Florence Township Public Schools

Energy Savings Plan

May 16, 2024

Schneider Electric

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1.0 Executive Summary

1.1 Overview of the Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) was created in 2009 by the NJ legislature to reduce energy & operational costs, reinvest in infrastructure, and support the individual goals of public entities across the state. ESIP is a design-build financing mechanism that is regulated by the NJ Board of Public Utilities (BPU). Florence Township School District will implement a comprehensive ESIP, using the ESCO model, that addresses building energy and infrastructure needs. The District is using Schneider Electric as the Engineer of Record, and their selected Third-Party Energy Auditor is DLB Associates. The District's financial advisor is Phoenix Advisors.

The energy conservation measures (ECMs) included in the ESIP were developed in partnership with the District's staff to meet the following project goals:

1. Reduce energy and operational expenses
2. Improve indoor air quality and comfort inside the facilities
3. Replace failing HVAC that is well beyond useful life
4. Provide a much-improved learning and teaching environment

The ECMs in the Energy Savings Plan include HVAC upgrades, Building Automation System (BAS) upgrades, building envelope improvements, air quality enhancements, LED lighting, and a solar PV Power Purchase Agreement (PPA). The following chart provides an overview of the ECMs included at each facility.

ECM Matrix	Roebling ES	Riverfront MS	Memorial HS	Admin	Transp
Efficiency					
LED Lighting - Interior	[orange]	[orange]	[green]	[green]	[green]
LED Lighting - Exterior	[orange]	[orange]		[green]	
Lighting Controls			[green]		
Building Envelope & Weatherization	[green]	[green]	[green]		[green]
Mechanical/Piping Insulation	[green]	[green]			
HVAC					
Replace UVs w/ HW htg + VRF cooling UVs	[green] 1st / 2nd				
Optimize Ventilation Rates			[green]		
Boiler Plant Upgrades	[green]		[green]		
Replace Domestic Water Heater		[green]			
Replace Steam Boiler Plant w/ HW Boiler Plant		[orange]			
Building Automation Systems					
Optimize Schedules and Setpoints		[green]	[green]		[green]
New or Upgrade BAS	[green]				
Demand Controlled Ventilation Controls			[green]		
Bi-Polar Ionization	[green]				
Infrastructure					
Micro CHP		[green]			
Sustainability					
Solar PV - PPA		[green]	[green]		

Legend	
Possible ECMs	[green]
Non-ESIP Project - Energy Savings	[orange]

2.0 Financial Analysis

2.1 Scope Summary

The intent of this project is to maximize savings for the District, improve indoor air conditions, reduce maintenance costs, and fund critical capital improvements (new classroom airside equipment with improved filtration and air purification, and cooling capacities). The following energy conservation measures have been reviewed with the School and are included in the ESIP project.

FORM II

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ENERGY CONSERVATION MEASURES (ECMs) SUMMARY FORM
FLORENCE TOWNSHIP PUBLIC SCHOOLS
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **Schneider Electric**

Proposed Preliminary Energy Savings Plan: ECMs		Estimated Installed Hard Costs[1] ($)	Estimated Annual Savings ($)
Efficiency			
1	LED Lighting & Controls	$ 191,553	$ 39,623
2	Building Envelope & Insulation	$ 165,657	$ 10,942
Comfort & Indoor Air Quality			
3	New Unit Ventilators w/ VRF Cooling & BAS	$ 2,590,549	$ 3,776
4	Boiler Plant Upgrades and New Domestic Water Heater	$ 255,375	$ 24,078
5	Optimize Ventilation & Advanced Air Purification	$ 201,445	$ 35,509
6	New/Upgrade Building Automation Systems (BAS)	$ 267,480	$ 46,614
Infrastructure			
7	Micro Combined Heat & Power	$ 171,929	$ 608
Sustainability			
8	Solar PV - PPA	$ -	$ 53,923
	Project Summary:	$ 3,843,989	$ 215,074

***Note: The Estimated Annual Savings above, $215,074, matches the amount shown in Section 4.2 when the OA Baseline Adjustment ($8,787) is added to the listed savings amount in Section 4.2, $206,287.*

This ESIP project includes savings of 29% of Florence Township School District's baseline energy spend.

The table below was created to correlate ECMs in the ECM Matrix in Section 1.1 to the ECM names in Form II.

ECM Name on Form II	Correlated ECMs from ECM Matrix (from Section 1.1)
LED Lighting & Controls	LED Lighting - Interior
	LED Lighting - Exterior
	Lighting Controls
Building Envelope & Insulation	Building Envelope & Weatherization
	Mechanical/Piping Insulation
New UVs w/ VRF Cooling & BAS	Replace UVs with HW htg + VRF cooling UVs
Boiler Plant Upgrades and New Domestic Water Heater	Boiler Plant Upgrades
	Replace Domestic Water Heater
	Replace Steam Boiler Plant w/ HW Boiler Plant
Optimize Ventilation & Advanced Air Purification	Optimize Ventilation Rates
	Demand Controlled Ventilation Controls
	Bi-Polar Ionization
New/Upgrade Building Automation System (BAS)	Optimize Schedules and Setpoints
	New or Upgrade BAS
Micro Combined Heat & Power	Micro CHP
Solar PV – PPA	Solar PV – PPA

2.2 Financial Summary

The table below represents the total, turnkey cost of the ESIP based on the scope of work listed in Section 2.1 on Form II. Schneider Electric will serve as the primary contractor, responsible for the execution of all scopes of work under the ESP program.

FORM V

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCOs PROPOSED FINAL PROJECT COST FORM FOR BASE CASE PROJECT
FLORENCE TOWNSHIP PUBLIC SCHOOLS
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **Schneider Electric**

PROPOSED CONSTRUCTION FEES

Fee Category	Fees [1] Dollar ($) Value	Percentage of Hard Costs
Estimated Value of Hard Costs [2]:	$ 3,843,989	
Project Service Fees		
Investment Grade Energy Audit	$ 124,930	3.25%
Design Engineering Fees	$ 182,589	4.75%
Construction Management & Project Administration	$ 230,639	6.00%
System Commissioning	$ 67,270	1.75%
Equipment Initial Training Fees	$ 57,660	1.50%
ESCO Overhead	$ 240,249	6.25%
ESCO Profit	$ 201,809	5.25%
ESCO Termination Fee [*]	$ -	0.00%
Project Service Fees Sub Total	$ 663,088	17.25%
TOTAL FINANCED PROJECT COSTS:	$ 4,949,135	28.75%

PROPOSED ANNUAL SERVICE FEES

First Year Annual Service Fees	Fees [1] Dollar ($) Value	Percentage of Hard Costs
SAVINGS GUARANTEE *(OPTION)*	$ 15,000	
Measurement and Verification *(Associated w/ Savings Guarantee Option)*	included	
ENERGY STAR™ Services *(optional)*		
Post Construction Services *(if applicable)*		
Performance Monitoring	$ 4,000	
On-going Training Services	included	
Verification Reports	included	
TOTAL FIRST YEAR ANNUAL SERVICES	$ 19,000	

2.3 Cash Flow Analysis

FORM VI

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
FLORENCE TOWNSHIP PUBLIC SCHOOLS

ESCO Name: **Schneider Electric**

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

(a) The cost of all types of energy should be assumed to inflate at **2.4% gas, 2.2% electric** per year. No other escalators will be permitted.

1. Term of Agreement: 20 *years*
2. Construction Period [(2)]: 20 *months*

Cost of Construction [(1)]: $ 4,949,135
Additional Funding: $ 1,250,000
Financing Costs: $ 13,500
Total Financed Cost: $ 3,712,635

Interest Rate: 3.90%

Year	Annual Electric Savings	Annual Natural Gas Savings	Annual Distributed Gen. Savings	Annual Operational Savings	Energy Rebates / Incentives	Annual Solar PPA Savings	Total Annual Savings	Annual Project Costs	Annual Service Costs [(3)]	District Costs	Net Cash-Flow to District	Cumulative Cash Flow
Installation	$ 73,257	$ 65,057	$ 690		$ -	$ 32,354	$ 171,359					$ -
1	$ 73,257	$ 86,743	$ 1,151	$ 47,690	$ 250,500	$ 53,923	$ 513,264	$ 658,023	$ 19,000	$ 677,023	$ 7,600	$ 7,600
2	$ 74,869	$ 88,825	$ 1,176	$ 47,690		$ 54,031	$ 266,591	$ 258,991		$ 258,991	$ 7,600	$ 15,200
3	$ 76,516	$ 90,957	$ 1,202	$ 22,090		$ 54,139	$ 244,904	$ 237,304		$ 237,304	$ 7,600	$ 22,800
4	$ 78,200	$ 93,140	$ 1,228	$ 22,090		$ 54,247	$ 248,905	$ 241,305		$ 241,305	$ 7,600	$ 30,400
5	$ 79,920	$ 95,375	$ 1,255	$ 22,090		$ 54,355	$ 252,996	$ 245,396		$ 245,396	$ 7,600	$ 38,000
6	$ 81,678	$ 97,664	$ 1,283	$ -		$ 54,464	$ 235,089	$ 227,489		$ 227,489	$ 7,600	$ 45,600
7	$ 83,475	$ 100,008	$ 1,311	$ -		$ 54,573	$ 239,367	$ 231,767		$ 231,767	$ 7,600	$ 53,200
8	$ 85,312	$ 102,408	$ 1,340	$ -		$ 54,682	$ 243,742	$ 236,142		$ 236,142	$ 7,600	$ 60,800
9	$ 87,188	$ 104,866	$ 1,370	$ -		$ 54,792	$ 248,216	$ 240,616		$ 240,616	$ 7,600	$ 68,400
10	$ 89,107	$ 107,383	$ 1,400	$ -		$ 54,901	$ 252,790	$ 245,190		$ 245,190	$ 7,600	$ 76,000
11	$ 91,067	$ 109,960	$ 1,430	$ -		$ 55,011	$ 257,468	$ 249,868		$ 249,868	$ 7,600	$ 83,600
12	$ 93,070	$ 112,599	$ 1,462	$ -		$ 55,121	$ 262,252	$ 254,652		$ 254,652	$ 7,600	$ 91,200
13	$ 95,118	$ 115,301	$ 1,494	$ -		$ 55,231	$ 267,145	$ 259,545		$ 259,545	$ 7,600	$ 98,800
14	$ 97,211	$ 118,069	$ 1,527	$ -		$ 55,342	$ 272,148	$ 264,548		$ 264,548	$ 7,600	$ 106,400
15	$ 99,349	$ 120,902	$ 1,561	$ -		$ 22,181	$ 243,993	$ 236,393		$ 236,393	$ 7,600	$ 114,000
16	$ 101,535	$ 123,804	$ 1,595	$ -		$ -	$ 226,934	$ 219,334		$ 219,334	$ 7,600	$ 121,600
17	$ 103,769	$ 126,775	$ 1,630	$ -		$ -	$ 232,174	$ 224,574		$ 224,574	$ 7,600	$ 129,200
18	$ 106,052	$ 129,818	$ 1,666	$ -		$ -	$ 237,535	$ 229,935		$ 229,935	$ 7,600	$ 136,800
19	$ 108,385	$ 132,934	$ 1,703	$ -		$ -	$ 243,021	$ 235,421		$ 235,421	$ 7,600	$ 144,400
20	$ 110,769	$ 136,124	$ 1,740	$ -		$ -	$ 248,633	$ 240,989		$ 240,989	$ 7,644	$ 152,044
Totals	**$ 1,889,104**	**$ 2,258,713**	**$ 29,214**	**$ 161,650**	**$ 250,500**	**$ 819,345**	**$ 5,408,526**	**$ 5,237,482**	**$ 19,000**	**$ 5,256,482**	**$ 152,044**	

2.4 Incentives and Rebates

A variety of incentive and rebate programs were evaluated during the development of the Project. Based upon the scope of this project and discussions with the utility rebate program administrators, the following rebates are currently included:

Incentive/Rebate Summary

ECM Description	Incentive / Rebate Type	Source	Estimated Rebates
LED Lighting	Prescriptive Rebate	PSE&G	$ 19,500
Building Envelope & Insulation	Custom Rebate	PSE&G	$ 24,673
Optimize BAS Schedules & Setpoints	Custom Rebate	PSE&G	$ 101,220
New JCI BAS	Custom Rebate	PSE&G	$ 18,628
Demand Controlled Ventilation	Custom Rebate	PSE&G	$ 11,519
Advanced Air Purification	Custom Rebate	PSE&G	$ 18,514
Micro CHP	Investment Tax Credit (ITC - Direct Pay)	Federal	$ 56,446
			$ 250,500

All rebates and incentives are subject to program terms, conditions, approvals, and availability of funds. All rebates will be applied for by Schneider Electric on behalf of the District, with all rebate funds being sent directly to Florence Township School District.

3.0 Facility Descriptions and Energy Conservation Measures

3.1 Facility Descriptions

Memorial High School (MHS)

Memorial High School is a 132,702 square foot facility, built in 2005, that consists of classrooms, administrative offices, gymnasiums, locker and weight rooms, an auditorium, media center, kitchen, cafeteria, and other educational spaces. The facility is heated and cooled by equipment that is mostly original to building construction. The facility has a high utility spend when considering costs per square foot. HVAC equipment is aging and in need of recommissioning, repair and in some cases replacement. Memorial HS has experienced a lot of humidity issues, which have been present since the construction of the building. There are two air-cooled chillers on the roof, along with most of the airside HVAC equipment (RTUs, AHUs, and ERUs). There is an abandoned ice thermal energy storage system that has been valved off.

Riverfront Middle School (RMS)

Riverfront Middle School is a 138,377 square foot school that originally served as the High School for Florence Township. The first section of the building was constructed in 1951, but additions were made in 1963 and 1993. It consists of classrooms, administrative offices, a multipurpose room used as an auditorium and cafeteria, gymnasium, locker rooms, a media center, and other educational spaces. The facility is heated by hot water boilers that were installed in 2024, where steam boilers previously existed. Some spaces are also cooled. Some electrical equipment in the building is original to the 1951 construction. Cooling coils in air handling equipment are mostly operating on R22 refrigerant, the production of which has been phased out in the United States. Some outdoor condensing units have failed and are no longer operational. Most classrooms are served by UVs.

Roebling Elementary School (RES)

Roebling Elementary School is a 61,648 square foot facility that was constructed in 1914 with an addition in 1993. The building consists of classrooms, a multipurpose room, library, kitchen, and administrative offices. Heating is provided by hot water boilers installed in 1993. Cooling is provided to some classrooms by portable AC units or window units. Each classroom has a heating-only unit ventilator. Some spaces, such as the offices and multipurpose room, have AHUs with DX coils. Most, if not all HVAC equipment have passed their useful life expectancy. There is not building automation system at RES.

Admin Building

The Administration Building, housing the Board of Education, is a 2400 square foot building located adjacent to Riverfront MS. It has offices plus a conference room, and is fed electrically from the RMS building but it has its own gas meter. Because of the shared electric meter, the Admin Building energy usage is shown as part of RMS.

Transportation Center

The Transportation Center is located adjacent to Memorial HS. It is a 2800 square foot metal building, also constructed in 2005. This facility also has a high utility cost per square footage, though the overall energy budget impact is small since the building is small. It is mostly a two-bay garage with an office and break room.

More comprehensive facility descriptions with equipment sizes, quantities, and capacities are available in the LGEA Reports [see Appendix 6.3 – Local Government Energy Audit (LGEA)].

3.2 ECM Descriptions

Please see the following descriptions of ECMs currently included in the project. Reference Appendix 6.2 – Preliminary Mechanical Designs and Appendix 6.4 – Scope of Work Details for additional project scope details.

1. LED Lighting & Controls

During Schneider Electric's energy audit, the lighting was converted to LEDs at Riverfront MS and Roebling ES by the District under a separate agreement, independent of the ESIP. These lights were retrofitted to LEDs just before Florence went out for an ESIP RFP. The LGEAs were completed while the lighting was still fluorescent, but soon after, many of the lights were retrofitted to LED. During the IGA process, Schneider Electric performed an audit of all the lights at Memorial HS, Admin, and Transportation Center buildings, in order to develop a scope of work to ensure the remainder of the District's lighting was retrofitted to LED. Retrofitting the lights to LEDs at these three sites are the scope of work for this Energy Savings Plan.

All of the site lighting at Memorial HS is on 24/7. This ECM will also correct the run-hours for the exterior lighting, so the lights are on only when needed.

Please see Appendix 6.4 for a detailed line-by-line of the lighting scope of work and cutsheets for this project. The lighting line-by-lines for 3rd party LED work are provided as well, and was used to calculate lighting savings. The LED upgrade work at RMS and RES was completed at the end of 2022.

Savings Methodology

Energy unit savings for the lighting upgrades are calculated by the difference in lighting energy consumption from before the baseline to the post-retrofit timeframe. Electric energy and demand savings were run through Schneider Electric's rate tariff simulation tool to arrive at annual energy cost savings, rather than using a blended or average utility rate, resulting in a more accurate representation of cost savings. A natural gas heating penalty is included for lighting, due to the reduced heat output from LED lamps.

2. Building Envelope & Insulation

Building Envelope

This ECM addresses the shell of the building and how well it is keeping conditioned air in and ambient air out. During the IGA, we performed an onsite building envelope audit to identify and measure what specific improvements could be made to each site. Our onsite testing and analysis of energy consumption indicate there is an opportunity to improve the indoor air quality, occupant comfort, and reduce energy use by upgrading the existing air barrier systems. A detailed description of the scope, with measurements and floor plan layouts is in Appendix 6.4 – Scope of Work Details.

A tighter building envelope will provide the following benefits for Florence:

- Drafts will be reduced providing greater comfort for the building occupants. A tighter building envelope will lower the possibility of "hot" or "cold" spots from unconditioned air infiltrating into conditioned spaces.
- Decreased Energy Consumption - Less conditioned air will be lost through the building envelope and the Heating and Cooling equipment will operate less to maintain the set point of the conditioned space. This will decrease the energy consumed and save on energy costs.
- Improved Air Quality – Decreasing infiltration of contaminated air promotes less humidity and greater air quality. This allows for the existing systems to run at peak performance and maintain the highest level of air quality for the occupants.
- Reduced Maintenance Costs – Reducing the "runtime" will increase the operating life of the heating and cooling equipment and increase the performance of new equipment.

The descriptions below describe the specific findings and improvements as part of the scope:

- Attic Bypass Sealing – Interior walls, plumbing, electrical, and HVAC penetrations entering the attics that are not properly sealed allow conditioned air to escape into the vented attic space. Since warm air rises, sealing the attic from the conditioned space is crucial to maintaining an efficient building. Air movement through fibrous insulation reduces the effectiveness of the existing insulation.
  - Install Attic Access Hatch – The ladder interferes with the attic hatch setup at the Roebling Elementary School attic. A new hatch should be constructed for an airtight attic access assembly.
  - Install Soffit Baffles – Install soffit baffles/propavents at full perimeter of the attics as indicated on floor plans. Materials are to be installed to prevent blockage of current attic ventilation by new attic flat insulation.
- Attic Flat Insulation – Attic insulation is crucial for controlling conductive heat loss in a building. After air gaps are sealed and convective air loss is reduced the biggest remaining form of heat loss becomes conduction. Under-insulated surfaces at Roebling ES result in excessive energy loss due to the lack of a properly insulated thermal barrier.
- Door Weather Stripping – Deteriorated weather-stripping materials, ineffective weather-stripping installation and daylight showing at the perimeter of door systems create direct pathways for unwanted infiltration/ exfiltration throughout the school district.
- Overhang Air Sealing – Overhangs are roofs, floor systems or areas above entryways that extend beyond the plane of the exterior wall system. These areas of construction at Riverfront MS were misunderstood by builders and the cavity that extends beyond the plane of the exterior wall system was incorrectly "connected" to the interior heated spaces of the building in many locations. Overhangs that are not properly sealed at the plane of the surface that should separate the conditioned space from the outdoors lead to excessive air leakage and heat loss at these vulnerable areas in the building envelope.

- Overhead Door Weather Stripping/ Roll-up Door Weather Stripping – Remove existing weather stripping and replace with new commercial grade weather stripping to create a full air seal around the door. With existing materials in place, overhead and roll-up doors are a major air leakage source.
- Roof-Wall Intersection Air Sealing – The roof-wall intersection is regularly an area that allows unwanted air leakage through the building shell. Exterior flashing and finish details at this area are not constructed to stop air leakage (exterior flashings are for water control, not air control); unsealed exterior flashing details combine with interior gaps in the framing between the roof and wall assembly to allow infiltration/ exfiltration.

Task	Roebling ES	Riverfront MS	Memorial HS	Transportation	Total
Attic Bypass Air Sealing (SF)	10,190				10,190
Attic Flat Insulation (SF)	10,190				10,190
Door - Install Jamb Spacer (Units)		1	35	3	39
Door Weather Striping - Doubles (Units)	8	16	17		41
Door Weather Stripping - Singles (Units)	3	10	18	3	34
Install New Attic Hatch (Units)	1				1
Overhang Air Sealing (LF)		41			41
Overhead Door Weather Stripping (Units)			2		2
Roll-Up Door Weather Stripping (Units)		1		2	3
Roof-Wall Intersection Air Sealing (LF)		762			762

Savings Methodology

Savings for this ECM are derived by observing and measuring the size of openings or gaps in the building envelope and applying the ASHRAE 90.1 Crack Method. Annual energy and cost savings for this measure are listed by building in the Savings Table in Section 4.2 of this report.

Hot Water Pipe Insulation

When Florence replaced the steam boiler plant at Riverfront MS with a new hot water boiler plant in 2023, most of the piping and appurtenances from the installation were not insulated. There is a number of valves, fittings, and other materials in the Roebling ES boiler plant that are also un-insulated. As part of the ESIP scope of work, the following items would be insulated to reduce the heat losses to the mechanical room space.

Task	Roebling ES	Riverfront MS	Total
3-Way Valve Insulation (Units)		2	2
Ball Valve Insulation (Units)	6	6	12
Bonnet Inuslation (Units)		7	7
Butterfly Valve Insulation (Units)	8	3	11
Check Valve Insulation (Units)	3	4	7
End Cap Insulation (Units)	4	8	12
Flange Insulation (Units)	33	46	79
Flex Fitting Insulation (UT)		2	2
Flo-Check Insulation (Units)	1	2	3
Gate Valve Insulation (Units)		10	10
Pipe Fitting Insulation (Units)	3	37	40
Pipe Reducer Insulation (Units)	1	5	6
Pump Insulation (Units)	5	2	7
Steam Trap Insulation (Units)		4	4
Straight Pipe Insulation (LF)	7	156	163
Strainer Insulation (Units)	6	6	12
Suction Diffuser Insulation (Units)	4	2	6
Tank Insulation (Units)		4	4

Savings Methodology

Savings for this measure are derived by identifying appurtenances throughout the District that were not insulated. The pipe diameter, piece of equipment, fluid type, proposed insulation thickness, proposed insulation type, total length, and annual heating hours were used to predict energy savings for insulation needed throughout the building. Annual energy and cost savings for this measure are listed in the Savings Table in Section 4.2 of this report.

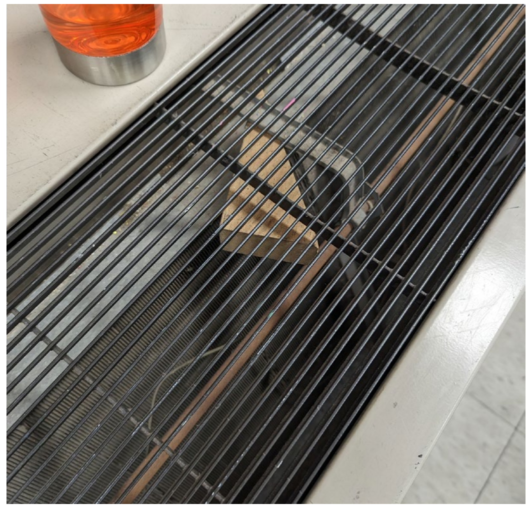
3. New Unit Ventilators w/ VRF Cooling and Building Automation System

Roebling ES has (35) unit ventilators (UVs) with HW coils throughout the school that were installed in 1993, so they are 31 years old. The entire building lacks building automation controls, including thermostats to control the UVs. Occupant comfort is a serious concern at Roebling. There are no HW valves on the UVs, so when the boiler is on, the heat to the entire building is on. Teachers manually turn the UVs on/off with the unit's toggle switch when the space temperatures get too high. And their next course of action, when the hot water is still being pumped through the UV coil and the fin-tube radiators in each classroom, is for teachers to open the windows to help cool the room. Many of the UV dampers or actuators are broken or disconnected as well. As you can imagine, temperature control is nearly impossible in Roebling. Proper ventilation is also a challenge because of the manual control of fans and windows.

This ECM will replace (27) UVs at Roebling ES, leaving the (8) UVs on the ground floor/basement in place and operational as they currently exist. The ECM scope of work will see the UVs demolished and new UVs with VRF cooling installed. Each UV will still have a hot water coil, but that HW coil will be the secondary stage of heating. The primary heat will come from the electric VRF system. We anticipate needing 6 condensing units that will serve all of the UVs in the building. New BAS controllers will be installed with the new UVs. There is some new electrical work required because of the added DX load, so panelboard and wiring changes are included in the scope. A more detailed scope of work is specified below.

New Work – Unit Ventilators:

- New unit ventilators with hot water coils and VRF coils will be installed in the place of the removed UVs.
- Highlights of the new UVs specifications:
  - Economizer dampers for fresh air ventilation to the space
  - Electronically commutated (EC) fan motor for variable airflow with maximum energy efficiency
  - HW coil in reheat position for active dehumidification
  - VRF DX cooling coils
- New UVs will be connected to the electrical, hydronic heating piping, and outside air (OA) louvers from the removed UVs.
- New VRF DX condensing units will be installed, with refrigerant piping connected to new UVs. Condensing units will be installed on grade with equipment pads or on approved supports on the roof, as indicated in the mechanical sketches in Appendix 6.2 Prelim Mechanical Designs.
  - Crane hoists and roof cutting and patching as required for condensing units installed on the roof.
- New BAS controls will be installed in the new UVs.
- A new heating valve and actuator will be installed in each UV to control the heat supplied to the space.
- A new economizer damper and actuator will be included in each UV.
- Electrical work required for the new UVs and condensers is included.
- Carpentry, plus typical patching and painting of areas surrounding of new UV to match interior space.
- Perform air and water balancing of new equipment.
- Startup and commission UVs and all related controls and devices.
- Provide training to Florence maintenance staff on operation and maintenance of the new equipment.

	
Typical UVs, installed in 1993 with many non-working components.	

Exhaust and ventilation scope is included in this ECM, to ensure proper and adequate ventilation for each space. Details on the ventilation scope is included in Appendix 6.2 Prelim Mechanical Designs. A pre-TAB survey was performed on the UVs at Roebling ES to verify the amounts of fresh air being brought into the building through the UVs. The pre-TAB findings clearly indicated that the OA intakes were taking in much less air than designed. There were contributing factors to this, including: open windows in most classrooms, UVs being powered off by occupants due to overheating, and inoperable dampers within the UVs. Because of these pre-TAB findings, an outside air baseline adjustment was implemented to simulate energy models as though the proper amount of fresh air was being introduced into the classrooms through the UVs.

Viconics thermostats will be added to the eight basement floor UVs that are not being replaced in order to have those UVs connected to the new Building Automation System, and to be controlled by the same occupancy schedules as the rest of the building. These controls will also give Florence monitoring capabilities for these spaces.

Savings and Savings Methodology

Savings for this measure are derived by identifying existing unit ventilators throughout the District that were past their useful life. The existing fan size and cooling efficiency were gathered (if applicable - window or portable AC units), and the proposed unit ventilators were then identified to provide sufficient heating and cooling to the space. Savings were calculated by including the increased fan size for the proposed unit ventilators together with the increased efficiency of the proposed UVs. The increase in efficiency, as compared to the existing window A/C unit, provides a positive energy savings. Gas savings would be achieved by the use of electrical VRF as the primary heating source, rather than the hot water boilers and coils. Annual energy and cost savings for this measure are listed by building in the Savings Table in Section 4.2 of this report.

4. Boiler Plant Upgrades and New Domestic Water Heater

Boiler Plant Upgrades

The Roebling ES boiler plant consists of two 4640 MBH hot water boilers, with five zone pumps that distribute the hot water throughout the building. There are currently no building automation controls on the boiler plant; it runs to maintain 180°F temperature setpoint, and the zone pumps operate when the boiler is on. The building gets full heat whenever the boiler is running, with no temperature modulation or controls. With the UV upgrades described in ECM #3, it is critical to get control of the boiler plant equipment to properly control the building comfort levels. This ECM will add boiler plant controls that will work with the new BAS being installed in ECM #3. Hot water reset of the boilers, with automatic mixing valves and bypass valves for each zone are required as well.

There are five condensing hot water boilers in the Memorial HS boiler plant, but they do not have acid neutralization kits installed. The acidic condensate leaks out of the stack pipe and onto the floor and eventually down the floor drain. Irreparable damage is being done to the drain pipes, but in an effort to stop any more damage from occurring, this ECM will install acid neutralization kits to properly manage and treat the stack condensate.

Savings and Savings Methodology

Savings for this measure are the result of increasing boiler system efficiency with the addition of hot water reset controls, which reduce the heating energy required to deliver a decreased hot water temperature to the system. Annual energy and cost savings for this measure are listed by building in the Savings Table in Section 4.2 of this report. There are some O&M savings associated with the acid neutralization kit measure.


Damage from boiler stack condensate seen at each condensing boiler and floor drain.

New Domestic Water Heater

In the 2nd floor mechanical room of Riverfront Middle School, there is a 180 MBH Lochinvar domestic hot water generator that serves the kitchen and most of the building's domestic hot water usage. This hot water generator is twenty years old and at the end of its useful life. This hot water generator will be replaced with a more efficient unit, and still utilize the new storage tank next to it.

Old domestic hot water generator next to new storage tank.

Savings and Savings Methodology

Savings for this measure are derived by comparing the existing water heater efficiency to the new water heater efficiency rating, leading to some fuel savings. Annual energy and cost savings for this measure are listed by building in the Savings Table in Section 4.2 of this report.

5. Optimize Ventilation and Advanced Air Purification

Optimize Ventilation Rates

Memorial High School was built in 2005 and its HVAC equipment is mostly original to construction, making most of it 19 years old. The building was constructed off the building code at the time, but new building codes are quite a bit different in some aspects. One such area is ventilation requirements. This ventilation optimization ECM for Memorial HS would bring the ventilation rates in line with current building codes (2021 NJ Ventilation Code), using the existing HVAC and BAS equipment. This exercise would be largely a Test, Adjust, and Balance (TAB) effort to properly measure and set outside air (OA) flow rates to current standards.

Across the (26) units that can be re-balanced for OA and EA, a total of 23,000 cfm of OA can be reduced from current operating conditions. This will yield significant energy and cost savings for Florence Township School District.

Typical RTU or AHU that can be re-balanced to optimize ventilation rates to code levels.

Savings and Savings Methodology

Savings for this measure are derived from the difference in pre-TAB flow measurements and final TAB airflow measurements. Current savings are estimated using the design airflow measurements and the TAB report from when the building was commissioned. Annual energy and cost savings for this measure are listed by building in the Savings Table in Section 4.2 of this report.

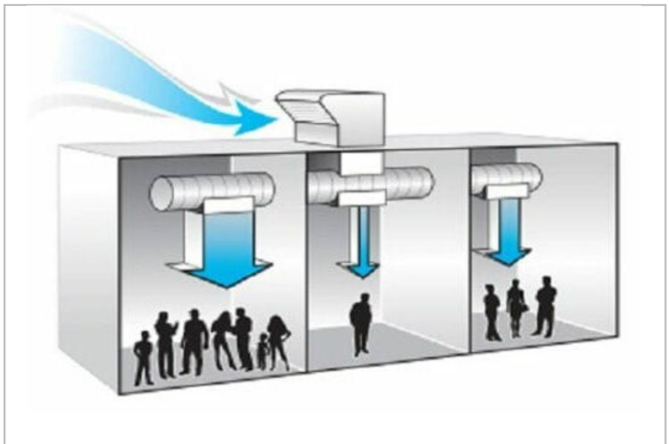
Demand Controlled Ventilation

Conditioning outdoor air (both heating and cooling) is one of the single largest energy-consuming tasks for a building. Any space that uses more ventilation than its occupancy levels require, results in excess energy usage to condition that outdoor air unnecessarily. HVAC systems are designed to provide a specified quantity of ventilation air corresponding to the maximum occupancy conditions for the space served. However, there are periods throughout the day when spaces within the building may be partially occupied or even unoccupied (such as gyms and cafeterias), yet ventilation rates are maintained at the maximum level, as though it were fully occupied. Demand Controlled Ventilation (DCV) can greatly reduce the energy consumed by the HVAC system by providing the right level of ventilation based on occupancy.

DCV is a ventilation control strategy that measures the carbon dioxide levels in a space (CO_2 is a great indicator of occupancy) and uses that measurement to adjust the amount of outdoor air supplied to a space at any given time. This strategy continuously adjusts the ventilation rate as dictated by ASHRAE ventilation requirements. By ventilating the space only as required, the energy and associated costs spent to heat and cool outdoor air are reduced.

DCV will be implemented at Memorial High School's large rooms that also have highly variable and unpredictable occupancy. DCV scope areas are:

- Media Center
- Auditorium
- Cafeteria
- Gym
- Auxiliary Gym



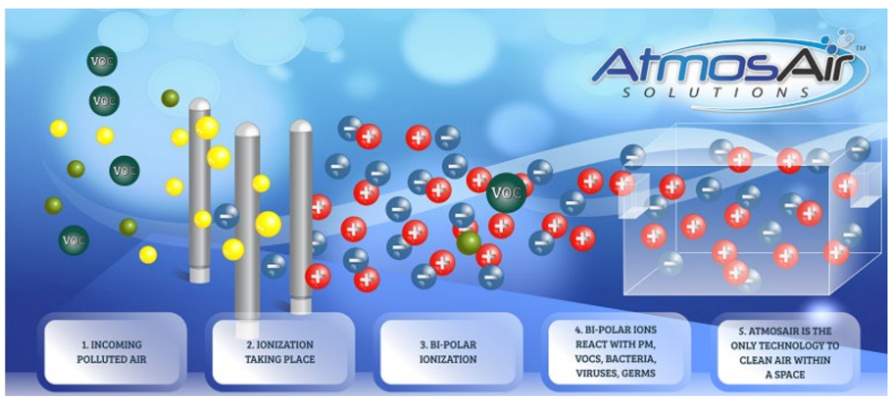
Demand controlled ventilation varies outside air rates based on building occupancy. Blue arrows indicate amounts of fresh, outdoor air.

Savings and Savings Methodology

Savings for this measure are derived by modifying the volume of outside air delivered to the space within the building models created based on the anticipated variability of space occupancy. Annual energy and cost savings for this measure are listed by building in the Savings Table in Section 4.2 of this report.

Bi-Polar Ionization (Air Purification)

Bringing in fresh outside air is a code requirement for buildings to remain healthy for people to occupy. Reducing the outside air flow rates, when permissible, and installing air purification technology will reduce particulate matter, volatile organic compounds, pathogens, other VOCs, and will create a healthier indoor environment. One such method is bi-polar ionization (BPI). A BPI device will be installed in each new classroom unit ventilator, plus some split system air handling units. Bi-polar ionization allows less outside air to be brought into the building because of the enhanced air purification performed by the BPI device. BPI will provide two critical benefits for Florence:



Atmos Air is a reputable manufacturer of air purification technology we have used in many buildings across the country, many including schools.

- Improved indoor air quality
- Energy and cost savings from bringing in less OA

A small device will be installed in the airstream. This device will consume a small amount of power to generate ions. These ions will bond to particulate molecules in the space, and these bonded ions become heavier than air and fall out of the air, or increase in size so they are much more likely to be captured in the HVAC unit's air filters.

BPI Scope at Roebling ES:

- (27) UVs [1st and 2nd floors]
- (2) Split systems

Savings and Savings Methodology

Savings for this measure are derived by modifying the ventilation requirements (cfm/person, cfm/sqft) for each unit to optimize Indoor Air Quality Procedure (IAQP). This uses concentrations of pollutants to determine the outdoor air requirement. Based on space type and number of people certain pollutants will be generated at difference rates. This allows the reduction of outdoor air from the existing Ventilation Requirement Procedure (VRP). The VRP uses a standardized cfm/person and cfm/sqft to calculate the required outdoor air. The difference of VRP and IAQP is what can be recognized as the bi-polar ionization reduction percentage. Annual energy and cost savings for this measure are listed by building in the Savings Table in Section 4.2 of this report.

6. New/Upgrade Building Automation System

Opportunities exist in each Florence facility to improve the operation of space conditioning equipment. The District's schools are mostly scheduled occupied 24/7 because the equipment is so old and unreliable, that turning equipment on/off and having setup and setback temperatures cause too many issues for school staff.

Implementing schedules, consistent heating and cooling setpoints, and setup and setback controls will provide significant energy and cost savings for Florence. The most effective way to save energy is to turn off equipment when it is not needed. The District will realize O&M savings due to this BAS optimization scope because there will be less wear and tear on the equipment with much shorter daily run times.

Roebling ES

There will be a new Building Automation System (BAS) at Roebling, which is tied into the new UVs being installed. As stated in previous ECMs, the boiler plant will be included in the new BAS as well. The basement UVs will not receive a full BAS control system because they are not being replaced, however these UVs will receive Viconics thermostats so they can communicate with the rest the BAS and be scheduled and monitored through the new BAS. Also included in the new BAS scope is replacing the existing controls on AHU.3 that serves the all-purpose room. The controls for this AHU will match the new BAS being installed. There is no BAS currently installed at this school.

Riverfront MS

Currently, the BAS runs almost 24/7, so there are great opportunities for savings. The existing Johnson Controls BAS will have the schedules and setpoints optimized according to mutually-agreed-upon terms between the District and Schneider Electric to achieve the most energy savings, while still having realistic control parameters.

Memorial HS

Currently, the BAS runs 24/7, so there are great opportunities for savings. The existing Johnson Controls BAS will have the schedules and setpoints optimized according to mutually-agreed-upon terms between the District and Schneider Electric to achieve the most energy savings, while still having realistic control parameters.

Admin

The Admin AHUs are controlled by programmable thermostats; however the staff doesn't know the password to adjust the parameters. The time clock is also off, which makes the installed schedule inaccurate. Installing new programmable thermostats and setting the schedules and setpoints consistent with the rest of the schools will yield some energy savings.

Transportation Center

The UVs and FCUs at the Transportation Center are controlled by programmable thermostats. One of the thermostats is broken as well. Installing new programmable thermostats and setting the schedules and setpoints consistent with the rest of the schools will yield some energy savings.

Savings and Savings Methodology

Savings for this measure are derived by modifying the existing fan schedules that are operating in the on position constantly. The excess fan usage along with the inability to incorporate setback temperatures allowed each building to recognize energy savings by establishing a setback temperature when spaces are unoccupied. They will also have reduced run hours to turn the fans off when the spaces are unoccupied. Annual energy and cost savings for this measure are listed by building in the Savings Table in Section 4.2 of this report.

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7. Micro Combined Heat & Power (mCHP)

Traditional fossil fuel burning power plants are limited to a thermal efficiency of electricity production of approximately 40%. The remainder of the thermal energy produced by burning fossil fuels is lost to internal process demands or rejected from the system through cooling towers or other means which heat the atmosphere. On-site power generation provides the opportunity to recover useful waste heat that would otherwise be lost to the atmosphere. A combined heat and power system uses natural gas to drive an engine which generates electricity, and then uses the waste heat from the system to provide heat to the building.

Axiom mCHP unit that consists of a reciprocating engine to generate electricity, and using the waste heat from the jacket.

A mCHP system would be installed at Riverfront MS to generate electricity, while simultaneously using the waste heat for the domestic water heating system. mCHP does save energy by reducing losses in the electricity-generation process from utility providers, while also using the waste heat from the combustion process, and using it within the building to help offset the load on the domestic water heater. Per equivalent energy unit, the cost of electricity from a utility is higher than the cost for natural gas from the utility. So the main benefit from CHP comes from the cost savings of using natural gas to generate electricity onsite and utilizing the waste heat to further increase heating efficiencies, rather than purchasing electricity from the utility.

The mCHP unit will be installed near the new water heater mentioned in ECM #4, and these two domestic water heating units will work together to create domestic hot water as efficiently as possible. The mCHP will be integrated into the Building Automation System for monitoring purposes as well. It is a 4.4 kW mCHP with a 42 MBH output with 93% overall efficiency. Please see Appendix 6.2 Preliminary Mechanical Sketches for more detail on the scope.

The table below shows the emissions calculations related to just the mCHP scope, using the BPU protocols.

Therms Savings	kWh Savings	Emission Product	Emission Reduction (lbs)
-695	17,702	CO_2	16,191
		NO_x	13
		SO_2	17

The emissions reductions are calculated based on the following factors, based on BPU protocols.

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

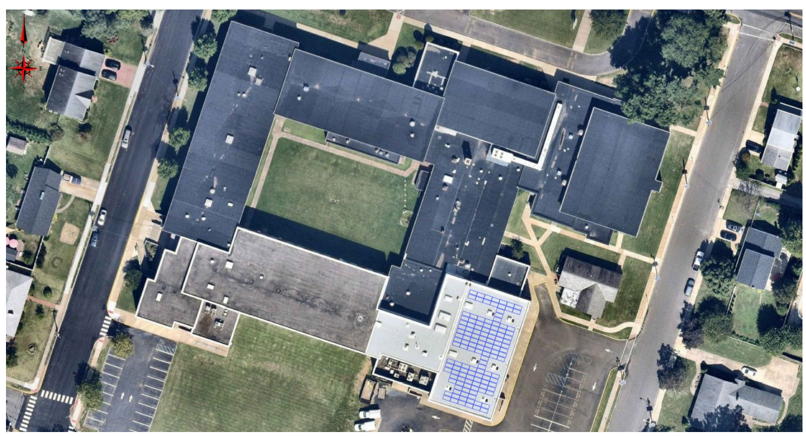
Savings and Savings Methodology

Savings for this measure are derived by incorporating the mCHP into the existing domestic water heating plant. The mCHP boiler will function as the primary water heating source. The annual electric savings are calculated by using the heating operating hours along with the mCHP Part Load Ratio to provide electricity with the 4.4 kW generator. Annual energy and cost savings for this measure are listed in the Savings Table in Section 4.2 of this report.

8. Solar PV Power Purchase Agreement

Florence Township School District went out for RFP for a Power Purchase Agreement for Solar at two sites, Memorial HS and Riverfront MS. PSE&G had put a non-export restriction on the solar for these locations, so the solar development was decreased from typical design parameters. The system designs below was developed by the company that was awarded the PPA RFP, HESP Solar. Savings are achieved by paying the PPA company a reduced rate for the electricity that is generated onsite, compared to the brown power rate from PSE&G. Some demand savings are included in the solar savings.

Schneider Electric performed their own calculations for production, degradation, and savings based on the HESP design in their proposal. HESP Solar and Florence Township School District have agreed to terms on the PPA already, with construction supposed to be completed in 2024, including Permission-To-Operate.

Solar PV layout at Memorial HS, per HESP proposal	
Solar PV layout at Riverfront MS, per HESP proposal	

Building	PV Size (kW DC)	Est. Production (kWh)	PPA Rate ($ / kWh)	Calculated Savings (Year.1)	Calculated Savings (15 Yrs)
Memorial HS	510	602,915	$0.0550	$47,948	$728,562
Riverfront MS	65	82,851	$0.0550	$5,975	$90,783
Total	**575**	**685,766**	**$0.0550**	**$53,923**	**$819,345**

**15-year cumulative savings are escalated per BPU electric rate guidelines, but also negatively escalated for PPA annual rate increases (1.5%) and 0.5% production degradation annually.*

Customer-Driven Projects with Energy Savings

LED Lighting

Florence Township School District hired a contractor to retrofit their lights at Riverfront MS and Roebling MS at the end of 2022. Since this scope of work occurred after the baseline period, and was ongoing during the ESIP RFP and IGA process, the energy savings from this scope were included in the ESIP savings. The LGEA reports provide a lighting line-by-line of what existed prior to this LED retrofit. A line-by-line was provided by the lighting retrofit company for the scope at RMS and RES. From these audits and line-by-lines, we can accurately estimate the lighting savings at each building.

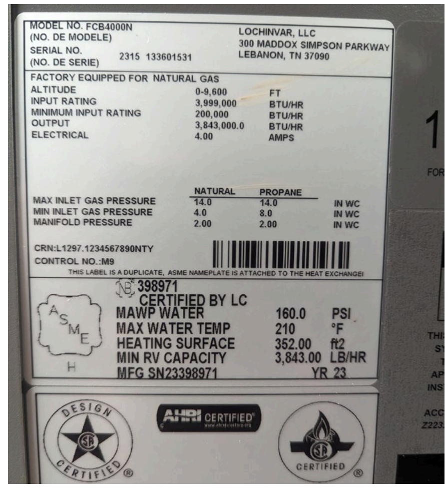
Savings and Savings Methodology

Energy unit savings for the lighting upgrades were calculated using data collected from lighting audits. Electric energy and demand savings were then run through Schneider Electric's rate tariff simulation tool to arrive at annual energy cost savings.

Replace Steam Boiler Plant with Hot Water Boiler Plant

In the summer/fall of 2023, Florence had their steam heating plant at Riverfront MS demolished and replaced with a hot water boiler plant by a 3rd party contractor. Because this upgrade occurred after the baseline period, the savings from this boiler plant upgrade are included in the ESIP savings. We have documentation and photos of what existed prior to the upgrade, as Schneider Electric had already visited the facilities numerous times and had created an energy baseline from this existing equipment before it was changed out. We have also documented the new boiler plant equipment that was installed. The table below details the before and after details.

Old Boilers	New Boilers
(2) Weil McLain 4640 MBH output *steam boilers*	*(2) Lochinvar* 3843 *MBH* output *hot water boilers*
	

Old Boilers	New Boilers
(2) Weil McLain 4640 MBH output *steam boilers*	*(2) Lochinvar* 3843 *MBH* output *hot water boilers*
	

Savings and Savings Methodology

Savings for this measure are derived by modifying the operating efficiency and boiler type of the heating equipment within the model. Energy and cost savings for this measure shown in the Savings Table in Section 4.2 of this report.

3.3 Optional ECMs

The following opportunities were identified and investigated during the Investment Grade Audit but are not currently included in the Energy Savings Plan.

1. **LED Lighting Controls –** Install lighting controls to further save on energy costs. Additionally, dimming controls on the LED light bars to reduce the light levels where they are very high.
2. **HVAC Upgrades** – Unit ventilators at Riverfront MS and Roebling ES were identified as potential ESIP scope. Replacement of the FCUs at Memorial HS were developed to meet some of Florence's needs as well.
3. **Boiler Replacements –** Replacement of the boiler plant at Roebling, including all HW equipment within the boiler room was developed, but ultimately removed from the scope of work. Replacing the boilers at Memorial HS was investigated as well.
4. **Replace Chillers –** Replacing the two air-cooled chillers on the Memorial HS roof was looked at for possible energy-saving scope, but wasn't included in the final ESIP project.
5. **Repair or Replace Ice Thermal Storage System –** Schneider Electric investigated the repair and replacement of the ice TSS at Memorial HS, but decided not to include it in the final project scope.
6. **Replacing AHUs –** Replacement of split system AHUs, ERUs, and RTUs was investigated at every school, but these HVAC replacements or repairs did not make the final project scope of work.
7. **DX Equipment Refurbishment –** Cleaning and coating DX coils was investigated for savings, but not ultimately included in the final ESIP scope.
8. **Building Ventilation Systems –** Replacement of the failed exhaust fans at RMS was developed during the IGA. Upgrading the ventilation and exhaust systems at Roebling, especially the basement level that had to be value-engineered out, were developed during the IGA. Ventilation improvements, such as DCV, BPI, and other upgrades and replacements were partially developed but not included in the ESIP scope.
9. **Building Automation Controls –** Many different scope items related to BAS controls were investigated as part of the IGA; including but not limited to a new BAS system throughout the District, upgrading the firmware and graphics for the existing BAS, tying the BAS into occupancy controls, and upgrading the existing controls with new HVAC equipment.
10. **Envelope and Attic Capital Project –** Comprehensive attic envelope scope at Admin was developed but not included in the final scope of work, including soffit baffle insulation and retrofitting the attic pull-down stairs .
11. **Direct Purchase Solar PV and Public Remote Net Metering Solar** – Because the onsite solar was limited by PSE&G's non-export restriction, direct purchase solar development stopped, and Florence went out for a Power Purchase Agreement RFP.
12. **Combined Heat & Power –** CHP was examined for different sites to become more energy efficient, but the total ECM price made this scope unachievable under current conditions.
13. **Replace Domestic Water Heaters –** Replacement of additional water heaters in-kind, with condensing water heaters, and with heat pump water heaters was developed, but isn't included in the final scope.
14. **Walk-in Freezer/Cooler Controls –** The walk-in coolers and freezers were analyzed for efficiency upgrades, however the scope was dropped to allow as much high-priority ECMs into the project as possible.

15. **Water Conservation Measures** – Water fixtures at the buildings are a mix of low flow and older higher flow fixtures and could benefit from recommissioning or replacement, however savings is not sufficient to cover the cost to perform such upgrades.
16. **Replace Electrical Infrastructure and Switchgear** – The electrical equipment at Riverfront MS is very old and desperately needs to be replaced. This scope was researched and eventually dropped because of the high price tag and lack of energy savings.
17. **Secondary Transformers –** Secondary transformers were looked at for energy efficiency replacements at each school, however the scope wasn't able to fit into the ESIP project.
18. **Diesel Engine Block Heaters –** Adding block heaters for the school buses at the Transportation Center were investigated, especially as part of the solar PV carport proposition, but this scope didn't make it into the final project.
19. **Kitchen Hood Controls –** Controls for the Memorial High School kitchen hoods and equipment.
20. **Kitchen Food Service Equipment –** MHS was looked into as a candidate for receiving new kitchen equipment, especially when a state grant opened up, but the scope just didn't align with the school's priorities.
21. **Window Replacement** – Some windows in the District are old and failing. These were looked at during development, but ultimate dropped from the scope to focus on higher priority needs.
22. **Roof Replacement –** The roofs were investigated for repair or replacement, but the cost and savings were too detrimental to ESIP project financials, so it was dropped from the scope. The roofs for all three schools are in need of replacement.
23. **Other Capital Projects –** Other priorities from Florence were investigated, such as resolving the humidity issues at MHS, replacing the auditorium stage lighting, wiring, and curtains, among other capital projects that weren't able to be part of the final ESIP scope.
24. **Curriculum and Student Learning –** Many Schneider Electric-led learning programs and curriculum materials are available to bring the benefits and knowledge of the ESIP and energy-savings behaviors and technology to students, teachers, staff, and even parents.
25. **Energy Related Scopes –** All energy-related scope items were audited and reviewed by Schneider Electric, but some were excluded from the ESIP for various reasons, including available funding and sufficient savings to pay for the scope installation.

3.4 Ongoing Maintenance

Under the New Jersey ESIP legislation, all maintenance contracts are required to be procured separately from the ESIP contract. As part of the ESIP, Schneider Electric will:

- Properly commission all new equipment provided
- Provide meaningful equipment and operational training to Florence staff for all new equipment
- Provide a comprehensive Operation and Maintenance (O&M) Manual for the District to follow
    - This will provide a roadmap of how to properly maintain the new equipment and ensure it is operating efficiently and as intended by the manufacturer and per the design documents
    - The O&M Manual will also include all warranty information

Below are expected O&M impacts for the District.

Improvement Measure	O&M Impact
LED Lighting	Reduced O&M by replacing non-LEDs with LEDs. Less frequent lamp changeouts will be required, as well as very minimal maintenance during the warranty period. Most ballasts should be removed, thus requiring less O&M in the future.
Building Envelope & Insulation	No change to current envelope maintenance.
UVs w/ DX Cooling & BAS Controls	Reduced O&M by having HVAC equipment that is 30+ years younger than existing. All UVs will be fully commissioned and started up before turning equipment over to Florence. Preventive maintenance will be required to optimize equipment performance and lifespan. These tasks will be specified in the O&M Manual. BAS controls will be fully commissioned (point-to-point) and sequences of operation will be fully verified as well. Upgrading the controls and HVAC equipment together will lead to less O&M on the classroom UVs than what is currently performed.
Boiler Plant Upgrades & New Domestic Water Heater	The boiler plant upgrades will decrease the O&M requirements by installing new devices that will protect the boiler plant equipment. A new domestic water heater will eliminate this scope from the District's planned HVAC work.
Advanced Air Purification	BPI measures do not require ongoing maintenance once they are initially installed and commissioned.
Ventilation Optimization	With TAB work being performed, it is anticipated that some repairs will be needed to existing-to-remain dampers and actuators to get the equipment in proper working order.
Building Automation System	A new BAS is being installed at Roebling ES, where a BAS doesn't currently exist. It is reasonable to expect an increased service cost from the BAS service provider with an expanded scope to maintain.
Micro CHP	This will require some additional maintenance that the District doesn't currently provide, as they do not have a micro-CHP. The O&M requirements are to change the engine oil every 4,000 hours, so the O&M tasks will not be unfamiliar to Florence. The specific O&M tasks will be clearly identified in the O&M Manual provided at project closeout, and will be covered during customer training.
Solar PV PPA	This PV system will be owned and maintained by a 3rd party, so there is no ongoing maintenance for the District.

4.0 Energy Savings

4.1 Baseline Energy Use

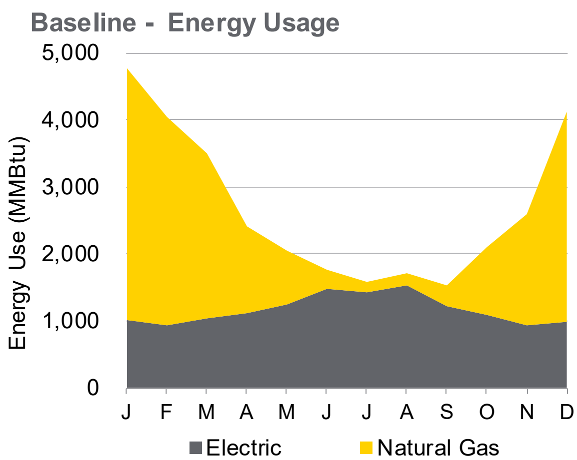
This baseline includes all facilities and was created by taking several years of utility data and utilizing the following:

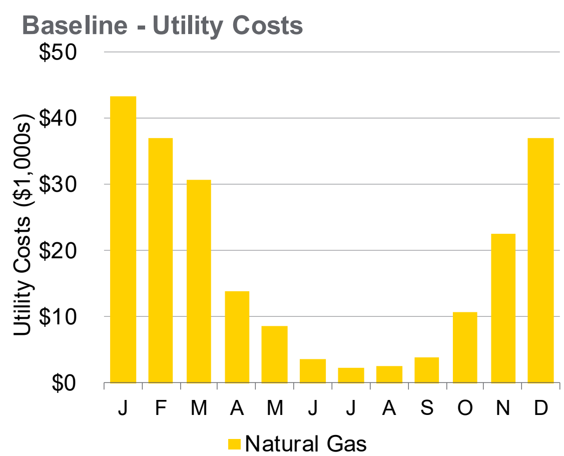
- Prorating the usage into clean monthly bins
- Weather normalizing the baseline to represent a typical meteorological year

Florence Township SD - All Sites - Baseline

	Electricity		Natural Gas		Total	
Month	Energy Use	Energy Demand	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*Therm*	*$*	*MMBtu*	*$*
Jan	299,960	799	37,366	$43,270	4,760	$75,463
Feb	277,227	860	31,025	$37,034	4,049	$66,768
Mar	302,432	887	24,641	$30,727	3,496	$61,009
Apr	326,985	1,022	12,996	$13,810	2,416	$47,392
May	367,724	1,122	7,815	$8,604	2,037	$45,123
Jun	433,547	1,072	2,808	$3,537	1,760	$55,020
Jul	416,347	980	1,563	$2,230	1,577	$54,132
Aug	448,008	1,011	1,814	$2,496	1,710	$59,838
Sept	357,078	1,077	3,052	$3,868	1,524	$59,500
Oct	316,517	952	10,163	$10,775	2,097	$54,445
Nov	272,006	840	16,730	$22,505	2,601	$60,729
Dec	288,248	733	31,271	$36,908	4,111	$74,606
Year	**4,106,079**	**11,355**	**181,244**	**$215,764**	**32,138**	**$714,026**

	Electricity		Natural Gas		Total	
Indices	kBtu/sf	W/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	43.9	3.5	56.7	$0.68	100.6	$2.24





The following charts depict the month-by-month energy baseline for each facility.

Memorial High School

Florence Township SD - MHS - Baseline

	Electricity		Natural Gas		Total	
Month	Energy Use	Energy Demand	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*Therm*	*$*	*MMBtu*	*$*
Jan	199,216	468	16,500	$21,104	2,330	$44,468
Feb	184,549	530	13,685	$18,034	1,998	$39,585
Mar	202,553	553	10,308	$14,287	1,722	$36,168
Apr	239,212	705	6,069	$7,105	1,423	$33,043
May	277,623	768	4,407	$5,118	1,388	$33,800
Jun	335,541	705	2,373	$2,763	1,382	$42,756
Jul	316,542	652	1,402	$1,695	1,221	$42,312
Aug	348,884	685	1,738	$2,059	1,365	$47,865
Sept	266,141	699	3,007	$3,427	1,209	$43,253
Oct	227,805	605	5,898	$6,585	1,367	$37,897
Nov	182,114	510	7,096	$10,485	1,331	$36,190
Dec	195,299	397	12,995	$17,139	1,966	$42,398
Year	2,975,479	7,279	85,477	$109,800	18,703	$479,736

	Electricity		Natural Gas		Total	
Indices	kBtu/sf	W/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	82.1	6.2	69.1	$0.89	151.2	$3.88

Riverfront Middle School & Admin Building

Florence Township SD - RMS - Baseline

	Electricity		Natural Gas		Total	
Month	Energy Use	Energy Demand	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*Therm*	*$*	*MMBtu*	*$*
Jan	65,469	177	13,810	$13,248	1,604	$17,617
Feb	59,756	175	11,438	$11,334	1,348	$15,193
Mar	66,308	189	8,922	$9,329	1,118	$13,434
Apr	62,493	191	4,299	$3,642	643	$7,480
May	64,322	229	2,135	$1,897	433	$5,872
Jun	71,529	244	250	$382	269	$6,953
Jul	72,753	207	60	$238	254	$6,637
Aug	71,491	196	76	$248	252	$6,697
Sept	63,905	235	0	$190	218	$10,747
Oct	59,844	202	2,948	$2,534	499	$10,811
Nov	59,232	195	6,329	$7,210	835	$15,616
Dec	58,831	187	12,228	$11,952	1,424	$20,025
Year	775,934	2,427	62,495	$62,204	8,898	$137,083

	Electricity		Natural Gas		Total	
Indices	kBtu/sf	W/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	20.2	1.9	47.6	$0.47	67.8	$1.04

Roebling Elementary School

Florence Township SD - RES - Baseline

	Electricity		Natural Gas		Total	
Month	Energy Use	Energy Demand	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*Therm*	*$*	*MMBtu*	*$*
Jan	29,664	126	6,635	$8,320	765	$12,145
Feb	28,639	126	5,500	$7,094	648	$10,867
Mar	30,061	126	5,092	$6,653	612	$10,498
Apr	23,117	110	2,474	$2,833	326	$6,292
May	24,120	109	1,158	$1,411	198	$4,962
Jun	25,160	110	168	$350	103	$4,872
Jul	25,532	108	100	$278	97	$4,762
Aug	26,124	116	0	$170	89	$4,838
Sept	26,058	129	0	$170	89	$5,040
Oct	27,094	133	1,131	$1,381	206	$5,164
Nov	27,627	122	3,074	$4,474	402	$8,197
Dec	29,365	126	5,668	$7,276	667	$11,086
Year	322,561	1,441	30,999	$40,410	4,201	$88,724

	Electricity		Natural Gas		Total	
Indices	kBtu/sf	W/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	17.9	2.2	50.3	$0.66	68.1	$1.44

Transportation Building

Florence Township SD - Trans - Baseline

	Electricity		Natural Gas		Total	
Month	Energy Use	Energy Demand	Energy Use	Cost	Energy Use	Cost
mmm	*kWh*	*kW*	*Therm*	*$*	*MMBtu*	*$*
Jan	5,611	27	422	$598	61	$1,233
Feb	4,282	29	402	$572	55	$1,123
Mar	3,510	19	319	$457	44	$909
Apr	2,163	17	154	$230	23	$578
May	1,659	16	115	$177	17	$489
Jun	1,317	13	17	$42	6	$438
Jul	1,520	13	0	$19	5	$421
Aug	1,508	14	0	$19	5	$437
Sept	974	13	45	$81	8	$459
Oct	1,775	12	186	$275	25	$573
Nov	3,033	13	231	$336	33	$726
Dec	4,753	23	380	$541	54	$1,098
Year	32,106	208	2,273	$3,350	337	$8,483

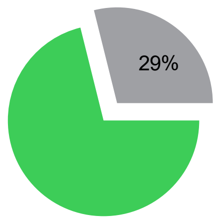
	Electricity		Natural Gas		Total	
Indices	kBtu/sf	W/sf	kBtu/sf	$/sf	kBtu/sf	$/sf
	39.1	10.4	81.2	$1.20	120.3	$3.03

4.2 Energy Savings

The following table highlights projected energy savings as a result of implementing the recommended ECMs.

Florence Township SD - Project Summary

Energy Cost Savings



Energy Indicies	Energy	Cost
	kBtu/sf	*$/sf*
Baseline	100.6	$2.24
Post Project	60.2	$1.59
% Savings	**40.1%**	**28.9%**

Project Summary by Site

Project	Electricity Costs	Fossil Fuels Costs	Total Costs
Phase	*$*	*$*	*$*
Baseline	**$498,262**	**$215,764**	**$714,026**
Memorial High School	$99,824	$34,833	$134,656
Riverfront Middle School	$30,891	$23,485	$54,377
Roebling Elementary School	-$3,305	$19,482	$16,177
Transportation Bldg	$515	$562	$1,077
Post Project	**$370,338**	**$137,402**	**$507,739**
Savings	**$127,925**	**$78,363**	**$206,287**
Percent Savings	**25.7%**	**36.3%**	**28.9%**

To estimate savings from the proposed project, Schneider Electric utilized energy modeling software and engineering formulas. Schneider Electric used Excel spreadsheets to accurately quantify savings for measures that have low interactivity. For measures that are significantly affected by interactions of different components, such as mechanical and BAS upgrades, Schneider Electric utilized ELEMENT, a proprietary building modeling tool used to develop baselines and savings for some builds. Using these modeling tool allows for the ability to model existing conditions and proposed retrofits to assess potential energy savings.

For detailed savings calculations for each ECM, please see the Appendix 6.1 Savings Calculations & Documentation and Appendix 6.1 Box Folder.

ECM Savings Summary by Site

ECM Detail		Total Energy Savings			Total Cost Savings			Detail Unit Savings			Detailed Cost Savings	
Site	ECM	Energy Savings	EUI Savings	Site % Savings	Cost Savings	ECI Savings	Site % Savings	Electric	Electric	Natural Gas	Electric	Natural Gas
Name	Name	MMBtu	kBtu/sf	%	$	$/sf	%	kWh	kW	Therm	$	$
MHS	BAS Optimization	2,102	17.0	11.2%	$34,946	$0.28	7.3%	186,334	0.0	14,664	$19,108	$15,838
MHS	Building Envelope	157	1.3	0.8%	$1,930	$0.02	0.4%	3,490	0.0	1,455	$358	$1,572
MHS	DCV Controls	316	2.6	1.7%	$4,168	$0.03	0.9%	11,533	0.0	2,764	$1,183	$2,985
MHS	LED Lighting - Interior	235	1.9	1.3%	$15,876	$0.13	3.3%	143,488	535.6	-2,546	$18,626	-$2,750
MHS	Lighting Controls	123	1.0	0.7%	$4,486	$0.04	0.9%	36,056	105.2	0	$4,486	$0
MHS	Optimize Ventilation Rates	1,804	14.6	9.6%	$25,302	$0.20	5.3%	62,236	179.0	15,913	$8,115	$17,187
MHS	Solar PV PPA	2,058	16.6	11.0%	$47,948	$0.39	10.0%	602,915	1,284.9	0	$47,948	$0
RES	BAS Optimization	518	8.4	12.3%	$5,587	$0.09	6.3%	12,518	7.8	4,750	$460	$5,127
RES	Bi-Polar Ionization	501	8.1	11.9%	$6,040	$0.10	6.8%	24,245	71.5	4,181	$1,527	$4,513
RES	Building Envelope	249	4.0	5.9%	$2,696	$0.04	3.0%	3,959	0.0	2,355	$155	$2,540
RES	LED Lighting - Exterior	0	0.0	0.0%	$3	$0.00	0.0%	40	0.0	0	$3	$0
RES	LED Lighting - Interior	68	1.1	1.6%	$4,277	$0.07	4.8%	66,520	353.4	-1,592	$5,996	-$1,719
RES	OA Baseline Adjustment	-803	-13.0	-19.1%	-$8,787	-$0.14	-9.9%	-7,689	-14.2	-7,765	-$406	-$8,381
RES	Replace Uvs with HW Heat and VRF Cooling Uvs	969	15.7	23.1%	$3,776	$0.06	4.3%	-118,315	-904.1	13,725	-$11,040	$14,816
RES	Mechanical/Piping Insulation	127	2.1	3.0%	$1,366	$0.02	1.5%	0	0.0	1,266	$0	$1,366
RES	DDC Controls on Existing HW Plant	113	1.8	2.7%	$1,219	$0.02	1.4%	0	0.0	1,130	$0	$1,219
RMS	Admin LED Lighting - Exterior	0	0.0	0.0%	$4	$0.00	0.0%	57	0.0	0	$4	$0
RMS	Admin LED Lighting - Interior	4	0.0	0.0%	$243	$0.00	0.2%	3,527	17.4	-84	$360	-$117
RMS	BAS Optimization	495	3.8	5.6%	$5,610	$0.04	4.1%	38,723	47.9	3,629	$2,779	$2,832
RMS	Building Envelope	259	2.0	2.9%	$2,105	$0.02	1.5%	2,332	0.0	2,514	$145	$1,960
RMS	LED Lighting - Exterior	9	0.1	0.1%	$162	$0.00	0.1%	2,725	0.0	0	$162	$0
RMS	LED Lighting - Interior	113	0.9	1.3%	$14,347	$0.11	10.5%	206,998	807.4	-5,935	$18,978	-$4,631
RMS	Micro CHP	-9	-0.1	-0.1%	$608	$0.00	0.4%	17,702	0.0	-695	$1,151	-$542
RMS	Replace DHW	55	0.4	0.6%	$427	$0.00	0.3%	0	0.0	548	$0	$427
RMS	Replace Steam Boiler Plant with Hot Water Boiler Plant	2,773	21.1	31.2%	$22,432	$0.17	16.4%	20,229	20.9	27,035	$1,338	$21,094
RMS	Solar PV PPA	283	2.2	3.2%	$5,975	$0.05	4.4%	82,851	247.3	0	$5,975	$0
RMS	Mechanical/Piping Insulation	316	2.4	3.5%	$2,463	$0.02	1.8%	0	0.0	3,157	$0	$2,463
Trans	BAS Optimization	31	11.1	9.2%	$470	$0.17	5.5%	2,507	0.0	224	$163	$308
Trans	Building Envelope	27	9.7	8.1%	$382	$0.14	4.5%	428	0.0	258	$28	$354
Trans	LED Lighting - Interior	3	1.1	0.9%	$225	$0.08	2.7%	3,034	15.2	-73	$324	-$100
Total Project Savings		12,895	40.4	40.1%	$206,287	$0.65	28.9%	1,408,443	2,775.3	80,879	$127,925	$78,363

**The electricity generated from the CHP (boxed in red above) is in actuality Distributed Generation (DG), not energy savings. The modeling and calculation tools do not distinguish the difference in this report, but it is important to note the DG compared to the rest of the energy savings in the project.*

**The Cost Savings matches the savings on Form II in Section 2.1 ($215,074) when the OA Baseline Adjustment amount of $8,787 is added to the $206,287 energy savings in the table above.*

ECMs or ECM names may change during the course of the IGA development, or may vary slightly across various tool, so some of the ECM names in the ECM Savings Summary by Site table above do not perfectly match up with the ECM name on Form II. The table below correlates ECMs between the two tables.

ECM Name on Form II	Correlated ECM Savings Summary by Site Description (from Section 4.2)
LED Lighting & Controls	LED Lighting – Interior
	LED Lighting – Exterior
	Admin LED Lighting – Interior
	Admin LED Lighting – Exterior
	Lighting Controls
Building Envelope & Insulation	Building Envelope
	Mechanical/Piping Insulation
New UVs w/ VRF Cooling & BAS	Replace UVs with HW Heat and VRF Cooling UVs
	OA Baseline Adjustment
Boiler Plant Upgrades and New Domestic Water Heater	Replace Steam Boiler Plant w/ HW Boiler Plant
	Replace DHW
	DDC Controls on Existing HW Plant
Optimize Ventilation & Advanced Air Purification	Optimize Ventilation Rates
	DCV Controls
	Bi-Polar Ionization
New/Upgrade Building Automation System (BAS)	BAS Optimization

ECM Name on Form II	Correlated ECM Savings Summary by Site Description (from Section 4.2)
Micro Combined Heat & Power	Micro CHP
Solar PV – PPA	Solar PV PPA

In addition to the energy savings noted above, this project will provide O&M savings for the District.

ECM	Annual O&M Savings	Years Claimed
LED Lighting	$22.090	5
UV Replacements	$5,500	2
Steam to Hot Water Boiler Plant Conversion	$13,250	2
Building Automation Upgrades	$3,350	2
Optimizing Ventilation Rates	$3,500	2

4.3 Environmental Impact

The following table summarizes the environmental impact of the project.

Therms Savings	kWh Savings	Emission Product	Emission Reduction (lbs)
80,879	1,408,443	CO_2	2,881,485
		NO_x	2,307
		SO_2	1,380

The emissions reductions are calculated based on the following factors, based on BPU protocols.

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

5.0 Implementation

5.1 Design & Compliance Issues

This project was developed using the proper Building Codes, Energy Codes, and Electrical Codes. Safety is of the utmost important to Schneider Electric, not only for our customers, but also for our employees and subcontractors. SE will comply with all the required safety codes and protocols to ensure a successful implementation.

5.2 Assessment of Risks

This assessment of risks is meant to provide Florence Township School District with an idea of the potential risks that lie within the ESIP project. By no means is this an effort to eliminate responsibility of the ESCO to provide an Energy Savings Plan that meets industry standards of engineering, energy analysis, and expertise. This is included to allow the District to understand where potential failure points could be that would result in savings not being achieved or operational issues.

- If actual operation of the buildings deviates significantly from the parameters outlined in the Energy Savings Plan with respect to temperature setpoints and occupied times, energy savings associated with the building automation system and HVAC upgrades could be affected.
- Building Automation System sequences of operation must not be overridden or changed permanently. Overrides are permitted for maintenance or special occasions but must be reset to maintain energy savings.
- If outside air dampers or control sequences are overridden for extended periods, it would have an impact on the savings realized by Florence.
- Lighting systems will require maintenance as they age. Replacement parts (lamps) need to be of similar energy efficiency to maintain savings.
- The Solar PV system must be maintained by the PPA company, but it would be prudent of the District to keep tabs on the performance of the PV system, as well as the maintenance being performed. Good record-keeping of this information could be instrumental in future negotiations with the PPA company.
- The optimization of ventilation rates at Memorial HS will not resolve all of the humidity issues being experienced there. This ECM should help alleviate some of the humidity issues, but because of the nature of the building construction and the site itself (on a spring), Schneider Electric expects humidity to remain an ongoing concern even after this Energy Savings Plan is installed.

5.3 Post Project Support

The following is a description of services and terms that are used within this section.

Remote Energy Management, Training & Technical Support

This involves live remote telephone and internet support used to provide instruction, assisted troubleshooting, and system training. This on-call service provides technical support for all installed systems and measures and helps reduce system downtime.

Remote System Monitoring and Reporting

Activities include monitoring live conditions, reviewing and analyzing trends, recording deficiencies, as well as tuning, adjusting, and optimizing parameters. This also includes reporting operational performance of specific systems and equipment necessary to sustain energy savings, comfort, and safety. This helps manage and ensure key variables for energy measures are maintained to allow for sustained savings, performance, and comfort.

On-site Visits

On-site visits include a review and report of changes to operations (past, present, and future), usage, status, and conditions of building systems and equipment relative to their impact on energy performance. ECM and systems training can be provided upon request. Benefits include:

- Expert advice to aid in energy planning based on operational and future commitments
- Identifying excess energy targets and recommendations for improvement
- An increase in overall energy awareness

Resource Advisor

Resource Advisor is Schneider Electric's enterprise-level application providing secure access to data reports and summaries to drive the City's energy and sustainability programs. Resource Advisor combines quality assurance and data capture capabilities of utility information into one energy management solution.

Client Services Program

Schneider Electric's Client Services program is designed to assist Florence Township School District in sustaining savings over the long term. Schneider Electric recommends an ongoing services and post-project support program that is tailored specifically to this scope of work and Florence's needs. The Installation scope and price is included in the ESIP project cash flow, and the price of the 1st year of post project support is provided below, but since the scope is still being worked out between the District and Schneider Electric, this pricing is not included in the ESIP cash flow. Florence has the option to select whichever services they would like, and enter into a separate agreement with Schneider Electric for these services.

	Initial Term			
	Installation	**Year 1**	**Year 2**	**Year 3**
Measurement & Verification with Savings Reporting - Solar	Included	Included	Included	Included
Remote Energy Management Training and Technical Support - Total Hours	Included	8	4	Customer Option
Remote System Monitoring and Reporting - BAS Reviews and Interaction	Included	Monthly	Monthly	Customer Option
On-Site Visits – Energy Consulting and Assessment	Included	Quarterly	Bi-Annual	Customer Option
On-Site Training - Total Hours	Included	Customer Option	Customer Option	Customer Option
Resource Advisor - with Energy Star Module Package (2 meters) - Setup and Annual Subscription (Setup Fee only included during Installation Period)	Included	Included	Included	Customer Option
	Installation	**Year 1**	**Year 2**	**Year 3**
Price	**$14,895**			
Total (Base Price)		**$24,851**		

5.4 Measurement and Verification (M&V) Plan

The M&V Plan that is recommended for Florence for this ESIP project is based around non-measured savings and Option C (whole utility meter) verification. If Option C M&V is desired by the District, then Schneider Electric would propose Option C monitoring only on the gas and electric meters at Memorial HS, with the remainder of the project scope being non-measured savings. The District would not see a favorable return on their investment if a more detailed M&V strategy was selected. Since the ongoing services needs to be a separate contract than the ESIP construction contract, the final M&V and Ongoing Services scope and costs haven't been finalized with Florence as of yet.

6.0 Appendices

Appendix 6.1 – Savings Calculations & Documentation

Below is a high-level summary of how savings were calculated for each measure included in this report. **For further documentation of savings calculations, please see the Appendices Box folder.**

Energy Analysis Methodology

Many tools and approaches exist for effectively analyzing energy conservation measures. Some ECMs are best analyzed in an individual spreadsheet calculation while other more comprehensive ECMs require higher levels of computer modeling to capture the entirety of their impact on energy consumption and demand. In general, the complexity of analysis tools escalates from spreadsheet calculations to, to more sophisticated computer software-based building simulation tools such as eQuest. Aspects such as total savings potential, influence on other ECMs, influence from weather, and overall complexity are all considered when selecting the analysis approach or tool for an ECM.

Below is a table displaying the ECMs and the analysis tool used for calculating the savings. Following the table are descriptions for each of the analysis tool and approaches used for calculating savings.

ECM	Analysis Tool
LED Lighting and Controls	ELEMENT/Spreadsheet Calculations
BAS Optimization	ELEMENT/Spreadsheet Calculations
Optimize Ventilation Rates	ELEMENT
Building Envelope	ELEMENT/Spreadsheet Calculations
DCV Controls	ELEMENT/Spreadsheet Calculations
Micro CHP	Spreadsheet Calculations
Solar PV PPA	Spreadsheet Calculations
Bi-Polar Ionization	ELEMENT/Spreadsheet Calculations
Replace Steam Boiler with Hot Water Boiler	ELEMENT
Replace DHW	ELEMENT/Spreadsheet Calculations
Replace UVs with HW Heat and VRF Cooling UVs	ELEMENT/Spreadsheet Calculations
Outdoor Air Baseline Adjustment	ELEMENT
Mechanical/Piping Insulation	ELEMENT/Spreadsheet Calculations
DDC Controls on Existing HW Plant	ELEMENT

Savings Methods – Spreadsheet Calculations

Schneider Electric utilizes a mixture of spreadsheet calculations and basic formula calculation tools. eCalc is a proprietary Microsoft Excel based spreadsheet calculation tool used for calculating energy consumption and savings for an ECM, rather than a comprehensive building analysis approach. Often an approach using eCalcs or other spreadsheet calculations is the most accurate and reasonable way of approaching ECMs in which their operation, situation, or contribution to the baseline is limited.

What separates eCalcs from other spreadsheet-based tools is its integration of bin weather data into many of its standard calculations. Equipment or infiltration often has fluctuating savings opportunity as outside air reaches new high and low average temperatures through different seasons. By capturing the quantity of hours inside specific temperature ranges, these ECMs can better replicate the demand on the system, run hours, and heating and cooling loads. Below is an example of an eCalc spreadsheet for calculating envelope improvement savings.

eCalcs: Energy Calculation Suite

Life Is On Schneider Electric

projectName - Memorial HS

Infiltration

Building Data

Building Name	Memorial HS
Weather City	NJ, Trenton
Building Height, ft	13
Building Orientation, deg	0
Building L/W Ratio	3.0
Internal Draft Coefficient	0.7

Building Operating Conditions

Occupied Set Point Temp, oF	72.0
Cooling Setup Temp, oF	75.0
Percent of Building Cooled, %	100%
Cooling Seasonal Efficiency, %	284%
Heating Setback Temp, oF	65.0
Percent of Building Heated, %	100%
Heating Seasonal Efficiency, %	93%

Shelter Characteristics

Direction	Shelter Class	Terrain Category
See Reference Tables for Descriptions		
North	3	3
East	3	3
South	3	3
West	3	3

Building Crack Definitions

Penetration	Type	H	Qty	Length	Gap	% Open	Total Area	Wall Only
Name	*Select*	*ft*	*#*	*ft*	*inches*	*%*	*sqft*	*sqft*
Crack 1	Door	-3.5	1	147	1/6	100%	2.0	2.0
Crack 2	Door	-3.5	1	16	1/6	100%	0.2	0.2
Crack 3	Door	-3.5	1	12	1/6	100%	0.2	0.2
Crack 4	Door	-3.5	1	186	1/6	100%	2.6	2.6
Crack 5	Slab	-6.5	1	24	1/8	100%	0.3	0.3
Crack 6	Door	-3.5				100%	0.0	0.0
Crack 7	Slab	-6.5				100%	0.0	0.0
Crack 8	Wall	0.0				100%	0.0	0.0
Crack 9	Wall	0.0				100%	0.0	0.0
Crack 10	Wall	0.0				100%	0.0	0.0
Crack 11	Wall	0.0				100%	0.0	0.0
Crack 12	Wall	0.0				100%	0.0	0.0
Crack 13	Wall	0.0				100%	0.0	0.0
Effective H (Wall Only)		**-3.6**					**5.3**	**5.3**

Notes: H is the height difference between the crack and the neutral pressure level of the building.

Effective Building Coefficients

Shelter Coefficient	0.7
Wind Shear Exponent	0.14
Boundary Layer Thickness, ft	900
Wall Pressure Coefficient	0.10
Roof Pressure Coefficient	-0.30

Site Para 2422=3112/L12

Average Wind Speed, mph	7.8
Site Corrected Wind Speed, mph	6.9
Model Wind Coefficient	0.15
Draft Factor	0.13
Volume Factor, ft/min (in-wg)^0.5	2,603

Energy Engineering Calculations

	Temperature Bin Hours						Calculated Infiltration Rates				Energy Transfer		Energy Savings	
	Mid Pt				MHS BAS		Occupied Rates		Unoccupied Rates		Occupied	Unocc	Cooling	Heating
	Temp	MCWB	Density	Enthalpy	Occupied	Unocc	Wall	Roof	Wall	Roof	Load	Load	Savings	Savings
Ref	*oF*	*oF*	*lb/ft3*	*Btu/lb*	*hrs/yr*	*hrs/yr*	*cfm*	*cfm*	*cfm*	*cfm*	*kBtu/yr*	*kBtu/yr*	*kBtu/yr*	*kBtu/yr*
1	4	3.1	0.085	1.7	9	6	921	0	859	0	-1,043	-552	0	1,715
2	8	7.0	0.084	2.9	17	17	884	0	819	0	-1,788	-1,398	0	3,425
3	12	10.0	0.083	3.8	62	27	847	0	779	0	-5,945	-1,995	0	8,538
4	16	13.8	0.083	5.1	73	50	807	0	736	0	-6,258	-3,236	0	10,209
5	20	17.2	0.082	6.2	94	68	767	0	692	0	-7,190	-3,839	0	11,859
6	24	21.0	0.081	7.5	153	79	723	0	643	0	-10,230	-3,784	0	15,069
7	28	24.1	0.081	8.7	185	127	679	0	593	0	-10,802	-5,133	0	17,134
8	32	27.6	0.080	10.0	176	121	632	0	538	0	-8,764	-3,982	0	13,705
9	36	31.1	0.079	11.4	249	153	581	0	477	0	-10,368	-3,956	0	15,403
10	40	35.0	0.078	13.0	347	263	523	0	405	0	-11,513	-4,908	0	17,657
11	44	39.1	0.078	14.8	365	207	458	0	316	0	-9,088	-2,434	0	12,389
12	48	42.3	0.077	16.3	415	248	386	0	199	0	-7,530	-1,477	0	9,685
13	52	45.8	0.076	18.0	324	149	296	0	148	0	-3,707	-480	0	4,501
14	56	50.4	0.076	20.5	558	310	140	0	300	0	-2,110	-953	0	3,294
15	60	54.9	0.075	23.2	287	168	220	0	398	0	-943	111	0	895
16	64	58.1	0.074	25.2	373	208	332	0	469	0	-697	1,051	125	0
17	68	61.1	0.073	27.2	288	165	412	0	458	0	386	0	136	0
18	72	64.8	0.073	29.9	419	257	485	0	455	0	3,040	0	1,071	0
19	76	66.6	0.072	31.3	498	179	537	0	490	0	5,561	1,172	2,372	0
20	80	69.0	0.072	33.2	348	86	587	0	545	0	5,897	1,007	2,432	0
21	84	70.5	0.071	34.4	265	30	628	0	589	0	5,645	470	2,155	0
22	88	72.7	0.070	36.4	128	11	670	0	633	0	3,585	241	1,348	0
23	92	73.7	0.070	37.3	167	4	703	0	668	0	5,328	102	1,913	0
24	96	75.2	0.069	38.7	26	0	736	0	703	0	972	0	342	0
25	100	77.4	0.069	40.8	1	0	772	0	741	0	46	0	16	0
					5,827	**2,933**							**11,910**	**145,477**

Savings Summary

Type	Savings	Units	Utility Type
Cooling	3,490	kWh	Electricity
Heating	1,455	Therm	Natural Gas - Therm

Savings Methods – ELEMENT

The ELEMENT tool was developed to provide transparency into the end use breakdown of energy consumption for each fuel type. The simplified building inputs and schedules are used in a powerful hourly load analysis to provide quick building calibrations. Energy saving scenarios can be run quickly to see the financial impact to the overall project and generate useful graphs for visualization and reports.

ELEMENT is Schneider Electric's proprietary Microsoft Excel based spreadsheet calculation tool used for simulating building energy consumption. Its purpose is to allow a user with prior knowledge of a facility and its energy using equipment to simulate energy consumption, compare the outputs to historical utility data of the facility, breakout the calibrated baseline into its end use components and determine the energy savings of Energy Conservation Measures (ECMs).

The tool uses a variety of Excel functions and custom generated algorithms written in Visual Basic for Applications (VBA) to quickly simulate the energy consumption of a simple to moderately complex building. Heating and cooling loads are determined on an hourly basis (8,760 hours per year) using TMY2 or TMY3 weather data and the building definitions specified by the user. Loads are generated by the user inputs and key building variables are defined and adjusted to calibrate and predict energy impacts.

Calculations

The Element tool is an hourly load and energy analysis tool used for whole building energy models. The results show end use breakdowns of energy on a monthly basis while allowing for quick calibration to utility billing data. Energy conservation measures can be easily defined and reviewed using the ECM tab to redefine variables used in the baseline model. Each new ECM run is sequential and uses the variable last defined by the previously successful run. The savings are determined by the difference in runs by either actual, percent or minimum unit method, as described previously.

The hourly outdoor air conditions and solar data are imported from the National Renewable Energy Laboratories (NREL) typical meteorological year (TMY) data set. The building calendar defines up to four typical day types that occur throughout the year. These day types are used by the hourly load percentage schedules and HVAC schedules used to define the operation of internal and external building loads, as well as the fan operation of the HVAC system. All 365 days of the year are assigned a day type as defined by the calendar and each hour of the day has an hourly load percentage for each load schedule name and on or off status for each HVAC schedule name. The occupied and unoccupied set points are also driven by the on/off status of the HVAC fan. An algorithm determines if the system is in heating or cooling mode based on the user inputs and weather data in order to determine which occupied heating or cooling set point to use.

Zone and system loads are calculated using industry standard engineering equations (ASHRAE) as listed below based on the user defined building parameters described in the baseline calculation inputs section. The total sensible system load determines if heating or cooling energy is required (negative results for heating and positive values for cooling). Calculations are repeated for each hour of the year to determine the total annual loads and energy consumption.

The following is a sampling of the variables and equations used for calculations the building loads and energy consumption and demand.

Weather and Solar Data

Outdoor Air Dry Bulb Temperature, ^{o}F
Outdoor Air Density, lbm air/ft^3
Outdoor Air Humidity Ratio, lbm water/lbm air
Solar Direct Normal Irradiance, Btu/ft^2
Solar Diffuse Horizontal Irradiance, Btu/ft^2

Sol-air Temperature, °F

- $T_{SA} = T_{OA} + (\alpha \times I_N / h_o) - (\varepsilon \times \Delta R / h_o)$
  - α = wall or roof absorptivity of solar radiation based on surface color, dimensionless
  - I_N = direct normal solar flux on wall and diffuse horizontal irradiance on roof, Btu/hr-ft^2
  - h_o = the convective heat transfer coefficient on exterior wall or roof = 3.0 Btu/h-ft^2 °F
  - ε = hemispherical emittance of exterior surface = 1.0 Btu/h-ft^2
  - ΔR = long wave radiation incident on exterior surface and blackbody radiation
    - For vertical surfaces (walls), ΔR = 0 (vertical surfaces)
    - For horizontal surfaces (roof), ΔR = 20.0 Btu/h-ft^2

Zone Loads

Sensible Zone Loads, Btu

Internal Heat Gains

- Lighting, $Q_{S\_LTG} = L_{LTG} \times A_{BLDG} / 1000 \times HLP_{LTG} \times C$
- Equipment, $Q_{S\_EQUIP} = L_{EQUIP} \times A_{BLDG} / 1000 \times HLP_{EQUIP} \times C$
- People, $Q_{S\_PEOPLE} = n_{PEOPLE} \times HGF_{S\_PEOPLE} \times HLP_{PEOPLE}$
  - A_{BLDG} = building area, ft^2
  - C = conversion factor kW to kBtu = 3412 kBtu/kWh
  - HGF_{S_PEOPLE} = heat gain factor (sensible) based on activity level, (see Table 1), Btu/h-person
  - HLP = hourly load percentage of peak load based on assigned schedule, %
  - L = peak load density, W/ft^2
  - n_{PEOPLE} = number of people, persons

Envelope Loads

- Wall, $Q_{S\_WALL} = 1/R_{WALL} \times (A_{WALL} - A_{WINDOW}) \times (T_{SA\_WALL} - T_{SP})$
- Roof, $Q_{S\_ROOF} = 1/R_{ROOF} \times (A_{ROOF}) \times (T_{SA\_ROOF} - T_{SP})$
- Window Conduction, $Q_{S\_WINDOW,C} = U_{WINDOW} \times A_{WINDOW} \times (T_{OA} - T_{SP})$
- Window Radiation, $Q_{S\_WINDOW,R} = A_{WINDOW} \times SHGC \times (1 - ES) \times I_N$
- Infiltration, $Q_{S\_INFIL} = \rho \times c_p \times q_{INF} \times A_{WALL} \times 60 \times (T_{OA} - T_{SP})$
  - ρ = density of outdoor air, lbm/ft^3
  - A_{ROOF} = roof area, ft^2
  - A_{WALL} = exterior wall area, ft^2
  - A_{WINDOW} = window area, ft^2
  - c_p = heat capacity of air = 0.24 Btu/lbm °F
  - ES = exterior shading, %
  - q_{INF} =infiltration rate per area of exterior wall, CFM/ft^2
  - R_{WALL} = R-value of roof, hr-ft^2-°F/Btu
  - R_{ROOF} = R-value of roof, hr-ft^2-°F/Btu
  - SHGC = solar heat gain coefficient based on window selection (see Table 2), dimensionless
  - T_{OA} = outdoor air dry bulb temperature, °F
  - T_{SA_ROOF} = sol-air temperature of the roof, °F
  - T_{SA_WALL} = sol-air temperature of the wall, °F
  - T_{SP} = indoor air dry bulb temperature, °F
  - U_{WINDOW} = U-value of the window based on window selection (see Table 3), Btu/h-°F-ft^2

Latent Zone Loads, Btu

Internal Heat Gains

- People, $Q_{L\_PEOPLE} = n_{PEOPLE} \times HGF_{L\_PEOPLE} \times HLP_{PEOPLE}$
  - HGF_{L_PEOPLE} = heat gain factor (latent) based on activity level (see Table 1), Btu/h-person

Envelope Loads

- Infiltration, $Q_{L\_INFIL} = \rho \times h_{fg} \times q_{INF} \times A_{WALL} \times 60 \times (\omega_{OA} - \omega_{SP})$
  - h_{fg} = latent heat of vaporization of water = 1054.8 Btu/lbm water
  - ω_{OA} = humidity ratio of outdoor air, lbm water/lbm air
  - ω_{SP} = humidity ratio of indoor space set point, lbm water/lbm air

Total Zone Loads, kBtu

- Sensible, $Q_{S\_ZONE} = (Q_{S\_LTG} + Q_{S\_EQUIP} + Q_{S\_PEOPLE} + Q_{S\_WALL} + Q_{S\_ROOF} + Q_{S\_WINDOW,C} + Q_{S\_WINDOW,R} + Q_{S\_INFIL}) / 1000$
- Latent, $Q_{L\_ZONE} = (Q_{L\_PEOPLE} + Q_{L\_INFIL}) / 1000$
- Total, $Q_{TOTAL\_ZONE} = Q_{S\_ZONE} + Q_{L\_ZONE}$

System Loads

Ventilation, CFM

- Ventilation Rate, $Q_{OA} = R_{PEOPLE} \times n_{PEOPLE} + R_{AREA} \times A_{BLDG}$
  - R_{PEOPLE} = outdoor air rate per person, CFM/person
  - R_{AREA} = outdoor air rate per floor area, CFM/ft^2

Ventilation Loads, Btu

- Ventilation Sensible, $Q_{S\_VENT} = \rho \times c_p \times 60 \times Q_{OA} \times (T_{OA} - T_{SP})$
- Ventilation Latent, $Q_{L\_VENT} = \rho \times h_{fg} \times 60 \times Q_{OA} \times (\omega_{OA} - \omega_{SP})$

Total System Loads, kBtu

- System Sensible, $Q_{S\_SYSTEM} = Q_{S\_ZONE} + (Q_{S\_VENT} / 1000)$
- System Latent, $Q_{L\_SYSTEM} = Q_{L\_ZONE} + (Q_{L\_VENT} / 1000)$
- System Total, $Q_{TOTAL\_SYSTEM} = Q_{S\_SYSTEM} + Q_{L\_SYSTEM}$

Energy Consumption

Electric, kWh

- Lighting, $E_{LTG} = L_{LTG} \times A_{BLDG} / 1000 \times HLP_{LTG}$
- Equipment, $E_{EQUIP} = L_{EQUIP} \times A_{BLDG} / 1000 \times HLP_{EQUIP}$
- Miscellaneous Electric Load 1, $E_{MISCE,1} = L_{MISCE,1} \times HLP_{MISCE,1}$ (typical of 3)
  - $L_{MISCE,1}$ = peak miscellaneous electric load 1, kW (typical of 3)
  - $HLP_{MISCE,1}$ = hourly load percentage of miscellaneous electric load 1 (typical of 3)
- Fans, $E_{FAN} = E_{C,FAN} + E_{P,FAN} + E_{V,FAN}$
  If the HVAC schedule is on or if the fan availability is enabled and there is a load on the system, then
  - Constant fan speed, $E_{C,FAN} = L_{C,FAN}$
  - Proportional fan speed, $E_{P,FAN} = L_{V,FAN} \times PL$
  - Variable fan speed, $E_{V,FAN} = L_{V,FAN} \times PL^{2.5}$
    - $L_{C,FAN}$ = constant fan load, kW
    - $L_{V,FAN}$ = variable fan load, kW
    - S_{MIN_FAN} = minimum fan speed, %
    - PL = percentage of load equal to the maximum of $(Q_{S\_SYSTEM} / Q_{HTG\_DESIGN})$, $(Q_{TOTAL\_SYSTEM} / Q_{CLG\_DESIGN})$, or (S_{MIN_FAN})

- Pumps, $E_{PUMP} = E_{C,PUMP} + E_{P,PUMP} + E_{V,PUMP}$ (typical of heating and cooling)
  If the HVAC schedule is on or if the pump availability is enabled and there is a load on the system, then
  - Constant pump speed, $E_{C,PUMP} = L_{C,PUMP}$
  - Proportional pump speed, $E_{P,PUMP} = L_{V,PUMP} \times PL$
  - Variable pump speed, $E_{V,PUMP} = L_{V,PUMP} \times PL^{2.5}$
    - $L_{C,PUMP}$ = constant pump load, kW (typical of heating and cooling)
    - $L_{V,PUMP}$ = variable pump load, kW (typical of heating and cooling)
    - S_{MIN_PUMP} = minimum pump speed, % (typical of heating and cooling)
    - PL_{HTG} = percentage of heating load equal to the maximum of (Q_{S_SYSTEM} / Q_{HTG_DESIGN}) or $S_{MIN\_PUMP,HTG}$
    - PL_{CLG} = percentage of cooling load equal to the maximum of (Q_{TOTAL_SYSTEM} / Q_{CLG_DESIGN}) or $S_{MIN\_PUMP,CLG}$

If the HVAC schedule is on or if the fan availability is enabled and there is a load on the system, then energy calculations will be done for heating or cooling depending on the polarity of the load (positive for cooling, negative for heating).

- Heating (Electric), $E_{HTG} = (-1) \times Q_{S\_SYSTEM} \times P_{HTG,E} / \eta_{HTG\_E} / 3.412$
    - $\eta_{HTG,E}$ = electric nominal heating efficiency, %
    - $P_{HTG,E}$ = percentage of load assigned to electric heat, %
    - Q_{S_SYSTEM} = hourly calculated heating load (negative values), kBtu
- Cooling, $E_{CLG} = Q_{TOTAL\_SYSTEM} / 12 \times \eta_{CLG\_PL} \times P_{CLG}$
  - Part Load Ratio, $PLR_{CLG} = Q_{TOTAL\_SYSTEM} / (Q_{CLG\_DESIGN} \times OF_{CLG})$, dimensionless
  - Energy Input Ratio, $EIR_{CLG} = a + b \times PLR_{CLG} + c \times PLR_{CLG}^2 + d \times PLR_{CLG}^3$, dimensionless
  - Cooling Part Load Efficiency, $\eta_{CLG\_PL} = \eta_{CLG} \times PLR_{CLG} / EIR_{CLG}$, kW/ton
    - a, b, c, d = cooling efficiency curve coefficients (see Table 4) based on system selection, dimensionless
    - η_{CLG} = nominal cooling efficiency, kW/ton
    - OF_{CLG} = oversize factor used to adjust calculated cooling design load, %
    - P_{CLG} = percent of building with cooling, %
    - Q_{CLG_DESIGN} = total cooling design load based on design day conditions, kBtu
    - Q_{TOTAL_SYSTEM} = hourly calculated cooling load (positive values), kBtu

Fuel, kBtu

- Miscellaneous Fuel Load 1, $F_{MISCF,1} = L_{MISCF,1} \times HLP_{MISCF,1} / \eta_{MISCF,1}$ (typical of 3)
  - $L_{MISCF,1}$ = peak miscellaneous fuel load 1, kBtu (typical of 3)
  - $HLP_{MISCF,1}$ = hourly load percentage of miscellaneous fuel load 1 (typical of 3)
  - $\eta_{MISCF,1}$ = miscellaneous fuel load 1 stand-alone efficiency, % (typical of 3)
    - Note: $\eta_{MISCF,1} = \eta_{HTG\_PL,F}$ if miscellaneous load is included on main boiler plant

The heating energy consumption of fuel is calculated and further broken down to provide more resolution into three main end use categories: Envelope, Infiltration, and Ventilation.

- Envelope, $F_{HTG\_ENV} = (-1) \times Q_{S\_ZONE} \times (1 - P_{HTG,E}) \times (1 - P_{INF}) / \eta_{HTG\_PL,F}$
- Infiltration, $F_{HTG,INF} = (-1) \times Q_{S\_ZONE} \times (1 - PHTG,E) \times P_{INF} / \eta_{HTG\_PL,F}$
- Ventilation, $F_{HTG,VENT} = (-1) \times Q_{S\_VENT} \times (1 - P_{HTG,E}) / \eta_{HTG\_PL,F}$
  - Part Load Ratio, $PLR_{HTG} = Q_{S\_SYSTEM} / (Q_{HTG\_DESIGN} \times OF_{HTG})$, dimensionless
    - For miscellaneous fuel loads on the plant, Q_{S_SYSTEM} includes these loads.
  - Energy Input Ratio, $EIR_{HTG} = a + b \times PLR_{HTG} + c \times PLR_{HTG}^2$, dimensionless
  - Fuel Part Load Efficiency, $\eta_{HTG\_PL,F} = \eta_{HTG,F} \times PLR_{HTG} / EIR_{HTG}$, %

- a, b, c = heating efficiency curve coefficients (see Table 5) based on system selection, dimensionless
- $\eta_{HTG,F}$ = fuel nominal heating efficiency, %
- OF_{HTG} = oversize factor used to adjust calculated heating design load, %
- $P_{HTG,E}$ = percentage of load assigned to electric heat, %
- Q_{HTG_DESIGN} = heating design load calculated on design day conditions, kBtu
- Q_{S_SYSTEM} = hourly calculated heating load (negative values), kBtu

- Zone Envelope Sensible Load, $Q_{S\_ZONE,ENV} = Q_{S\_WALL} + Q_{S\_ROOF} + Q_{S\_WINDOW,C} + Q_{S\_WINDOW,R}$
- Percent of Zone Sensible Load attributed to infiltration, $P_{INF} = Q_{S\_ZONE,INF} / (Q_{S\_ZONE,ENV} + Q_{S\_INF})$

Energy Demand

Electric, kW

The tool determined the peak kW load of the month and displays the demand of each end use category component for that hour.

On the following page is an example of an Element model for Memorial HS. The element model below was used to predict savings for modified BAS scheduling as well as other ECMs.

ELEMENT+

Memorial HS

Element

Schneider Electric

Baseline Calculation Inputs

Building Envelope

123,688	Building Area, sqft
Medium	Building Weight
Exterior Walls	
11.00	R_wall, hr-sqft-oF/Btu
45,418	Total Exterior Wall Area, sqft
Medium	Outside Surface Color
Windows	
Alum w/ Thermal Breaks	Frame Type
1/4 in. Clear Double	Glass Type
7%	Exterior Shading Percentage
6,813	Window Area, sqft
22%	% North Facing
28%	% East Facing
22%	% South Facing
28%	% West Faci ecm goal:
Roof	
34.00	R-value, hr-sqft-oF/Btu
120,791	Roof Area, sqft
Dark	Outside Surface Color
3.00	Plenum Height, ft

Internal Space Loads

	Peak Load	Units	Schedule
Lighting	0.88	W / sqft	Lighting
Equipment	0.50	W / sqft	Equipment
People	576	People	People BL
People Activity Level	Medium Work		

Outdoor Air

Infiltration	
0.320	CFM / sqft of Exterior Wall Area
13.0	Average Ceiling Height, ft
0.542	Air Change Per Hour, ACH
Ventilation	
22.0	OA Rate, CFM per person
0.250	OA Rate, CFM per sqft
43,594	OA CFM Total
OFF Night	OA Modulation Schedule

Dehumidification

No	Does Building Dehumidify?
Fuel	Type of Reheat

Supply Fans

Const kW	130.66	Variable kW	2.19
Schedule	Baseline	Speed Ctrl	Variable
Availability?	Enabled	Min Speed	60%

Space Set Points

	Occupied	Unoccupied	
Heating	69.0	67.0	oF
Cooling	73.0	74.0	oF
	50.0	50.0	% RH

Heating Pumps

Pump kW	15.28	Availability?	Enabled
Speed Ctrl	Variable	Min Speed	40%

Cooling Pumps

Pump kW	25.83	Availability?	Enabled
Speed Ctrl	Variable	Min Speed	61%

Fuel Distribution

Fuel 1	100%	Fuel 2	0%

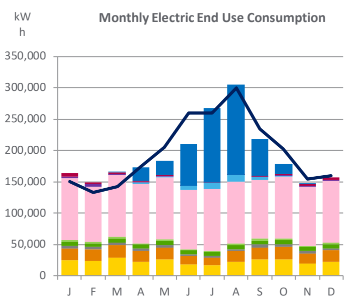
Heating and Cooling Systems

Heating	HW Blr - Condensing		System Type
	92%	Fuel Efficiency, %	
	1.00	Oversize Factor	
	2.0%	% Load Electric Heat	
	250%	Electric Efficiency, %	
Cooling	Screw Chiller, 2 Compressor		System Type
	1.23	Cooling Efficiency, kW/ton	
	0.70	Oversize Factor	
	95%	% Bldg Cooled	
	No	Remote Chilled Water?	

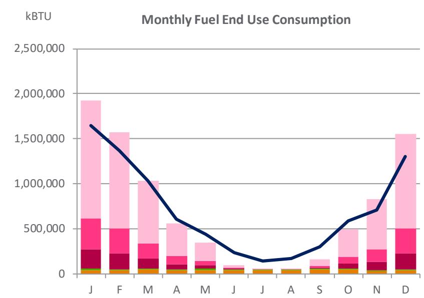
Miscellaneous Loads

Electric	Peak kW	Schedule		
Kitchen	53.7	Kitchen Elec		
Exterior Ligh	9.2	Exterior 8760		
Shop Eq	30.0	Shop Eq		Stand-alone
Fuel	**Peak kBtu**	**Schedule**	**Plant?**	**Efficiency**
DHW	500.0	DHW	No	90%
Kitch	137.0	Kitch Fuel	No	90%
	0.0	Kitch Fuel	No	100%

Energy Modeling Calibration



	Electric Calibration			Fuel Calibration		
	Modeled	Utility	Error	Modeled	Utility	Error
	kWh	kWh	%	kBTU	kBTU	%
Jan	163,263	149,872	9%	1,923,652	1,649,998	17%
Feb	149,364	133,114	12%	1,572,768	1,368,469	15%
Mar	166,458	141,626	18%	1,035,095	1,030,770	0%
Apr	173,059	173,567	0%	562,551	606,869	-7%
May	183,701	204,664	-10%	347,798	440,719	-21%
Jun	210,325	260,025	-19%	98,519	237,257	-58%
Jul	267,713	259,771	3%	52,306	140,229	-63%
Aug	305,142	299,483	2%	56,284	173,849	-68%
Sep	218,006	233,929	-7%	160,450	300,650	-47%
Oct	177,928	202,145	-12%	497,337	589,816	-16%
Nov	146,456	154,417	-5%	830,827	709,552	17%
Dec	157,188	159,952	-2%	1,555,413	1,299,502	20%
	2,318,605	2,372,563	-2.3%	8,693,000	8,547,680	1.7%



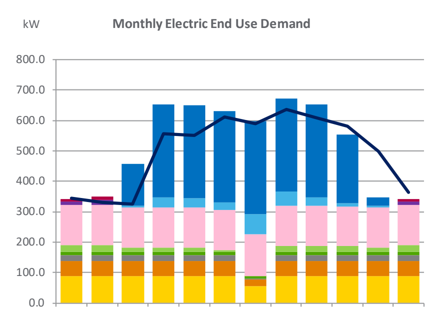
Baseline Breakout Analysis

Electric Consumption / **Fuel Consumption**

	Internal Loads		Miscellaneous Loads			Fans and Pumps			Heating and Cooling				Miscellaneous Loads			Heating			
	Lighting	Equipment	Kitchen	Exterior Lighting	Shop Eq	Fans	Clg Pumps	Htg Pumps	Heating	Cooling	Dehumid	Reheat	DHW	Kitch	0	Envelope	Infiltration	Ventilation	Reheat
	12.0%	9.0%	2.0%	3.3%	1.3%	49.7%	1.7%	0.6%	0.9%	19.6%	0.0%	0.0%	6.1%	1.4%	0.0%	10.9%	16.7%	65.0%	0.0%
Month	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kBtu	kBtu	kBtu	kBtu	kBtu	kBtu	kBtu
1	24,959	18,646	4,243	6,525	2,769	97,836	0	3,571	4,714	0	0	0	44,967	11,447	0	218,491	343,789	1,304,958	0
2	24,076	17,421	4,049	5,894	2,661	88,370	38	2,991	3,863	0	0	0	43,067	10,899	0	174,050	276,954	1,067,798	0
3	28,293	19,908	4,715	6,525	3,117	97,679	448	1,472	2,604	1,697	0	0	50,300	12,665	0	109,751	163,618	698,761	0
4	22,164	17,292	3,824	6,315	2,472	94,558	2,006	924	1,434	22,071	0	0	40,333	10,351	0	59,520	89,020	363,326	0
5	25,792	18,961	4,361	6,525	2,856	97,693	2,513	724	872	23,404	0	0	46,300	11,752	0	36,133	51,455	202,158	0
6	18,143	13,729	2,406	6,315	2,130	94,676	5,965	323	182	66,457	0	0	42,333	6,698	0	7,131	9,832	32,525	0
7	16,432	12,925	1,998	6,525	1,974	98,081	10,266	27	20	119,466	0	0	41,633	5,663	0	731	1,006	3,273	0
8	22,447	16,562	3,416	6,525	2,550	98,109	10,652	8	5	144,869	0	0	45,633	9,316	0	164	225	945	0
9	26,332	18,869	4,414	6,315	2,907	94,613	4,713	373	341	59,130	0	0	47,000	11,873	0	12,949	18,059	70,570	0
10	26,626	19,277	4,479	6,525	2,943	97,670	2,041	805	1,242	16,320	0	0	47,633	12,056	0	54,872	78,303	304,473	0
11	19,663	16,345	3,469	6,315	2,211	94,520	243	1,349	2,167	174	0	0	36,333	9,438	0	92,803	139,383	552,869	0
12	22,458	17,700	3,888	6,525	2,508	97,743	0	2,491	3,875	0	0	0	40,967	10,534	0	179,468	277,408	1,047,036	0
	277,385	207,635	45,262	76,829	31,098	1,151,547	38,884	15,057	21,321	453,588	0	0	526,500	122,691	0	946,064	1,449,053	5,648,692	0

Electric Demand

	Internal Loads		Miscellaneous Loads			Fans and Pumps			Heating and Cooling			
	Lighting	Equipment	Kitchen	Exterior Lighting	Shop Eq	Fans	Clg Pumps	Htg Pumps	Heating	Cooling	Dehumid	Reheat
	16.2%	9.1%	3.8%	1.7%	3.1%	25.5%	4.0%	0.6%	0.5%	35.5%	0.0%	0.0%
Month	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1	87.2	49.5	21.5	8.8	22.5	132.3	0.0	11.1	10.0	0.0	0.0	0.0
2	87.2	49.5	21.5	8.8	22.5	132.9	0.0	15.5	11.4	0.0	0.0	0.0
3	87.2	49.5	21.5	8.8	15.0	131.3	7.6	0.0	0.0	136.9	0.0	0.0
4	87.2	49.5	21.5	8.8	15.0	133.3	31.2	0.0	0.0	305.6	0.0	0.0
5	87.2	49.5	21.5	8.8	15.0	133.1	28.5	0.0	0.0	305.6	0.0	0.0
6	87.2	49.5	21.5	8.8	7.5	132.6	23.1	0.0	0.0	299.3	0.0	0.0
7	54.5	21.6	2.7	8.8	1.5	136.3	66.1	0.0	0.0	305.6	0.0	0.0
8	87.2	49.5	21.5	8.8	19.5	134.5	45.2	0.0	0.0	305.6	0.0	0.0
9	87.2	49.5	21.5	8.8	19.5	133.1	28.2	0.0	0.0	305.6	0.0	0.0
10	87.2	49.5	21.5	8.8	19.5	131.6	10.9	0.0	0.0	226.0	0.0	0.0
11	87.2	49.5	21.5	8.8	15.0	131.3	7.6	0.0	0.0	27.4	0.0	0.0
12	87.2	49.5	21.5	8.8	22.5	132.3	0.0	11.1	10.0	0.0	0.0	0.0
	1,013	566	239	105	195	1,594	248	38	31	2,217	0	0



Modeling the ECMs

After the model has been calibrated, changes are made to the model, which represent implementation of the proposed scope conditions of the energy and water conservation measure. ECMs are implemented and run individually to assess the energy savings of each ECM. All ECMs are modeled with consideration to potential overlap inflating modeled savings. ECMs are run sequentially, building upon each other. This results in more accurate estimate of savings than if each ECM were run in comparison to the baseline.

For detailed savings calculations for each ECM, please see the Appendix 6.1 – Savings Calcs and Documentation Box Folder.

Appendix 6.2 – Preliminary Mechanical Designs

Please see the Appendices Box folder for preliminary mechanical designs.

Appendix 6.3 – Local Government Energy Audit (LGEA)

Please see the Appendices folder in Box for the Local Government Energy Audit reports.

Appendix 6.4 – Scope of Work Details

Please see the Appendices folder in Box for additional scope of work details not detailed in the Energy Savings Plan.