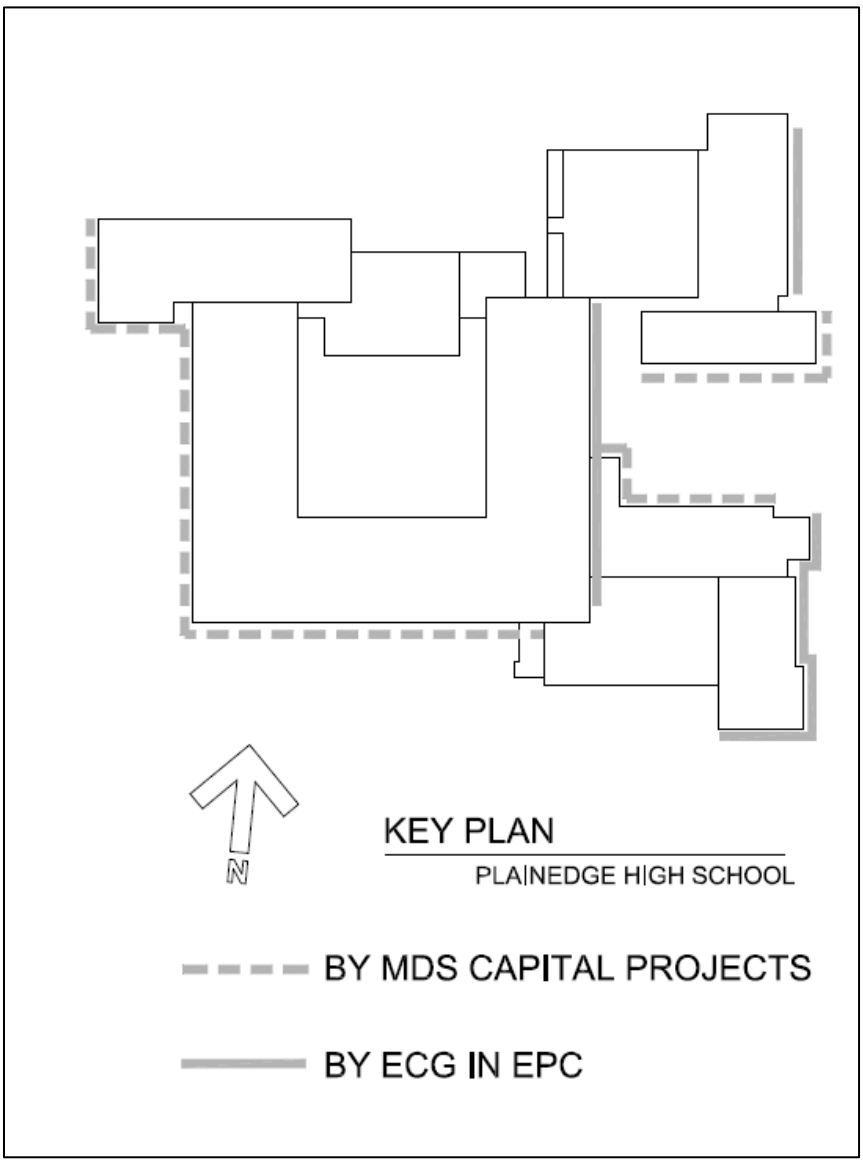
ECM 4: Building Envelope – Window Replacement

At Plainedge High School, Johnson Controls shall furnish and install new energy efficient window system for the East elevation first and second floor windows per the NYS Energy Code.

Johnson Controls will also include new solar shades at this elevation.

Building	Window Area (SF)
Plainedge High School	3,397

Locations outlined on the floor plan below shows locations of the Window Replacement at the High School:



Scope of Work:

- Proposed windows to match existing configuration and window type.
- New windows to be 115 series 4700I double hung windows manufactured by Architectural Window
- All windows & accessories will match the new windows that are being installed on the west elevation.
- Glazing will be 1" insulated glass consisting of 1/8" clear annealed glass –TPS air space filled with Argon gas –1/8" tempered with Low "E" solar ban 60 glass.
- Insulated panels to consist of .032 smooth aluminum skins with a Kynar finish, 1/8" cement board stabilizers and a polyisocyanurate core.
- Any required interior restoration associated with removal of existing windows is included.
- Removal and dispose of existing blinds.
- Furnish and install new Draper Flex Shades Sunblock SB9040 with clear anodized hardware/fascia
- Abatement of exterior window caulking is included.
- Abating caulk between frame and masonry ahead of removal.
- Boys and Girls Locker rooms shall receive new lintels. Existing bricks shall be repaired as necessary as part of the installation of new lintels.

d. **On Page 28 of the agreement, under "ECM 9: Renewable Energy – Photovoltaic Electric Generation", remove the scope in its entirety and replace with the following:**

ECM 9: Renewable Energy – Photovoltaic Electric Generation

Johnson Controls will furnish, install, and commission a total of 1,334.3 kW roof mounted and carports photovoltaic electrical generation systems as detailed in the table below that will interconnect with the existing electrical distribution system at the associated schools.

The following table identifies the PV sizes and installation type at each location:

Locations	Roof Mounted PV (kW-DC)	Carports PV (kW-DC)	Total PV (kW-DC)
Plainedge High School	260.2	317.2	577.4
Plainedge Middle School	414.2		414.2
Eastplain Elementary School	28.8		28.8
John H. West Elementary School	204.5		204.5
Charles E. Schwarting Elementary School	109.4		109.4
Total	**1017.1**	**317.2**	**1334.3**

Installation includes the following specifications for new Roof Ballasted Systems:

- UL Certificate.
- New wiring to meet the requirements of the 2017 National Electric Code ("NEC"), as amended.
- Solar Module to be 72 cell 400 watt JA Solar or equal and as approved by Customer's Architect/Engineer.
- Inverters to be SMA or equal and as approved by Customer's Architect/Engineer.
- Balance of new system to meet 2017 NEC Code, as amended.
- Required Interconnection to building system located as per 2017 NEC Code, as amended, lineside tap as determined by the utility(ies) having jurisdiction.
- Unirac RM, Ecofoot or equal self-ballasted racking system
- Furnish and install required ballast block as per design.
- One time training for 4 hours to the District
- District to support monitoring by supplying an IT drop to a gateway location and necessary IP addresses that the District will maintain for guarantee period.
- Protective slip sheet to meet roofing warranty certifications

Installation includes the following specifications for Carport, Canopy Systems:

- Carport system to have a minimum height of 14 ft. in roadway areas
- Canopy system to have a minimum height of 10 ft. in non-roadway areas
- Solar Modules to be 72 cell 400-watt JA Solar Customer approved equal
- Solar Inverters to be SMA or Customer approved equal 1500-volt family.
- Solar equipment to be mounted at no less than 10 ft above grade.
- Conduit work up to 10 ft. above grade will be hard wall galvanized.
- Should any new exterior switchgear be required, a 6 ft chain-link fence shall be installed with an access gate.
- New underground conduit to be PVC
- Work to conform to PSEG and regulatory or governmental agencies requirements. JCI is responsible for all costs necessary to conform to these requirements.

- Carport/Canopy Racking system, including hardware and module mounting hardware to be engineered carport/canopy structure to support PV modules.
- New members and hardware are galvanized steel with Columns and Top Beams hot dipped to ASTM A123 and purlins pre-galvanized to a G140 minimum. Module hardware is stainless steel.
- New member connections shall be bolted. No on-site welding shall be required or undertaken without the prior written permission of the District and its Architect.
- Parking lot restoration in affected areas to be saw cut and hot patched to match existing surface conditions.
- Columns to be set directly on concrete piers with chemical anchors or wet set anchor bolts.
- Temporary fencing, barricades, or storage trailers necessary to secure site.
- Disposal of soil/spoil created from the foundation installation is included. JCI shall undertake necessary soil testing and properly dispose of soil at its cost and expense in accordance with all applicable laws, rules, regulations and codes.
- Grounding hardware for modules and racking
- Module grounding to be per module manufacturer's installation instructions.
- Base design includes pre-punched holes in the purlin for wire management.
- Electrical Underwriters Certificate.
- Electrical installation to be installed as per the NEC 2017 code, as amended and updated.
- Electrical conduit will be installed outside of concrete piers and/or baseplates.
- JCI will provide a web-based dashboard for PV production for students and staff to use and access.
- District to support monitoring by supplying an IT drop to a gateway location and all necessary IP addresses that the District will maintain for 18 years.
- SED approved system design drawings shall be prepared by the Customer's Architect of Record.

In the event that any of the building roofs, parking lots are determined to be unsuitable for roof mounted/carport PV arrays, Johnson Controls will attempt to move the arrays or portions of the arrays to another location that is suitable at any of the other buildings outlined above, subject to all necessary review and approvals and written approval of the Customer.

Johnson Controls shall install the new PV systems with existing roof manufacturer standards to maintain current and any new roof warranty(ies) as it relates to the solar panel installation. At impacted locations, existing structural steel, joists, roof decks, are anticipated to be adequate for solar panel installation. If during the design phase the architect / engineer of record, ECG Engineering, encounters structural issues, with any of roofs, roof framing, geo-tech issues, drainage issues, septic system issues with any of parking lots and walkways shall relocate the problem areas of solar arrays to a different location in order to maintain the 1,334.3 kW DC of total system size. JCI shall be fully responsible for coordinating its work with any ongoing capital work at the District. An adjustment to the guarantee may occur in form of Contract Amendment if the new location is on a different electric rate.

In the event that any of the proposed locations are determined to not be a viable option, the scope of work for this ECM shall be reduced subject to all necessary approvals, including Customer's written approval by amendment and the costs associated with the reduced scope shall be credited to the Customer. The guaranteed savings shall also be adjusted accordingly by a formal written amendment to the Agreement. All adjustments require Customer's written approval and must maintain a positive cash flow as set forth in the contract documents.

The weather station monitoring is included through the web-based dashboard as long as the internet IP address is maintained. The weather station includes a pyranometer at each location, one at each of the 5 schools. The irradiance value will be trended and logged into the cloud for 10 years. At the end of the 10 years, the Customer can elect to renew the monitoring service at an additional cost.

Power to the building will be temporarily shut down by the utility for up to four (4) hours during the tie-in. Advanced coordination with the District will be required before the tie-in.

Exclusions:

1. Repair or replacement of defective electrical equipment and electrical distribution system, except the equipment described in the Scope of Work, unless said repair or replacement is required due to the acts or omissions of JCI. (Defective equipment identified by JCI during implementation of the Scope of Work will be brought to the attention of the Customer in writing).

e. **On Page 33, remove the Exhibit 1: Total Project Benefits in its entirety, up to the heading "Annual Measurement and Verification (M&V) Services," and replace with the following:**

EXHIBIT 1: Total Project Benefits

Subject to the terms and conditions of this Agreement, JCI and Customer agree that Customer will be deemed to achieve a total of $1,105,794 in Operational and Maintenance Cost Avoidance, $115,500 in guaranteed rebates from JCI and JCI further guarantees that Customer will achieve a total of $8,987,243 in Measured Project Benefits during the term of this Agreement, for Total Project Benefits of $10,208,538, as set forth in the Total Project Benefits table below.

Total Project Benefits

Year	Utility Cost Avoidance* Measurable Savings	Operations & Maintenance Cost Avoidance**	Guaranteed Energy Rebate- Non Recurring Savings	Total Guaranteed Project Benefits
1	$419,723	$61,433	$115,500	$596,656
2	$428,118	$61,433		$489,551
3	$436,680	$61,433		$498,113
4	$445,414	$61,433		$506,847
5	$454,322	$61,433		$515,755
6	$463,408	$61,433		$524,841
7	$472,676	$61,433		$534,109
8	$482,130	$61,433		$543,563
9	$491,773	$61,433		$553,206
10	$501,608	$61,433		$563,041
11	$511,640	$61,433		$573,073
12	$521,873	$61,433		$583,306
13	$532,310	$61,433		$593,743
14	$542,957	$61,433		$604,390
15	$553,816	$61,433		$615,249
16	$564,892	$61,433		$626,325
17	$576,190	$61,433		$637,623
18	$587,714	$61,433		$649,147
Totals	**$8,987,243**	**$1,105,794**	**$115,500**	**$10,208,538**

[1*] Utility Cost Avoidance is a Measured Project Benefit. Utility Cost Avoidance figures in the Table above are based on anticipated 2% increase in unit energy costs as set forth in the Tables at Exhibit 2.6.1 and 2.6.2.
[2]Operational and maintenance cost avoidance figures in the table above are based on anticipated 0% increase of material cost.
[3]See Exhibit 4 for guaranteed rebate source.

f. **On Page 48 of the Agreement, replace entire EXHIBIT 3: Measured Project Benefits with the following:**

Exhibit 3: Measured Project Benefits

Table 2.3 below defines and describes the ECMs included in this guarantee that comprise Measured Utility Cost Avoidance savings:

Table 2.3: Measured Project Benefits Summary

ECM	Energy Conservation Measures	Electric Savings			Thermal Savings		Total ($)
		kW	kWh	$/Year	MMBtu	$/Year	$/Year
ECM 1	Lighting - Interior Retrofit	163	605,221	$103,924	(719)	-$6,671	$97,253
ECM 2	Lighting - Exterior Retrofit	0	7,908	$1,169	0	$0	$1,169
ECM 3	Building Envelope - Weatherization	0	4,146	$611	336	$3,358	$3,968
ECM 4	Building Envelope - Window Replacement	0	7,014	$992	491	$4,327	$5,319
ECM 5.1	Energy Management System - Temperature Setback	0	55,958	$8,154	902	$9,148	$17,301
ECM 5.2	Energy Management System - Demand Controlled Ventilation	0	14,559	$1,967	960	$8,373	$10,340
ECM 5.3	Energy Management System - Relief Damper Control	0	0	$0	139	$1,229	$1,229
ECM 6	Heating System - Furnace Controllers	0	0	$0	72	$733	$733
ECM 7	Heating System - Pipe and Valve Insulation	0	0	$0	301	$2,727	$2,727
ECM 8	Energy Efficient Transformers	7	45,676	$6,188	0	$0	$6,188
ECM 9	Renewable Energy- Photovoltaic Generation	0	1,750,178	$246,843	0	$0	$246,843
ECM 10	Plug Load Controllers	0	111,500	$15,902	0	$0	$15,902
ECM 11	Heating System - DHW Replacement	0	0	$0	0	$0	$0
ECM 12	AC Compressor Controllers	0	0	$0	1,042	$9,000	$9,000
	TOTAL SAVINGS	**170**	**2,614,729**	**$387,500**	**3,523**	**$32,223**	**$419,723**

Table 2.3.2: Detailed breakdown required by 8 N.Y.C.R.R. §155.20(d)(4)

Table 2.3.2 represents the detailed breakdown set forth in 8 N.Y.C.R.R. §155.20(d). Said chart is subject to modification based upon review by SED. All modifications to this Table must be submitted to the Customer for its written approval.

ECM #	Proposed Measures	Savings	Costs	SPB (yr.)
ECM 1	Lighting - Interior Retrofit	$97,253	$1,238,000	12.7
ECM 2	Lighting - Exterior Retrofit	$1,169	$7,300	6.2
ECM 3	Building Envelope - Weatherization	$3,968	$25,841	6.5
ECM 4	Building Envelope - Window Replacement	$5,319	$849,193	159.7
ECM 5.1	Energy Management System - Temperature Setback	$17,301	$854,669	49.4
ECM 5.2	Energy Management System - Demand Controlled Ventilatio	$10,340	$31,937	3.1
ECM 5.3	Energy Management System - Relief Hood Control	$1,229	$40,290	32.8
ECM 6	Heating System - Furnace Controllers	$733	$6,664	9.1
ECM 7	Heating System - Pipe and Valve Insulation	$2,727	$21,559	7.9
ECM 8	Energy Efficient Transformers	$6,188	$71,919	11.6
ECM 9	Renewable Energy- Photovoltaic Generation	$246,843	$4,278,495	17.3
ECM 10	Plug Load Controllers	$15,902	$33,804	2.1
ECM 11	Heating System - DHW Replacement	$9,000	$100,724	11.2
ECM 12	AC Compressor Controllers	$1,750	$9,520	5.4

Annual Energy Savings	$419,723
Annual Operations & Maintenance (O&M) Savings	$61,433
Energy Engineering, SED Submission & General Conditions	$817,843
Architect/Engineering Fees	$377,449
Total Project Cost	$8,765,205
Guaranteed Rebates	$115,500
Simple Payback (Yrs)	17.98

**The Architectural/Professional Fees as set forth at Schedule 4 are included within the above costs.

g. **On Page 50 of the Agreement, under EXHIBIT 4: Operational & Maintenance (O&M) & Rebate Project Benefits, replace section "Operational and Maintenance Cost Avoidance" with the following:**

Operational and Maintenance Cost Avoidance:

M&V Option: NEMVP-A
For measures where the baseline (or boundary) is well understood, and measure operating hours are not currently expected to change, only the "change in equipment performance" is needed in order to calculate the savings (or cost avoidance).

Lighting Operational Cost Avoidance is calculated by comparing the existing lamp and ballast average failure rate and replacement cost with the proposed project replacement lamp and ballast average failure rate and replacement cost. Measure operating hours are not expected to change. The average annual savings for all schools is determined to be $8,872.

Window Replacement Cost Avoidance is calculated by comparing the cost of repair of the existing windows versus the newly installed windows. The reduction in repairs of the windows is deemed to be the cost avoidance. The average annual savings for the window replacement is determined to be $8,561.

Energy Management System Operational Cost Avoidance is calculated by comparing the cost of maintaining the existing pneumatic controls system and all associated components versus the new direct digital controls. The average annual savings for the Energy Management System is determined to be $44,000.

Total Operational Cost Avoidance: $61,433

The O & M savings are based on the scope of work as well as discussions with the customer. Customer agrees that the O&M Project Benefits are reasonable and supportable, and that the installation of the Improvement Measures will enable Customer to take actions that will result in the achievement of such O&M Project Benefits.

h. **On top of Page 60 of the Agreement, under Price and Payment Terms, remove "Total Project Costs" in its entirety and replace with the following:**

Total Project Costs. The total cost of the Project, including payment for JCI and the Architect of Record is $8,765,205 and is broken down as follows:

Johnson Controls, Inc.:	$8,387,756
ECG Engineering, P.C.:	$377,449

i. **On middle of Page 60 of the Agreement, under 2. Payments for Architectural/Engineering Services replace "$384,641" with "377,449".**

2. Nothing contained herein shall be deemed a waiver of any of the terms, provisions or conditions of the Agreement.

3. Except as expressly provided in this Amendment, all other terms, conditions and provisions of the Agreement shall continue in full force and effect as provided therein.

4. In executing this Amendment, the parties acknowledge that they have the authority to enter into this Amendment, and that all necessary action has been taken to cause this Amendment to become legal, valid and binding.

5. This Agreement may be executed in any number of counterparts, all of which when taken together shall constitute one single agreement between the parties.

IN WITNESS WHEREOF, JCI and Customer have entered this Amendment, effective as of the date first set forth above.

BOARD OF EDUCATION OF THE PLAINEDGE SCHOOL DISTRICT

Signature:_____

Printed Name:_____

Title:_____

Date:_____

JOHNSON CONTROLS, INC.

Signature: Robert J. Steele

Printed Name: ROBERT J. STEELE

Title: AREA GENERAL MANAGER

Date: 12/16/2022

Attachment 8 – Detailed Energy Audit

Detailed Energy Audit

Plainedge Union Free School District
North Massapequa, NY

April 2022

Johnson Controls

Table of Contents

SECTION 1 Executive Summary

Johnson Controls, Inc. (hereinafter “JCI”) is assisting Plainedge Union Free School District (hereinafter “District”) in North Massapequa, New York to reduce energy costs by implementing an energy performance contract. The goals of the project are to cut energy costs, provide capital upgrades, increase energy efficiency and the reliability of District’s mechanical and electrical systems and to maintain or increase occupant comfort and well-being. This report provides the results of the Detailed Energy Audit (“DEA”), which is a part of the overall performance contract.

JCI wishes to thank the staff at the District for their invaluable assistance and generous time spent with the JCI team during this study effort. Without their help and guidance, data collection and system understanding would have been significantly more difficult. The fact that there are staff members who have been with the District for many years, and who know the systems quite intimately is a huge asset both to the District as well as to a contractor such as JCI.

Table 1 below provides an overall economic summary of the recommended measures. A detailed list of the measures is shown in Table 2. Notwithstanding the foregoing, JCI guarantees the energy rebates as set forth in detail in the energy performance contract.

In the event that the scope of work identified herein and/or the provisions contained herein conflict with the energy performance contract, the most favorable terms/scope to the District shall apply, as determined solely by the District.

Table 1: Project Summary

Several Energy Conservation Measures (ECMs) were identified as a result of the DEA conducted at the District. The following table summarizes the various measures to be installed to achieve energy savings.

ECM #	Proposed Measures	Savings	Costs	SPB (yr.)
ECM 1	Lighting - Interior Retrofit	$97,253	$1,238,000	12.7
ECM 2	Lighting - Exterior Retrofit	$1,169	$7,300	6.2
ECM 3	Building Envelope - Weatherization	$3,968	$25,841	6.5
ECM 4	Building Envelope - Window Replacement	$5,319	$849,193	159.7
ECM 5.1	Energy Management System - Temperature Setback	$17,301	$854,669	49.4
ECM 5.2	Energy Management System - Demand Controlled Ventilatio	$10,340	$31,937	3.1
ECM 5.3	Energy Management System - Relief Hood Control	$1,229	$40,290	32.8
ECM 6	Heating System - Furnace Controllers	$733	$6,664	9.1
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ECM 8	Energy Efficient Transformers	$6,188	$71,919	11.6
ECM 9	Renewable Energy- Photovoltaic Generation	$246,843	$4,278,495	17.3
ECM 10	Plug Load Controllers	$15,902	$33,804	2.1
ECM 11	Heating System - DHW Replacement	$9,000	$100,724	11.2
ECM 12	AC Compressor Controllers	$1,750	$9,520	5.4

Annual Energy Savings	$419,723
Annual Operations & Maintenance (O&M) Savings	$61,433
Energy Engineering, SED Submission & General Conditions	$817,843
Architect/Engineering Fees	$377,449
Total Project Cost	$8,765,205
Guaranteed Rebates	$115,500
Simple Payback (Yrs)	17.98

Recommendations

The following table lists the measures to be implemented at the District.

Table 2: Energy Conservation Measures

ECM #	Proposed Measures	Plainedge High School	Plainedge Middle School	Eastplain Elementary School	John H. West Elementary School	Charles E. Schwarting Elementary School	Plainedge Athletic Center
ECM 1	Lighting - Interior Retrofit	x	x	x	x	x	x
ECM 2	Lighting - Exterior Retrofit	x		x	x	x	
ECM 3	Building Envelope - Weatherization	x		x	x	x	
ECM 4	Building Envelope - Window Replacement	x					
ECM 5.1	Energy Management System - Temperature Setback	x		x	x	x	
ECM 5.2	Energy Management System - Demand Controlled Ventilation	x	x				
ECM 5.3	Energy Management System - Relief Damper Control	x					
ECM 6	Heating System - Furnace Controllers			x		x	x
ECM 7	Heating System - Pipe and Valve Insulation	x	x	x	x	x	
ECM 8	Energy Efficient Transformers		x				
ECM 9	Renewable Energy- Photovoltaic Generation	x	x	x	x	x	
ECM 10	Plug Load Controllers	x	x	x	x	x	x
ECM 11	Heating System - DHW Replacement		x				
ECM 12	AC Compressor Controllers	x		x		x	x

SECTION 2 Energy Conservation Measures (ECMs)

On the following pages, we have described several ECMs deemed as viable energy conservation opportunities for the District that are included in and subject to the requirements set forth in the energy performance contract. The recommended ECMs were selected from a long list of possible improvements and were based on gaining the greatest benefit for the money spent. Based on the information gathered during the DEA and JCI's extensive experience with K-12 facilities throughout New York State, the measures identified represent a significant reduction to base year utility costs for the District.

Listed below are assumptions that are common to all ECMs:

- Savings for all measures are interacted with each other. The proposed conditions from one measure may be the existing condition for another.
- All savings are calculated using the present electricity rates.
- Unit operating conditions (air flow, kW, temperatures) were determined with field measurements whenever possible.
- The retrofits will occur in the existing building areas only. Any future building additions or renovations are not included at this point.
- All new systems will be designed and constructed according to applicable codes and standards.
- Prevailing wages are included.

ECM 1 Lighting – Interior Retrofit

Executive Summary

All locations were surveyed for the application of this measure. Lighting energy efficiency upgrades provide a substantial energy benefit and quality of light improvement in most facilities.

State-of-the-art LED lighting technology is now cost-effective, efficient and recommended for all light fixtures in the School District. LED technology also allows efficient dimming which drives additional savings and extends the life of the LED investment.

Facility owners realize significant operating utility savings, reduced maintenance costs, and improved overall lighting systems performance, visual comfort and acuity. In addition to saving energy and reducing costs, the lighting upgrades will:

- Improve lighting quality through designs that meet or exceed current Illuminating Engineering Society (IES) recommendations while addressing specific illumination requirements for task/area functions. The scope will provide a quality of light superior to what is currently installed.
- Be economically viable and meet customer financial requirements.
- Improve lighting inventory standardization for long-term maintenance improvements.
- Be environmentally sustainable via reduced greenhouse gas emissions and eliminate hazardous materials such as mercury in linear fluorescent and compact fluorescent lamps.

Johnson Controls has developed the efficiency and technology improvement solutions through conducting site audits in cooperation with site personnel providing valuable support and insights for the project, including a description of which buildings should be excluded from the audits, identification of current lighting deficiencies and initiatives, ongoing energy efficiency initiatives, building access and escort requirements, utility data, operating schedules, and other priorities.

In an effort to reduce electricity consumption, Johnson Controls shall retrofit the existing lighting system with newer energy efficient technology. The lighting retrofit design incorporates the replacement of lamps as well as the replacement of light fixtures in the gyms. New fixtures may also be designed into areas where greater fixture efficiency is required to properly illuminate a space.

The overall lighting project is designed to meet or exceed current Illuminating Engineering Society (IES) recommendations while addressing specific illumination requirements for task/area functions. The scope will provide a quality of light superior to what is currently installed.

LED Lighting systems exhibit the following characteristics:

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

Existing System

Johnson Controls has performed a detailed room-by-room survey of existing lighting systems at the six (6) buildings within the District. Most of the fixtures in the building are T8 lamps with electronic ballast with some CFL and T-5 fixtures. The fixtures are operated with tandem wall switches and occupancy sensors. Some locations are good candidates for fixture modification to reduce the number of lamps while still maintaining proper light levels with new LED technology.

Plainedge High School

The majority of the fixtures in the building are T-8 and T-5 fixtures with electronic ballasts. Some locations are good candidates for fixture modification to reduce the number of lamps while still maintaining proper light levels. The fixtures are operated with tandem wall switches and occupancy sensors. The gymnasiums are equipped with fixtures that can be retrofit to more efficient LED applications. All of the exit signs within the building will be retrofitted with new LED fixtures.

Plainedge Middle School

The majority of the fixtures in the building are T-8 and T-5 fixtures with electronic ballasts. The fixtures are operated with tandem wall switches and occupancy sensors. Some locations are good candidates for fixture modification to reduce the number of lamps while still maintaining proper light levels. The gymnasiums are equipped with fixtures that can be retrofit to more efficient LED applications. All of the exit signs within the building will be retrofitted with new LED fixtures.

Eastplain School

The majority of the fixtures in the building are T-8 and T-5 fixtures with electronic ballasts. The fixtures are operated with tandem wall switches and occupancy sensors. Some locations are good candidates for fixture modification to reduce the number of lamps while still maintaining proper light levels. The gymnasiums are equipped with fixtures that can be retrofit to more efficient LED applications. All of the exit signs within the building will be retrofitted with new LED fixtures.

John West Elementary School

The majority of the fixtures in the building are T-8 and T-5 fixtures with electronic ballasts. Some locations are good candidates for fixture modification to reduce the number of lamps while still maintaining proper light levels. The fixtures are operated with tandem wall switches and occupancy sensors. The gymnasiums are equipped with fixtures that can be retrofit to more efficient LED applications. All of the exit signs within the building will be retrofitted with new LED fixtures.

Schwarting School

The majority of the fixtures in the building are T-8 and T-5 fixtures with electronic ballasts. Some locations are good candidates for fixture modification to reduce the number of lamps while still maintaining proper light levels. The fixtures are operated with tandem wall switches and occupancy sensors. The gymnasiums are equipped with fixtures that can be retrofit to more efficient LED applications. All of the exit signs within the building will be retrofitted with new LED fixtures.

Athletic Center

The majority of the fixtures in the building are T-8 and T-5 fixtures with electronic ballasts. Some locations are good candidates for fixture modification to reduce the number of lamps while still maintaining proper light levels. The fixtures are operated with tandem wall switches and occupancy sensors. The gymnasiums are equipped with fixtures that can be retrofit to more efficient LED applications. All of the exit signs within the building will be retrofitted with new LED fixtures.

New System

Johnson Controls has identified opportunities for energy savings through the installation of new high efficiency lighting and automatic lighting controls. Refer to the Attachment 4 - Line by Line Lighting Survey for the listing of fixtures being retrofitted / replaced.

In an effort to reduce electricity consumption, JCI will retrofit the existing lighting system with newer energy efficient technology. The primary retrofit on this project is a re-lamp of the existing T8 and T5 lamps with new T8 and T5 LED tubes.

The primary upgrade and energy savings strategies consist of the following categories.

- Older technology T8 lamps and U-Tube T8 lamps will be eliminated and new LED technology will be installed in its place. Recessed fixtures will be replaced with new LED volumetric style fixtures using an integrated motion/daylight sensor that is wirelessly programmable and can be grouped for added convenience and safety.
- Incandescent and compact fluorescent lamps (short life & less efficient) will be replaced with new long life and highly efficient LED lamps.
- Occupancy sensors (fixture installed/embedded in most cases) will be installed within spaces that would benefit from their inclusion based on energy savings. Lights will go to a low level (instead of going off) quickly after an area is vacated. After a longer time of vacancy, the lights can go off with some staying very low for safety while using a minimal amount of energy.
- Existing gymnasium fixtures will be replaced with new LED High Bay fixtures with integrated motion/daylight sensors programmable via remote control.
- Existing non-LED exit signs will be replaced with new LED exit signs with battery backup.

By retrofitting the existing lamps ballasts and fixtures, Johnson Controls guarantees that the District will be able to:

- Lower energy costs;
- Reduce demand or load;
- Reduce maintenance requirements or costs;
- Increase equipment reliability; and,
- Decrease heat load by installing more energy efficient technology.

Energy Savings Methodology

Energy savings calculations are based upon hours of operation for each area surveyed.. Ballast wattages presented within the energy savings analysis are based upon the manufacturers' reported technical data.

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

Existing kW Cost per kWh Cost of Existing Lighting Proposed kW Cost per kWh Cost of Proposed Lighting Energy Savings $	= Existing Fixture wattage/1000 watts per kW = Average Site $/kWh = Existing kW x Cost per kWh x Hours of Operation = Proposed Fixture wattage/1000 watts per kW = Average Site $/kWh = Proposed kW x Cost per kWh x Hours of Operation = Cost of Existing Lighting – Cost of Proposed Lighting

Equipment Information

Manufacturer and Type	Customer will determine final selections, subject to the written approval of Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

Coordination of the electrical tie in will be required. Work shall be performed with no interruptions to Customer's operations.

ECM 2 Lighting - Exterior Retrofit

Executive Summary

All locations were surveyed for the application of this measure. Exterior lighting energy efficiency upgrades provide a substantial energy benefit and quality of light improvement in most facilities. Facility owners realize significant operating utility savings, reduced maintenance costs, and improved overall lighting systems performance.

Johnson Controls Lighting Services has developed the efficiency and technology improvement solutions through conducting site audits in cooperation with site personnel providing valuable support and insights for the project. This includes a description of which buildings should be excluded from the audits, identification of current lighting deficiencies and initiatives, ongoing energy efficiency initiatives, building access and escort requirements, utility data, operating schedules, and other priorities.

To reduce electricity consumption, JCI shall retrofit the existing lighting systems with newer technology energy efficient lamps and light fixtures. The lighting retrofit design incorporates the replacement of lamps and ballasts as well as the replacement of light fixtures when the fixtures are in poor condition. New fixtures may also be designed into areas where greater fixture efficiency is required to properly illuminate a space. Every effort has been made to standardize the installed components to reduce operational and maintenance costs over the life of the installed system.

Energy savings calculations are based upon hours of operation as set forth in the energy performance contract.

The overall lighting project is designed to meet or exceed current Illuminating Engineering Society (IES) recommendations while addressing specific illumination requirements for task/area functions. Furthermore, the scope will provide a quality of light superior to what is currently installed.

Existing System

Johnson Controls has performed a detailed survey of existing exterior lighting systems at the six (6) buildings within the District. The exterior lighting is primarily wall packs, flood lights, shoebox, canopy and pole-mounted fixtures currently using outdated high wattage metal halide (MH) and high-pressure sodium (HPS) lamps. These will be replaced with high efficiency - low watt LED fixtures with advanced specular properties that deliver quality light, while also limiting light pollution.

New System

Johnson Controls will furnish and install energy efficient LED lighting in specified areas in the facilities listed in line by line Lighting Survey either by retrofitting the existing fixture with new lamps and ballasts or by replacing with new lighting fixtures. Please refer to the detailed lighting survey for the retrofit type and locations.

The exterior lighting comprises mainly HID technology (wall or pole mounted) and some compact fluorescents. Johnson Controls will replace these fixtures with new LED fixtures that will produce a crisper whiter light that will enhance pedestrian visibility and safety. In addition, photocell sensors will be added to most of these fixtures to turn off lights automatically during day-lit periods.

Energy Savings Methodology

Energy savings calculations are based upon hours of operation for each area surveyed. Ballast wattages presented within the energy savings analysis are based upon the manufacturers' reported technical data.

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

Existing kW	= Existing Fixture wattage/1000 watts per kW
Cost per kWh	= Average Site $/kWh
Cost of Existing Lighting	= Existing kW x Cost per kWh x Hours of Operation
Proposed kW	= Proposed Fixture wattage/1000 watts per kW
Cost per kWh	= Average Site $/kWh
Cost of Proposed Lighting	= Proposed kW x Cost per kWh x Hours of Operation
Energy Savings $	= Cost of Existing Lighting – Cost of Proposed Lighting

Equipment Information

Manufacturer and Type	Customer will determine final selections, subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

New fixtures and energy efficient lamps, ballasts and fixtures will be supplied and installed in the existing fixtures as identified in the Attachment 4, Line by Line Survey. No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

Coordination of the electrical tie-in will be required. Work shall be performed with no interruptions to Customer's operations.

ECM 3 Building Envelope - Weatherization

Executive Summary

All locations were surveyed for the application of this measure. Energy is lost from various leakages throughout the buildings due to infiltration. This measure will seal these leaks, resulting in energy savings and improved comfort in the areas and occupied spaces that are subject to outside air infiltration.

Existing System

Infiltration/Exfiltration is the rate of uncontrolled air exchange that occurs through unintentional building openings. Throughout the buildings, many leaks were found that would allow heat to be lost during the winter and heat gained during the summer. These openings range from gaps around doors, exhaust fans and various other gaps allowing air to pass from a region of higher pressure to that of lower pressure. Outside wind conditions also provide increased pressure gradients across the leakage surfaces, which allow for correspondingly increased leakage rates. Temperature gradients also create the "source to sink" flow, therefore the greater the difference between the outside air and the indoor air temperature, the greater the rate of infiltration. Doors, roof to wall joints, rooftop ventilators and defunct relief vents are all major heat loss contributors to the buildings.

New System

Johnson Controls will furnish and install weatherproofing and caulking around structural leakage. During the door weatherproofing process, the hinges may need to be replaced to ensure proper mechanical functioning. Also, the treads may need to be replaced with higher compressive strength units to maintain seal quality and ensure that deformation does not occur after the improvement due to possible rolling loads. All necessary work will be supplied and installed by JCI. Cracks and openings within the building envelope will be sealed properly to prevent the rate of infiltration. All weather-stripping is to be of aluminum mill finish with a black gasket unless otherwise specified.

Johnson Controls shall furnish and install foam and caulking around structural leakage where appropriate as outlined below:

Plainedge High School

158' Buck Frame Air Sealing (Above Windows)
305' Roof-Wall Intersection Air Sealing (Block, Seal Paint)

Charles Schwarting School

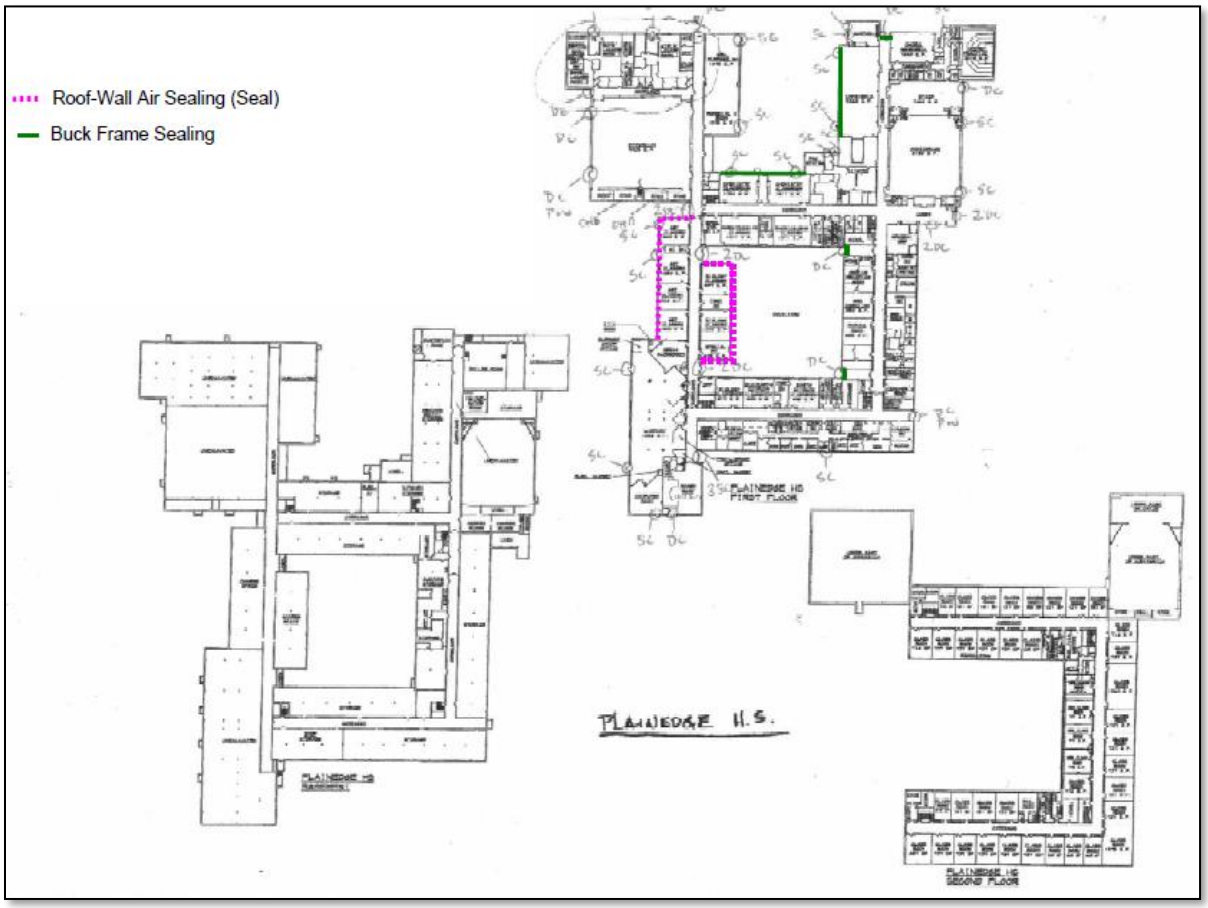
316' Buck Frame Air Sealing (Above Windows)

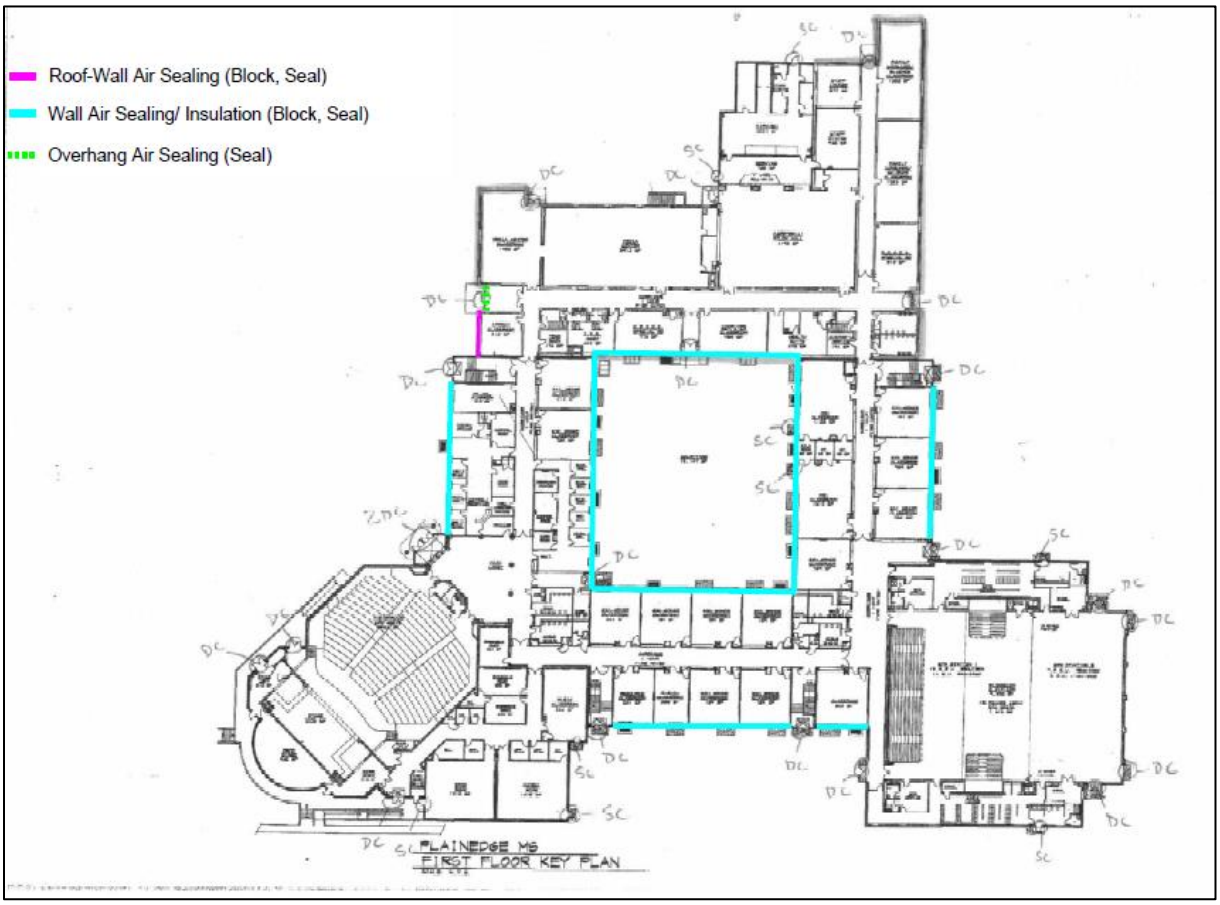
Eastplain Elementary School

336’ Buck Frame Air Sealing (Above Windows)

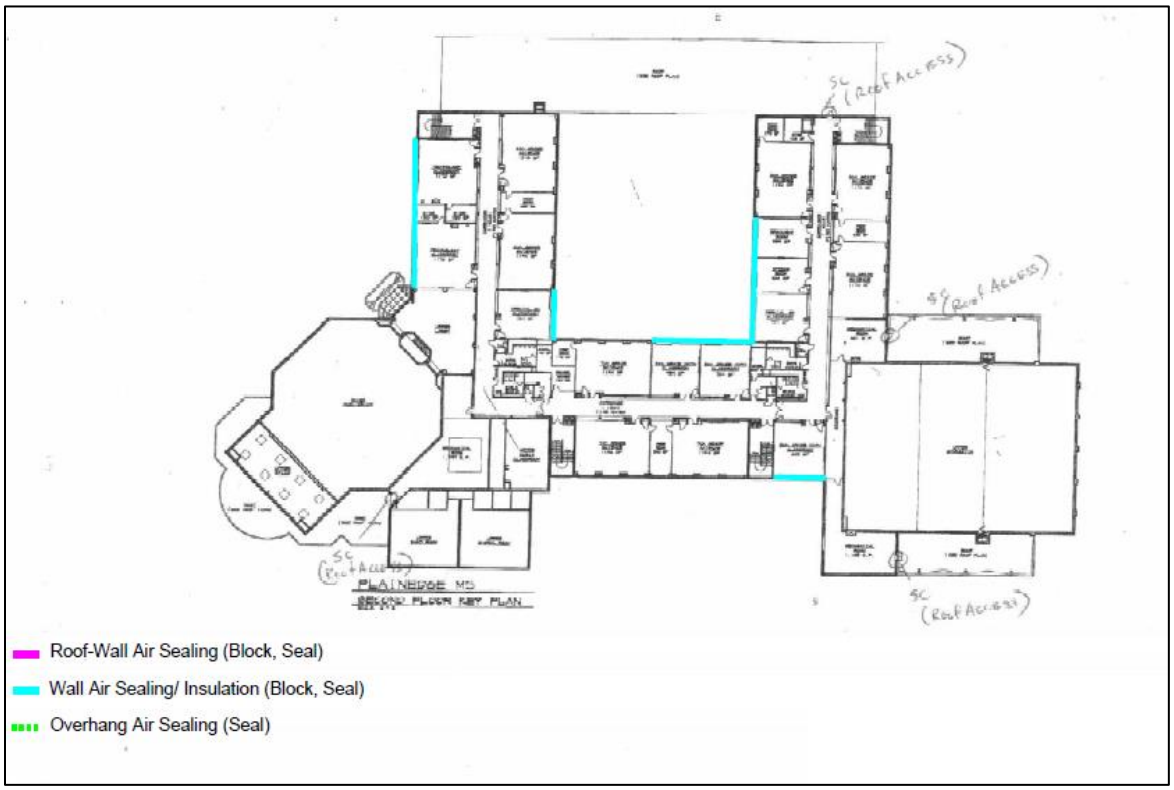
John West Elementary School

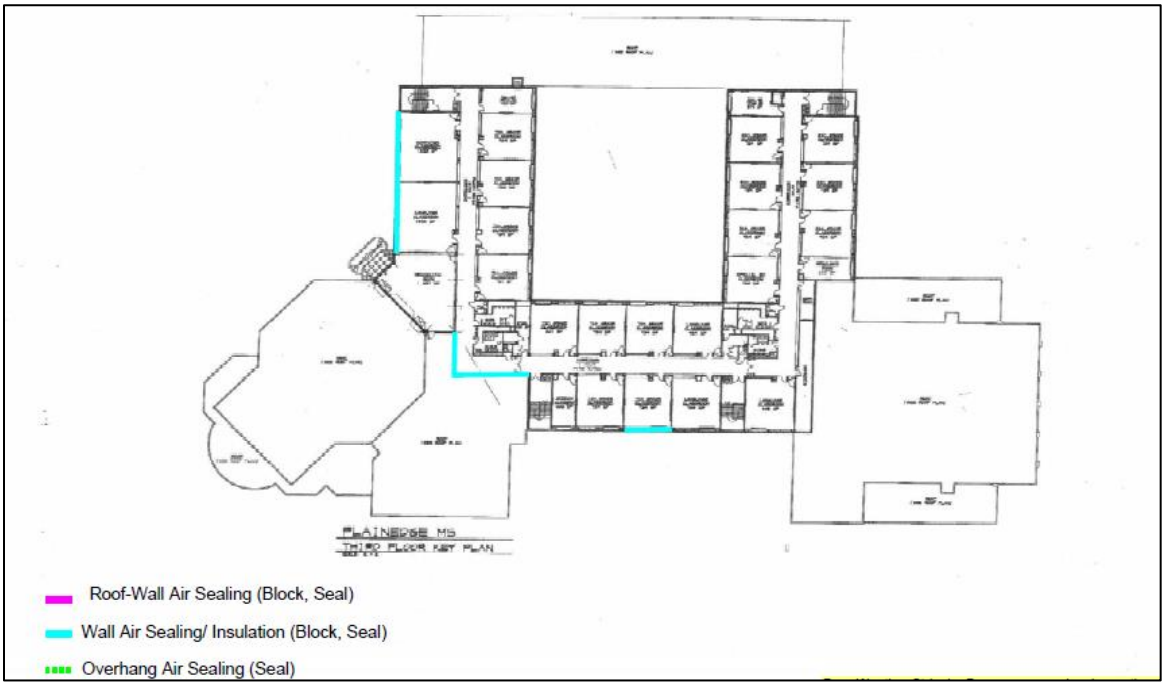
264’ Buck Frame Air Sealing (Above Windows)
12 Caulking (Interior Seal)
22’ Overhand Air Sealing (Block, Seal)
479’ Roof-Wall Intersection Air Sealing (Block, Seal Paint)



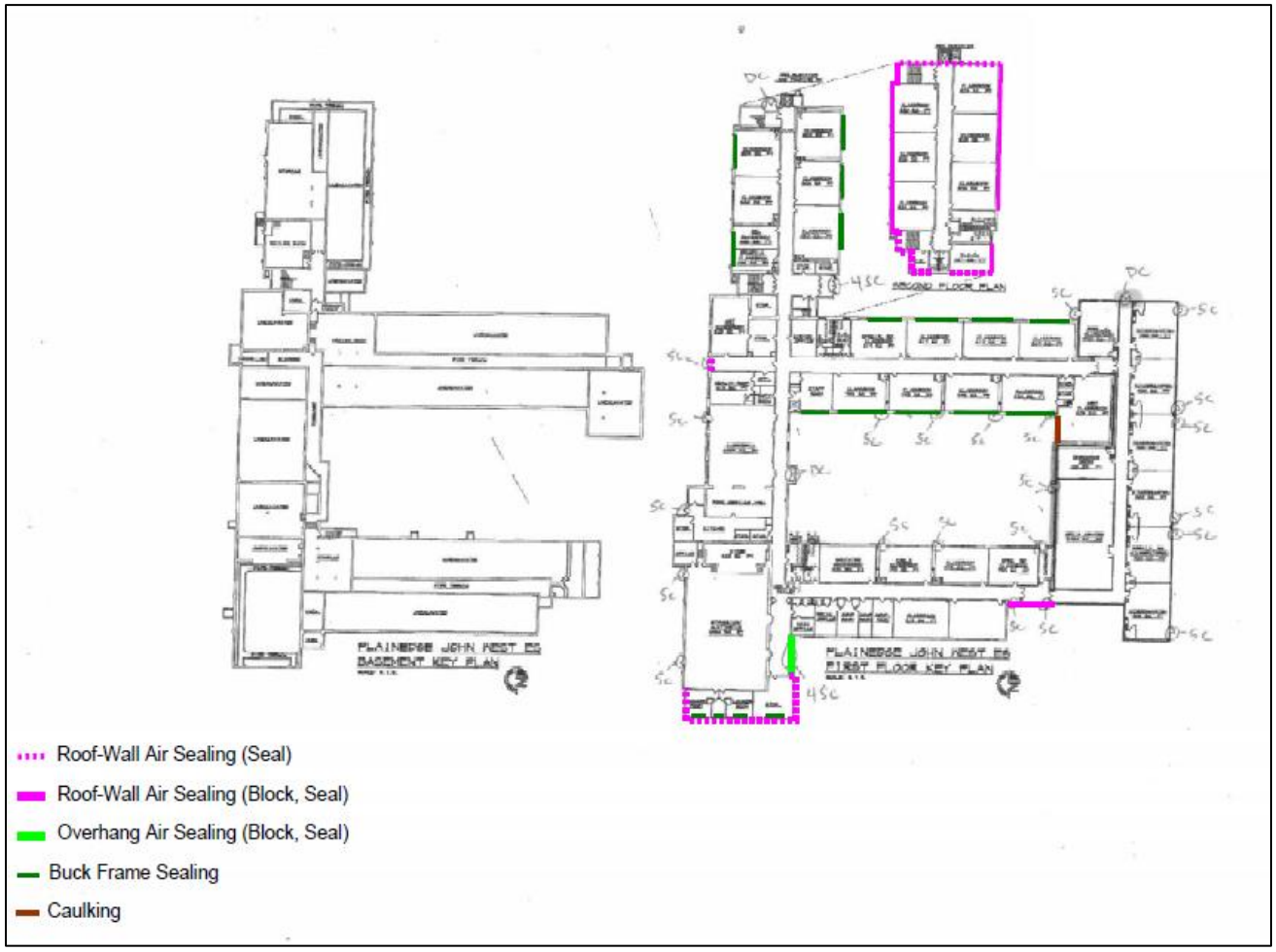


Plainedge High School

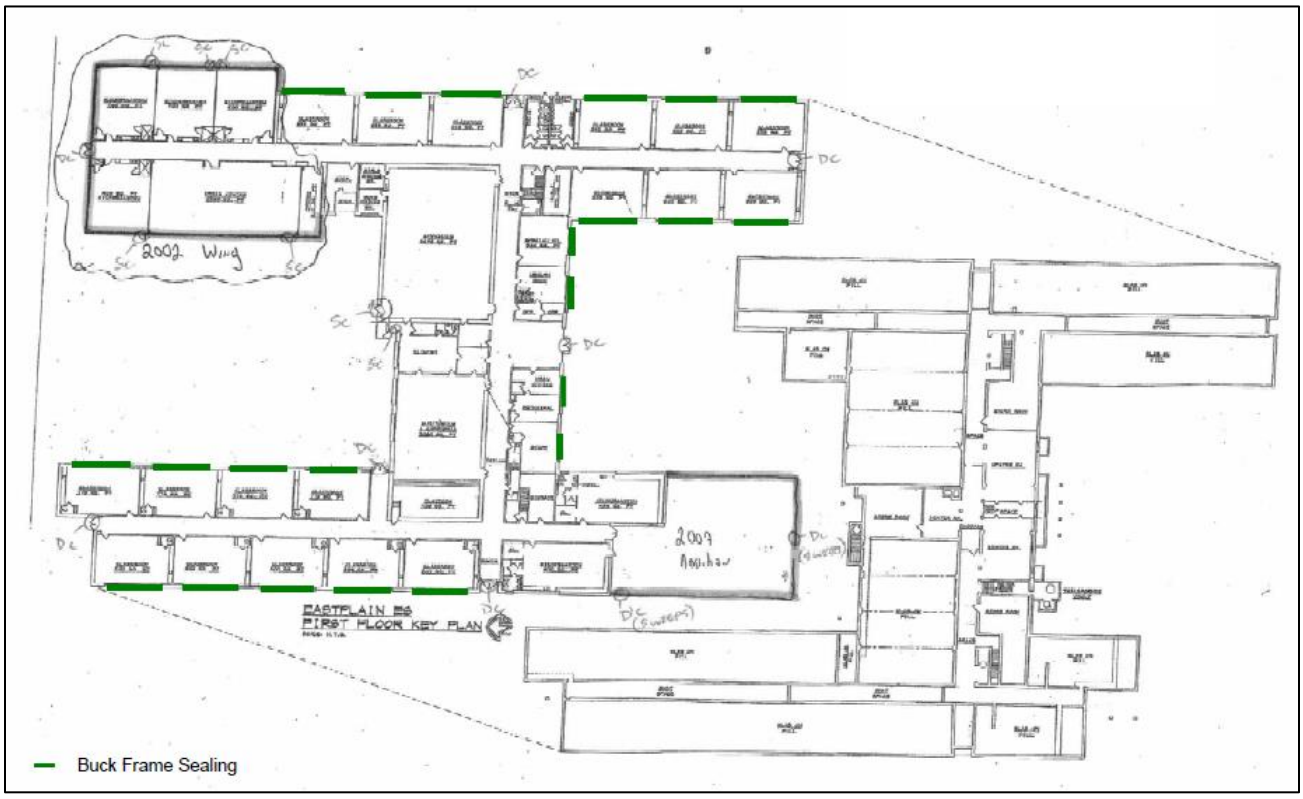




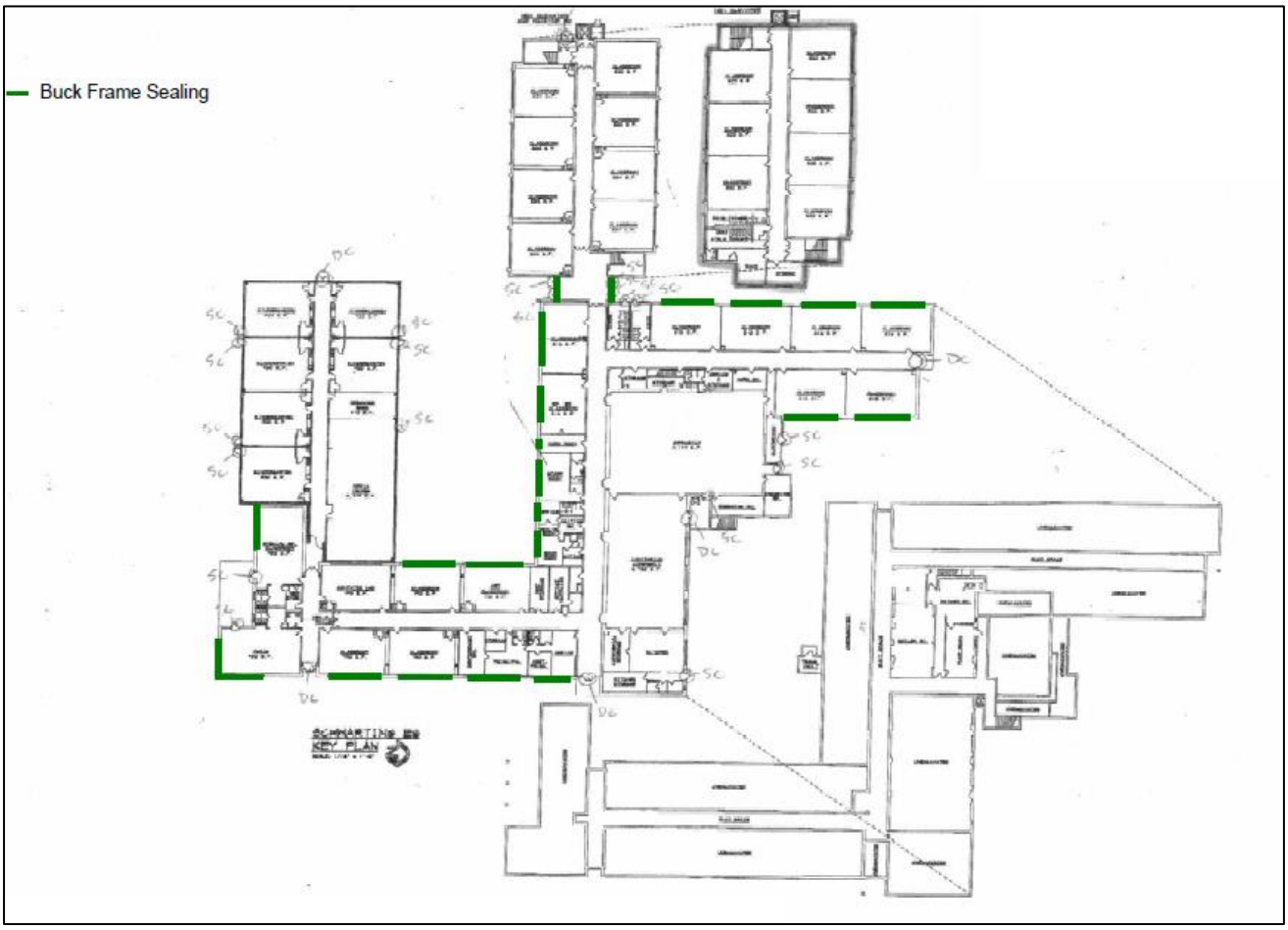
Plainedge Middle School



John West Elementary School



Eastplain Elementary School



Schwarting Elementary School

Energy Savings Methodology

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

Energy Savings $	= (Existing Airflow – Proposed Airflow) x 1.08 (OA Avg. Temp – Inside Avg. Temp)/ Boiler Efficiency) x (fuel cost)

Note: ASHRAE Chapter 26.21 Infiltration formula 2001 Fundamentals, pages 26.21 and 26.22

Equipment Information

Manufacturer and Type	The Customer will determine the final selection, subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

Work shall be performed with no interruptions to Customer's operations.

ECM 4 Building Envelope – Window Replacement

Executive Summary

All locations were surveyed for the application of this measure. Locations where doors are new or are in good condition this measure does not apply. The rate of infiltration that occurs due to the leakage around the frames is a major cause of energy loss as well as the insulation factor of the glass. The upgrade will result in substantial savings and improved comfort to those affected spaces. Overall, through the implementation of this measure, the District will reduce its heating fuel usage and air conditioning costs each year.

Existing System

Plainedge High School

The windows that are installed in the building are double pane, double hung and fixed units in insulated metal frame that are in fair condition. These units were fitted with energy efficient window film under the Phase I EPC.

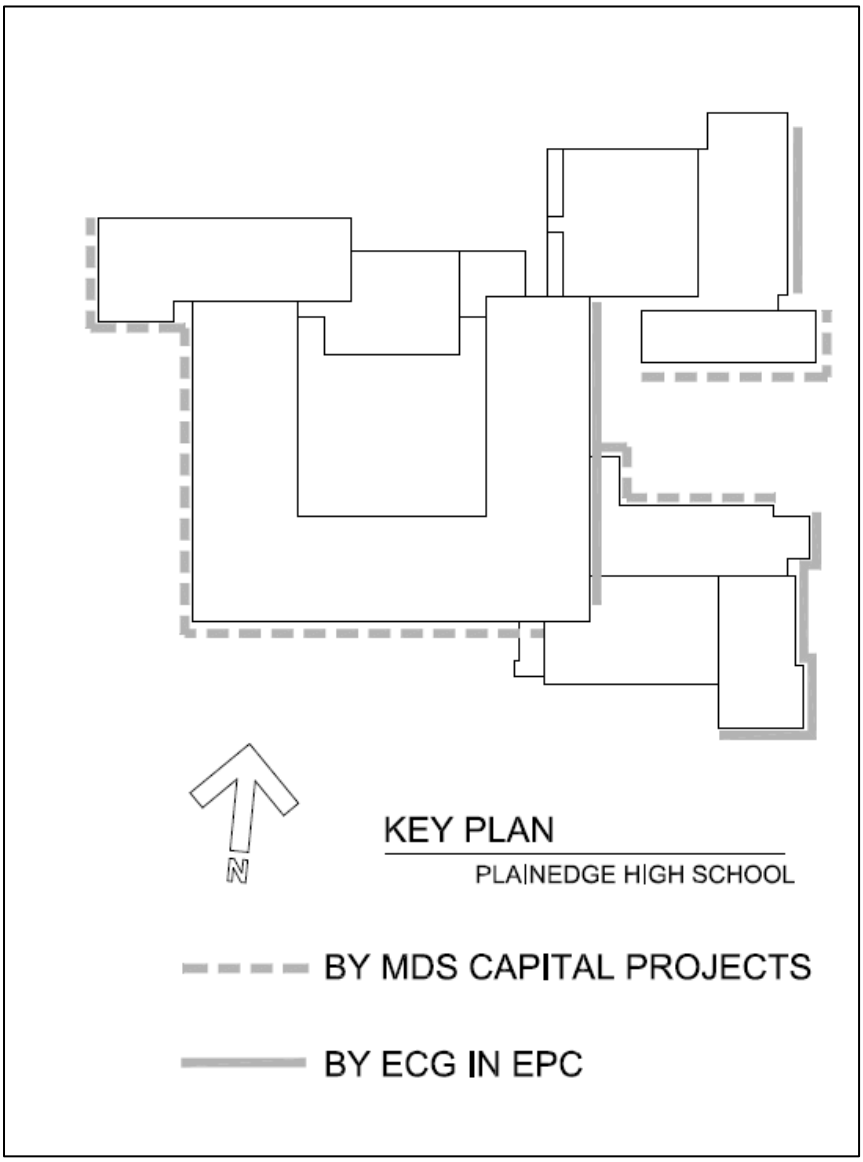
New System

At Plainedge High School, Johnson Controls shall furnish and install new energy efficient window system for the East elevation first and second floor windows per the NYS Energy Code.

Johnson Controls will also include new solar shades as specified by the District at this elevation.

Building	Window Area (SF)
Plainedge High School	3,397

Locations outlined on the floor plan below shows locations of the Window Replacement at the High School:



Scope of Work:

- Proposed windows to match existing configuration and window type.
- New windows to be 115 series 4700I double hung windows manufactured by Architectural Window
- All windows & accessories will match the new windows that are being installed on the west elevation.
- Glazing will be 1" insulated glass consisting of 1/8" clear annealed glass –TPS air space filled with Argon gas –1/8" tempered with Low "E" solar ban 60 glass.
- Insulated panels to consist of .032 smooth aluminum skins with a Kynar finish, 1/8" cement board stabilizers and a polyisocyanurate core.

- Any required interior restoration associated with removal of existing windows is included.
- Removal and dispose of existing blinds.
- Furnish and install new Draper Flex Shades Sunblock SB9040 with clear anodized hardware/fascia
- Abatement of exterior window caulking is included.
- Abating caulk between frame and masonry ahead of removal.
- Boys and Girls Locker rooms shall receive new lintels. Existing bricks shall be repaired as necessary as part of the installation of new lintels.

Energy Savings Methodology

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

Existing Cooling. Gain (In mmBtu's) = (Avg. OA Temp. - Summer Inside Setpoint) x Sqft. x Existing U Value x Total Bin Hours/1,000,000
Proposed Cooling. Gain (In mmBtu's) = (Avg. OA Temp. - Summer Inside Setpoint) x Sqft. x Proposed U Value x Total Bin Hours/1,000,000
Existing Heating. Loss (In mmBtu's) = (Avg. OA Temp. - Winter Inside Setpoint) x Sqft. x Existing U Value x Total Bin Hours/1,000,000
Proposed Heating. Loss (In mmBtu's) = (Avg. OA Temp. - Winter Inside Setpoint) x Sqft. x Proposed U Value x Total Bin Hours/1,000,000

Equipment Information

Manufacturer and Type	The Customer will determine the final selection , subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

Windows as noted will be replaced. All architectural or structural changes to the facility will be coordinated through the Architect and the District.

Customer Support and Coordination with Utilities

Work shall be performed with no interruptions to Customer's operations.

ECM 5 Energy Management System

ECM 5.1 Energy Management System - Temperature Setback

Executive Summary

All locations were surveyed for the application of this measure. This measure will install improved building controls to provide reliable occupancy and temperature control as well as improved operator interface allowing for greater ease of system operation.

Existing System

Plainedge High School

The HVAC equipment is controlled with an electro-pneumatic control system that is in good condition. This system was upgraded in the Phase I EPC. There are five (5) zones installed on the JCI Metasys system as listed as follows.

Table 1 shows the five (5) zones that are installed.

Zone	Area Served
1	Music & Classrooms
2	Auditorium
3	Gymnasium
4	Cafeteria
5	Administration

Table 1

Plainedge Middle School

All HVAC equipment installed for the building is fully DDC controlled. The main Metasys network control panel and the head end computer; both installed in the head custodian's office.

Eastplain Elementary School

The HVAC equipment is controlled with a new electro-pneumatic control system that is in good condition as shown below. This system was upgraded in the Phase 1 EPC.

John West Elementary School

The HVAC equipment is controlled with an electro-pneumatic control system that is in good condition. This system was upgraded in the Phase I EPC. The pneumatic thermostats are in fair condition and overheating has occurred due to supply branch leakage. The remaining pneumatic controls should be converted to DDC. There are two (2) zones installed on the system, they are listed as follows.

Zone	Area Served
1	Classroom
2	Gym

Table 2

Schwarting School

The HVAC equipment is controlled with an electro-pneumatic control system that is in good condition. This system was upgraded in the Phase It EPC. The pneumatic thermostats are in fair condition and overheating has occurred due to supply branch leakage. The remaining pneumatic controls should be converted to DDC.

The following table shows set-points at all the buildings:

School/Building	Summer Inside Setpoint (F)			
	Existing Occupied	Existing Unoccupied	Proposed Occupied	Proposed Unoccupied
Plainedge High School	72	74	76	80
Plainedge Middle School	72	74	72	80
Eastplain Elementary School	72	74	76	80
John H. West Elementary School	72	74	76	80
Charles E. Schwarting Elementary School	72	74	76	80
Plainedge Athletic Center	72	74	76	80

School/Building	Winter Inside Setpoint (F)			
	Existing Occupied	Existing Unoccupied	Proposed Occupied	Proposed Unoccupied
Plainedge High School	72	68	70	55
Plainedge Middle School	72	68	70	55
Eastplain Elementary School	72	68	70	55
John H. West Elementary School	72	68	70	55
Charles E. Schwarting Elementary School	72	68	70	55
Plainedge Athletic Center	72	68	70	55

New System

Johnson Controls will include following scope of work as part of this EPC and eliminate pneumatics from the three elementary schools and the High School.

Unit Ventilator DDC Conversions (includes fan coil units with OA ventilation):
(Eastplain, John West, and Schwarting)

- Provide DDC conversion to existing units, as listed in table below, including low voltage field wiring required for zone temperature sensor, auxiliary heat, and network connections.
- Impacted pneumatic devices shall be changed out with electric/electronic, including damper and valve actuators, sensors and relays, and power supplies such that the units will be fully DDC and no longer require a compressed air supply.
- Fabricate pre-wired controller assembly to include controller, mounting bracket, low-temperature cut-out relays, and terminal strip with printed identification.
- Unit ventilators shall be integrated onto the existing Facility Explorer BMS, and configured for control and monitoring by the system operator, historical data collection, and alarm routing.

Unit Ventilator BMS Tie-in:
(John West and Schwarting)

Johnson Controls will tie-in existing Honeywell system-controlled Unit Ventilators, as listed in table below, to the Johnson Controls FX BMS system.

Stand-alone Radiators, Baseboards, Convectors & Unit Heaters:
(Eastplain, John West, Schwarting, and High School)

- Provide full DDC conversion to existing units, as listed in table below, including all low voltage field wiring required for remote zone control panels, temperature sensors, valve actuators, and network connections.

- Existing pneumatic valves shall be refit with electronic actuators.
- Remote zone control panels (maximum 12 zones per panel) shall be shop-fabricated and shall include controllers, expansion modules, power supplies, terminal strips with printed identification, and panel ID tags of engraved acrylic.
- Zone controls shall be integrated onto the existing Facility Explorer BMS, and configured for control and monitoring by the system operator, historical data collection, and alarm routing.

Unit Heaters, Cabinet Unit Heaters, and Recirculating Fan Coils:
(Eastplain, John West, Schwarting, and High School)

- Provide DDC conversion to existing units, as listed in table below, including all low voltage field wiring required for remote zone control panels, temperature sensors, valve actuators, and network connections.
- Existing pneumatic valves shall be refit with electronic actuators. Remote zone control panels (maximum 12 zones per panel) shall be shop-fabricated and shall include controllers, expansion modules, power supplies, terminal strips with printed identification, and panel ID tags of engraved acrylic.
- Zone controls shall be integrated onto the existing Facility Explorer BMS, and configured for control and monitoring by the system operator, historical data collection, and alarm routing.

Replacement of Central Plant Hot Water Mixing Valve and Zone Control Valve Actuators:
(Eastplain, John West, and Schwarting)

- Convert existing pneumatic building hot water tempering valves, as listed in table below, from pneumatic to electric actuation.
- Remove existing actuator, refit new electric, tie back to existing BMS command and test.

Replacement of Central Plant Hot Water Mixing Valve and Zone Control Valve Actuators:
(High School)

The central plant controls will have existing pneumatic control valve actuators, as listed in table below, upgraded to DDC type. All new control wiring shall be installed in Electric Metallic Tube (EMT).

The scope includes actuator upgrades of the existing, working valve bodies, and whole replacement of the defective valve assemblies. Work also includes all hardware as required to integrate the new valves back into the existing DDC controls.

Additionally, there are 2 main hot water mixing valves in the boiler room which are pneumatically actuated. These are to be converted to DDC control.

Supervisory Controller:
(High School)

Provide one new supervisory controller (JCI FX80) to accommodate the additional memory overhead required by the proposed additions of scope identified in this measure and wellness center and café expansion being undertaken by Customer at High School.

The following table lists the controls to be upgraded as part of this scope:

Scope	High School	Eastplain	John West	Schwarting	Total
Convert Boiler Rm Hot Water Mixing Valves to Elec. Actuation	2				**2**
Convert Electric Stand-Alone Cabinet Heaters to DDC/BMS			3	7	**10**
Convert Head Pressure Control Valves to Electric Actuation	7				**7**
Convert Honeywell XL50 Unit ventilators to JCI			19	18	**37**
Convert Pneumatic Convectors & UHs to DDC/BMS	97				**97**
Convert Pneumatic Convectors To DDC/BMS			17	4	**21**
Convert Pneumatic Relief Hoods to Electric/DDC Actuation	4				**4**
Convert Pneumatic Unit Vents To DDC		4	12	15	**31**
Refit HW Mixing Valve with Electric Actuation			1	1	**2**
Replace Defective Pneumatic Head Pressure Control Valve Assemblies, Replace with Elect/DDC Actuation	3				**3**
Total	**113**	**4**	**52**	**45**	**214**

Energy Savings Methodology

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

Envelope Load Btu/Hr	= (UA x (∑ (OAT-Occupied Setpoint)
Infiltration Load Btu/Hr	= (1.08 x Infiltration CFM x (∑ (OAT-Occupied Setpoint)

Where:	
UA	= 1/R-Value of Wall x Wall Area + 1/R-Value of Roof x Roof Area
Infiltration CFM	= Building Area x 10 Feet Average Height x Building Air Changes Per Hour/60
Warm-Up Hours	= Hours Before Occupancy Unit Ventilators Turned to Occupied Mode
Heating MMBtu Savings	= (Baseline MMBtu - Proposed MMBtu) / Heating System Efficiency

Equipment Information

Manufacturer and Type	The Customer will determine the final selection, , subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

New controls will be installed at the locations that will allow operators to efficiently operate the building. No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

No utility interruptions are required for this measure. Work shall be performed with no interruptions to Customer's operations.

ECM 5.2 Energy Management System - Demand Controlled Ventilation

Executive Summary

All locations were surveyed for the application of this measure. Johnson Controls will install CO_2 sensors that will control the ventilation rates to reduce outside air during periods of low or no occupancy. This measure accurately measures the amount of CO_2 that is present and can assist in improving indoor air quality.

Existing System

The High School supplies outside air into the spaces noted during un-occupied periods, the supply fans are not cycled off by the existing energy management system and the outside air dampers supply air into the space regardless of occupancy requirements. Since the existing supply fans are designed to handle maximum load, during periods of less than maximum occupancy load, excessive outside air is introduced and heated/cooled unnecessarily.

The max occupancy for the locations is shown below.

Building	Location	Occupancy
HS	Auditorium	800
MS	Auditorium	650

New System

New controls will be installed to measure the concentration of CO_2 and vary the amount of outside air that is drawn into the space by modulating the outdoor and exhaust air dampers. New dampers controls will be installed to interface with the existing control system. The sensors will provide the Customer with a trend to show concentrations over time.

At each location, the following will be installed:

- Install new zone CO2 transmitters to monitor CO2 levels to provide an indication of occupancy in the area specified for use in demand-controlled ventilation.
- Install new outside air duct mounted CO2 transmitter to monitor outdoor CO2 levels.
- Wire CO2 transmitters to the existing DDC panel for the air handling unit(s).
- All CO2 installation work must be in accordance withal applicable laws, rules, codes and regulations and requirements of the State Education Department.

Provide programming as required to reset the minimum outside air damper position based on the CO2 levels in the space.

On the units listed below, demand control ventilation strategies will be employed.

Building	Location	Area Served	Equipment Name	Supply Fan (HP)	Return Fan (HP)
Plainedge Middle School	Mechanical Room #1	Auditorium	AHU-B1	10	5
Plainedge Middle School	Mechanical Room #1	Auditorium	AHU-B2	10	5
Plainedge High School	Roof	Auditorium	HC-1	5	2
Plainedge High School	Roof	Auditorium	HC-2	5	2

For the systems in this section, new auto-calibrating CO_2 sensors will be installed to measure the concentration of CO_2 and vary the amount of outside air that is drawn into the space by modulating the outdoor and exhaust air dampers. New damper controls will be installed to interface with the existing control system. The sensors will be able to provide the building owner with a trend to show concentrations over time.

Johnson Controls shall install CO_2 controls on the previously listed air handlers to reduce outside air during periods of low or no use. These controls will be installed on the return airside of the plenum before the outside air mixing section of the air handlers. As the CO_2 upper set point limit is approached the sensor will indicate via the energy management system to modulate the outside air damper to maintain minimum CO_2 levels.

CO_2 monitoring and control is considered an important part of green building design. It is one of the criteria that can now be used to meet the LEED™ (Leadership in Energy and Environmental Design) criteria for green building design.

At each location the following will be installed:

- Install new zone CO_2 transmitters (two per AHU) to monitor CO_2 levels to provide an indication of occupancy in the space return air acceptable to the engineer for use in demand-controlled ventilation.
- Install new outside air duct mounted CO_2 transmitter to monitor outdoor CO_2 levels (one per building).
- Wire CO_2 transmitters to the existing DDC panel for the Air Handling Unit.
- Provide programming as required to reset the minimum outside air damper position based on the CO_2 levels in the space.
- Installation of cabling between CO_2 sensor and unit controls.
- Reconfiguration of unit controls to incorporated CO_2 ventilation routines.
- Integration of CO_2 controls into BMS, permitting full monitoring and adjustment capabilities.
- Alarming and trending as specified and as deemed necessary by the Customer and/or the Customer's Architect/Engineer.

Sequence of Operations

Pre-Occupancy Purge:

Thirty minutes prior to the scheduled occupancy time of the air handling unit, the unit will be indexed into a pre-occupancy cycle. This cycle shall consist of the air handling unit running for 30 minutes. Once the fan is proven running, the outdoor air damper will open to 100% open. The heating valve will be under controls of the low limit discharge sensor, maintaining at least 60 degrees F.

Post-Occupancy Purge:

When the unit goes into unoccupied mode, as dictated by the occupancy schedule in the FX-40 front-end, the unit will run in a post-occupancy flush cycle, with the running and outdoor air damper open to 100%, until the space CO_2 level reaches the same CO_2 level as that of the outdoor air. When this is accomplished, the unit will shut down. The fan will be off, and the dampers closed.

Damper Control:

The economizer dampers will be controlled to provide Carbon Dioxide based Demand Controlled Ventilation. Once the fan has been proven running, the dampers will move to their minimum position. When the space CO_2 level approaches a level that is 100 ppm higher than the outdoor air CO_2 level, the dampers will begin modulating open further. When the space CO_2 level reaches an Upper CO_2 limit above that of the outdoor air or 1000 ppm, the dampers will be fully open. The dampers will be allowed to modulate open beyond that required for demand-controlled ventilation if free cooling is available, and required, to maintain the space setpoint.

Occupied Cycle:

The supply fan shall run continuously. Whenever the space temperature is below the occupied space set point, the heating valve will be fully open and the outside air damper will modulate to maintain the CO_2 setpoint (See Damper Control Sequence). As the space temperature reaches set point, the heating valve shall modulate closed. Upon further rise in space temperature, the outside air damper shall modulate open. The UNIT's discharge low limit program will maintain a minimum discharge temperature of 60 degrees (adjustable) by closing the outdoor air damper and opening the heating valve, in sequence. When the space temperature exceeds the space setpoint, the dampers will modulate open to maintain the space setpoint.

Unoccupied Cycle:

The UNIT controller will cycle the supply fan as needed to maintain an unoccupied set point of 60 degrees (adjustable). The outside air damper will be fully closed.

Energy Savings Methodology

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

Total Savings	= Air handling motor savings + Heating savings
Air Handling Motor Savings kWh	kWh reduced = [(Fan kW) x (Reduced Air Flow/Original Air Flow)^2] x EFLH Where EFLH = Effective Full Load Horus
Heating Savings BTUs	Btu = cfm reduced x (supply temp – outside bin temp) x 1.08 x hours

Equipment Information

Manufacturer and Type	The Customer will determine the final selection, subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

New controls will be installed to improve energy use characteristics of the building and provide indoor air analysis. No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

No utility interruptions are required for this measure. Work shall be performed with no interruptions to Customer's operations.

ECM 5.3 Energy Management System – Relief Damper Control

Executive Summary

All locations were surveyed for the application of this measure. This measure shall install improved building controls to provide reliable occupancy control as well as improved operator interface allowing for greater ease of system operation of the exhaust fans and relief dampers that are not controlled by a BMS.

Existing System

At all locations, the air is introduced into the building is removed by the use of exhaust fans and relief dampers. Maintaining proper exhaust fan operation is very important to reduce energy usage. The volume of air that is exhausted is drawn into the building by the supply fans of the unit ventilators, air handlers and through any openings that exist around windows, doors and other building envelope penetrations. The exhaust fans installed are designed to remove air from the corridors, bathrooms, locker rooms and various other areas.

Controlling the relief dampers through the main BMS will ensure that they turn off/close properly during unoccupied hours of the day and will produce significant energy savings, especially during the heating season. Some of the fans are currently controlled by the BMS. Johnson Controls will control the remaining fans and relief vents.

New System

Johnson Controls shall tie in relief dampers to the facilities' BMS to achieve energy savings.

The following scope of work will be performed:

Relief Hoods, Relief Dampers & Gravity Dampers

- Remove existing pneumatic damper actuators on roof-mounted vents;
- Replace with new electric/DDC damper actuators on roof-mounted vents; and
- Extend existing signal from control panels to new actuators.

Building	Relief Dampers
Plainedge High School	4
Total	4

Energy Savings Methodology

Savings is generated by incorporating effective night setback with improved scheduling and thermostat replacement and installation. The building modeling utilizes ASHREA's bin method. This method begins with recording the average temperature for every hour of the year, then tallying those values by temperature range. These ranges become thus "bins".

The next step is to evaluate the building to determine the gains and the overall heat transfer coefficient. This is based upon a combination of the following variables.

Building Weight(Density)

Heat Gains (UadT*EFLH)

Mechanical Ventilation (1.08*cfm*dT*EFLH)

SAVINGS = Total existing MBH – Proposed

Based Upon the following Factors:

ELECCOST = {(KW * KWCOST) + (KW * HR * KWHCOST)} / η_{ELEC}

KW = Maximum Demand (Power) of the heating element for the Year

KWCOST = Demand Unit Cost per Utility

HR = Total Annual Operating Hours

KWHCOST = Energy Unit Cost

η_{ELEC} = Efficiency of Electric Heating Element (Assumed 100%)

FUELCOST = {{[(500 * GPM * DT) * HR] / HV} * FUELPRICE} / η_{FUEL}

GPM = Total Volumetric Flow Rate

ΔT = Temperature Differential

= Supply Hot Water Temperature - Return Hot Water Temperature

HV = Fuel Heating Value

FUELPRICE = Fuel Unit Cost

h_{FUEL} = Efficiency of the Hot Water Boiler

The final summarized calculation is thus

Btu/Hr	= (1.08 x Infiltration CFM x (∑ (OAT-Occupied Setpoint)
Heating MMBtu Savings	= (Baseline MMBtu - Proposed MMBtu) / Heating System Efficiency
kWh	= (HP x % Loading x .746 x Annual Hours)/Eff.
kWh Savings	= (Baseline kWh - Proposed kWh)

Equipment Information

Manufacturer and Type	The Customer will determine the final selection, subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

New controls will be installed at the locations that will allow operators to efficiently operate the building. No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

No utility interruptions are required for this measure. Work shall be performed with no interruptions to Customer's operations.

ECM 6 Heating System – Furnace Controllers

Executive Summary

All locations were surveyed for the application of this measure. This measure incorporates a controller to optimize boiler/domestic hot water heater/furnace operation by delaying the start signal. As a result, the units will fire for longer durations but less frequently resulting in reduced fuel consumption due to higher effective efficiency during the extended combustion cycle and fewer pre purge and post purge air cycles.

Existing System

The existing furnaces installed throughout the District, cycle on and off based upon pressure/temperature set points. All burners operate with minimal modulation and fire on and off to meet load requirements. The figures below show the technology to be controlled.

Proposed System

Johnson Controls will furnish and install seven (7) Intelligent Control Systems ICON-3300 controllers furnace controllers at the following locations on existing, functioning furnaces.

Building	Gas Fired RTU Furnace Controllers
Schwarting School	1
Eastplain School	1
Athletic Center	5
Total	7

Typically, heating systems are sized to accommodate the maximum heating output. During these periods of maximum demand, the burner is constantly on and the boiler is operating at its maximum capacity. At all other times, the burner cycles on and off maintaining temperature of the system as required by setpoint. It is during these periods of lesser demand, that the controller will learn the equipment loading and efficiently manage the firing of the boiler. Further, when configured in this manner, the equipment often short cycles and therefore causes unnecessary wear and tear on the systems and ancillaries that serve them.

The length of the burner's off-cycle is the best measure of total heating demand, or load. In other words, the load is directly related to the time it takes for heated medium to drop from its high-limit temperature to its low-limit or "call" setting. When demand is high, these off-cycles are short and the on-cycles are longer. When demand is lower, off-cycles are longer and on-cycles are reduced. To optimize the

operation of the heating systems within the District's school buildings, new burner controllers should be installed.

The device, which is a microprocessor based computer, constantly monitors the demand on the boiler by assimilating all factors affecting a buildings heating requirements, including occupancy, climate, wind chill, solar gain, type of building, and many others. Most other energy saving devices only considers outdoor temperature. With this information, the controller then calculates the optimum time between off and on cycles and controls burner ignitions accordingly.

The controllers reduce: fuel consumption, wear on parts, flue emissions, and electrical usage, when installed on any new or existing gas or oil burner.

Energy Savings Methodology

The savings approach is based upon reducing the amount of furnace on time without reducing the heating response time or system capacity in response to warmer periods of the year and when demand for heating is low or non-existent. Based upon extensive research and data gathering, general buildings of the style surveyed within the District will save 3 to 4 % of the thermal input of the existing units when compared to the similar control group with no controls during the same heating degree requirements.

Equipment Information

Manufacturer and Type	The Customer will determine the final selection, subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

Work shall be performed with no interruptions to Customer's operations.

ECM 7 Heating Distribution System - Pipe and Valve Insulation

Executive Summary

All locations were surveyed for the application of this measure. The insulation audit was conducted identifying a definite quantity of heat that is lost at a number of locations. These heat losses result from piping and surfaces giving off heat to the space around it. This measure will insulate these surfaces resulting in energy savings and improved comfort of those areas in or near occupied spaces.

Existing System

Some of the energy in the steam or hot water distribution systems at the buildings is wasted through radiant thermal energy loss from a wide range of sources, including piping, valves and tanks. Escaping heat can lead to uncomfortable temperatures in areas adjacent to machine rooms. In addition, with surface temperatures in some cases exceeding 200°F, the exposed service piping and fittings represent a safety hazard and wasted energy. During the detailed energy audit, a number of valves, fittings, and lengths pipe were identified as not having insulation. There are some pipes and valves on the building heating systems that do not have insulation, either as a result of frequent maintenance or because none ever existed. All of these conditions lead to excessive energy use. Hot water piping, tanks and valves/flanges throughout the District were found to be un-insulated. These pipes, tanks and valves/flanges will be insulated to improve the overall efficiency of the heating system.

New System

All bare piping and valves identified above will be finished, installed and insulated as required under NYS Energy Law.

Johnson Controls shall install pipe and valve insulation and/or thermal jackets based on specifications submitted to SED on existing hot water to reduce heat loss according to the table below.

The fiberglass pipe insulation shall be manufactured by Johns Manville or a manufacturer of equivalent type and quality (subject to Customer approval), and with PVC fitting covers where applicable. The removable insulated fiberglass pads on serviceable connections shall be made with Silicone Impregnated Fiberglass Cloth manufactured by GLT Products or a manufacturer of equivalent type and quality (subject to Customer approval).

The following table lists the items that will be insulated:

Scope	Charles Schwarting School	Eastplain Elementary School	John West Elementary School	Plainedge High School	Plainedge Middle School	Total Quantity
Ball Valve Insulation (Units)	2	1	4			7
Butterfly Valve Insulation (Units)	1					1
Check Valve Insulation (Units)					1	1
End Cap Insulation (Units)				1		1
Flange Insulation (Units)	1	1		5	10	17
Pipe Fitting Insulation (Units)	4			11	13	28
Pipe Reducer Insulation (Units)			2			2
Pump Insulation (Units)	4	5	4	6	5	24
Straight Pipe Insulation (LF)	10	6		72	20	108
Strainer Insulation (Units)	2		4			6

Energy Savings Methodology

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

Energy Savings $	= ((Heat Loss Rate per foot of Un-insulated Pipe – Heat Loss Rate per foot of Insulated Pipe) x (length of Pipe x Hours of Operation) x Cost/btu)/(Boiler Efficiency))

Reference is made to the ASHRAE 1989 Fundamentals text page 22.19 Table 9A “Heat Loss from Bare Steel Pipe to Still Air at 80°F, Btu/hr-ft” for losses from un-insulated lines and Table 11 “Recommended Thickness for Pipe and Equipment Insulation”.

Equipment Information

Manufacturer and Type	The Customer will determine the final selection, subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer’s review and approval.

Changes in Infrastructure

The insulation of the appurtenances can happen anytime without impact on building operation. No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

Work shall be performed with no interruptions to Customer's operations.

ECM 8 Energy Efficient Transformers

Executive Summary

All locations were surveyed for the application of this measure. Energy savings can be obtained by replacing the standard efficiency transformers located at Schools listed below.

Existing System

The original 480-120/208 D-Y transformers were found to be operating with evidence of harmonic disturbance, they are also not high efficiency units. The electrical systems that are installed in the buildings experience harmonic losses developed on the 3rd, 5th and 9th harmonic waves. These waves are caused by non-linear power supplies that are connected to the load side of the transformer. These loads include lighting ballasts, fax machines, copiers, printers and computer power supplies. These waves do not provide useful power to the loads but are reflected back to the transformer and are dissipated in the form of heat along the conductors and in the transformer core. This condition allows current to flow on the neutral which should be current free. Furthermore, the additional load that is translated back to the transformer actually de-rates the transformer lowering its efficiency and ability to supply the loads with rated voltage.

New System

Johnson Controls will replace the existing transformer installed at the locations specified, and furnish and install with new Hammond high efficiency transformers.

Building	Location	Equipment Manufacturer	Eq Model Number	Serial Number	Capacity	Notes
Plainedge Middle School	Main Electric Room	Cutler-Hammer	V48M28F55CU	J03G00629	500 kVA	5.5% IMP, PRI: 480 Delta, SEC: 208Y/120
Plainedge Middle School	Technology Elec. Closet C217	Cutler-Hammer	N48M28F33CU	J04D06701	300 kVA	3.4% IMP, PRI: 480 Delta, SEC: 208Y/120

Johnson Controls will install the following scope at each location:

- Accept delivery of Transformers.
- Rigging of transformers from staging area to transformer location, new pads where needed.
- Disconnect and remove existing transformer as per table above and properly dispose in accordance with all laws, rules, codes and regulations.
- Install new high efficiency transformer of same size, utilizing existing feeds and grounds.

- Work will be coordinated and scheduled in advance with the site contact to minimize interruptions. No temporary power will be provided.

Energy Savings Methodology

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

Cost per kWh	= Average Site $/kWh
Cost of Existing Loss	= kWh **x** (1-Efficiency of Transformer Existing)
Proposed Loss	= kWh **x** (1-Efficiency of Transformer Proposed)
Energy Savings $	= (Existing kWh – Proposed kWh) **x** kWh Rate

Equipment Information

Manufacturer and Type	The Customer will determine the final selection, subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

New transformers will be installed in place of the existing transformers. 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. Work shall be performed with no interruptions to Customer's operations.

ECM 9 Renewable Energy – Photovoltaic Electric Generation

Executive Summary

All locations were surveyed for the application of this measure. This measure will reduce the quantity of purchased power from the local utility resulting in good financial benefits for both electric and fossil fuels.

Existing System

Sections of roofs, parking lot and open fields throughout the District are suited for the installation of solar panels to produce electricity.

New System

Johnson Controls will furnish, install and commission a total of 1,334.3 kW roof mounted and carports photovoltaic electrical generation systems as detailed in the table below that will interconnect with the existing electrical distribution system at the associated schools.

The following table identifies the PV sizes and installation type at each location:

Locations	Roof Mounted PV (kW-DC)	Carports PV (kW-DC)	Total PV (kW-DC)
Plainedge High School	260.2	317.2	577.4
Plainedge Middle School	414.2		414.2
Eastplain Elementary School	28.8		28.8
John H. West Elementary School	204.5		204.5
Charles E. Schwarting Elementary School	109.4		109.4
Total	**1017.1**	**317.2**	**1334.3**

Installation includes the following specifications for new Roof Ballasted Systems:

- UL Certificate.
- New wiring to meet the requirements of the 2017 National Electric Code (“NEC”), as amended.
- Solar Module to be 72 cell 400 watt JA Solar or equal and as approved by Customer’s Architect/Engineer.
- Inverters to be SMA or equal and as approved by Customer’s Architect/Engineer.

- Balance of new system to meet 2017 NEC Code, as amended.
- Required Interconnection to building system located as per 2017 NEC Code, as amended, lineside tap as determined by the utility(ies) having jurisdiction.
- Unirac RM, Ecofoot or equal self-ballasted racking system
- Furnish and install required ballast block as per design.
- One time training for 4 hours to the District
- District to support monitoring by supplying an IT drop to a gateway location and necessary IP addresses that the District will maintain for guarantee period.
- Protective slip sheet to meet roofing warranty certifications

Installation includes the following specifications for Carport, Canopy Systems:

- Carport system to have a minimum height of 14 ft. in roadway areas
- Canopy system to have a minimum height of 10 ft. in non-roadway areas
- Solar Modules to be 72 cell 400-watt JA Solar Customer approved equal
- Solar Inverters to be SMA or Customer approved equal 1500-volt family.
- Solar equipment to be mounted at no less than 10 ft above grade.
- Conduit work up to 10 ft. above grade will be hard wall galvanized.
- Should any new exterior switchgear be required, a 6 ft chain-link fence shall be installed with an access gate.
- New underground conduit to be PVC
- Work to conform to PSEG and regulatory or governmental agencies requirements. JCI is responsible for all costs necessary to conform to these requirements.
- Carport/Canopy Racking system, including hardware and module mounting hardware to be engineered carport/canopy structure to support PV modules.
- New members and hardware are galvanized steel with Columns and Top Beams hot dipped to ASTM A123 and purlins pre-galvanized to a G140 minimum. Module hardware is stainless steel.
- New member connections shall be bolted. No on-site welding shall be required or undertaken without the prior written permission of the District and its Architect.
- Parking lot restoration in affected areas to be saw cut and hot patched to match existing surface conditions.
- Columns to be set directly on concrete piers with chemical anchors or wet set anchor bolts.
- Temporary fencing, barricades, or storage trailers necessary to secure site.
- Disposal of soil/spoil created from the foundation installation is included. JCI shall undertake necessary soil testing and properly dispose of soil at its cost and expense in accordance with all applicable laws, rules, regulations and codes.
- Grounding hardware for modules and racking
- Module grounding to be per module manufacturer's installation instructions.
- Base design includes pre-punched holes in the purlin for wire management.
- Electrical Underwriters Certificate.
- Electrical installation to be installed as per the NEC 2017 code, as amended and updated.
- Electrical conduit will be installed outside of concrete piers and/or baseplates.
- JCI will provide a web-based dashboard for PV production for students and staff to use and access.

- District to support monitoring by supplying an IT drop to a gateway location and all necessary IP addresses that the District will maintain for 18 years.
- SED approved system design drawings shall be prepared by the Customer's Architect of Record.

In the event that any of the building roofs, parking lots are determined to be unsuitable for roof mounted/carport PV arrays, Johnson Controls will attempt to move the arrays or portions of the arrays to another location that is suitable at any of the other buildings outlined above, subject to all necessary review and approvals and written approval of the Customer.

Johnson Controls shall install the new PV systems with existing roof manufacturer standards to maintain current and any new roof warranty(ies) as it relates to the solar panel installation. At impacted locations, existing structural steel, joists, roof decks, are anticipated to be adequate for solar panel installation. If during the design phase the architect / engineer of record, ECG Engineering, encounters structural issues, with any of roofs, roof framing, geo-tech issues, drainage issues, septic system issues with any of parking lots and walkways shall relocate the problem areas of solar arrays to a different location in order to maintain the 1,334.3 kW DC of total system size. JCI shall be fully responsible for coordinating its work with any ongoing capital work at the District. An adjustment to the guarantee may occur in form of Contract Amendment if the new location is on a different electric rate.

In the event that any of the proposed locations are determined to not be a viable option, the scope of work for this ECM shall be reduced subject to all necessary approvals, including Customer's written approval by amendment and the costs associated with the reduced scope shall be credited to the Customer. The guaranteed savings shall also be adjusted accordingly by a formal written amendment to the Agreement. All adjustments require Customer's written approval and must maintain a positive cash flow as set forth in the contract documents.

The weather station monitoring is included through the web-based dashboard as long as the internet IP address is maintained. The weather station includes a pyranometer at each location, one at each of the 5 schools. The irradiance value will be trended and logged into the cloud for 10 years. At the end of the 10 years, the Customer can elect to renew the monitoring service at an additional cost.

Power to the building will be temporarily shut down by the utility for up to four (4) hours during the tie-in. Advanced coordination with the District will be required before the tie-in.

Energy Savings Methodology

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

Existing kW	= Existing wattage of Solar Panels/1000 watts per kW
Cost per kWh	= Average Site Data Package $/kWh
Full Hours of Solar Exposure	= Zone 3
Energy Savings $	

	= kW x Cost per kWh x Full Hours of Solar Exposure (*) Hours of operation are to be stipulated

Equipment Information

Manufacturer and Type	The Customer will determine final selection , subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	Product cut sheets and specifications for generally used product can be included if requested by the Customer. As part of the measure design and approval process, specific product selection will be provided for Customer's written review and approval.

Changes in Infrastructure

New equipment will be installed and electric tie in required.

Customer Support and Coordination with Utilities

Coordination of the electrical tie into the main electric panels will be required. Work shall be performed with no interruptions to Customer's operations.

ECM 10 Plug Load Controllers

Executive Summary

All locations were surveyed for the application of this measure. The amount of plug load devices is ever increasing in today's schools. Unfortunately, as the number of these devices increase, electricity consumption also increases. Newly deployed water coolers and existing water fountains are another source of plug load energy use. Managing plug load equipment provides an opportunity for optimizing energy savings. This measure adds a plug load management system that will effectively manage selective plug load devices. The device will provide energy management through a user interface, where opportunity will exist to turn equipment / appliance on / off or change schedule to optimize energy savings.

Existing System

Many plug load devices have been documented throughout the District. These include large copier/printers water fountains and window air conditioning units. Opportunity exists to save energy by installing a plug load management system on those units that consume energy during sleep mode or when inadvertently left on.

New System

Johnson Controls shall furnish and install 128 plug load management controllers that will gain control of specified plug load equipment listed below. The system will use an existing Wi-Fi network that will communicate to an energy management user interface. Through the user interface, equipment shall be monitored, scheduled and turned on / off. In areas where no Wi-Fi connection exists, plugs shall be programmed one time with the intended schedule for the equipment.

Building	Window A/C	Large Copy Machine	Water Fountain	Large Coffee Maker
Plainedge High School	0	2	3	0
Plainedge Middle School	0	6	20	0
Eastplain School	16	1	1	1
Schwarting School	35	2	3	0
John West Elementary School	31	1	4	0
Athletic Center	0	0	2	0
Total	**82**	**12**	**33**	**1**

Following is the scope of work for the plug load controllers:

- Provide plug load control devices as per final schedule of outlets
- Install and connect devices
- Load and configure software on an owner designated head custodian PC

- Start, test, and checkout the system

Energy Savings Methodology

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

Energy Savings Methodology	
Existing kW	= Listed Equipment Amperage x Voltage of Equipment
Cost per kWh	= Average Site Data Package $ / kWh
Cost of Existing Equipment	= Existing kW x Cost per kWh x Effective Full Load Hours
Cost of Proposed Equipment	= Existing kW x Cost per kWh x Full Load Hours Using Control
Energy Savings $	= Existing Equipment Costs – Proposed Equipment Costs

Equipment Information

Manufacturer and Type	Customer will determine final selections, subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the FIM design and approval process, specific product selection will be provided for Customer's review and approval.

Changes in Infrastructure

No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

Work shall be performed with no interruptions to Customer's operations.

ECM 11 Heating System – DHW Replacement

Executive Summary

All locations were surveyed for the application of this measure. This measure shall install new high efficiency hot water heater at the buildings noted. The savings is derived from improving the overall system efficiency.

Existing System

Plainedge Middle School

Domestic hot water is supplied to the buildings by standard efficiency units installed in the boiler rooms as shown in below. These units are at the end of their useful life or approaching and operate at lower than industry standards. These units should be replaced with new high efficiency units.

The table below lists the units installed.

Building	Fuel	Equipment Manufacturer
Plainedge Middle School	Hot Water	RECO

New System

Johnson Controls will install new high-efficiency, condensing domestic hot water heaters. The new DHW heaters will be properly sized to run at optimum efficiency levels.

Johnson Controls shall furnish and install one (1) AO Smith Model XP Plus 1250, domestic hot water heater at Plainedge Middle School.

- Remove existing hot water heater and dispose of properly;
- Provide Pipe Supports, Hangers and Brackets;
- Provide Valve Tags and ID Chart;
- Provide Pipe Labeling and Directional Arrows;
- Provide new Replacement Re-circulation Bronze Pumps (DHW);
- Provide new Domestic Hot Water 3 Way Mixing Valves;
- Seal and fireproof all penetrations;
- Furnish and install all piping required;
- Insulate all new piping and repair or replace insulation of point of connection as required; and

- Provide Required Electrical Control Wiring.

Energy Savings Methodology

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

Existing DHW Heater Efficiency	= Existing Heat Production/ Existing Fuel Input
Proposed DHW Heater Efficiency	= Proposed Heat Production/ Proposed Fuel Input
Energy Savings $	= Heating Production (Proposed Efficiency – Existing Efficiency)

Equipment Information

Manufacturer and Type	Customer will determine final selections , subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

New domestic hot water heater will be installed in the boiler room. No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

Work shall be performed with no interruptions to Customer's operations.

ECM 12 Air Conditioning Compressor Controllers

Executive Summary

All locations were surveyed for the application of this measure. The existing air conditioning units that are installed at the itemized buildings are good candidates for improved controllers to improve the efficiency of the system operation. Johnson Controls shall install new controllers on the individual compressor units located in the District that provide sufficient financial support in energy savings.

Existing System

The buildings are equipped with rooftop units and/or outdoor condensing units. The controls for these units use standard pressure switches that do not utilize advanced control methodology.

New System

Intelligent Control Systems uses intelligent Dynamic Cycle Management (DCM) technology to determine the cooling demand and "thermal characteristics" of the entire air conditioning system by analyzing the compressor's cycle pattern, and dynamically modifying that cycle pattern to provide the required cooling in the most efficient manner. This is accomplished in "real-time" by delaying the start of the next compressor on cycle by an amount determined by the cooling demand analysis. These new cycle patterns are less frequent and more efficient. This electrically augments the existing controls, and will not cause the compressor to run unless the existing thermostat is calling for it to do so – improving the electrical efficiency of air conditioning systems, by supplementing and antiquated on/off action of the thermostat (even a "smart" one) with the cycle analysis and control capabilities of a computer.

The i-CON 2400/2600 controllers work in conjunction with the existing thermostat and will not void the compressor manufacturer's warranty. An additional feature is the accepted industry practice of compressor anti-short-cycling control.

Johnson Controls shall furnish and install Intelligent Control Systems ICON-2400/2600 controllers on the existing, functioning, individual compressor units located in the buildings listed below:

Location	No. of Compressors
Plainedge High School	1
Schwarting School	1
Eastplain School	1
Athletic Center	7
Total	10

Building	Location	Equipment Name	Manufacturer	Model	Cooling Capacity (Tons)	Compressor Data	No. of Compressors
Plainedge High School	Roof	Split Condensing Unit	Trane	TTA090G300AA	7.5	25 RLA 164 LRA 208V	1
Charles E. Schwarting School	Roof	RTU	Trane	YSC090H3RHA02	7.5	25 RLA 164 LRA 208V	1
Eastplain Elementary School	Roof	RTU	Trane	YSC090H3RHA02	7.5	25 RLA 164 LRA 208V	1
Athletic Center	Roof	RTU	Carrier	48PGFC06-A-50YTM	5	17.6 RLA 123 LRA 208/230	1
Athletic Center	Roof	RTU	Carrier	48PGFC04-A-50YTM	3	11.5 RLA 77 LRA	1
Athletic Center	Roof	RTU	Carrier	48PGFC05-A-50YTM	4	14.6 RLA 91 LRA	1
Athletic Center	Roof	RTU	Carrier	48PGFC12-A-50YTM	10	17.6 RLA 123 LRA 208/230	2
Athletic Center	Roof	RTU	Carrier	48PGFC12-A-50YTM	10	17.6 RLA 123 LRA 208/230	2

Energy Savings Methodology

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

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

Equipment Information

Manufacturer and Type	Customer will determine final selections, subject to the written approval of the Customer and its Architect/Engineer.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for the Customer's review and approval.

Changes in Infrastructure

A new controller for each air conditioning unit will be installed and tested. No architectural or structural changes to the facility are anticipated with the implementation of this measure.

Customer Support and Coordination with Utilities

. Work shall be performed with no interruptions to Customer's operations.

Attachment 10 – Pro Forma Cash Flow
7-Dec-22

Plainedge Union Free School District

7-Dec-22

Yr	*A1* NYSED Building Aid	*A2* Annual Energy Cost With Out Savings	*A3* Annual Energy Cost with Improvements	*A=A2-A3* Annual Energy Savings	*B* Annual O&M savings	*C* Estimated Rebate Program	*D=A1+A+B+C* **Total Annual Savings**	*E* **Annual Lease Payment**	*F* **Annual Service M&V Costs**	*D+E* **Annual Cash Flow**	**Cumulative Cash Flow**
1	$333,015	$908,075	$488,352	$419,723	$61,433	$115,500	**$929,671**	($778,022)	$0	$151,649	***$151,649***
2	$333,015	$926,237	$498,119	$428,117	$61,433	$0	**$822,566**	($778,022)	$0	$44,544	***$196,193***
3	$333,015	$944,762	$508,082	$436,680	$61,433	$0	**$831,128**	($778,022)	$0	$53,106	***$249,299***
4	$333,015	$963,657	$518,243	$445,413	$61,433	$0	**$839,862**	($778,022)	$0	$61,840	***$311,139***
5	$333,015	$982,930	$528,608	$454,322	$61,433	$0	**$848,770**	($778,022)	$0	$70,748	***$381,887***
6	$333,015	$1,002,588	$539,180	$463,408	$61,433	$0	**$857,856**	($778,022)	$0	$79,834	***$461,722***
7	$333,015	$1,022,640	$549,964	$472,676	$61,433	$0	**$867,125**	($778,022)	$0	$89,103	***$550,824***
8	$333,015	$1,043,093	$560,963	$482,130	$61,433	$0	**$876,578**	($778,022)	$0	$98,556	***$649,381***
9	$333,015	$1,063,955	$572,183	$491,772	$61,433	$0	**$886,221**	($778,022)	$0	$108,199	***$757,579***
10	$333,015	$1,085,234	$583,626	$501,608	$61,433	$0	**$896,056**	($778,022)	$0	$118,034	***$875,614***
11	$333,015	$1,106,939	$595,299	$511,640	$61,433	$0	**$906,088**	($778,022)	$0	$128,066	***$1,003,680***
12	$333,015	$1,129,077	$607,205	$521,873	$61,433	$0	**$916,321**	($778,022)	$0	$138,299	***$1,141,979***
13	$333,015	$1,151,659	$619,349	$532,310	$61,433	$0	**$926,759**	($778,022)	$0	$148,737	***$1,290,716***
14	$333,015	$1,174,692	$631,736	$542,956	$61,433	$0	**$937,405**	($778,022)	$0	$159,383	***$1,450,099***
15	$333,015	$1,198,186	$644,370	$553,816	$61,433	$0	**$948,264**	($778,022)	$0	$170,242	***$1,620,341***
16	$0	$1,222,150	$657,258	$564,892	$61,433	$0	**$626,325**	$0	$0	$626,325	***$2,246,666***
17	$0	$1,246,593	$670,403	$576,190	$61,433	$0	**$637,623**	$0	$0	$637,623	***$2,884,288***
18	$0	$1,271,525	$683,811	$587,714	$61,433	$0	**$649,147**	$0	$0	$649,147	***$3,533,435***
Total	***$4,995,230***	***$19,443,992***	***$10,456,752***	***$8,987,240***	***$1,105,794***	***$115,500***	***$15,203,764***	***($11,670,329)***	***$0***	***$3,533,435***	***$3,533,435***

Total Project Net Cost:	**$8,765,205**	***NYSED Capital Building Aid Rate:***	**53.2%**
Gross Project Costs:		***NYSED Capital Building Aid Nominal Interest Rate:***	**1.875%**
Other Costs (Construction Interest):		***NYSED Amortized Amount:***	**$8,765,205**
Net Financed Investment:	**$8,765,205**	***NYSED Aid Payment Period (yrs):***	**15.0**
Loan Interest Rate:	**4.00%**	***NYSED Adjusted Payback (yrs):***	**17.90**
Loan Term in Years:	**15**	***Service Inflation Rate:***	**0%**
Loan Payments Per Year:	**1**	***Energy Inflation Rate:***	**2%**
Total No. of Loan Payments in Arrears:	**15**	***Operational Savings Inflation Rate:***	**0%**
Sum of Annual Loan Payments:	**$778,022**		
		Total Program Cumulative Cash Flow:	**$3,533,435**
Johnson Controls' Guarantee Period:	**18**	***Net Present Value (at 5%):***	**$1,896,835**