ENERGY SAVINGS PLAN

SUBMITTED BY:
DCO Energy Efficiency Division
100 Lenox Drive
Lawrenceville, NJ 08648
Rev 0
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SECTION 1 – PROJECT OVERVIEW

Project Overview

The Energy Savings Plan (ESP) is the core of the Energy Savings Improvement Program (ESIP) process. It describes the Ridgefield Public Schools' preferred Energy Conservation Measures (ECMs), the budget cost for each ECM and the ECM energy savings calculations that self-fund the project via reduced operating costs. The ESP provides the Ridgefield Public Schools the necessary information to decide which proposed ECMs to implement as part of your (ESIP) project. Working with the School District's staff, your selected ESIP project would:

1. Self-fund a $4,498,128project
2. Generate $166,531 in annual energy savings and an additional $54,230 on solar PPA savings –48% of current utility spend
3. Eligible for $62,087 in rebates and incentives
4. Reduce utility related annual CO2 emissions by 844 metric tons – a 52% reduction

NOTE: This submitted ESP doesn't constitute any contractual obligation between the Ridgefield Public Schools and DCO Energy (DCO). Any contractual obligations will be performed under separate legal documents per mutual signed agreement of the parties involved and subject to the applicable laws and requirements of the ESIP legislation and State of New Jersey.

To ensure conformance with the requirements of Public Finance Notice LFN 2009-11, the ESP must address the following elements:

- *The results of the energy audit (APPENDIX H)*
- *A description of the energy conservation measures that will comprise the program; (Section 3)*
- *An estimate of greenhouse gas reductions resulting from those energy savings; (Section 3)*
- *Identification of all design and compliance issues and identification of who will provide these services; (Section 5)*
- *An assessment of risks involved in the successful implementation of the plan; (Section 5)*
- *Identify the eligibility for, and costs and revenues associated with the PJM Independent System Operator for demand response and curtailable service activities; (Section 3)*
- *Schedules showing calculations of all costs of implementing the proposed energy conservation measures and the projected energy savings; (Section 3)*

- *Maintenance requirements necessary to ensure continued energy savings, and describe how they will be provided; and (Section 6)*
- *If developed by an ESCO, a description of, and cost estimates of a proposed energy savings guarantee. (Section 7)*

In addition, and per LFN 2009-11, the ESP requires several other important elements:

- *The calculations of energy savings must be made in accordance with protocols for their calculation adopted by the BPU. The calculation shall include all applicable State and federal rebates and tax credits, but shall not include the cost of an energy audit and the cost of verifying energy savings. (Section 3)*
- *An independent third party must review the plan and certify that the plan savings were properly calculated pursuant to the BPU protocols.*
- *If an ESCO is used to prepare the plan, the ESCO must provide an estimate of the cost of a guarantee of energy savings. When adopting the plan, the local unit must decide whether or not to accept the guarantee (covered below). (Section 7)*
- *The plan must be verified by an independent third party to ensure that the calculations were made in accordance with the BPU standards and that all required elements of the ESP are covered.*
- *After verification is completed, the governing body must formally adopt the plan. At that point, the plan must be submitted to the Board of Public Utilities where it will be posted on the BPU website. BPU approval is not required. If the contracting unit maintains its own website, the plan must also be posted on that site.*

DCO Energy looks forward to the third-party review of our energy calculations and the Ridgefield Public Schools' approval of the Energy Savings Plan to implement via the requirements of the ESIP legislation. Your time, effort, and support are appreciated.

Slocum Skews School

Slocum Skews School is a two-story, 92,147 square foot building built in 1923. Spaces include classrooms, a gymnasium, offices, a cafeteria, corridors, stairwells, and basement mechanical space. The school is occupied from September through June. Typical weekday occupancy is about 914 people including staff and students. The schools operating hours are from 8:00 AM - 4:00 PM on the weekdays. No operating hours on the weekend.

Description of Building HVAC

The multipurpose room and gym are both cooled by Daikin packaged units. The unit serving the multipurpose room has a cooling capacity of 20 tons, while the unit serving the gym has a cooling capacity of 15 tons. Classrooms have unit ventilators that are heating-only units. Half of the UVs have steam coils and the rest have hot water coils. There are approximately 25 window units, each with a 2-ton capacity that provide cooling to the classrooms. There are four gas-fired forced draft steam boilers, two serving the old and two serving the new wings. Two boilers have output capacities of 4184 MBh, and two are rated at 3348 MBh output. For half the school steam is converted to hot water using a heat exchanger. There are two gas-fired hot water heaters with heating input capacity of 199 MBh and 40 MBh in the school serving the kitchen and the restrooms. Gymnasium fixtures have high bay, 400-watt metal halide fixtures that are controlled by manual switches. All exit signs contain incandescent lamps.

Description of Building Lighting

The primary interior lighting system uses 40-Watt linear fluorescent T12 lamps, although there are a considerable number of 32-Watt T8 fixtures and a few T5 fixtures. Additionally, there are some 28-watt compact fluorescent lamps (CFL), 60- and 100-watt incandescent, and 10-watt LED general purpose lamps. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts. Fixture types include 2-, 3-, or 4-lamp, 2- or 4-foot-long troffers, recessed- or surface mounted fixtures, and 2-foot fixtures with U-bend tube lamps. Gymnasium fixtures have high bay, 400-watt metal halide fixtures that are controlled by manual switches. All exit signs contain incandescent lamps.

Exterior lights have CFL, incandescent, or LED lamp fixtures that are controlled using photocells.

Memorial High School

Memorial High School is a three-story, 87,850 square foot building built in 1957. Spaces include classrooms, a gymnasium, an auditorium, offices, a cafeteria, corridors, stairwells, a commercial kitchen, and basement mechanical space. The High School is occupied from September through June. Typical weekday occupancy has 645 members including students and full-time staff members. The operating hours on a weekday are from 8:00 AM- 4:00 PM. There are no operating hours on the weekend.

Description of Building HVAC

Heating is provided to most classrooms through unit ventilators. There are about 30 UVs throughout the school. Various spaces such as auditorium, several classrooms, the weight room, and the cafeteria are all cooled using packaged units with capacities ranging from 4-ton to 20-ton. Most of the classrooms are equipped with recently installed 1.5-ton window AC units. The music room and Room 154 have split AC units of 2.5-ton capacity that provide space cooling to those areas. Classroom 161 and 162 and a few hallways that are conditioned by three packaged air-source heat pumps of 4-ton capacity that are conditioning these spaces. Two EASCO boilers with heating input of 10,500 MBh serve the building heating load. Hot water is circulated and heats the spaces through hot water coils located in the distributed unit ventilators and packaged units. Hot water is produced with an 825 MBh gas-fired hot water heater then stored in two 200-gallon tanks for distribution.

Description of Building Lighting

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several 40- Watt T12 fixtures. Additionally, there are some compact fluorescent lamps (CFL, 40-watt), incandescent (60-watt), and LED (13-watt) general purpose lamps. Typically, T8 fluorescent lamps use electronic ballasts, and T12 fluorescent lamps use magnetic ballasts. Fixture types include 2-, 3-, or 4-lamp, 2- or 4-foot-long troffers, surface-mounted fixtures, and 2-foot fixtures with U-bend tube lamps. Most fixtures are in good condition. Gymnasium fixtures have 3-lamp, T5 fixtures controlled by manual switches. All exit signs are incandescent units and have been recommended for replacement.

Exterior lighting includes high-pressure sodium lamp fixtures (100, 150 and 250-watt), incandescent lamp fixtures (75-watt), and LED lamp fixtures (30-watt). Most of these fixtures are controlled using photocells.

Shaler Academy

Shaler Academy is a two-story, 47,368 square foot building built in 1957. Spaces include: classrooms, a gymnasium, offices, a cafeteria, corridors, stairwells, and a mechanical space. The Academy is occupied from September through June. Typical weekday occupancy is 270 staff and students. The building's operating hours are 8:00 AM to 4:00 PM on the weekdays. No operating hours on the weekend.

Description of Building HVAC

Some of the classrooms have Unit Ventilators that are supplied with chilled and hot water to condition the spaces. A few new wing areas are served with three York packaged air source heat pumps with 4- and 2-ton capacities. Various classrooms are cooled using 3-ton American Series split AC units. A few offices are cooled using window air conditioning (AC) units of 2-ton capacity. There are seven Hydro Therm AM-300 condensing hot water boilers, each with an output capacity of 272 MBh. Three boilers are on at a time and the rest serve as backups. The heat is distributed to the respective spaces through the unit ventilators with hot water coils and a supply fan. The temperatures are controlled within a few degrees with thermostats in the respective spaces. The Academy consists of a 50-ton, Trane, air-cooled screw chiller. The chiller supplies chilled water to unit ventilators and ceiling ducts in the various spaces. Hot water is produced with a 200-gallon 40 MBh gas-fired storage water heater (AO Smith).

Description of Building Lighting

The primary interior lighting systems use 32-Watt linear fluorescent T8 lamps. Typically, T8 fluorescent lamps use electronic ballasts. Fixture types include 2-, 3-, or 4-lamp, 2- or 4-foot-long troffers and 2-foot fixtures with U-bend tube lamps. Additionally, there are some 23-watt compact fluorescent lamps (CFL), 60-watt incandescent, and 10-watt LED general purpose lamps lighting the smaller spaces. Most fixtures are in good condition. Gymnasium/Auditorium fixtures have high bay 400-watt metal halide fixtures that are manually controlled. All exit signs are 40-watt incandescent units.

Exterior lighting for the Academy is provided by 100-watt metal halide, 40-watt LED, and 23-watt CFL wall pack fixtures that are controlled by photocells. The exterior hallway has 4-foot, 3-lamp linear T8 surfacemounted fixtures. These are also controlled by photocells.

Bergen Boulevard School

Bergen Boulevard School is a two-story, 29,954 square foot building built in 1923. Spaces include classrooms, multipurpose rooms, offices, and mechanical space. The school is occupied from September through June. Typical weekday occupation is 250 people including staff and students. The building's operating hours are usually from 8:00 AM- 4:00 PM on weekdays. The weekend has no operation hours.

Description of Building HVAC

Unit ventilators provide heating only to the zones. They are equipped with supply fan motors, pneumatically controlled outside air dampers, and fan coil valves. This system is original to the building. Cooling is provided from window AC units in offices and classrooms. The portable classroom has a packaged unit that provides electrical heating and cooling. Two gas fired EASCO non-condensing hot water boiler provide an input capacity of 3360 MBh. The heat is distributed to the end uses through heating and ventilating units in the multipurpose rooms and through unit ventilators in the classrooms. Hot water is produced with an 4.5 kW electric hot water heater with a capacity of 40 gallons.

Description of Building Lighting

The primary interior lighting system uses 14-Watt LED linear tubes. There are also few 32-Watt T8 and 40- Watt T12 fixtures. Additionally, there are some 23-watt compact fluorescent lamps (CFL), 60-watt incandescent, and 13-watt LED general purpose lamps located in service spaces. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts. Fixture types include 2-, 3-, or 4-lamp, 2- or 4-foot-long troffer and surface-mounted fixtures and 2-foot fixtures with U-bend lamps. Most fixtures are in good condition. Gymnasium fixtures have 150-watt high bay LED fixtures controlled using manual switches. Most exit signs are LED, although there are a few CFL units.

Exterior lighting for the school includes 150-watt LED wall pack fixtures and 13-watt LED screw-in lamps. The wall pack fixtures are on a timeclock, and the screw-in lamp fixtures are controlled using wall switches. The portable classrooms also have a few 4-foot 2 lamp T8 linear fixtures that are controlled using occupancy sensors.

Central Office

Central Office is a one-story, 2,952 square foot building built in 1965. Spaces include offices, hallways, restrooms, storage spaces, and mechanical space. The office is occupied year-round. On a typical weekday there around 11 full-time staff members in the building. He operating hours are from 8:00 AM -4:00 PM on the weekdays. No operating hours on the weekend.

Description of Building HVAC

Unit ventilators (UV) have supply fan motors, pneumatically controlled, and the system is original to the building. The UVs supply hot and chilled water to the zones. The accounts payable office is cooled using a 1.5-ton split AC unit (York). The site is heated by one gas-fired, non-condensing Weil McLain hot water boiler with an output capacity of 247 MBh and heating efficiency of 78%. The hot water from the boiler is circulated throughout the building using a constant speed 1 hp hot water pump and distributed to the zones by unit ventilators through a 2-pipe system. The building is cooled using an Acme water cooled chiller. Hot water is produced with a 40-gallon 38 MBh gas-fired storage water heater.

Description of Building Lighting

The primary interior lighting system uses 13- and 22-watt lamps in 2-, 3-, or 4-lamp LED linear tube fixtures. The lights are controlled partly using manual switches and occupancy sensors. The exit signs are 16-watt fluorescent fixtures throughout the building. The facility has one exterior light fixture with 26-watt, 2-lamp compact fluorescent wall pack fixture controlled using photocells.

SECTION 2 – ENERGY BASELINE

Total Utility Consumption and Site EUI

The Ridgefield Public Schools Energy Savings Plan includes 5 buildings: 1 high school, 3 elementary schools, and an Administration building. To develop the ESP, DCO Energy was provided with all available utility data (electric, natural gas, fuel oil). DCO Energy tracked and documented this utility data from June 2021 through May 2022. A listing of the buildings, the total utility consumption, and Energy Usage Index for the 5 sites are detailed below.

RIDGEFIELD PUBLIC SCHOOLS BUILDINGS/FACILITIES	
BUILDING/FACILITY NAME	SQFT
Slocum Skews School	92,147
Memorial High School	87,850
Shaler Academy	47,368
Bergen Blvd School	29,954
Central Office	2,952
TOTALS	**260,271**

Ridgefield Public Schools - Energy Use Summary

RIDGEFIELD PUBLIC SCHOOLS BUILDINGS/FACILITIES		ELECTRIC					
BUILDING/FACILITY NAME	SQFT	USAGE kWh	DEMAND kW	USAGE kWh / SQFT	USAGE BTU / SQFT	TOTAL COST $$	MARIGINAL COST $$ / kWh
Slocum Skews School	92,147	471,828	239	5.1	17,471	$90,246	$0.157
Memorial High School	87,850	663,873	304	7.6	25,784	$120,101	$0.146
Shaler Academy	47,368	307,745	138	6.5	22,167	$61,484	$0.166
Bergen Blvd School	29,954	258,257	120	8.6	29,418	$53,789	$0.172
Central Office	2,952	47,561	18	16.1	54,972	$7,640	$0.123
TOTALS	**260,271**	**1,749,264**	**818**	**6.7**	**22,932**	**$333,260**	**-**

RIDGEFIELD PUBLIC SCHOOLS BUILDINGS/FACILITIES		NATURAL GAS			
BUILDING/FACILITY NAME	SQFT	USAGE THERMS	USAGE BTU / SQFT	TOTAL COST $$	MARGINAL COST $$ / THERM
Slocum Skews School	92,147	63,157	68,539	$55,519	$0.879
Memorial High School	87,850	47,051	53,558	$38,678	$0.822
Shaler Academy	47,368	12,081	25,504	$11,107	$0.919
Bergen Blvd School	29,954	17,389	58,052	$21,100	$1.213
Central Office	2,952	2,809	95,165	$3,700	$1.317
TOTALS	**260,271**	**142,486**	**54,745**	**$130,104**	**$0.913**

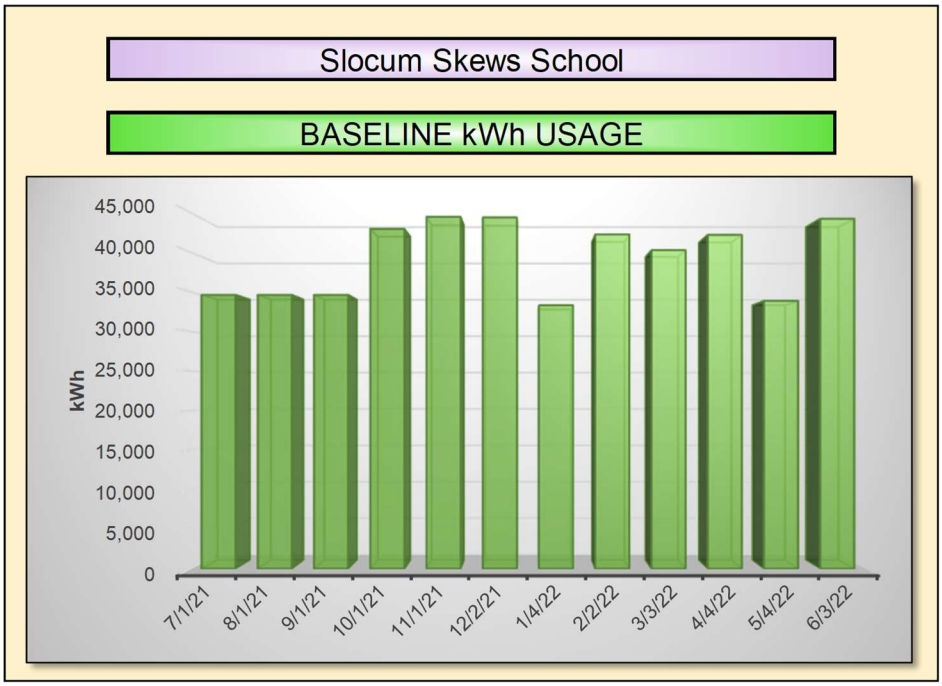
RIDGEFIELD PUBLIC SCHOOLS BUILDINGS/FACILITIES		SITE ENERGY	SOURCE ENERGY	TOTAL COST
BUILDING/FACILITY NAME	SQFT	USAGE BTUs	USAGE BTUs	$$
Slocum Skews School	92,147	7,925,532,236	11,139,093,836	$145,765
Memorial High School	87,850	6,970,193,676	11,282,689,043	$158,779
Shaler Academy	47,368	2,258,116,740	4,208,567,972	$72,591
Bergen Blvd School	29,954	2,620,070,546	4,293,126,620	$74,890
Central Office	2,952	443,206,232	749,353,275	$11,340
TOTALS	**260,271**	**20,217,119,430**	**31,672,830,746**	**$463,364**

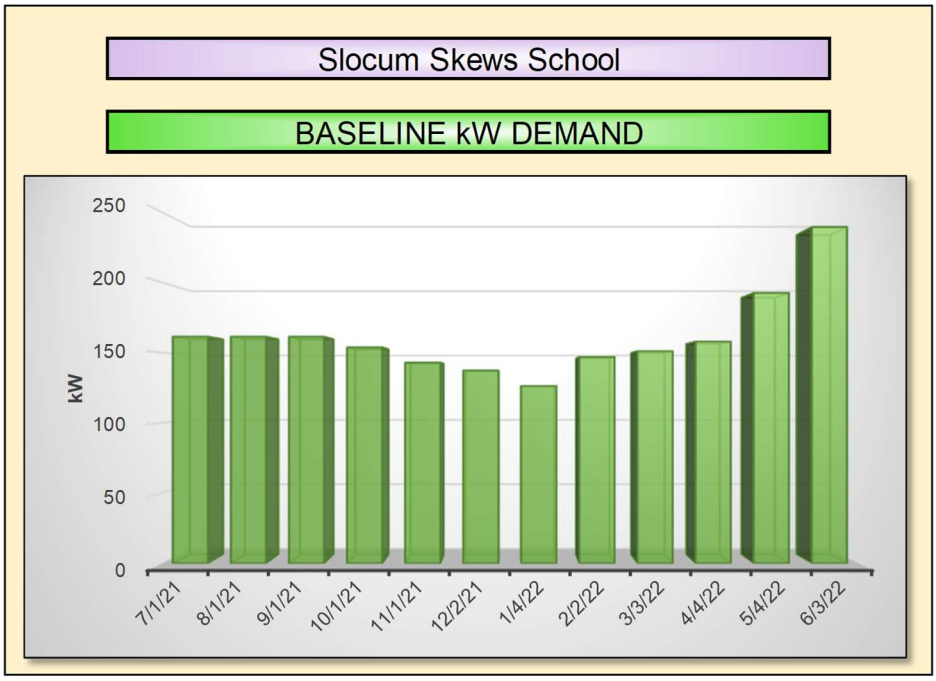
Ridgefield Public Schools – Energy Use & Cost Index

RIDGEFIELD PUBLIC SCHOOLS BUILDINGS/FACILITIES		SITE EUI		
BUILDING/FACILITY NAME	SQFT	USAGE BTU / SQFT	NATIONAL MEDIAN BTU / SQFT	NATIONAL MEDIAN +/- %
Slocum Skews School	92,147	86,010	62,700	-37%
Memorial High School	87,850	79,342	62,700	-27%
Shaler Academy	47,368	47,672	62,700	24%
Bergen Blvd School	29,954	87,470	62,700	-40%
Central Office	2,952	150,138	65,600	-129%
TOTALS	**260,271**	**77,677**	**62,733**	**-24%**

RIDGEFIELD PUBLIC SCHOOLS BUILDINGS/FACILITIES		SITE ECI		
BUILDING/FACILITY NAME	SQFT	COST $$ / SQFT	NATIONAL MEDIAN $$ / SQFT	NATIONAL MEDIAN +/- %
Slocum Skews School	92,147	$1.58	$1.55	-2%
Memorial High School	87,850	$1.81	$1.55	-16%
Shaler Academy	47,368	$1.53	$1.55	1%
Bergen Blvd School	29,954	$2.50	$1.55	-61%
Central Office	2,952	$3.94	$1.63	-142%
TOTALS	**260,271**	**$1.78**	**$1.55**	**-15%**

Slocum Skews School Baseline Energy Use



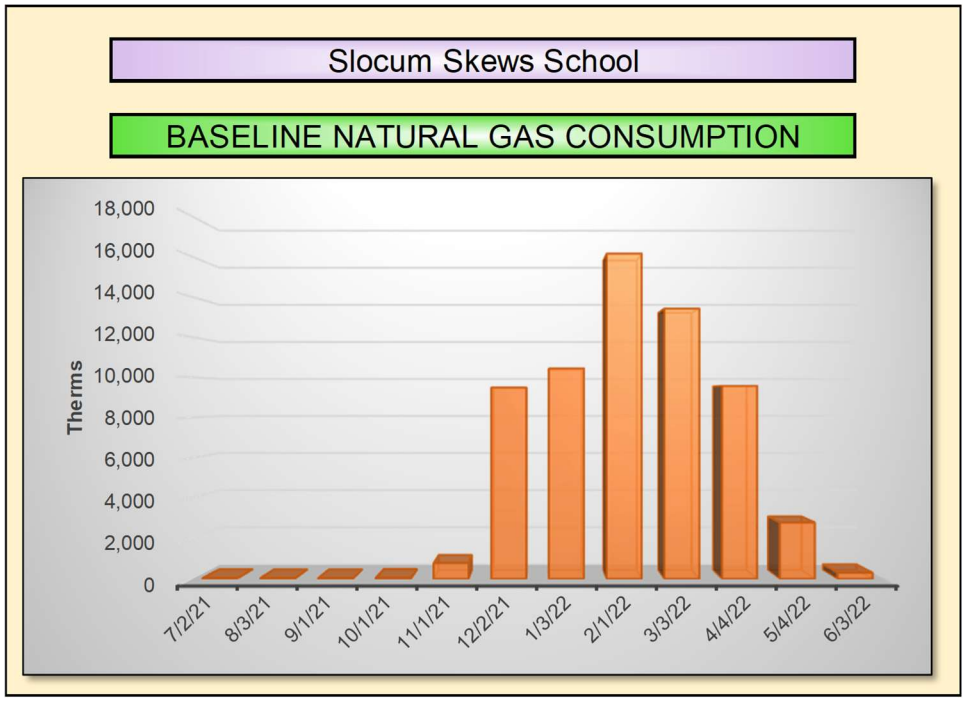


Slocum Skews School							ELECTRIC METER #1					
Provider:	PSEG			Account #:	65 604 221 00				Meter #:	5316530 - Main Electric		
Commodity:	Hudson Energy Services/BGS			Commodity:					Rate Tariff:	General Lighting & Power (GLP)		
Billing Period Start Date	**Actual Reading**	**Usage kWh**	**Demand kW**	**Electric Delivery Charges**	**Electric Commodity Charges**	**Customer Charge**	**Electric Demand Charges**	**Total Electric Charges**	**Marginal Rate $/kWh**	**Days**	**Load Factor**	**BTU**
6/4/21	7/1/21	6,573	50	$110	$1,016	$5	$699	$1,831	$0.171	28	19%	22,428,213
7/2/21	8/1/21	6,573	50	110	1,016	5	699	$1,831	$0.171	31	18%	22,428,213
8/2/21	9/1/21	6,573	50	110	1,016	5	699	$1,831	$0.171	31	18%	22,428,213
9/2/21	10/1/21	11,000	53	$179	$1,122	$5	$733	$2,039	$0.118	30	29%	37,532,000
10/2/21	11/1/21	12,760	54	$284	$1,201	$5	$212	$1,702	$0.116	31	32%	43,537,120
11/2/21	12/2/21	14,720	54	$328	$1,274	$5	$214	$1,820	$0.109	31	37%	50,224,640
12/3/21	1/4/22	9,720	30	$216	$1,055	$5	$119	$1,395	$0.131	33	41%	33,164,640
1/5/22	2/2/22	18,160	52	$409	$1,426		$207	$2,042	$0.101	29	50%	61,961,920
2/3/22	3/3/22	14,900	52	336	1,459		204	$1,999	$0.120	29	41%	50,838,800
3/4/22	4/4/22	14,900	52	$336	$1,459		$204	$1,999	$0.120	32	38%	50,838,800
4/5/22	5/4/22	12,000	51	$272	$1,393		$201	$1,865	$0.139	30	33%	40,944,000
5/5/22	6/3/22	10,840	48	$247	$1,334		$190	$1,771	$0.146	30	31%	36,986,080
TOTALS		138,720	54	$2,938	$14,771	$34	$4,382	$22,124	$0.128	365	29%	473,312,640

Slocum Skews School							ELECTRIC METER #2					
Provider:	PSEG			Account #	65 610 161 06				Meter #	728011215 - Temp 2		
Commodity:	Hudson Energy Services			Account #					Meter #	General Lighting & Power (GLP)		
Billing Period Start Date	**Actual Reading**	**Usage kWh**	**Demand kW**	**Electric Delivery Charges**	**Electric Commodity Charges**	**Customer Charge**	**Electric Demand Charges**	**Total Electric Charges**	**Cost / kWh Checksum**	**Days**	**Load Factor**	**BTU**
6/4/21	7/1/21	1,013	27	$17	$609	$5	$372	$1,003	$0.618	28	6%	3,457,493
7/2/21	8/1/21	1,013	27	17	609	5	372	$1,003	$0.618	31	5%	3,457,493
8/2/21	9/1/21	1,013	27	17	609	5	372	$1,003	$0.618	31	5%	3,457,493
9/2/21	10/1/21	3,640	23	$59	$703	$5	$322	$1,089	$0.209	30	22%	12,419,680
10/2/21	11/1/21	3,000	14	$67	$680	$5	$57	$809	$0.249	31	28%	10,236,000
11/2/21	12/2/21	1,960	11	$44	$637	$5	$43	$729	$0.347	31	24%	6,687,520
12/3/21	1/4/22	1,920	8	$43	$628	$5	$32	$708	$0.350	33	30%	6,551,040
1/5/22	2/2/22	2,240	9	$55	$550		$35	$639	$0.270	29	37%	7,642,880
2/3/22	3/3/22	2,040	8	$50	$537		$33	$621	$0.288	29	35%	6,960,480
3/4/22	4/4/22	2,040	8	50	537		33	$621	$0.288	32	32%	6,960,480
4/5/22	5/4/22	1,600	8	$40	$530		$32	$602	$0.356		0%	5,459,200
5/5/22	6/3/22	2,600	16	$63	$577		$65	$704	$0.246	30	22%	8,871,200
TOTALS		24,080	27	$522	$7,207	$34	$1,767	$9,530	$0.321	335	11%	82,160,960

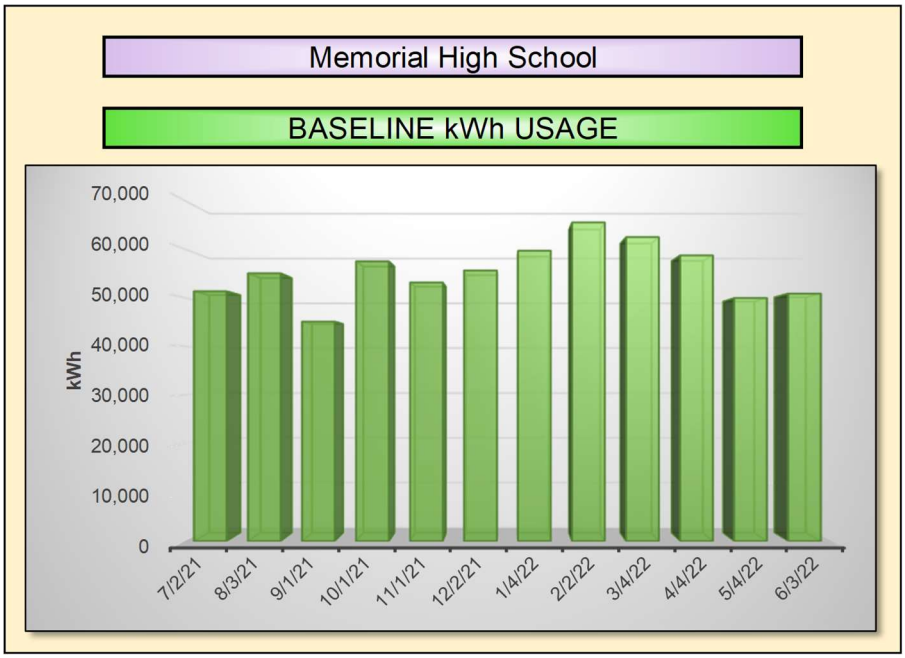
Slocum Skews School							ELECTRIC METER #3					
Provider:	PSEG			Account #	66 988 604 09				Meter #	728011221 - Temp 2		
Commodity:				Account #	Account Closed				Meter #			
Billing Period Start Date	**Actual Reading**	**Usage kWh**	**Demand kW**	**Electric Delivery Charges**	**Electric Commodity Charges**	**Customer Charge**	**Electric Demand Charges**	**Total Electric Charges**	**Cost / kWh Checksum**	**Days**	**Load Factor**	**BTU**
6/4/21	7/1/21	907	18	$15	$419	$5	$255	$695	$0.48	28	7%	3,093,547
7/2/21	8/1/21	907	18	15	419	5	255	$695	$0.48	31	7%	3,093,547
8/2/21	9/1/21	907	18	15	419	5	255	$695	$0.48	31	7%	3,093,547
9/2/21	10/1/21	2,200	12	$36	$461	$5	$167	$668	$0.23	30	25%	7,506,400
10/2/21	11/1/21	2,600	9	$58	$479	$5	$36	$578	$0.21	31	38%	8,871,200
11/2/21	12/2/21	1,600	7	$36	$438	$5	$27	$505	$0.30	31	32%	5,459,200
12/3/21	1/4/22	1,680	6	$37	$433	$5	$24	$499	$0.28	33	35%	5,732,160
1/5/22	2/2/22	1,720	6	$43	$368		$25	$437	$0.24	29	39%	5,868,640
2/3/22	3/2/22	1,760	6	44	371		25	$441	$0.24	28	41%	6,005,120
3/3/22	4/4/22	1,760	6	$44	$371		$25	$441	$0.24	33	35%	6,005,120
4/5/22	5/4/22	1,480	6	$38	$370		$24	$432	$0.28	30	34%	5,049,760
5/5/22	6/3/22	2,800	10	$67	$438		$40	$545	$0.18	30	39%	9,553,600
TOTALS		20,320	18	$449	$4,988	$34	$1,159	$6,629	$0.27	365	13%	69,331,840

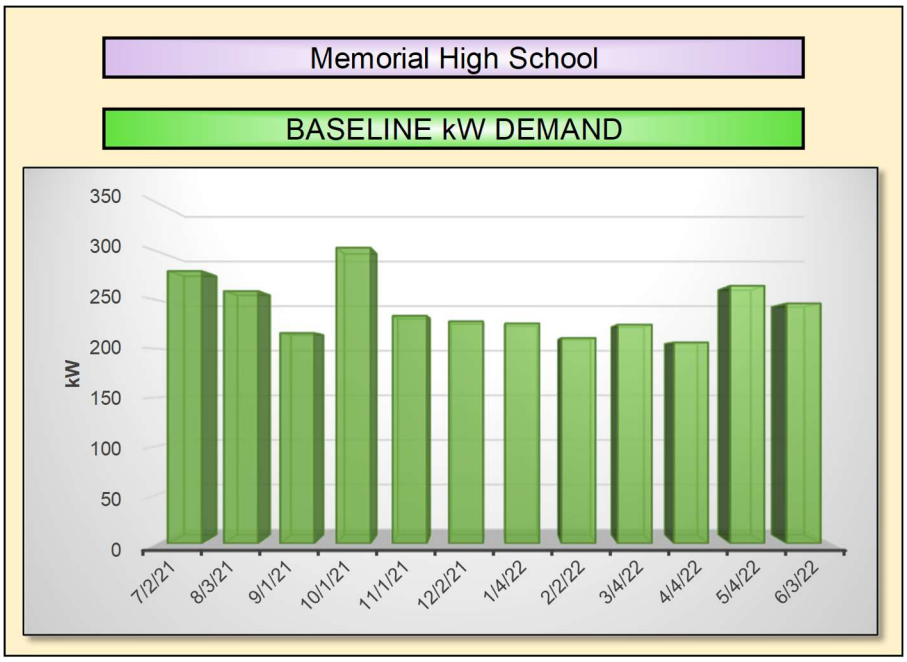
Slocum Skews School							ELECTRIC METER #4					
Provider:	PSEG			Account #	42 542 520 05				Meter #	9212259 - Addition		
Commodity:	Hudson Energy Services			Account #					Rate Tariff:	Large Power & Lighting Secondary (LPLS)		
Billing Period Start Date	**Actual Reading**	**Usage kWh**	**Demand kW**	**Electric Delivery Charges**	**Electric Commodity Charges**	**Customer Charge**	**Electric Demand Charges**	**Total Electric Charges**	**Cost / kWh Checksum**	**Days**	**Load Factor**	**BTU**
6/4/21	7/1/21	26,126	66	$378	$3,306	$371	$662	$4,716	$0.141	28	59%	89,140,206
7/2/21	8/1/21	26,126	66	378	3,306	371	662	$4,716	$0.141	31	53%	89,140,206
8/2/21	9/1/21	26,126	66	378	3,306	371	662	$4,716	$0.141	31	53%	89,140,206
9/2/21	10/1/21	26,126	66	378	3,306	371	662	$4,716	$0.141	30	55%	89,140,206
10/2/21	11/1/21	26,126	66	378	3,306	371	662	$4,716	$0.141	31	53%	89,140,206
11/2/21	12/2/21	26,126	66	378	3,306	371	662	$4,716	$0.141	31	53%	89,140,206
12/3/21	1/4/22	19,983	82	$669	$2,466		$311	$3,446	$0.157	33	31%	68,181,996
1/5/22	2/2/22	20,136	79	$671	$2,485		$300	$3,456	$0.157	29	36%	68,704,032
2/3/22	3/4/22	21,568	85	$691	$2,803		$320	$3,815	$0.162	30	35%	73,590,016
3/5/22	4/4/22	23,494	91	$720	$3,122		$346	$4,188	$0.164	31	35%	80,161,528
4/5/22	5/4/22	18,779	128	$650	$2,480		$483	$3,614	$0.167		$0.00	64,073,948
5/5/22	6/3/22	27,995	165	$789	$3,733		$625	$5,146	$0.162	30	24%	95,518,940
TOTALS		288,708	165	$6,456	$36,924	$2,225	$6,358	$51,963	$0.150	335	22%	985,071,696



Slocum Skews School							Natural Gas Meter #1		
Provider	PSEG		Account #	65 295 126 08			Meter #	3637640 - Main Gas	
Commodity	DEB		Commodity	604797-27618			Rate Tariff:	Large Volume Gas	
Billing Period Start Date	**Actual Reading**	**Therms**	**Gas Delivery Charges**	**Gas Customer Charge**	**Gas Demand Charge**	**Gas Commodity Charges**	**Gas Total Charges**	**$/Therm Marginal Rate**	**BTU**
6/4/21	7/2/21	48	$3	$158		$23	$184	$0.54	4,806,100
7/3/21	8/3/21	45	$3	$158		$21	$182	$0.54	4,472,700
8/4/21	9/1/21	40	$2	$158		$19	$179	$0.54	3,951,700
9/2/21	10/1/21	64	$4	$158		$31	$192	$0.54	6,414,300
10/2/21	11/1/21	791	$122	$158		$377	$656	$0.63	79,140,200
11/2/21	12/2/21	9,495	$1,506	$158	$2,591	$4,518	$8,773	$0.63	949,480,000
12/3/21	1/3/22	10,440	$1,756	$164	$2,648	$5,010	$9,578	$0.65	1,043,992,300
1/4/22	2/1/22	16,138	$5,532			$7,746	$13,278	$0.82	1,613,750,000
2/2/22	3/3/22	13,408	$4,890			$6,436	$11,326	$0.84	1,340,828,500
3/4/22	4/4/22	9,578	$4,242			$4,597	$8,839	$0.92	957,795,900
4/5/22	5/4/22	2,800	$629			$1,344	$1,973	$0.70	279,990,900
5/5/22	6/3/22	310	$211			$149	$360	$1.16	31,032,500
TOTALS		63,157	$18,900	$1,110	$5,239	$30,270	$55,519	$0.78	6,315,655,100

Memorial High School Baseline Energy Use

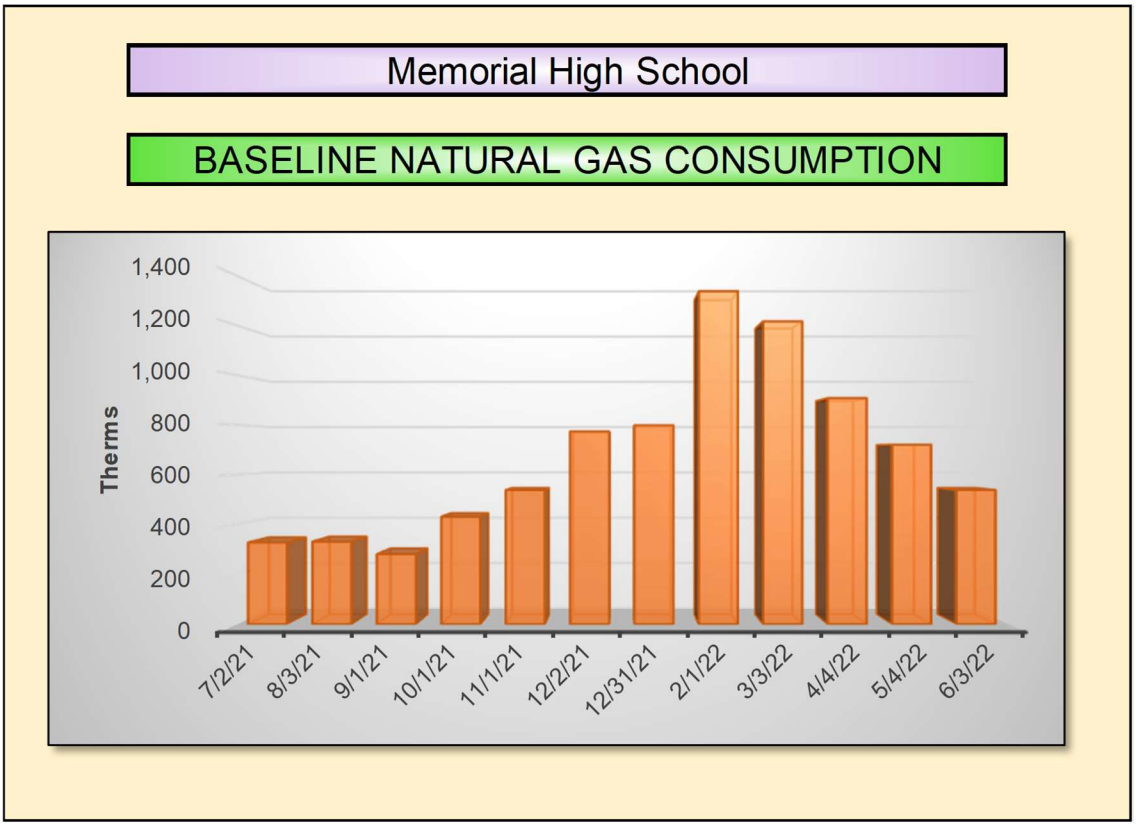




Memorial High School							ELECTRIC METER #1					
Provider:	PSEG			Account #	42 254 028 00				Meter #	9204375 - Main Electric		
Commodity:	Hudson Energy services			Commodity:					Rate Tariff:	LPLS-Large Power & Lighting Secondary		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Customer Charge	Electric Demand Charges	Total Electric Charges	Marginal Rate $/kWh	Days	Load Factor	BTU
6/4/21	7/2/21	50,525	225	$693	$6,026	$371	$3,297	$10,387	$0.133	29	32%	172,391,300
7/3/21	8/3/21	51,724	242	$739	$6,166	$371	$3,099	$10,375	$0.134	32	28%	176,482,288
8/4/21	9/1/21	43,865	203	$624	$5,244	$371	$2,600	$8,839	$0.134	29	31%	149,667,380
9/2/21	10/1/21	55,642	284	$775	$6,624	$371	$3,177	$10,947	$0.133	30	27%	189,850,504
10/2/21	11/1/21	50,330	203	$750	$5,893	$371	$770	$7,784	$0.132	31	33%	171,725,960
11/2/21	12/2/21	42,954	149	$640	$7,212	$371	$565	$8,788	$0.183	31	39%	146,559,048
12/3/21	1/4/22	46,193	158	$688	$8,433	$371	$599	$10,091	$0.197	33	37%	157,610,516
1/5/22	2/2/22	43,555	146	$1,020	$8,185		$553	$9,758	$0.211	29	43%	148,609,660
2/3/22	3/4/22	46,704	164	$1,065	$6,143		$622	$7,831	$0.154	30	39%	159,354,048
3/5/22	4/4/22	49,875	166	$1,112	$6,667		$628	$8,407	$0.156	31	40%	170,173,500
4/5/22	5/4/22	38,781	181	$948	$5,159		$686	$6,793	$0.157	30	30%	132,320,772
5/5/22	6/3/22	48,039	199	$1,089	$6,418		$754	$8,261	$0.156	30	34%	163,909,068
TOTALS		568,187	284	$10,144	$78,171	$2,596	$17,349	$108,260	$0.155	365	23%	1,938,654,044

Memorial High School							ELECTRIC METER #2					
Provider:	PSEG			Account #	66 539 660 03				Meter #	266009926 - Addition		
Commodity:	Hudson Energy Services/BGS			Commodity					Rate Tariff	Generate Lighting & Power (GLP)		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Customer Charge	Electric Demand Charges	Total Electric Charges	Marginal Rate	Days	Load Factor	BTU
6/4/21	7/2/21	657	27	$11	$41	$5	$379	$435	$0.079	29	3%	2,241,684
7/3/21	8/3/21	1,863	3	$31	$101	$5	$47	$184	$0.071	32	71%	6,356,556
8/4/21	9/1/21	864	9	$14	$51	$5	$124	$193	$0.075	29	14%	2,947,968
9/2/21	10/1/21	567	9	$9	$30	$5	$124	$168	$0.069	30	9%	1,934,604
10/2/21	11/1/21	1,458	19	$32	$66	$5	$73	$177	$0.068	31	11%	4,974,696
11/2/21	12/2/21	4,104	29	$91	$171	$5	$116	$382	$0.064	31	19%	14,002,848
12/3/21	1/4/22	5,292	37	$118	$206	$5	$145	$473	$0.061	33	18%	18,056,304
1/5/22	2/2/22	8,379	31	$191	$423		$121	$735	$0.073	29	39%	28,589,148
2/3/22	3/4/22	6,309	28	$145	$355		$109	$609	$0.079	30	32%	21,526,308
3/5/22	4/4/22	4,266	26	$100	$353		$101	$553	$0.106	31	22%	14,555,592
4/5/22	5/4/22	3,096	17	$74	$289		$67	$430	$0.117	30	25%	10,563,552
5/5/22	6/3/22	1,631	32	$41	$214		$128	$383	$0.156	30	7%	5,564,972
TOTALS		38,486	37	$859	$2,298	$34	$1,532	$4,722	$0.082	365	12%	131,314,232

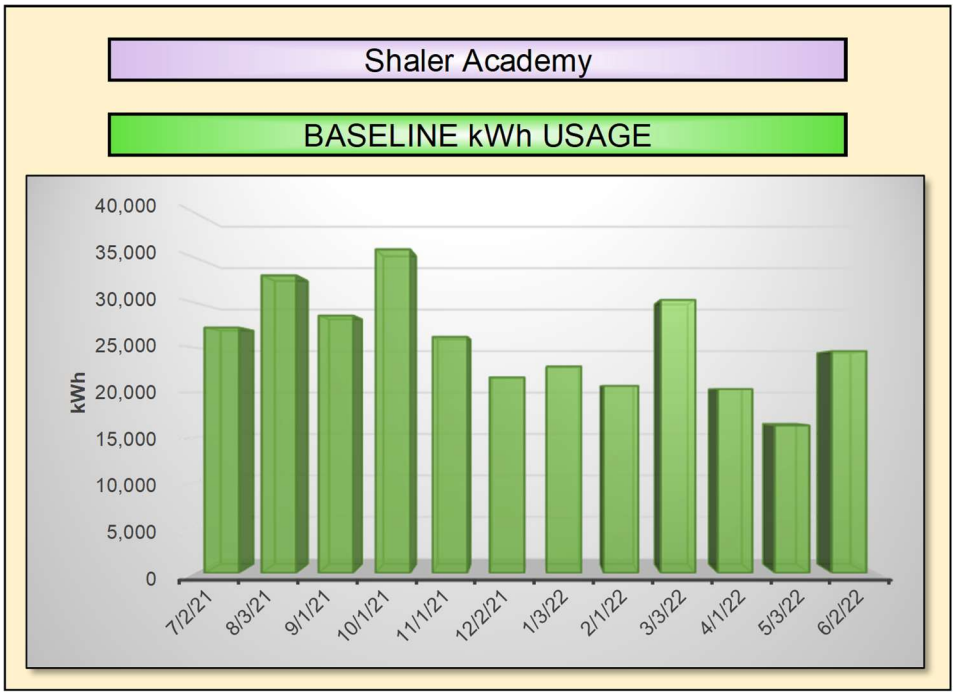
Memorial High School							ELECTRIC METER #3					
Provider:	PSEG			Account #	67 196 518 03				Meter #	9199648 - Addition		
Commodity:	Hudson Energy Services/BGS			Commodity					Rate Tariff	General Lighting & Power (GLP)		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Customer Charge	Electric Demand Charges	Total Electric Charges	Marginal Rate	Days	Load Factor	BTU
6/2/21	7/2/21	80	27	$1	$225	$10	$370	$606	$2.83	31	0%	272,960
7/3/21	8/3/21	1,360	14	$23	$166	$5	$189	$383	$0.14	32	13%	4,640,320
8/4/21	9/1/21	320	4	$5	$113	$5	$56	$179	$0.37	29	11%	1,091,840
9/2/21	10/1/21	1,200	10	$20	$145	$5	$144	$314	$0.14	30	16%	4,094,400
10/2/21	11/1/21	1,280	12	$29	$149	$5	$47	$230	$0.14	31	14%	4,367,360
11/2/21	12/2/21	8,480	50	$189	$435	$5	$196	$825	$0.07	31	23%	28,933,760
12/3/21	1/4/22	8,080	31	$180	$389	$5	$123	$698	$0.07	33	33%	27,568,960
1/5/22	2/2/22	13,440	34	$304	$645		$136	$1,086	$0.07	29	56%	45,857,280
2/3/22	3/4/22	9,360	33	$213	$515		$130	$858	$0.08	30	40%	31,936,320
3/5/22	4/4/22	4,480	15	$104	$410		$60	$575	$0.11	31	40%	15,285,760
4/5/22	5/4/22	8,000	66	$183	$601		$263	$1,047	$0.10	30	17%	27,296,000
5/5/22	6/3/22	1,120	15	$30	$230		$60	$320	$0.23	30	10%	3,821,440
TOTALS		57,200	66	$1,281	$4,025	$39	$1,774	$7,118	$0.09	367	10%	195,166,400

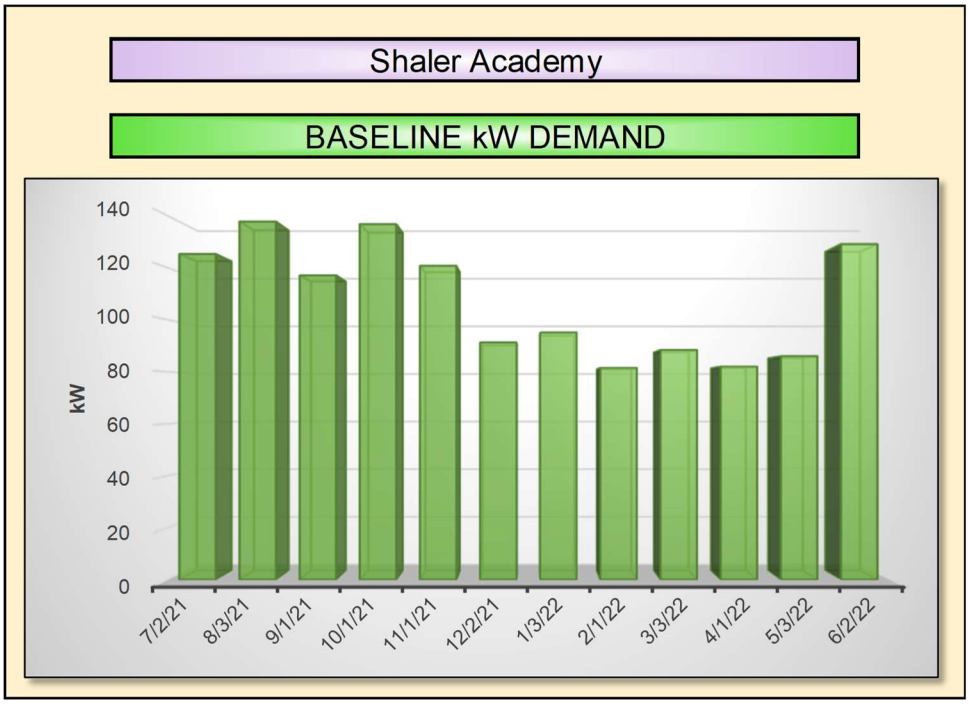


Memorial High School								Natural Gas Meter #1	
Provider	PSEG		Account #	42 010 163 07				Meter #	3567602 - Addition
Commodity	DEB		Commodity	604797-27616				Rate Tariff:	General Service Gas(GSG)
Billing Period Start Date	**Actual Reading**	**Therms**	**Gas Delivery Charges**	**Gas Customer Charge**	**Gas Demand Charge**	**Gas Commodity Charges**	**Gas Total Charges**	**$/Therm Marginal Rate**	**BTU**
6/4/21	7/2/21	328	$101	$18		$156	$275	$0.78	32,825,400
7/3/21	8/3/21	331	$102	$18		$158	$277	$0.78	33,147,000
8/4/21	9/1/21	281	$85	$18		$134	$237	$0.78	28,121,200
9/2/21	10/1/21	431	$137	$18		$205	$360	$0.79	43,112,000
10/2/21	11/1/21	538	$190	$18		$256	$464	$0.83	53,837,900
11/2/21	12/2/21	773	$287	$18		$368	$673	$0.85	77,343,100
12/3/21	12/31/21	798	$309	$18		$380	$706	$0.86	79,818,000
1/1/22	2/1/22	1,336	$552	$18		$635	$1,205	$0.89	133,570,200
2/2/22	3/3/22	1,215	$803	$18		$578	$1,399	$1.14	121,513,300
3/4/22	4/4/22	907	$370	$18		$431	$819	$0.88	90,689,400
4/5/22	5/4/22	720	$293	$18		$343	$653	$0.88	72,027,300
5/5/22	6/3/22	538	$216	$18		$256	$490	$0.88	53,837,400
TOTALS		**8,198**	**$3,444**	**$213**	**$0**	**$3,900**	**$7,557**	**$0.90**	**819,842,200**

Memorial High School							Natural Gas Meter #2		
Provider	PSEG		Account #	42 010 163 07			Meter #	1784710 - Main Gas Account	
Commodity	DEB		Commodity	604797-27617			Rate Tariff	Large Volume Gas (LVG)	
Billing Period Start Date	**Actual Reading**	**Therms**	**Gas Delivery Charges**	**Gas Customer Charge**	**Gas Demand Charge**	**Gas Commodity Charges**	**Gas Total Charges**	**Cost / Unit Checksum**	**BTU**
6/4/21	7/2/21	0		$158		$0	$158	-	0
7/3/21	8/3/21	0		$158		$0	$158	-	0
8/4/21	9/1/21	0		$158		$0	$158	-	0
9/2/21	10/1/21	0		$158		$0	$158	-	0
10/2/21	11/1/21	570	$91			$271	$362	$0.63	57,004,700
11/2/21	12/2/21	6,288	$1,000			$2,992	$3,992	$0.63	628,756,700
12/3/21	12/31/21	7,723	$1,300			$3,675	$4,975	$0.64	772,329,600
1/1/22	2/1/22	11,069	$3,565			$5,313	$8,878	$0.80	1,106,890,400
2/2/22	3/3/22	8,408	$3,115			$4,036	$7,151	$0.85	840,756,800
3/4/22	4/4/22	4,318	$2,424			$2,073	$4,496	$1.04	431,802,000
4/5/22	5/4/22	477	$243			$229	$471	$0.99	47,676,600
5/5/22	6/3/22	0	$165			$0	$165	-	0
TOTALS		38,852	$11,903	$630	$0	$18,588	$31,121	$0.78	3,885,216,800

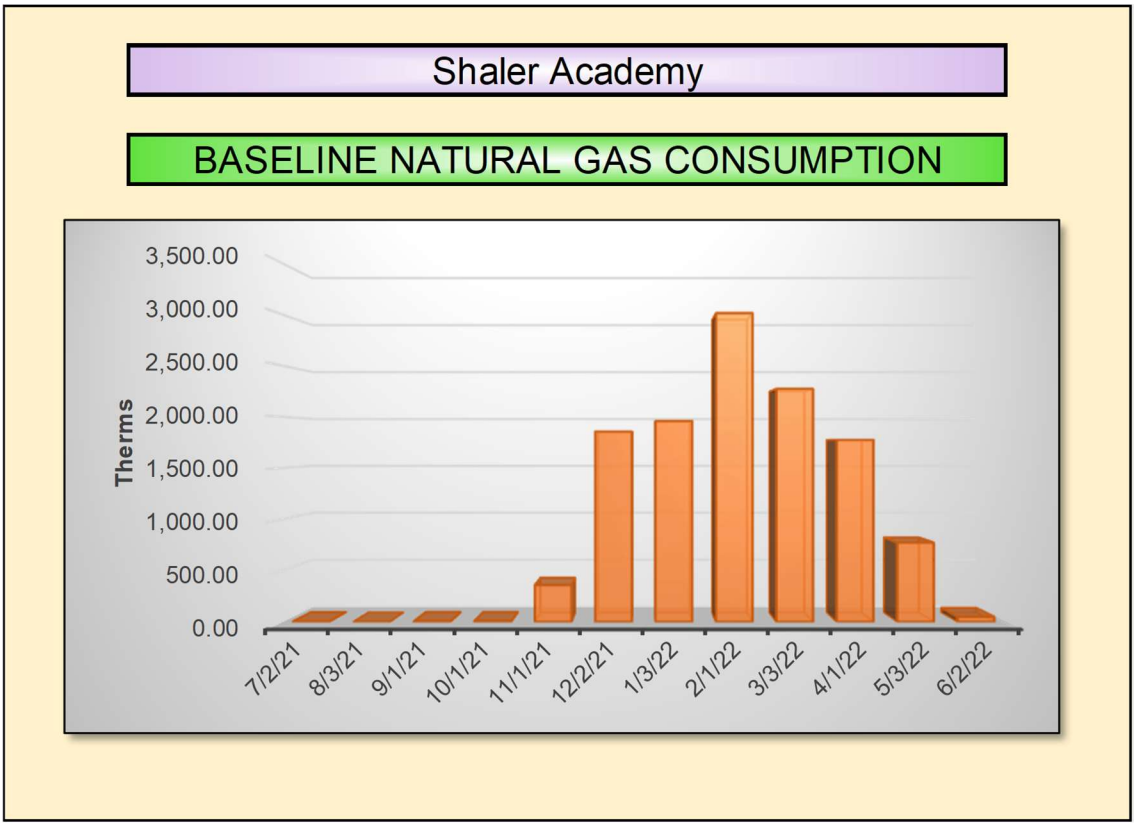
Shaler Academy Baseline Energy Use





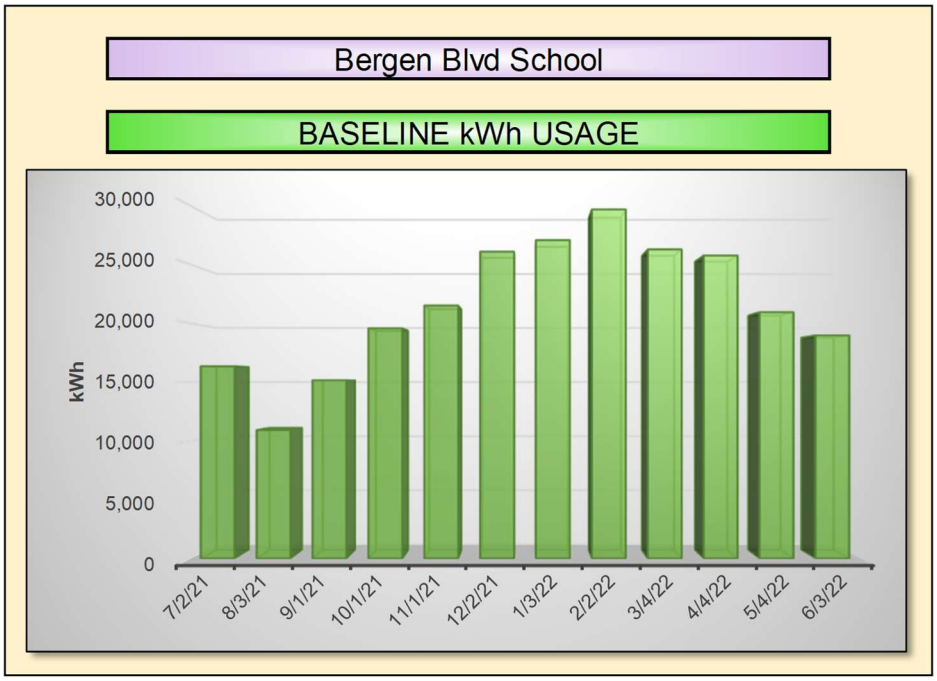
Shaler Academy							ELECTRIC METER #1					
Provider:	PSEG			Account #	66 263 330 03				Meter #	9211036 - Main Electric		
Commodity:	BGS-/Hudson Energy Services			Commodity:					Rate Tariff:	General Lighting & Power (GLP)		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Customer Charge	Electric Demand Charges	Total Electric Charges	Marginal Rate $/kWh	Days	Load Factor	BTU
6/4/21	7/2/21	25,809	111	$434	$3,358	$5	$1,540	$5,337	$0.147	29	33%	88,060,308
7/3/21	8/3/21	31,204	123	$524	$3,962	$5	$1,712	$6,204	$0.144	32	33%	106,468,048
8/4/21	9/1/21	26,921	104	$451	$3,321	$5	$1,439	$5,215	$0.140	29	37%	91,854,452
9/2/21	10/1/21	34,987	126	$568	$4,426	$5	$1,750	$6,749	$0.143	30	39%	119,375,644
10/2/21	11/1/21	25,279	111	$563	$3,232	$5	$439	$4,239	$0.150	31	31%	86,251,948
11/2/21	12/2/21	18,506	67	$402	$2,505	$5	$276	$3,188	$0.157	31	37%	63,142,472
12/3/21	1/3/22	17,783	69	$396	$2,194	$5	$273	$2,868	$0.146	32	34%	60,675,596
1/4/22	2/1/22	18,477	60	$416	$2,300		$237	$2,953	$0.147	29	44%	63,043,524
2/2/22	3/3/22	18,421	61	$414	$2,324		$239	$2,978	$0.149	30	42%	62,852,452
3/4/22	4/1/22	17,052	59	$5,884	$2,223		$232	$8,338	$0.475	29	42%	58,181,424
4/2/22	5/3/22	14,639	66	$330	$1,892		$262	$2,485	$0.152	32	29%	49,948,268
5/4/22	6/2/22	23,079	105	$520	$3,130		$414	$4,064	$0.158	30	31%	78,745,548
TOTALS		272,157	126	$10,904	$34,866	$34	$8,814	$54,617	$0.168	364	25%	928,599,684

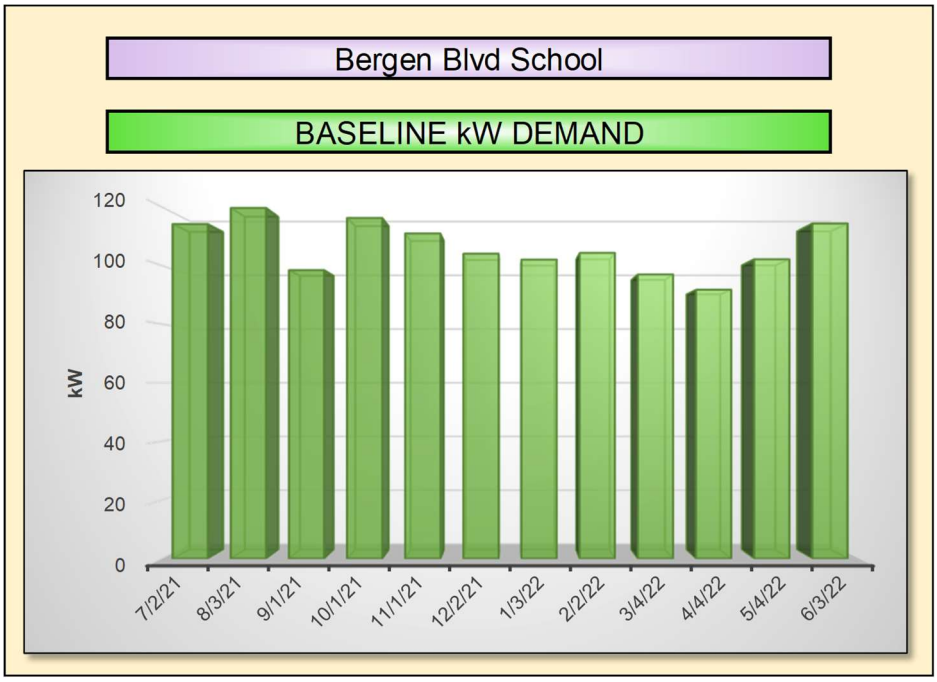
Shaler Academy							ELECTRIC METER #2					
Provider:	PSEG			Account #	67 696 579 02				Meter #	266024441 - Addition		
Commodity:	Hudson Energy Services			Account #					Rate Tariff:	General Lighting & Power (GLP)		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Customer Charge	Electric Demand Charges	Total Electric Charges	Cost / kWh Checksum	Days	Load Factor	BTU
6/4/21	7/2/21	1,395	14	$23	$179	$5	$198	$406	$0.291	29	14%	4,759,740
7/3/21	8/3/21	1,791	14	$30	$225	$5	$200	$460	$0.257	32	16%	6,110,892
8/4/21	9/1/21	1,611	13	$27	$204	$5	$186	$421	$0.261	29	17%	5,496,732
9/2/21	10/1/21	891	11	$15	$120	$5	$148	$288	$0.323	30	12%	3,040,092
10/2/21	11/1/21	900	10	20.05	$106	$5	$39	$169	$0.188	31	12%	3,070,800
11/2/21	12/2/21	3,186	24	$81	$432	$5	$95	$613	$0.192	31	18%	10,870,632
12/3/21	1/4/22	5,121	26	$114	$682	$5	$103	$903	$0.176	33	25%	17,472,852
1/5/22	2/2/22	2,268	22	$55	$296		$85	$437	$0.193	29	15%	7,738,416
2/3/22	3/4/22	11,853	28	$268	$1,595		$110	$1,973	$0.166	30	59%	40,442,436
3/5/22	4/4/22	3,339	23	$79	$440		$93	$612	$0.183	31	19%	11,392,668
4/5/22	5/4/22	1,719	20	$43	$220		$78	$342	$0.199	30	12%	5,865,228
5/5/22	6/3/22	1,514	25	$26	$119		$98	$243	$0.161	30	9%	5,165,768
TOTALS		35,588	28	$782	$4,617	$34	$1,434	$6,867	$0.193	365	15%	121,426,256



Shaler Academy								Natural Gas Meter #1	
Provider	PSEG		Account #	66 263 330 03				Meter #	2663399 - Main Gas
Commodity	DEB		Commodity	604797-27613				Rate Tariff:	General Service Gas (GSG)
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Customer Charge	Gas Demand Charge	Gas Commodity Charges	Gas Total Charges	$/Therm Marginal Rate	BTU
6/2/21	7/2/21	6.62	$2	$18		$3	$23	$0.79	662,100
7/3/21	8/3/21	1.10	$0	$18		$1	$19	$0.78	110,000
8/4/21	9/1/21	7.72	$2	$18		$4	$24	$0.78	772,400
9/2/21	10/1/21	8.84	$3	$18		$4	$25	$0.79	883,600
10/2/21	11/1/21	360	$146	$18		$171	$335	$0.88	35,972,500
11/2/21	12/2/21	1,856	$760	$18		$883	$1,661	$0.89	185,611,500
12/3/21	1/3/22	1,959	$832	$18		$932	$1,782	$0.90	195,923,800
1/4/22	2/1/22	3,010	$1,296	$18		$1,427	$2,741	$0.90	301,010,200
2/2/22	3/3/22	2,272	$983	$18		$1,073	$2,073	$0.90	227,196,300
3/4/22	4/1/22	1,775	$772	$18		$834	$1,624	$0.90	177,507,500
4/2/22	5/3/22	774	$347	$18		$353	$718	$0.90	77,355,200
5/4/22	6/2/22	51	$40	$18		$24	$82	$1.26	5,085,700
TOTALS		12,081	$5,184	$214	$0	$5,709	$11,107	$0.90	1,208,090,800

Bergen Boulevard School Baseline Energy Use

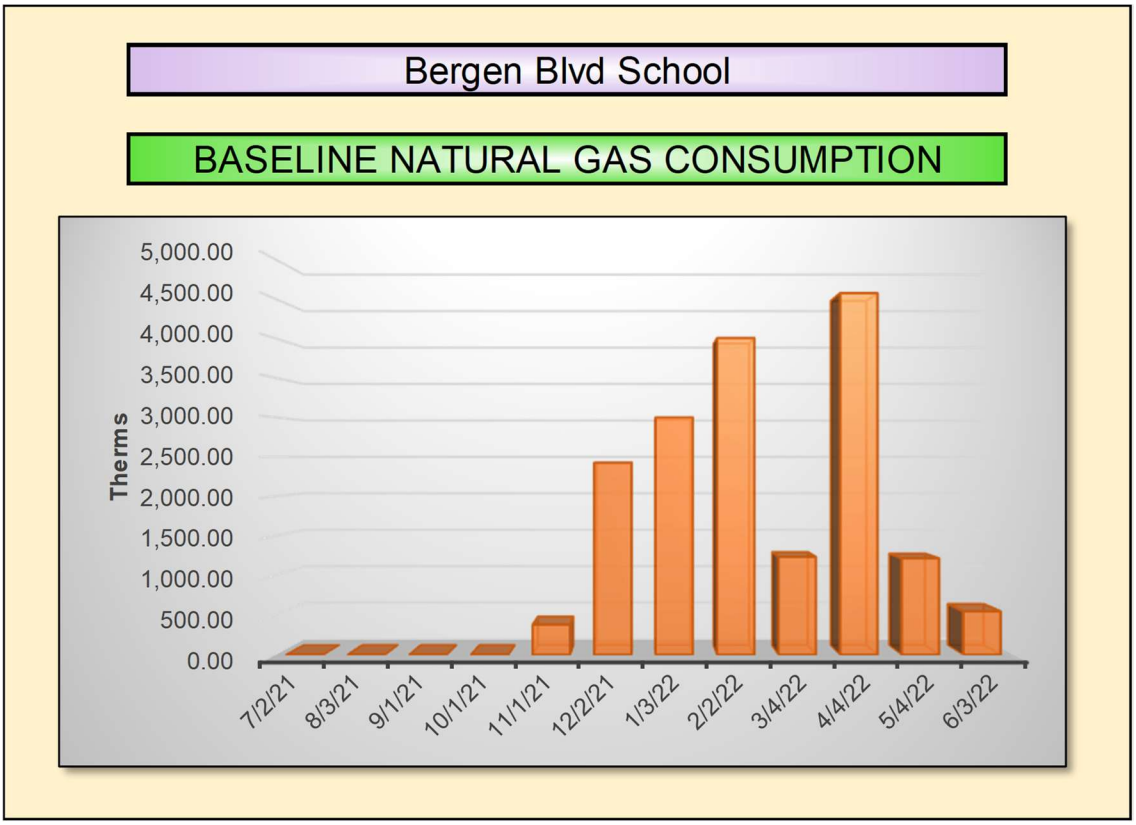




Bergen Blvd School							ELECTRIC METER #1					
Provider:	PSEG			Account #	67 312 842 03				Meter #	638000022 - Addition		
Commodity:	Hudson Energy Services			Commodity:					Rate Tariff:	General Lighting & Power (GLP)		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Customer Charge	Electric Demand Charges	Total Electric Charges	Marginal Rate $/kWh	Days	Load Factor	BTU
6/4/21	7/2/21	7,340	50.0	$123	$950	$5	$694	$1,772	$0.146	29	21%	25,044,080
7/3/21	8/3/21	600	58.4	$10	$91	$5	$810	$917	$0.169	32	1%	2,047,200
8/4/21	9/1/21	5,280	37.8	$88	$423	$5	$525	$1,041	$0.097	29	20%	18,015,360
9/2/21	10/1/21	9,720	58.4	$158	$1,254	$5	$810	$2,228	$0.145	30	23%	33,164,640
10/2/21	11/1/21	11,840	58.4	$264	$1,431	$5	$231	$1,931	$0.143	31	27%	40,398,080
11/2/21	12/2/21	12,100	46.6	$269	$1,545	$5	$184	$2,004	$0.150	31	35%	41,285,200
12/3/21	1/3/22	11,740	46.6	$261	$1,450	$5	$184	$1,900	$0.146	32	33%	40,056,880
1/4/22	2/2/22	10,280	46.7	$234	$1,267		$184	$1,686	$0.146	30	31%	35,075,360
2/3/22	3/4/22	9,900	38.6	$225	$1,221		$153	$1,598	$0.146	30	36%	33,778,800
3/5/22	4/4/22	10,020	35.8	$228	$1,235		$142	$1,605	$0.146	31	38%	34,188,240
4/5/22	5/4/22	9,600	34.4	$218	$1,184		$136	$1,538	$0.146	30	39%	32,755,200
5/5/22	6/3/22	7,120	45.6	$164	$878		$181	$1,222	$0.146	30	22%	24,293,440
TOTALS		105,540	58	$2,243	$12,929	$34	$4,234	$19,441	$0.144	365	21%	360,102,480

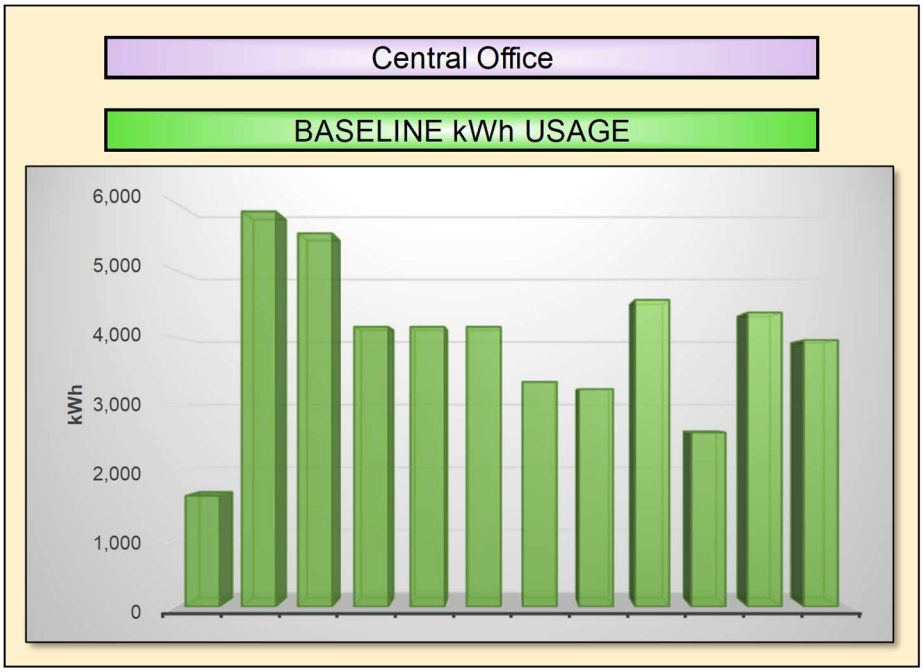
Bergen Blvd School							ELECTRIC METER #2					
Provider:	PSEG			Account #	67 312 842 03				Meter #	5317668 - Main Electric		
Commodity:	Hudson Energy Services			Account #					Meter #	General Lighting & Power (GLP)		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Customer Charge	Electric Demand Charges	Total Electric Charges	Marginal Rate $/kWh	Days	Load Factor	BTU
6/4/21	7/2/21	7,920	55	$133	$1,029	$5	$766	$1,933	$0.147	29	21%	27,023,040
7/3/21	8/3/21	9,120	53	$153	$1,215	$5	$733	$2,106	$0.150	32	22%	31,117,440
8/4/21	9/1/21	8,800	53	$147	$1,417	$5	$733	$2,302	$0.178	29	24%	30,025,600
9/2/21	10/1/21	8,960	51	$146	$1,158	$5	$710	$2,019	$0.145	30	24%	30,571,520
10/2/21	11/1/21	8,720	37	$194	$1,109	$5	$146	$1,454	$0.149	31	32%	29,752,640
11/2/21	12/2/21	11,120	36	$248	$1,426	$5	$142	$1,821	$0.151	31	42%	37,941,440
12/3/21	1/3/22	11,760	34	$262	$1,450	$5	$133	$1,849	$0.146	32	46%	40,125,120
1/4/22	2/2/22	12,640	34	$286	$2,848		$136	$3,270	$0.248	30	51%	43,127,680
2/3/22	3/4/22	12,640	36	$286	$2,894		$142	$3,323	$0.252	30	49%	43,127,680
3/5/22	4/4/22	12,000	34	$272	$2,901		$133	$3,305	$0.264	31	48%	40,944,000
4/5/22	5/4/22	10,080	50	$229	$2,581		$196	$3,006	$0.279	30	28%	34,392,960
5/5/22	6/3/22	11,040	50	$251	$2,365		$196	$2,813	$0.237	30	31%	37,668,480
TOTALS		124,800	55	$2,607	$22,392	$34	$4,167	$29,200	$0.200	365	26%	425,817,600

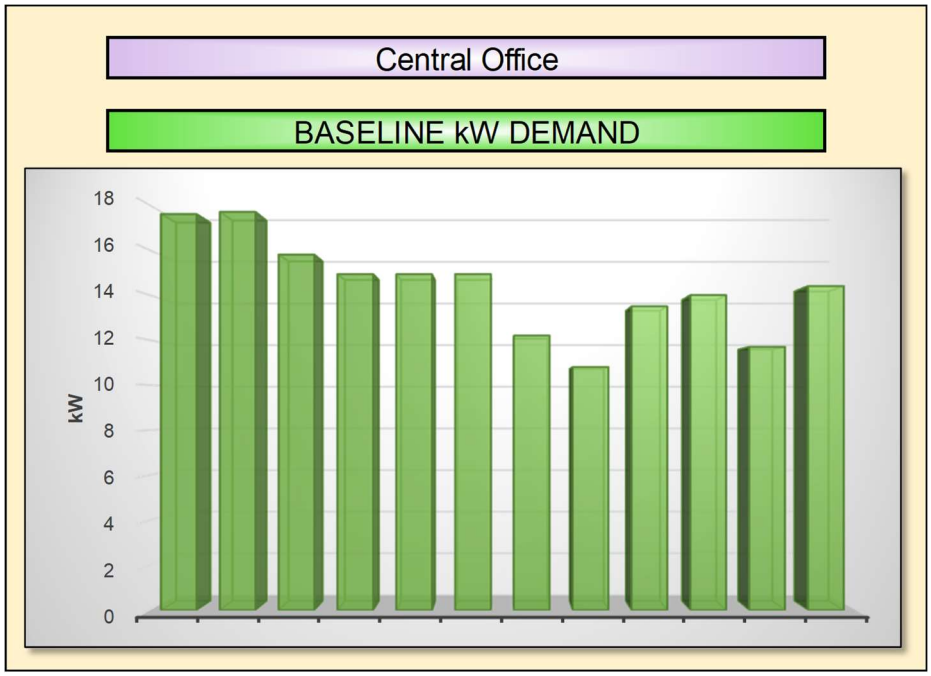
Bergen Blvd School							ELECTRIC METER #3					
Provider:	PSEG		Account #	72 797 187 01			Meter #	626101102 - Trailer				
Commodity:	Champion Energy Services		Account #				Meter #	Trailer				
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Customer Charge	Electric Demand Charges	Total Electric Charges	Marginal Rate $/kWh	Days	Load Factor	BTU
6/4/21	7/2/21	1,093	9	$18	$193	$5	$124	$339	$0.19	29	18%	3,729,316
7/3/21	8/3/21	1,204	8	$20	$212	$5	$117	$354	$0.19	32	19%	4,108,048
8/4/21	9/1/21	1,081	8	$18	$192	$5	$108	$323	$0.19	29	20%	3,688,372
9/2/21	10/1/21	892	7	$80	$183	$5	$26	$294	$0.29	30	19%	3,043,504
10/2/21	11/1/21	945	16	$21	$190	$5	$62	$278	$0.22	31	8%	3,224,340
11/2/21	12/2/21	2,860	21	$64	$324	$5	$85	$477	$0.14	31	18%	9,758,320
12/3/21	1/3/22	3,560	22	$79	$370	$5	$86	$541	$0.13	32	21%	12,146,720
1/4/22	2/2/22	6,749	23	$224	$591		$23	$838	$0.12	30	40%	23,027,588
2/3/22	3/2/22	3,731	22	$88	$382		$88	$558	$0.13	28	25%	12,730,172
3/3/22	4/4/22	3,731	22	88	382		88	$558	$0.13	33	21%	12,730,172
4/5/22	5/4/22	1,261	18	$33	$209		$72	$314	$0.19	30	10%	4,302,532
5/5/22	6/3/22	810	19	$23	$176		$76	$275	$0.25	30	6%	2,763,720
TOTALS		27,917	23	$756	$3,405	$34	$954	$5,149	$0.15	365	14%	95,252,804



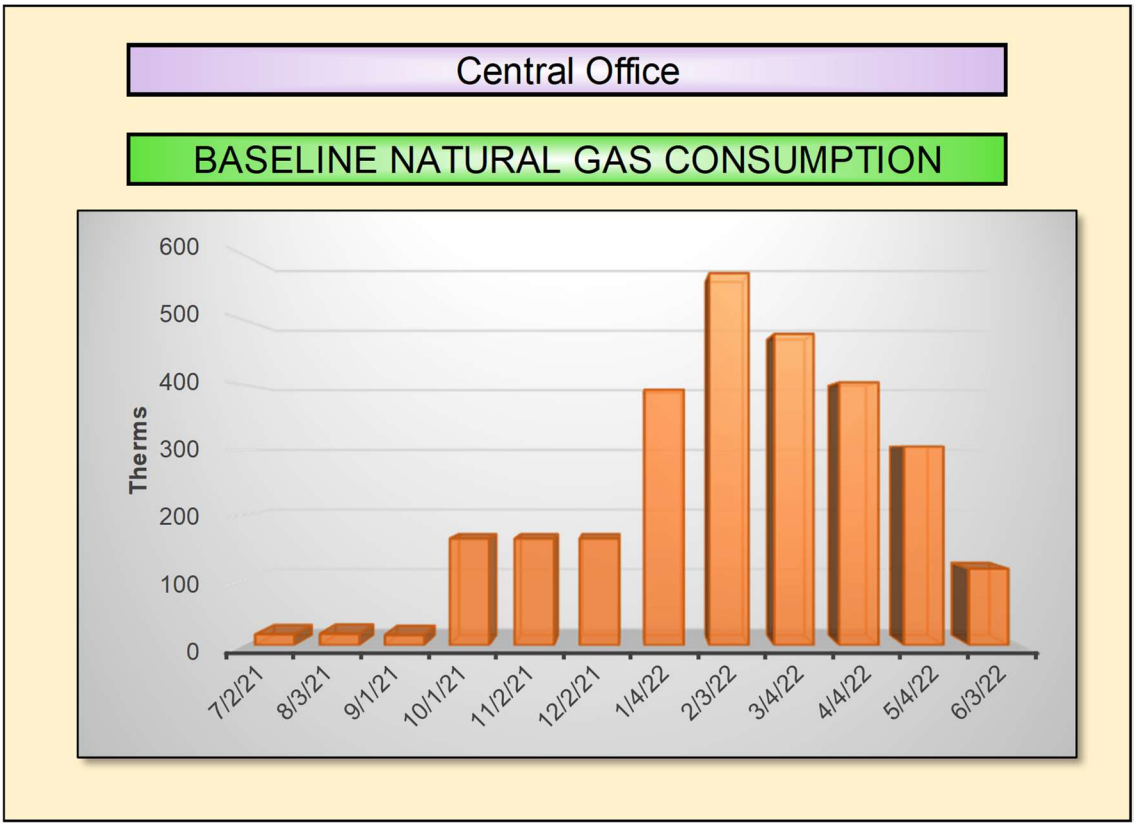
Bergen Blvd School							Natural Gas Meter #1		
Provider	PSEG		Account #	67 312 842 03			Meter #	2415421 - Main Gas	
Commodity	BGSS		Account #				Rate Tariff	LVG	
Billing Period Start Date	**Actual Reading**	**Therms**	**Gas Delivery Charges**	**Gas Customer Charge**	**Gas Demand Charge**	**Gas Commodity Charges**	**Gas Total Charges**	**$/Therm Marginal Rate**	**BTU**
6/4/21	7/2/21	1.05	$0	$158		$1	$158	$0.69	104,500
7/3/21	8/3/21	2.09	$0	$158		$1	$159	$0.71	208,500
8/4/21	9/1/21	2.09	$0	$158		$1	$159	$0.75	209,100
9/2/21	10/1/21	2.09	$0	$158		$2	$159	$0.85	209,300
10/2/21	11/1/21	383	$61	$158		$329	$547	$1.02	38,261,500
11/2/21	12/2/21	2,426	$386	$158	$351	$2,195	$3,090	$1.21	242,557,200
12/3/21	1/3/22	2,999	$502	$164	$359	$2,441	$3,466	$1.10	299,865,100
1/4/22	2/2/22	4,002	$1,428	$158		$2,665	$4,250	$1.02	400,186,500
2/3/22	3/4/22	1,237	$960	$158		$977	$2,095	$1.57	123,715,000
3/5/22	4/4/22	4,568	$1,523	$158		$3,256	$4,938	$1.05	456,801,800
4/5/22	5/4/22	1,218	$365	$158		$875	$1,399	$1.02	121,827,800
5/5/22	6/3/22	550	$165	$158		$357	$680	$0.95	54,951,362
TOTALS		17,389	$5,390	$1,900	$709	$13,100	$21,100	$1.06	1,738,897,662

Central Office Baseline Energy Use





Central Office							ELECTRIC METER #1					
Provider:	PSEG			Account #	66 971 901 08				Meter #	666007990 - Main Electric		
Commodity:	Hudson Energy Services			Commodity:					Rate Tariff:	General Lighting & Power		
Billing Period Start Date	**Actual Reading**	**Usage kWh**	**Demand kW**	**Electric Delivery Charges**	**Electric Commodity Charges**	**Customer Charge**	**Electric Demand Charges**	**Total Electric Charges**	**Marginal Rate $/kWh**	**Days**	**Load Factor**	**BTU**
6/4/21	7/2/21	1,647	18	$28	$168	$5	$244	$445	$0.119	29	13%	5,619,564
7/3/21	8/3/21	5,868	18	$99	$568	$5	$246	$917	$0.114	32	43%	20,021,616
8/4/21	9/1/21	5,544	16	$317	$541	$5	$219	$1,081	$0.155	29	50%	18,916,128
9/2/21	10/2/21	4,155	15	$85	$405	$5	$106	$601	$0.118	31	37%	14,176,860
10/3/21	11/1/21	4,155	15	$85	$405	$5	$106	$601	$0.118	30	39%	14,176,860
11/2/21	12/2/21	4,155	15	$85	$405	$5	$106	$601	$0.118	31	37%	14,176,860
12/3/21	1/4/22	3,339	12	$74	$330	$5	$48	$458	$0.121	33	35%	11,392,668
1/5/22	2/3/22	3,231	11	$77	$318	$43	$120	$557	$0.122	30	42%	11,024,172
2/4/22	3/4/22	4,554	14	$106	$449	$53	$160	$768	$0.122	29	48%	15,538,248
3/5/22	4/4/22	2,588	14	$58	$255	$55	$114	$482	$0.121	31	25%	8,830,256
4/5/22	5/4/22	4,368	12	$102	$430	$46	$148	$727	$0.122	30	52%	14,903,616
5/5/22	6/3/22	3,957	14	$93	$390	$57	$150	$690	$0.122	30	38%	13,501,284
TOTALS		**47,561**	**18**	**$1,208**	**$4,665**	**$289**	**$1,767**	**$7,928**	**$0.123**	**365**	**31%**	**162,278,132**



Central Office							Natural Gas Meter #1		
Provider	PSEG		Account #	66 971 901 08			Meter #	Combined - Main Gas	
Commodity	BGSS		Account #				Meter #	General Service Gas Heating - GSG (HTG)	
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Customer Charge	Gas Delivery Constant	Gas Commodity Charges	Gas Total Charges	$/Therm Marginal Rate	BTU
6/4/21	7/2/21	17	$5	$18		$9	$32	$0.87	1,672,600
7/3/21	8/3/21	18	$5	$18		$11	$34	$0.93	1,772,000
8/4/21	9/1/21	16	$5	$18		$11	$33	$0.98	1,568,100
9/2/21	10/1/21	164	$66	$18		$146	$229	$1.29	16,377,133
10/2/21	11/2/21	164	66	18		146	$229	$1.29	16,377,133
11/3/21	12/2/21	164	66	18		146	$229	$1.29	16,377,133
12/3/21	1/4/22	392	$165	$19		$324	$508	$1.25	39,230,800
1/5/22	2/3/22	571	$260	$19		$380	$658	$1.12	57,139,500
2/4/22	3/4/22	478	$220	$19		$423	$662	$1.35	47,808,500
3/5/22	4/4/22	404	$188	$19		$283	$490	$1.17	40,364,600
4/5/22	5/4/22	305	$147	$19		$241	$406	$1.27	30,509,400
5/5/22	6/3/22	117	$67	$19		$105	$190	$1.46	11,731,200
TOTALS		2,809	$1,259	$218	$0	$2,224	$3,700	$1.24	280,928,100

Energy Savings Utility Rates

DCO Energy used the following marginal rates to calculate energy cost savings:

CALCULATED UTILITY RATES - MARGINAL RATES USED FOR SAVINGS			
BUILDING/FACILITY	ELECTRIC		NATURAL GAS
	$ / kW	$ / kWh Rate	$ / Therm Rate
Slocum Skews School	$7.08	$0.157	$0.879
Memorial High School	$7.12	$0.146	$0.822
Shaler Academy	$7.94	$0.166	$0.919
Bergen Blvd School	$7.34	$0.172	$1.213
Central Office	$10.24	$0.123	$1.317

ENERGY SAVINGS PLAN

SECTION 3 – ENERGY CONSERVATION MEASURES

Energy Conservation Measure Breakdown by Building

The matrix below details which ECMs were applied and evaluated by building.

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
1	LED Lighting Replacement	✔	✔	✔	✔	
2	District Wide Energy Management System	✔	✔	✔	✔	✔
3	Boiler Replacement			✔		✔
4	Chiller Replacement					✔
5	Premium Efficiency Pump Motors and VFDs	✔	✔	✔	✔	✔
6	Rooftop Unit Replacement		✔			
7	Install High Efficiency Air Conditioning Units		✔	✔		✔
8	Install High Efficiency Heat Pumps		✔	✔		
9	Unit Ventilator Replacement	✔		✔	✔	
10	Domestic Hot Water Heater Replacement		✔			
11	Plug Load Controls	✔	✔	✔	✔	✔
12	Solar PPA	✔	✔	✔	✔	✔
13	Combined Heat & Power Unit		✔			
14	Add AC to Gym		✔			
15	Roof Refurbishment	✔	✔	✔	✔	✔
16	Lighting Controls	✔	✔	✔		
17	Building Envelope Improvements	✔	✔	✔	✔	✔
18	Pipe and Valve Insulation	✔	✔	✔	✔	✔

ECM Breakdown by Cost & Savings

RIDGEFIELD PUBLIC SCHOOLS		INCLUDED IN PROJECT	INSTALLED COST	ANNUAL ELECTRIC COST SAVINGS	ANNUAL NATURAL GAS COST SAVINGS	ANNUAL ENERGY COST SAVINGS	ANNUAL O&M COST SAVINGS	TOTAL ANNUAL COST SAVINGS	SIMPLE PAYBACK WITHOUT INCENTIVES
ECM #	ENERGY CONSERVATION MEASURE	"Y" OR "N"	$	$	$	$	$	$	YEARS
1	LED Lighting Replacement	Y	$588,148	$84,016	($836)	$83,180	$3,631	$86,811	6.8
2	District Wide Energy Management System	Y	$525,322	$16,866	$13,849	$30,715	$49,412	$80,128	6.6
3	Boiler Replacement	Y	$0	$0	$133	$133	$6,403	$6,535	0.0
9	Unit Ventilator Replacement	Y	$44,006	$256	$0	$256	$0	$256	172.2
11	Plug Load Controls	Y	$44,651	$9,139	$0	$9,139	$0	$9,139	4.9
12	Solar PPA	Y	$0	$45,088	$0	$45,088	$0	$45,088	0.0
13	Combined Heat & Power Unit	Y	$427,600	$17,363	($5,014)	$12,348	$0	$12,348	34.6
14	Add AC to Gym	Y	$448,400	($3,689)	$0	($3,689)	$0	($3,689)	-121.6
15	Roof Refurbishment	Y	$1,202,476	$182	$319	$501	$0	$501	2401.4
16	Lighting Controls	Y	$52,480	$4,017	($41)	$3,976	$0	$3,976	13.2
17	Building Envelope Improvements	Y	$95,204	$3,684	$7,371	$11,055	$0	$11,055	8.6
18	Pipe and Valve Insulation	Y	$47,520	$0	$8,251	$8,251	$0	$8,251	5.8
TOTALS			$3,475,806	$176,922	$24,031	$200,953	$59,447	$260,399	13.3

RIDGEFIELD PUBLIC SCHOOLS		INCLUDED IN PROJECT	ELECTRIC CONSUMPTION SAVINGS	NATURAL GAS SAVINGS	TOTAL SITE ENERGY SAVINGS	TOTAL SOURCE ENERGY SAVINGS
ECM #	ENERGY CONSERVATION MEASURE	"Y" OR "N"	kWh	THERMS	MMBTU	MMBTU
1	LED Lighting Replacement	Y	481,428	(970)	1,546	4,497
2	District Wide Energy Management System	Y	97,461	15,194	1,852	2,526
3	Boiler Replacement	Y	0	144	14	15
9	Unit Ventilator Replacement	Y	1,399	0	5	13
11	Plug Load Controls	Y	59,078	0	202	564
12	Solar PPA	Y	0	0	0	6,246
13	Combined Heat & Power Unit	Y	98,584	(6,100)	-274	301
14	Add AC to Gym	Y	(15,533)	0	-53	-148
15	Roof Refurbishment	Y	1,157	348	39	48
16	Lighting Controls	Y	22,616	(47)	72	211
17	Building Envelope Improvements	Y	14,655	8,259	876	1,007
18	Pipe and Valve Insulation	Y	0	9,184	918	964
TOTALS			760,845	26,011	5,197	16,246

ECM Breakdown by Greenhouse Gas Reduction

RIDGEFIELD PUBLIC SCHOOLS		INCLUDED IN PROJECT	Reduction of CO_2	Reduction of Nox	Reduction of SO_2	Reduction of Hg
ECM #	ENERGY CONSERVATION MEASURE	"Y" OR "N"	LBS	LBS	LBS	LBS
1	LED Lighting Replacement	Y	518,218	448	1,064	2,239
2	District Wide Energy Management System	Y	284,974	232	215	453.4
3	Boiler Replacement	Y	1,686	1	0	0
9	Unit Ventilator Replacement	Y	1,539	1	3	6.5
11	Plug Load Controls	Y	64,986	56	131	275
12	Solar PPA	Y	719,114	669	1,557	3,276
13	Combined Heat & Power Unit	Y	37,075	38	218	459
14	Add AC to Gym	Y	-17,087	-15	-34	-72
15	Roof Refurbishment	Y	5,348	4	3	5.4
16	Lighting Controls	Y	24,324	21	50	105
17	Building Envelope Improvements	Y	112,752	90	32	68
18	Pipe and Valve Insulation	Y	107,447	84	0	0
TOTALS			1,860,378	1,631	3,238	6,816

Note: Factors used to calculate Greenhouse Gas Reductions are as follows.

	UTILITIES		
	ELECTRIC	NATURAL GAS	OTHER ENERGY #2
UNITS	kW & kWh	Therms	Solar Owned (kWh)
BTU MULTIPLIER	3,412	100,000	3,412
CO2 EMISSION FACTOR (LB CO2/UNIT FUEL)	1.10	11.70	0.00
SITE-SOURCE MULTIPLIER	2.80	1.05	1.00

- ***NOx = (0.00095*kWh Savings) + (0.0092*Therm Savings)***
- ***SO2 = (0.00221*kWh Savings)***
- ***Hg = (0.00465*kWh Savings)***

See Combined Heat and Power ECM for emission calculation per NJ BPU Protocols.

ECM Breakdown by Building

Please see Appendix F for ECM Breakdown by Building.

ECM Budgeting Narrative

Detailed plans, schematics and specifications for Ridgefield Public Schools were not available to deliver a cost estimate for each ECM. The budgetary costs carried in the project are based on good faith estimates, contractor supplied budgets for similar ECMs on other recent projects and a database of actual installed costs for various ECMs.

RIDGEFIELD PUBLIC SCHOOLS		INCLUDED IN PROJECT	INSTALLED COST
ECM #	ENERGY CONSERVATION MEASURE	"Y" OR "N"	$
1	LED Lighting Replacement	Y	$588,148
2	District Wide Energy Management System	Y	$525,322
3	Boiler Replacement	Y	$0
9	Unit Ventilator Replacement	Y	$44,006
11	Plug Load Controls	Y	$44,651
12	Solar PPA	Y	$0
13	Combined Heat & Power Unit	Y	$427,600
14	Add AC to Gym	Y	$448,400
15	Roof Refurbishment	Y	$1,202,476
16	Lighting Controls	Y	$52,480
17	Building Envelope Improvements	Y	$95,204
18	Pipe and Valve Insulation	Y	$47,520
TOTALS			$3,475,806

Prescriptive Rebates

As part of the Energy Savings Plan for Ridgefield Public Schools, prescriptive rebate through PSE&G were investigated. The estimated incentive amount is listed below. Upon final selection of the project scope and award of subcontractor bids, the incentive applications will be filed.

Energy Conservation Measure	Facility	Estimated Incentive
Led Lighting Upgrades	Slocum Skews School	$21,432.79
Led Lighting Upgrades	Memorial High School	$25,480.55
Led Lighting Upgrades	Shaler Academy	$7,951.78
Led Lighting Upgrades	Bergen Blvd School	$452.87
Lighting Controls	Slocum Skews School	$1,613.96
Lighting Controls	Memorial High School	$1,011.74
Lighting Controls	Shaler Academy	$529.96
Plug Loads	Slocum Skews School	$1,324.90
Plug Loads	Memorial High School	$1,361.03
Plug Loads	Shaler Academy	$566.09
Plug Loads	Bergen Blvd School	$361.34
	Total Incentive	$ 62,087.00

Combined Heat & Power

One of the goals of the State of New Jersey is to enhance energy efficiency through on-site power generation with recovery and productive use of waste heat, and to reduce existing and new demands to the electric power grid. The Board of Public Utilities seeks to accomplish this goal by providing generous financial incentives for Combined Heat & Power (CHP) and Fuel Cell (FC) installations.

Eligible CHP or Waste Heat to Power (WHP) projects must achieve an annual system efficiency of at least 60% (Higher Heating Value - HHV), based on total energy input and total utilized energy output. Mechanical energy may be included in the efficiency evaluation.

In order to qualify for incentives, systems must operate a minimum of 5,000 full-load equivalent hours per year (i.e. run at least 5,000 hours per year at full rated kW output). The Office of Clean Energy (OCE) may grant exceptions to this minimum operating hours requirement for Critical Facilities, provided the proposed system operates a minimum of 3,500 full-load

equivalent hours per year and is equipped with blackstart and islanding capability. For this program, a Critical Facility is defined as any:

(a) public facility, including any federal, state, county, or municipal facility,

(b) non-profit and/or private facility, including any hospital, police station, fire station, water/wastewater treatment facility, school, multifamily building, or similar facility that:

(A) is determined to be either Tier 1 or critical infrastructure by the New Jersey Office of Emergency Management or the State Office of Homeland Security and Preparedness or

(B) could serve as a Shelter during a power outage. A Shelter is a facility able to provide food, sleeping arrangements, and other amenities to its residents and the community.

The CHP, FC, or WHP system must have a ten (10) year all-inclusive warranty. The warranty must cover the major components of the system eligible for the incentive, to protect against breakdown or degradation in electrical output of more than ten percent from the originally rated electrical output. The warranty shall cover the full cost of repair or replacement of defective components or systems, including coverage for labor costs to remove and reinstall defective components or systems. In the event the system warranty does not meet program requirements, customer must purchase an extended warranty or a ten (10) year maintenance/service contract. The cost of the ten (10) year warranty or service contract may be considered as part of the cost of the project. Notwithstanding the foregoing, public entities that are prohibited from entering into agreements for the full ten (10) years may comply with the 10-year requirement by:

(a) providing an agreement for the longest lawful term,
(b) committing the entity to purchase an agreement for the remaining years, and
(c) either:
(i) providing the vendor's commitment for specific pricing for those remaining years, or
(ii) assuming the pricing for the remaining years will increase by 2.5% each year

Incentive Structure:

Eligible Technologies	Size (Installed Rated Capacity)	Incentive ($/kW)	% of Total Cost Cap per project[3]	$ Cap per project[3]
Powered by non-renewable or renewable fuel source, or combination[4]: Gas Internal Combustion Engine Gas Combustion Turbine Microturbine Fuel Cells with Heat Recovery (FCHR)	≤500 kW	$2,000	30-40%[2]	$2 million
	>500 kW - 1 MW	$1,000		
	> 1 MW - 3 MW	$550	30%	$3 million
	>3 MW	$350		
Fuel Cell without Heat Recover (FCwoHR)	Same as above(1)	Applicable amount above	30%	$1 million
Waste Heat to Power	≤ 1MW	$1,000	30%	$2 million
	> 1MW	$500		$3 million

Footnotes:

(1) Incentives are tiered, which means the incentive levels vary based upon the installed rated capacity, as listed in the chart above. For example, a 4 MW CHP system would receive $2.00/watt for the first 500 kW, $1.00/watt for the second 500 kW, $0.55/watt for the next 2 MW and $0.35/watt for the last 1 MW (up to the caps listed).

(2) The maximum incentive will be limited to 30% of total project. For CHP-FC projects up to 1 MW, this cap will be increased to 40% where a cooling application is used or included with the CHP system (e.g. absorption chiller).

(3) Projects will be eligible for incentives shown above, not to exceed the lesser of % of total project cost per project cap or maximum $ per project cap. Projects installing CHP or FC with WHP will be eligible for incentive shown above, not to exceed the lesser caps of the CHP or FC incentive. Minimum efficiency will be calculated based on annual total electricity generated, utilized waste heat at the host site (i.e. not lost/rejected), and energy input.

(4) Systems fueled by a Class 1 Renewable Fuel Source, as defined by N.J.A.C. 14:8-2.5, are eligible for a 30% incentive bonus. If the fuel is mixed, the bonus will be prorated accordingly. For example, if the mix is 60/40 (60% being a Class 1 renewable), the bonus will be 18%. This bonus will be included in the final performance incentive payment, based on system performance and fuel mix consumption data. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

(5) CHP or FC systems located at Critical Facility and incorporating blackstart and islanding technology are eligible for a 25% incentive bonus. This bonus incentive will be paid with the second/Installation incentive payment. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

Incentive Payment Schedule

The total incentive is divided into three partial payments. Each stage of payment requires additional documentation and/or has conditions that must be met. At approval, the maximum incentive partial payment amounts are calculated by multiplying the total incentive by the ratios listed in the following table.

Purchase	Installation	Acceptance of 12 months post-installation performance data
30%	50%	20%

(e.g., for the purpose of calculating a payback period)

Incentive Calculations

All estimated incentive values for Ridgefield Public Schools ESIP project were calculated using PSE&G prescriptive rebates. The total incentive amount was calculated to be $62,087

No implied and/or written guarantee is being made with respective to the receipt of incentives. All incentives estimates carry inherent risks that may jeopardize the receipt of them. Therefore, Ridgefield Public Schools acknowledges and accepts that any project proposed should not rely on the receipt of incentives as a reason to implement it.

ECM 1 & 16– LED Lighting Replacement & Lighting Controls

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
1	LED Lighting Replacement	✔	✔	✔	✔	
16	Lighting Controls	✔	✔	✔		

Background

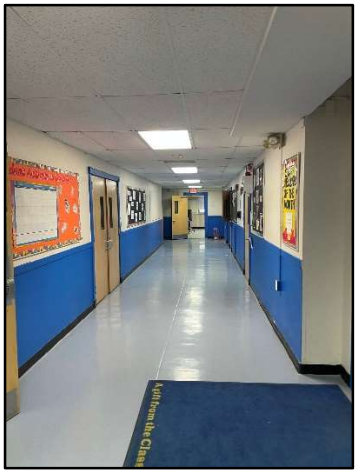
Lighting retrofits can greatly reduce energy consumption and lower energy bills, while maintaining lighting levels and quality by upgrading lighting components to more efficient and advanced technologies. Upgrading technologies can also offer employees greater control over lighting, allowing for additional energy savings

Improvements in lighting technologies have led to increased lifetimes for components that will result in fewer failures and lengthen the time between maintenance activities.

The implementation of a routine maintenance program in addition to the lighting retrofit will greatly simplify the maintenance practices and reduce the operational costs.

Existing Conditions


Existing interior lighting at Shaler Academy and Memorial High School

Existing interior lighting at Bergen Blvd and Slocum Skews School

Scope of Work – LED Lighting Replacement

Slocum Skews School - Retrofit or replace existing interior and exterior fixtures with LED bulbs/fixtures as proposed in the line-by-lines in Appendix G. Additional 3% attic stock of LED tubes are included and there is a 10-year warranty on all LED tubes.

Memorial High School - Retrofit or replace existing interior and exterior fixtures with LED bulbs/fixtures as proposed in the line-by-lines in Appendix G. Additional 3% attic stock of LED tubes are included and there is a 10-year warranty on all LED tubes.

Shaler Academy - Retrofit or replace existing interior fixtures with LED bulbs/fixtures as proposed in the line-by-lines in Appendix G. Additional 3% attic stock of LED tubes are included and there is a 10-year warranty on all LED tubes.

Bergen Boulevard School - Prior to beginning the Ridgefield Public Schools investment grade audit, the Bergen Boulevard school was already 90% converted to LED lighting. The remaining 10% will be converted with LED bulbs/fixtures as proposed in the line-by-lines in Appendix G. Additional 3% attic stock of LED tubes are included and there is a 10-year warranty on all LED tubes.

Central Office - Prior to beginning the Ridgefield Public Schools investment grade audit, the Central Office was already converted to 100% LED lighting. No LED lighting replacements are included for the Central Office as part of the ESIP. No attic stock or warranty is included.

Scope of Work – Lighting Controls

Add occupancy sensors to existing spaces to control LED tubes. Refer to appendix G for additional details.

ECM Calculations

A coincidence factor is applied to estimate peak demand savings. The impact on the HVAC systems is captured as well. See Appendix G for supporting documents, LED Lighting Replacement savings calculation and Lighting Controls savings calculation.

LED Lighting Replacement Savings				
BUILDING	**SQFT**	**kW Savings (Summer Peak Demand)**	**kWh SAVINGS**	**THERM SAVINGS**
Slocum Skews School	92,147	42.650	176,051	(350.810)
Memorial High School	87,850	56.3	230,695	(463)
Shaler Academy	47,368	17.6	69,334	(145)
Bergen Blvd School	29,954	1.4	5,348	(11)

Lighting Controls Savings				
BUILDING	**SQFT**	**kW Savings (Summer Peak Demand)**	**kWh SAVINGS**	**THERM SAVINGS**
Slocum Skews School	92,147	3.1	12,150	(25)
Memorial High School	87,850	1.7	6,569	(14)
Shaler Academy	47,368	1.0	3,897	(8)

ECM 2 – District Wide Energy Management System

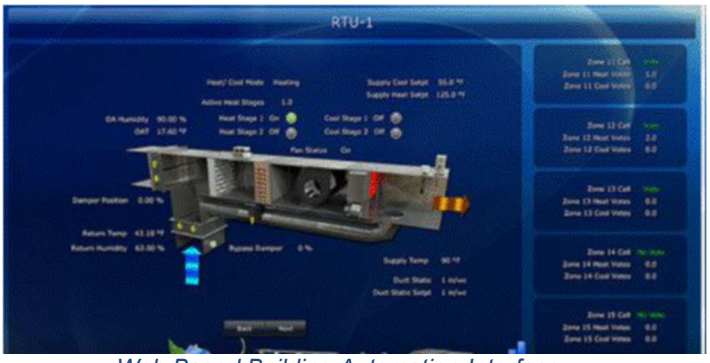
RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
2	District Wide Energy Management System	✔	✔	✔	✔	✔

Background

Energy Management Systems (EMS) are systems comprised of sensors, operators, processors, and a front-end user interface that controls and monitors electrical and mechanical building systems. Such systems provide automated control and monitoring of the heating, cooling, ventilation, lighting and performance of a building or group of buildings. The energy management system will provide Ridgefield Public Schools with continuous monitoring & reporting.



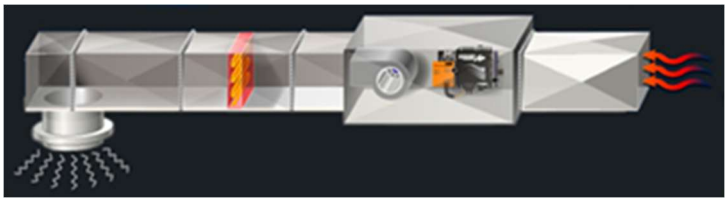
Web Based Building Automation Interface

Having building systems monitored from a central location enables the operator to receive alerts and predict future problems or troublesome conditions. The data obtained from these can be used to produce a trend analysis and annual consumption forecasts. Advanced control strategies implemented using these systems such as time scheduling, optimum start and stop, night set-back, demand-controlled ventilation, and peak demand limiting. The auditor

will be able to use the EMS to diagnose current building system problems as well as tailor specific energy savings strategies that utilize the full capability of the given EMS.

The upgraded District Wide EMS will integrate existing proprietary systems with new Open Protocol DDC Controls. Control strategies will be designed and programmed into the system to maintain building comfort while operating the building mechanical system in the most efficient manner possible. Strategies include:

1. Occupancy Scheduling
2. Building Wide Night Set Back
3. Morning Warm Up
4. Individual Room Temperature Set Point Control
5. Supply Air Temperature Reset
6. Chilled & Heating Supply Water Temperature Resets
7. Economizer Control
8. CO2 Ventilation Control



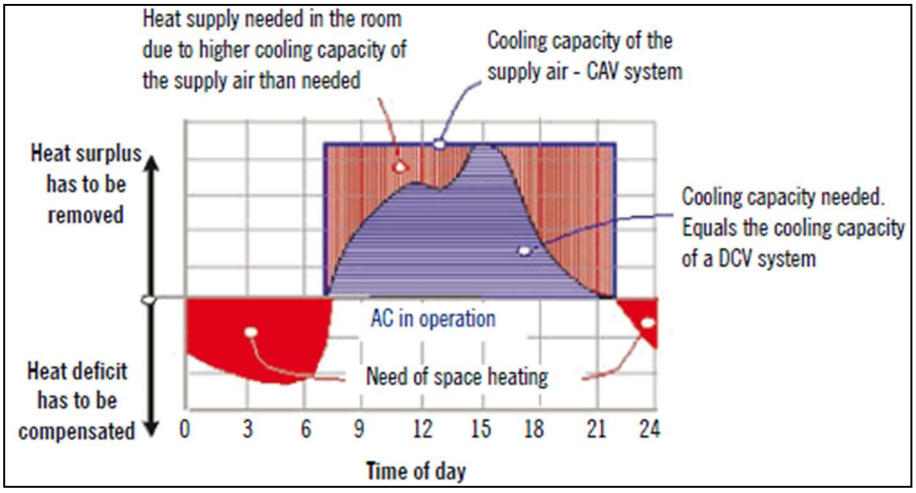
Demand Control Ventilation

In most commercial occupancies, ventilation is provided to deal with two types of indoor pollution: (1) odors from people, and (2) off-gassing from building components and furniture. When a space is vacant, it has no people pollution, so the people-related ventilation rate is not needed. Many types of high-occupancy spaces, such as classrooms, multipurpose rooms, theaters, conference rooms, or lobbies have ventilation designed for a high peak occupancy that rarely occurs. Ventilation can be reduced during the many hours of operation when spaces are vacant or at lower than peak occupancy. When ventilation is reduced, building owners or operators save energy because it is not necessary to heat or cool as much outside air. In colder climates, heating for ventilation air is greater and DCV saves the most energy.

Demand Control Ventilation Operation

The objective of a CO2 control strategy is to modulate ventilation to maintain target cfm/person ventilation rates based on actual occupancy. The strategy should allow for reduced overall ventilation during periods of less than full occupancy which will save energy. Typical control approaches have used a proportional or proportional-integral control algorithm to modulate ventilation between a base ventilation rate established for non-occupant-related sources and the design ventilation rate for the space. Typically, modulation of outside air above base

ventilation begins when indoor CO2 is 100 ppm above outside levels and continues until the target CO2 levels are reached and the design ventilation rate is provided.



Duct sensors are best used where a single space or multiple spaces with common occupancy patterns are being ventilated. An example of this approach would be to place a sensor in the return duct of an air handler that serves multiple classrooms, using an upper limit set point of 500 or 600 ppm CO2 above ambient (instead of 700 ppm). This approach works best when the AHU system is serving spaces that are occupied with very similar schedules and rates.

Existing Conditions

Existing pneumatic controls at Memorial High School and Bergen Blvd

Existing pneumatic controls at Slocum Skews School and Shaler Academy

Scope of Work

This measure involves upgrading the existing control system with an open-protocol, web-based Energy Management system. A Direct Digital Controller, which leverages current technology and advance capabilities for the control of the new HVAC equipment, will tie into the existing EMS's architecture. Additionally, where the existing HVAC equipment is to remain, integration to the existing legacy Direct Digital Controllers onto the new EMS Open platform will occur. The Open platform proposed is based on the Honeywell Niagara 4 frameworks. This allows the owner the advantage of having the availability of obtaining replacement and services of the proposed EMS through multiple commercial channels and provides an additional benefit of an Open-Source Building Management System. This distinctive feature unleashes the owner from obtaining support from only a single source provider, allowing them instead to obtain support from readily available multiple sources.

The proposed energy management system will be able to vary the operation of the unit, outdoor air damper, space temperature set points, and air conditioning systems (if applicable). This will include zone scheduling, temperature setback and unoccupied outdoor air shut off. Each building will be provided with electric and natural gas submetering for continuous monitoring and reporting of building energy consumption via Energy Dashboards.

A more specific scope of work includes:

- Building Automation Systems shall be accessible via the Internet.
- User shall have the ability to view the system graphics, change set points, perform overrides, view schedules, change schedules, view alarms, acknowledge alarms, view trend information as well as print, save & e-mail trend information.
- A Secure Internet Connection to the District Network shall be provided and managed by the District IT Department.

- 3-D Graphics Package will be provided for navigating the Building Automation System as well as viewing floor plans, system graphics and equipment graphics.
- The District Facilities and IT Staff will receive full training on the operation of the system.
- Demand Control Ventilation (DCV) will be utilized in the following spaces:

ECM Calculations

Energy Savings from the replacement of pneumatic controls were calculated using BIN weather data analysis. Refer to Appendix G for additional details.

EMS SAVINGS			
BUILDING	**kWh SAVINGS**	**kW Savings (Summer Peak Demand)**	**Therms**
Slocum Skews School	26,266.31	7.00	6,066.50
Memorial High School	56,245.56	17.00	5,648.84
Shaler Academy	14,837.28	-	1,185.21
Bergen Blvd School	111.90	-	2,293.22
Central Office	764.54	-	306.97

NJ BPU FY 2020 Protocols - Occupancy Controlled Thermostats

Algorithms

Cooling Energy Savings (kWh/yr) = $(((T_c * (H+5) + S_c * (168 - (H+5)))/168) - T_c) * (P_c * Cap_{hp} * 12 * EFLH_c/EER_{hp})$

Heating Energy Savings (kWh/yr) = $(T_h - ((T_h * (H+5) + S_h * (168 - (H+5)))/168)) * (P_h * Cap_{hp} * 12 * EFLH_h/EER_{hp})$

Heating Energy Savings (Therms/yr) = $(T_h - ((T_h * (H+5) + S_h * (168 - (H+5)))/168) * (P_h * Cap_h * EFLH_h/AFUE_h/100{,}000)$

Definition of Variables

T_h = Heating Season Facility Temp. (°F)
T_c = Cooling Season Facility Temp. (°F)
S_h = Heating Season Setback Temp. (°F)
S_c = Cooling Season Setup Temp. (°F)
H = Weekly Occupied Hours
Cap_{hp} = Connected load capacity of heat pump/AC (Tons) – Provided on Application.
Cap_h = Connected heating load capacity (Btu/hr) – Provided on Application.
$EFLH_c$ = Equivalent full load cooling hours
$EFLH_h$ = Equivalent full load heating hours
P_h = Heating season percent savings per degree setback
P_c = Cooling season percent savings per degree setup
$AFUE_h$ = Heating equipment efficiency – Provided on Application.
EER_{hp} = Heat pump/AC equipment efficiency – Provided on Application

12 = Conversion factor from Tons to kBtu/hr to acquire consumption in kWh.

168 = Hours per week.

7 = Assumed weekly hours for setback/setup adjustment period (based on 1 setback/setup per day, 7 days per week).

Summary of Inputs

Occupancy Controlled Thermostats

Component	Type	Value	Source
T_h	Variable		Application
T_c	Variable		Application
S_h	Fixed	T_h-5°	
S_c	Fixed	T_c+5°	
H	Variable		Application; Default of 84 hrs/week
Cap_{hp}	Variable		Application
Cap_h	Variable		Application
$EFLH_{c,h}$	Variable	See Table Below	1
P_h	Fixed	3%	2
P_c	Fixed	6%	2
$AFUE_h$	Variable		Application
EER_{hp}	Variable		Application

EFLH Table

Facility Type	Heating $EFLH_h$	Cooling $EFLH_c$
Assembly	603	669
Auto repair	1910	426
Dormitory	465	800
Hospital	3366	1424
Light industrial	714	549
Lodging – Hotel	1077	2918
Lodging – Motel	619	1233
Office – large	2034	720
Office – small	431	955
Other	681	736
Religious worship	722	279
Restaurant – fast food	813	645
Restaurant – full service	821	574

Facility Type	Heating $EFLH_h$	Cooling $EFLH_c$
Retail – big box	191	1279
Retail – Grocery	191	1279
Retail – small	545	882
Retail – large	2101	1068
School – Community college	1431	846
School – postsecondary	1191	1208
School – primary	840	394
School – secondary	901	466
Warehouse	452	400

Multi-family EFLH by Vintage

Facility Type	Prior to 1979	From 1979 to 2006	From 2007 through Present
Low-rise, Cooling	507	550	562
Low-rise, Heating	757	723	503
High-rise, Cooling	793	843	954
High-rise, Heating	526	395	219

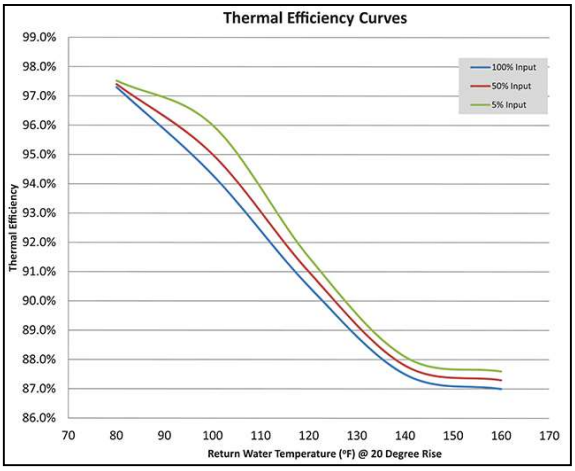
ECM 3 – Boiler Replacement

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
3	Boiler Replacement			✔		✔

Old, oversized boiler systems have efficiencies in the range of 56%–75%. A condensing boiler hot water heating system can achieve efficiencies as high as 97%, converting nearly all the fuel to useful heat. The efficiency of the boiler increases at lower return water temperature. Lower return water temperatures allow more water vapor from the exiting flue gas to condense, allowing its latent heat of vaporization to be recovered.



Existing Conditions

Shaler Academy – Seven (7) Hydro Therm 299 MBH condensing boilers served the hot water loop for heating to the entire school. The district was having on-going maintenance issues every heating season while these boilers were reaching the end of their useful life. DCO Energy witnessed during the investment grade audit, in the summer of 2022, the district began the removal of two (2) condensing boilers and are in the process of reinstalling one (1) new condensing boiler. Ridgefield Public Schools plan to have the new boiler plant up and ready for the upcoming heating season (October). DCO Energy will be claiming the energy savings associated with the boiler replacement within Ridgefield Public School's ESIP.

Central Office – One (1) Weil-McLain 305 MBH non-condensing hot water boiler that is beyond its useful life distributes to the unit ventilators through a 2-pipe system for heating the entire building.

Existing hot water boilers at Central Office and Shaler Academy

Scope of Work

Shaler Academy
Boilers are currently in the process of being replaced by the district for the 2022-2023 school year. DCO will be capturing energy savings from the boiler replacement within this ESIP.

- Remove (2) existing Hydro Therm MBH condensing hot water boilers
- Install (1) Weil-McLain 299 MBH condensing hot water boiler
- Heating Hot Water and Electrical tie-in
- Building Automation System integration

Central Office

- Remove (1) existing 305 MBH non-condensing hot water boiler
- Install (1) 305 MBH condensing hot water boiler
- Heating Hot Water and Electrical tie-in
- Building Automation System integration

ECM Calculations

Energy Savings from the installation of a high efficiency boilers were calculated using the BPU protocols. The existing hot water boilers at Shaler Academy are derated to 82.279% efficiency. The proposed hot water condensing boilers will operate at a minimum of 87% efficiency with higher efficiency achievable at lower return water temperatures. The central office boiler replacement is not included in the project due to poor financial payback. See Appendix G for detailed information for ECM cost and savings for the central office.

Boiler Replacement Savings

BUILDING	Existing Qty	Input Capacity (mbh) [CAPin]	Equivalent Full Load Hours [EFLHh]	Boiler Baseline Efficiency [EFFb]	Baseline Plant Rated Output MBH	Baseline Output Btuh/sq ft	Proposed Qty	Boiler Proposed Efficiency [EFFq]	Proposed Plant Rated Input MBH (CAPYbi)	Proposed Plant Rated Output MBH	Proposed Output Btuh/sq ft	Calculated Annual Fuel Savings (Therms)
Shaler Academy	1	299	840	82.279%	246	5.2	1	87%	299	260	5.5	144.1220

Algorithms

Fuel Savings (MMBtu/yr) = Cap_{in} * $EFLH_h$ * ((Eff_q/Eff_b)-1) / 1000 kBtu/MMBtu

Definition of Variables

Cap_{in} = Input capacity of qualifying unit in kBtu/hr

$EFLH_h$ = The Equivalent Full Load Hours of operation for the average unit during the heating season in hours

Eff_b = Boiler Baseline Efficiency

Eff_q = Boiler Proposed Efficiency

1000 = Conversion from kBtu to MMBtu

Summary of Inputs

Prescriptive Boilers

Component	Type	Value	Source
Cap_{in}	Variable		Application
$EFLH_h$	Fixed	See Table Below	1
Eff_b	Variable	See Table Below	2
Eff_q	Variable		Application

$EFLH_h$ Table

Facility Type	Heating EFLH
Assembly	603
Auto repair	1910
Dormitory	465
Hospital	3366
Light industrial	714
Lodging – Hotel	1077
Lodging – Motel	619
Office – large	2034
Office – small	431
Other	681
Religious worship	722

Facility Type	Heating EFLH
Restaurant – fast food	813
Restaurant – full service	821
Retail – big box	191
Retail – Grocery	191
Retail – small	545
Retail – large	2101
School – Community college	1431
School – postsecondary	1191
School – primary	840
School – secondary	901
Warehouse	452

Multi-family EFLH by Vintage

Facility Type	Prior to 1979	From 1979 to 2006	From 2007 through Present
Low-rise, Heating	757	723	503
High-rise, Heating	526	395	219

Baseline Boiler Efficiencies (Eff_b)

Boiler Type	Size Category (kBtu input)	Standard 90.1-2016
Hot Water – Gas fired	< 300 ≥ 300 and ≤ 2,500 > 2,500	82% AFUE 80% Et 82% Ec
Hot Water – Oil fired	< 300 ≥ 300 and ≤ 2,500 > 2,500	84% AFUE 82% Et 84% Ec
Steam – Gas fired	< 300	80% AFUE
Steam – Gas fired, all except natural draft	≥ 300 and ≤ 2,500	79% Et
Steam – Gas fired, all except	> 2,500	79% Ec

Boiler Type	Size Category (kBtu input)	Standard 90.1-2016
Steam – Gas fired, natural draft	≥ 300 and ≤ 2,500	79% Et
Steam – Gas fired, natural draft	> 2,500	79% Ec
Steam – Oil fired	< 300	82% AFUE
	≥ 300 and ≤ 2,500	81% Et
	> 2,500	81% Ec

Sources

1. New York State Joint Utilities, *New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs*, V7, April 2019. Appendix G – Equivalent Full-Load Hours (EFLH), For Heating and Cooling. P. 675-680. EFLH values for NYC due to proximity to NJ.
2. ASHRAE Standards 90.1-2016. *Energy Standard for Buildings Except Low Rise Residential Buildings*; available at: https://www.ashrae.org/standards-research--technology/standards--guidelines. Table 6.8.1-6

ECM 4 – Chiller Replacement

RIDGEFIELD PUBLIC SCHOOLS		Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
✔	ECM evaluated but not included					
✔	ECM included in the project					
ECM #	**ECM DESCRIPTION**					
4	Chiller Replacement					✔

Background

A chiller is one of the most energy-intensive units in any facility. Technology has made leaps and bounds in the past several years in making these machines more efficient. Chiller efficiency is rated by how much electrical energy is used to produce an amount of cooling. This is expressed in kilowatts per ton of cooling (kW/ton). An older machine may be as high as 1.5 kW/ton, whereas a new chiller may be as low as 1 kW/ton or even less. A new machine uses less electrical power to produce the same amount of cooling. The efficiency of the chiller can vary widely depending on whether the model is air-cooled, or water cooled.

Existing Conditions

The Central Office has one (1) 10-ton Acme water cooled chiller. Existing equipment to be replaced with (1) 10-ton high efficiency water cooled chiller. This chiller conditions a chilled water loop which serving unit ventilators throughout the building

Existing chiller at Central Office

Scope of Work

- Remove existing 10-ton water-cooled chiller
- Install new 10-ton water-cooled scroll chiller
- Structural Analysis (if required by code official)
- Electrical Tie-in
- Building Automation System integration

ECM Calculations

This ECM is not included in the project because of poor financial payback. See Appendix G for detailed savings calculations and ECM costs.

DCO Energy Efficiency Division
100 Lenox Drive
Lawrenceville, NJ 08648

ECM 5 - Premium Efficiency Pump Motors and VFDs

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
5	Premium Efficiency Pump Motors and VFDs	✔	✔	✔	✔	✔

Background

Premium efficiency electric motors will help optimize fan and pump efficiency, reduce electrical power consumption, and improve system reliability. These motors are designed to run cooler, last longer, and require less maintenance than the existing standard efficiency motors. Premium efficiency motors can be as high as 95% efficient (as opposed to standard efficiency motors of 78% to 88%) and are capable of operating at varying speeds allowing Variable Frequency Drive (VFD) installations where applicable.

Existing Conditions

Existing Pumps and Motors at Memorial High School and Shaler Academy

Existing Pumps and Motors at Slocum Skews and Bergen Blvd

Scope of Work

Slocum Skews School - The two (2) constant volume hot water loop pumps at Slocum Skews School will be replaced with new pumps, motors.

Memorial High School - The five (5) constant volume hot water loop pumps at Memorial High School will be replaced with new pumps, motors.

Shaler Academy - The five (5) constant volume hot water loop pumps and the two (2) constant volume chilled water loop pumps at Shaler Academy will be replaced with new pumps, motors.

Bergen Boulevard School - The two (2) constant volume hot water loop pumps at Bergen Boulevard School will be replaced with new pumps, motors.

Central Office - The one (1) constant volume hot water loop pump and the one (1) constant volume chilled water loop pump at the Central Office will be replaced with new pumps, motors.

Pump + VFD Estimate				
BUILDING	**SQFT**	**CATEGORY**	**QUANTITY**	**HP**
Slocum Skews School	92,147	HWLP-1-2	2	2.0
Memorial High School	87,850	HWLP-1-5	5	3.0
Shaler Academy	47,368	HWLP-1-3	3	1.5
		HWLP-4-5	2	3.0
		CHWLP-1-2	2	7.5
Bergen Blvd School	29,954	HWLP-1-2	2	5
Central Office	2,952	HWLP-1	1	1.0
		CHWLP-1	1	2.0

ECM Calculations

This ECM is not included in the project because of poor financial payback. See Appendix G for detailed savings calculations and ECM costs.

DCO Energy Efficiency Division
100 Lenox Drive
Lawrenceville, NJ 08648

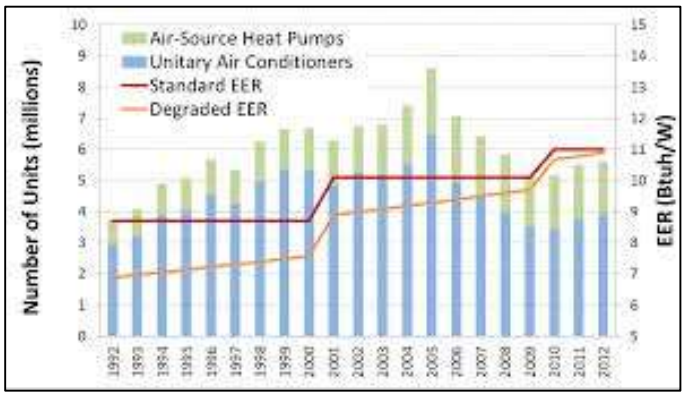
ECM 6 – Rooftop Unit Replacement

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
6	Rooftop Unit Replacement		✔			

Background



Many commercial buildings are operating with older and inefficient HVAC systems. The average life expectancy of commercial HVAC RTU equipment is 10 to 15 years—which means that many commercial buildings are ready for new natural gas rooftop units. Technology improvements and demand have led to greater energy efficiency and more choices in systems. Installing new, higher efficiency units will provide energy savings as well as deliver enhanced technology and controls of the RTUs when compared to the existing units.

Existing Conditions

Memorial High School – Nine (9) total direct expansion total rooftop units currently serve this high school. Five (5) direct expansional only units are McQuay and four (4) direct expansion with gas-fired for heat are Lennox units. These units range from 4 to 20 tons with a total of 75 tons of cooling. Within this measure, DCO Energy is evaluating 2 Lennox units for replacement, approxemently 8 tons of cooling. These units were identified to be in poor condition and past ASHREA useful life of 15 years.

Existing Rooftop Units at Memorial High School

Scope of Work

The following RTUs will be replaced with high efficiency constant volume units:

RTU Replacement Scope of Work						
BUILDING	SQFT	SYSTEM	Areas Served	Existing Qty	Tons Per Unit	Total Existing Tons
Memorial High School	87,850	RTU (Packaged AC)	101-104	2	4.0	8

ECM Calculations

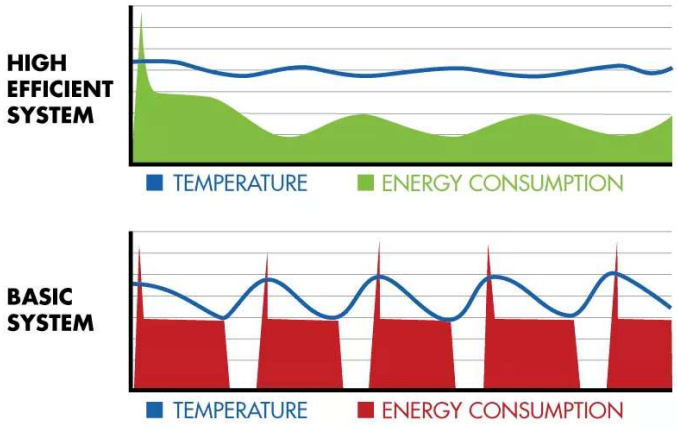
This ECM is not included in the project because of poor financial payback. See Appendix G for detailed savings calculations and ECM costs.

ECM 7 – Install High Efficiency Air Conditioning Units

RIDGEFIELD PUBLIC SCHOOLS		Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
✔ ECM evaluated but not included						
✔ ECM included in the project						
ECM #	**ECM DESCRIPTION**					
7	Install High Efficiency Air Conditioning Units		✔	✔		✔

Background

An air conditioning unit is one of the most energy-intensive units in any facility. Technology has made leaps and bounds in the past several years in making these machines more efficient. Air conditioning unit efficiency is rated by how much electrical energy is used to produce an amount of cooling. This is expressed in kilowatts per ton of cooling (kW/ton). An older machine may be as high as 1.2 kW/ton, whereas a new air conditioning unit may be as low as 0.9 kW/ton or even less. A new machine uses less electrical power to produce the same amount of cooling.



Existing Conditions

Existing AC Units at Shaler Academy and Central Office

Scope of Work

The following Air Conditioning units will be replaced high efficiency Air Conditioning Units units:

High Efficiency Air Conditioning Units Scope of Work					
BUILDING	**SQFT**	**Unit Tag**	**Area Served**	**Tons**	**QUANTITY**
Memorial High School	87,850	2A	Room 154, Music	2.5	3
		2B	IT	4	1
		2C	Guidance	2.5	1
Shaler Academy	47,368		Old Building	3	9
Central Office	2,952		Office	1.5	1

ECM Calculations

This ECM is not included in the project because of poor financial payback. See Appendix G for detailed savings calculations and ECM costs.

ECM 8 – Install High Efficiency Heat Pumps

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
8	Install High Efficiency Heat Pumps		✔	✔		

Background

Many commercial buildings are operating with older and inefficient HVAC systems. The average life expectancy of commercial HVAC Heat Pump equipment is 10 to 15 years—which means that many commercial buildings are ready for new units. Technology improvements and demand have led to greater energy efficiency and more choices in systems. Installing new, higher efficiency units will provide energy savings as well as deliver enhanced technology and controls of the Heat Pumps when compared to the existing units.

Existing Conditions

Existing Heat Pumps at Shaler Academy and Memorial High School

Scope of Work

The following Heat Pumps will be replaced high efficiency Heat Pump units:

BUILDING	SQFT	Model Number	Existing Qty	Tons Per Unit	Total Existing Tons
Memorial High School	87,850	B1PA024A06C	1	2	2
Memorial High School		B3CH048A25C	1	4	4
Memorial High School		B3CH048A25C	1	4	4
Memorial High School		B1PA024A06C	1	2	2
Memorial High School		B3CH048A25B	1	4	4
Memorial High School		B3CH048A25B	1	4	4
Shaler Academy	47,368	B3CH048A25C	1	4	4.0
Shaler Academy		B1PA024A06C	1	2	2.0
Shaler Academy		B3CH048A25C	1	4	4

ECM Calculations

This ECM is not included in the project because of poor financial payback. See Appendix G for detailed savings calculations and ECM costs.

ECM 9 – Unit Ventilator Replacement

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
9	Unit Ventilator Replacement	✔		✔	✔	

Background & Existing Conditions

New unit ventilators will improve classroom indoor air quality. Superior indoor air quality can help ensure a healthier and higher performance learning environment for students and staff, and the choice of ventilation equipment plays a big role in the quality of the indoor air. Proper ventilation with outdoor air is a key component for good indoor air quality in schools and classrooms since indoor air may be two to five times more polluted than outdoor air, and there are large populations of children who may be more susceptible to indoor pollutants than the general population.

Unit Ventilator

The high occupant densities of schools and classrooms often make it challenging for building designers to incorporate ventilation systems that provide adequate outdoor ventilation air while providing buildings with good indoor air quality and minimized costs.

Existing Conditions

Existing unit ventilators at Slocum Skews and Shaler Academy

Scope of Work

The following unit ventilators were evaluated for replacement with high efficiency units: The fifty-nine (59) unit ventilators at Slocum Skewes and the seven (7) unit ventilators in the Old Wing at Shaler Academy are not included in the project due to poor payback.

Unit Ventilator Replacement Scope of Work

BUILDING	SQFT	NOTES	CATEGORY	QUANTITY
Slocum Skews School	92,147	Metals	Entire Building	59
		Finishes		
		HVAC		
		Electrical		
		General Requirements & Conditions		
		Primes OH&P		
		Bonding & Insurance		
Shaler Academy	47,368	Metals	Old Wing	7
		Finishes	Room 104	1
		HVAC		
		Electrical		
		General Requirements & Conditions		
		Primes OH&P		
		Bonding & Insurance		
Bergen Blvd School	29,954	Metals	Conference Room	1
		Finishes		
		HVAC		
		Electrical		
		General Requirements & Conditions		
		Primes OH&P		
		Bonding & Insurance		

ECM Calculations

Energy Savings from the installation of unit ventilators were calculated using BPU protocols. The calculations are shown below. The Slocum Skews entire building and Shaler Academy old wing replacement unit ventilator replacement is not included in the project due to poor financial payback. See Appendix G for detailed cost and savings information for those locations.

Unit Ventilator Replacement Savings									
BUILDING	UNIT TAG	NUMBER OF UNITS	FAN MOTOR HP	EXISTING MOTOR EFFICIENCY (Nbase)	REPLACEMENT MOTOR EFFICIENCY (Nprem)	LF	CF	IFvfd	HRS
Shaler Academy	Room 104	1	0.33	71.3%	74.3%	0.75	0.74	1.0	2745
Bergen Blvd School	Conference Room	1	0.33	71.3%	74.3%	0.75	0.74	1.0	2745

Unit Ventilator Replacement Savings										
BUILDING	UNIT TAG	ΔkW	DEMAND SAVINGS (Kw)	ELECTRIC SAVINGS (kWh)	VFD ESF	VFD DSF	VFD DEMAND SAVINGS (kW)	VFD ELECTRIC SAVINGS (kWh)	TOTAL DEMAND SAVINGS (kW)	TOTAL ELECTRIC SAVINGS (kWh)
Shaler Academy	Room 104	0.01	0.010	29	2,033.00	0.286	0.1	671	0.1	700
Bergen Blvd School	Conference Room	0.01	0.010	29	2,033.00	0.286	0.1	671	0.1	700

Component	Type	Value	Source
HP	Variable	Nameplate/Manufacturer Spec. Sheet	Application
LF	Fixed	0.75	1
η_{base}	Fixed	ASHRAE 90.1-2016 Baseline Efficiency Table	ASHRAE
η_{prem}	Variable	Nameplate/Manufacturer Spec. Sheet	Application
IF_{VFD}	Fixed	1.0 or 0.9	3
Efficiency - η_{ee}	Variable	Nameplate/Manufacturer Spec. Sheet	Application
CF	Fixed	0.74	1
HRS	Fixed	Annual Operating Hours Table	1

Algorithms

Energy Savings (kWh/yr) = N * HP * ESF

Peak Demand Savings (kW) = N * HP * DSF

Definitions of Variables

N = Number of motors controlled by VFD(s) per application
HP = Nameplate motor horsepower or manufacturer specification sheet per application
ESF = Energy Savings Factor (kWh/year per HP)
DSF = Demand Savings Factor (kW per HP)

Summary of Inputs

Variable Frequency Drives

Component	Type	Value	Source
HP	Variable	Nameplate/Manufacturer Spec. Sheet	Application
ESF	Variable	See Table Below	Derived value based on the following sources: 1, 2, 3
DSF	Variable	See Table Below	Derived value based on the following sources: 1, 2, 3

The ESF for the supply and return fans and circulating pumps are derived from a 2014 NEEP-funded study of 400 VFD installations in eight northeast states. The derived values are based on actual logged input power data and reflect average operating hours, load factors, and motor efficiencies for the sample. Savings factors representing cooling tower fans and boiler feed water pumps are not reflected in the NEEP report. Values representing these applications are taken from April 2018 New York TRM, Appendix K, and represent average values derived from DOE2.2 simulation of various building types

VFD Savings Factors

Application	ESF (kWh/Year-HP)	DSF (kW/HP)	Source
Supply Air Fan	2,033	0.286	1
Return Air Fan	1,788	0.297	1
CHW or CW Pump	1,633	0.185	1
HHW Pump	1,548	0.096	1
WSHP Pump	2,562	0.234	1
CT Fan	290	-0.025	2, 3
Boiler Feedwater Pump	1,588	0.498	2, 3

1	.825	.825	.855	.855	.77	.77
1.5	.865	.875	.865	.865	.84	.84
2	.875	.885	.865	.865	.855	.855
3	.885	.895	.895	.895	.855	.865
5	.895	.895	.895	.895	.865	.885
7.5	.902	.91	.91	.917	.885	.895
10	.917	.91	.917	.917	.895	.902
15	.917	.917	.93	.924	.902	.91
20	.924	.917	.93	.930	.91	.91
25	.93	.93	.936	.936	.917	.917
30	.936	.93	.941	.936	.917	.917
40	.941	.941	.941	.941	.924	.924
50	.941	.941	.945	.945	.93	.93
60	.945	.945	.95	.950	.936	.936
75	.945	.945	.95	.954	.936	.936
100	.95	.95	.954	.954	.936	.941
125	.95	.95	.954	.954	.941	.95
150	.954	.958	.958	.958	.941	.95
200	.954	.958	.958	.962	.95	.954

Annual Operating Hours Table

Motor Horsepower	Operating Hours, HRS
1 to 5 HP	2,745
6 to 20 HP	3,391
21 to 50 HP	4,067
51 to 100 HP	5,329
101 to 200 HP	5,200

Algorithms

From application form calculate ΔkW where:

$$\Delta kW = 0.746 * HP * IF_{VFD} * (1/\eta_{base} - 1/\eta_{prem})$$

Demand Savings = (ΔkW) * CF

Energy Savings = (ΔkW)*HRS * LF

Definition of Variables
ΔkW = kW Savings at full load
HP = Rated horsepower of qualifying motor, from nameplate/manufacturer specs.
LF = Load Factor, percent of full load at typical operating condition
IF_{VFD} = VFD Interaction Factor, 1.0 without VFD, 0.9 with VFD
η_{base} = Efficiency of the baseline motor
η_{prem} = Efficiency of the energy-efficient motor
HRS = Annual operating hours
CF = Coincidence Factor

Electric HVAC Systems

The measurement of energy and demand savings for C/I Efficient HVAC program for Room AC, Central AC, and air cooled DX is based on algorithms. (Includes split systems, air to air heat pumps, packaged terminal systems, water source heat pumps, central DX AC systems, ground water or ground source heat pumps)

Algorithms

Air Conditioning Algorithms:

Demand Savings = (BtuH/1000) X ($1/EER_b$-$1/EER_q$) X CF

Energy Savings = (BtuH/1000) X ($1/EER_b$-$1/EER_q$) X EFLH

Definition of Variables

BtuH = Cooling capacity in Btu/Hour – This value comes from ARI/AHRI or AHAM rating or manufacturer data.

CF = Coincidence Factor – This value represents the percentage of the total load which is on during electric system's Peak Window. This value will be based on existing measured usage and determined as the average number of operating hours during the peak window period.

EFLH = Equivalent Full Load Hours – This represents a measure of energy use by season during the on-peak and off peak periods. This value will be determined by existing measured data of kWh during the period divided by kW at design conditions.

HVAC and Heat Pumps

Component	Type	Value	Source
BtuH	Variable	ARI/AHRI or AHAM or Manufacturer Data	Application
EER_b	Variable	See Table below	Collaborative agreement and C/I baseline study
EER_q	Variable	ARI/AHRI or AHAM Values	Application
CF	Fixed	67%	Engineering estimate
EFLH	Fixed	HVAC 1,131 HP cooling 381 HP heating 800	JCP&L metered data[8]

HVAC Baseline Table

Equipment Type	Baseline = ASHRAE Std. 90.1 - 2007
Unitary HVAC/Split Systems, Air Cooled	
· <=5.4 tons:	13 SEER
· >5.4 to 11.25 tons	11 EER
· >11.25 to 20 tons	10.8 EER
.> 21 to 63 tons	9.8 EER
>63 Tons	9.5 EER

ECM 10 – Domestic Water Heater Replacement

RIDGEFIELD PUBLIC SCHOOLS	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
✔ ECM evaluated but not included					
✔ ECM included in the project					
ECM # / **ECM DESCRIPTION**					
10 Domestic Hot Water Heater Replacement		✔			

Background

In a storage (tank) water heater, water is always kept hot and ready for use in insulated storage tanks with capacities ranging from 20 to 140 gallons. Many fuel options are available, including electricity, natural gas, oil, and propane. One drawback of these units is the energy used to always keep the water hot, otherwise known as "standby losses." Condensing gas water heaters are a very promising new entry to the market. A condensing gas water heater works like a normal tank-type water heater, except that before the combustion gases are vented outside, the heat in those gases is captured and used to help heat the water in the tank.

Existing Conditions/Scope of Work

Memorial High School has (1) existing hot water heater and (2) water heater storage tanks. Existing hot water heater to be replaced with (1) new high efficiency condensing water heaters.

Existing Water Heater at Memorial High School

ECM Calculations

This ECM is not included in the project because of poor financial payback. See Appendix G for detailed cost and savings information for this ECM.

ECM 11 – Plug Load Controls

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
11	Plug Load Controls	✔	✔	✔	✔	✔

Background & Existing Conditions

Plug loads are often used for a small portion of the day. Left unmanaged, these loads can add a significant usage and cost to a buildings electric load. Plug load controls utilize specialty sockets from BERT that have software to track real-time usage of your appliances. The software also allows the user to use a web browser to view this usage and automatically turn on/off all appliances plugged into these outlets.

Scope of Work

Existing wall plugs within the facilities will be retrofit with specialty controllable wall plugs. The central office is not included in the project due to poor financial payback. See Appendix G for detailed cost and savings information for this location.

Plug Load Controller Scope of Work			
BUILDING	CATEGORY	NOTES	QUANTITY
Slocum Skews School	Bert 110X	Network Verification Units	2
Slocum Skews School	Bert 110X		92
Slocum Skews School	Extended Maintenance	3 years extended software maintenance	92
Slocum Skews School	Bert Threshold Vend Software	Threshold/Vend Software Liscense Fee	26
Slocum Skews School	Extended Maint.	3 years extended software maintenance	26
Slocum Skews School	Bert 110I Inline		0
Slocum Skews School	Extended Maintenance	3 years extended software maintenance	0
Slocum Skews School	Bert 240I Inline		18
Slocum Skews School	Extended Maintenance	3 years extended software maintenance	18
Slocum Skews School	Device Sticker		92
Slocum Skews School	Instructions		110
Slocum Skews School	Set up	Preload SSID and Passphrase - plug in	92
Slocum Skews School	Set up	Preload SSID and Passphrase - inline	18
Slocum Skews School	Program	Name, Group and Schedule Berts	110
Slocum Skews School	Test	Verify Network Communication and Final Test	110
Slocum Skews School	Training	Remote Software Training/Customer Signoff	1
Slocum Skews School	Installation	Install Berts and record MAC Address - plug in units only. Assumes no prevailing wage	92
Slocum Skews School	Travel	Travel expenses	1
Slocum Skews School	Shipping charges	FedEx Ground	1
Slocum Skews School	Bert Harness / Installation	Bert Harness, Install Berts and record MAC Address	10
Memorial High School	Bert 110X	Network Verification Units	2
Memorial High School	Bert 110X		100
Memorial High School	Extended Maintenance	3 years extended software maintenance	100
Memorial High School	Bert Threshold Vend Software	Threshold/Vend Software Liscense Fee	22
Memorial High School	Extended Maint.	3 years extended software maintenance	22
Memorial High School	Bert 120I Inline		0
Memorial High School	Extended Maintenance	3 years extended software maintenance	0
Memorial High School	Bert 240I Inline		13
Memorial High School	Extended Maintenance	3 years extended software maintenance	13
Memorial High School	Device Sticker		100
Memorial High School	Instructions		113
Memorial High School	Set up	Preload SSID and Passphrase - plug in	100
Memorial High School	Set up	Preload SSID and Passphrase - inline	13
Memorial High School	Program	Name, Group and Schedule Berts	113
Memorial High School	Test	Verify Network Communication and Final Test	113
Memorial High School	Training	Remote Software Training/Customer Signoff	1
Memorial High School	Installation	Install Berts and record MAC Address - plug in units only. Assumes no prevailing wage	100
Memorial High School	Travel	Travel expenses	1
Memorial High School	Shipping charges	FedEx Ground	1
Memorial High School	Bert Harness / Installation	Bert Harness, Install Berts and record MAC Address	12

Plug Load Controller Scope of Work			
BUILDING	**CATEGORY**	**NOTES**	**QUANTITY**
Shaler Academy	Bert 110X	Network Verification Units	2
Shaler Academy	Bert 110X		46
Shaler Academy	Extended Maintenance	3 years extended software maintenance	46
Shaler Academy	Bert Threshold Vend Software	Threshold/Vend Software Liscense Fee	17
Shaler Academy	Extended Maint.	3 years extended software maintenance	17
Shaler Academy	Bert 120I Inline		0
Shaler Academy	Extended Maintenance	3 years extended software maintenance	0
Shaler Academy	Bert 240I Inline		1
Shaler Academy	Extended Maintenance	3 years extended software maintenance	1
Shaler Academy	Device Sticker		46
Shaler Academy	Instructions		47
Shaler Academy	Set up	Preload SSID and Passphrase - plug in	46
Shaler Academy	Set up	Preload SSID and Passphrase - inline	1
Shaler Academy	Program	Name, Group and Schedule Berts	47
Shaler Academy	Test	Verify Network Communication and Final Test	47
Shaler Academy	Training	Remote Software Training/Customer Signoff	1
Shaler Academy	Installation	Install Berts and record MAC Address - plug in units only. Assumes no prevailing wage	46
Shaler Academy	Travel	Travel expenses	1
Shaler Academy	Shipping charges	FedEx Ground	1
Shaler Academy	Bert Harness / Installation	Bert Harness, Install Berts and record MAC Address	4
Bergen Blvd School	Bert 110X	Network Verification Units	2
Bergen Blvd School	Bert 110X		26
Bergen Blvd School	Extended Maintenance	3 years extended software maintenance	26
Bergen Blvd School	Bert Threshold Vend Software	Threshold/Vend Software Liscense Fee	10
Bergen Blvd School	Extended Maint.	3 years extended software maintenance	10
Bergen Blvd School	Bert 120I Inline		1
Bergen Blvd School	Extended Maintenance	3 years extended software maintenance	1
Bergen Blvd School	Bert 240I Inline		3
Bergen Blvd School	Extended Maintenance	3 years extended software maintenance	3
Bergen Blvd School	Device Sticker		26
Bergen Blvd School	Instructions		30
Bergen Blvd School	Set up	Preload SSID and Passphrase - plug in	26
Bergen Blvd School	Set up	Preload SSID and Passphrase - inline	4
Bergen Blvd School	Program	Name, Group and Schedule Berts	30
Bergen Blvd School	Test	Verify Network Communication and Final Test	30
Bergen Blvd School	Training	Remote Software Training/Customer Signoff	1
Bergen Blvd School	Installation	Install Berts and record MAC Address - plug in units only. Assumes no prevailing wage	26
Bergen Blvd School	Travel	Travel expenses	1
Bergen Blvd School	Shipping charges	FedEx Ground	1
Bergen Blvd School	Bert Harness / Installation	Bert Harness, Install Berts and record MAC Address	6
Central Office	Bert 110X	Network Verification Units	2
Central Office	Bert 110X		10
Central Office	Extended Maintenance	3 years extended software maintenance	10
Central Office	Bert Threshold Vend Software	Threshold/Vend Software Liscense Fee	0
Central Office	Extended Maint.	3 years extended software maintenance	0
Central Office	Bert 120I Inline		0
Central Office	Extended Maintenance	3 years extended software maintenance	0
Central Office	Bert 240I Inline		0
Central Office	Extended Maintenance	3 years extended software maintenance	0
Central Office	Device Sticker		10
Central Office	Instructions		10
Central Office	Set up	Preload SSID and Passphrase - plug in	10
Central Office	Set up	Preload SSID and Passphrase - inline	0
Central Office	Program	Name, Group and Schedule Berts	10
Central Office	Test	Verify Network Communication and Final Test	10
Central Office	Training	Remote Software Training/Customer Signoff	1
Central Office	Installation	Install Berts and record MAC Address - plug in units only. Assumes no prevailing wage	10
Central Office	Travel	Travel expenses	1
Central Office	Shipping charges	FedEx Ground	1

ECM Calculations

The Central Office is not included in the project due to poor financial payback. Energy savings are calculated by multiplying the equipment Standby Power Draw (W) by the number of hours the plug load will shut the equipment off completely:

Plug Load Controller Savings											
BUILDING NAME	Device Type	Plug Load Type	Quantity	Standby Power Draw (W)	Hours per Year	Baseline Equipment ON Hours per Year	Baseline Equipment on STANDBY Hours	Proposed Equipment ON Hours per Year	Proposed Equipment No Power Draw (BERT Controller cuts off power) Hours per Year	Annual Energy Savings (kWh)	Total Annual Energy Savings (kWh)
Slocum Skews School	**Projector**	Bert 110X	6	8	8,760	2,750	6,010	2,750	6,010	288	
Slocum Skews School	**M Printer**	Bert 110X	5	15	8,760	2,750	6,010	2,750	6,010	451	
Slocum Skews School	**Charging Cart/Station**	Bert 110X	10	37	8,760	2,750	6,010	2,750	6,010	2,224	
Slocum Skews School	**Smartboard**	Bert 110X	20	8	8,760	2,750	6,010	2,750	6,010	962	
Slocum Skews School	**Proj/SmBrd Combo**	Bert 110X	0	10	8,760	2,750	6,010	2,750	6,010	0	
Slocum Skews School	**AC-110 15A**	Bert 110X	14	8	8,760	2,750	6,010	2,750	6,010	673	20,458
Slocum Skews School	**AC-110 20A**	Bert 110 Inline	0	8	8,760	2,750	6,010	2,750	6,010	0	
Slocum Skews School	**AC-220 20A**	Bert 220 Inline	18	8	8,760	2,750	6,010	2,750	6,010	865	
Slocum Skews School	**Copier- 110 15A**	Bert 110X	0	40	8,760	2,750	6,010	2,750	6,010	0	
Slocum Skews School	**Air Scrubber**	Bert 110X	34	68	8,760	2,750	6,010	2,750	6,010	13,895	
Slocum Skews School	**H/C Water**	Bert 110X	3	61	8,760	2,750	6,010	2,750	6,010	1,100	
Slocum Skews School	**Soda Vend**	Bert 110X	0	320	8,760	2,750	6,010	2,750	6,010	0	
Memorial High School	Projector	Bert 110X	12	8	8,760	2,750	6,010	2,750	6,010	577	
Memorial High School	M Printer	Bert 110X	10	15	8,760	2,750	6,010	2,750	6,010	902	
Memorial High School	Charging Cart/Station	Bert 110X	12	37	8,760	2,750	6,010	2,750	6,010	2,668	
Memorial High School	Smartboard	Bert 110X	10	8	8,760	2,750	6,010	2,750	6,010	481	
Memorial High School	Proj/SmBrd Combo	Bert 110X	0	10	8,760	2,750	6,010	2,750	6,010	0	
Memorial High School	AC-110 15A	Bert 110X	11	8	8,760	2,750	6,010	2,750	6,010	529	25,350
Memorial High School	AC-110 20A	Bert 110 Inline	0	8	8,760	2,750	6,010	2,750	6,010	0	
Memorial High School	AC-220 20A	Bert 220 Inline	13	8	8,760	2,750	6,010	2,750	6,010	625	
Memorial High School	Copier- 110 15A	Bert 110X	1	40	8,760	2,750	6,010	2,750	6,010	240	
Memorial High School	Air Scrubber	Bert 110X	39	68	8,760	2,750	6,010	2,750	6,010	15,939	
Memorial High School	H/C Water	Bert 110X	4	61	8,760	2,750	6,010	2,750	6,010	1,466	
Memorial High School	Soda Vend	Bert 110X	1	320	8,760	2,750	6,010	2,750	6,010	1,923	
Shaler Academy	Projector	Bert 110X	6	8	8,760	2,750	6,010	2,750	6,010	288	
Shaler Academy	M Printer	Bert 110X	6	15	8,760	2,750	6,010	2,750	6,010	541	
Shaler Academy	Charging Cart/Station	Bert 110X	4	37	8,760	2,750	6,010	2,750	6,010	889	
Shaler Academy	Smartboard	Bert 110X	11	8	8,760	2,750	6,010	2,750	6,010	529	
Shaler Academy	Proj/SmBrd Combo	Bert 110X	0	10	8,760	2,750	6,010	2,750	6,010	0	
Shaler Academy	AC-110 15A	Bert 110X	0	8	8,760	2,750	6,010	2,750	6,010	0	10,019
Shaler Academy	AC-110 20A	Bert 110 Inline	0	8	8,760	2,750	6,010	2,750	6,010	0	
Shaler Academy	AC-220 20A	Bert 220 Inline	1	8	8,760	2,750	6,010	2,750	6,010	48	
Shaler Academy	Copier- 110 15A	Bert 110X	0	40	8,760	2,750	6,010	2,750	6,010	0	
Shaler Academy	Air Scrubber	Bert 110X	18	68	8,760	2,750	6,010	2,750	6,010	7,356	
Shaler Academy	H/C Water	Bert 110X	1	61	8,760	2,750	6,010	2,750	6,010	367	
Shaler Academy	Soda Vend	Bert 110X	0	320	8,760	2,750	6,010	2,750	6,010	0	
Bergen Blvd School	Projector	Bert 110X	4	8	8,760	2,750	6,010	2,750	6,010	192	
Bergen Blvd School	M Printer	Bert 110X	3	15	8,760	2,750	6,010	2,750	6,010	270	
Bergen Blvd School	Charging Cart/Station	Bert 110X	6	37	8,760	2,750	6,010	2,750	6,010	1,334	
Bergen Blvd School	Smartboard	Bert 110X	6	8	8,760	2,750	6,010	2,750	6,010	288	
Bergen Blvd School	Proj/SmBrd Combo	Bert 110X	0	10	8,760	2,750	6,010	2,750	6,010	0	
Bergen Blvd School	AC-110 15A	Bert 110X	5	8	8,760	2,750	6,010	2,750	6,010	240	3,251
Bergen Blvd School	AC-110 20A	Bert 110 Inline	1	8	8,760	2,750	6,010	2,750	6,010	48	
Bergen Blvd School	AC-220 20A	Bert 220 Inline	3	8	8,760	2,750	6,010	2,750	6,010	144	
Bergen Blvd School	Copier- 110 15A	Bert 110X	0	40	8,760	2,750	6,010	2,750	6,010	0	
Bergen Blvd School	Air Scrubber	Bert 110X	0	68	8,760	2,750	6,010	2,750	6,010	0	
Bergen Blvd School	H/C Water	Bert 110X	2	61	8,760	2,750	6,010	2,750	6,010	733	
Bergen Blvd School	Soda Vend	Bert 110X	0	320	8,760	2,750	6,010	2,750	6,010	0	

4.6.3.11 Plug and Process Load Reduction Measures

- EEMs saving energy by eliminating or reducing idle or stand-by power consumption of connected plug loads through the use of the following eligible plug load controls. The percentages presented in the following tables represent the maximum energy reduction percentage that can be claimed for the plug load control.

  - *Load Sensing Controls:* Monitors a specific devices power state and de-energizes connected auxiliary units when the monitored devise enters a low power state.

Load Sensing Control	
Space Type	**Percent Energy Reduction from Baseline**
Workstation	4%
Print Rooms	32%

  - *Occupancy Sensing Controls:* Automatically de-energize devices when no user is present for a set period of time.

Occupancy Control	
Space Type	**Percent Energy Reduction from Baseline**
All	21%

  - *Scheduled Timer Control:* Allows users to set a schedule to energize and de-energize devices based on the devices usage pattern and space schedule.

Schedule Timer Control	
Space Type	**Percent Energy Reduction from Baseline**
Workstation	26%
Print Rooms	50%
Break Rooms	46%

ECM 12 – Solar PPA

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
12	Solar PPA	✔	✔	✔	✔	✔

Background

The renewable energy industry is one of the fastest growing and evolving components to modern building system design. The ability to capture solar energy will provide long term economic and environmental benefits. Technology improvements are rapidly evolving as well, and the market is flooded with new products with new features that have only been available within the last few years, with promising new technologies and updates on the verge of becoming available to the market.

Photovoltaic (PV) solar array

Clients have the opportunity to purchase power through a Power Purchase Agreement, predetermining fixed low rates for the duration of the agreement, without having to manage any part of the process. This allows the solar provider to manage compliance reporting, filings, and maintenance of the equipment for the entire length of the contract.

A solar PPA makes going green easy. Work takes place around the client's schedule, and a safe and functional environment is maintained throughout installation of the system.

Assessment
A preliminary assessment of your facilities will allow for the design of a system that meets your energy needs and environmental goals

Agreement
Power Purchase Agreements allow for the sale of the energy produced on a per kWh basis, while a lease agreement allows the solar provider to access the system, they own so that they may monitor and maintain the system for you.

Installation
A turnkey system includes the design, construction, commissioning, and interconnection with local utilities.

Monitoring
The solar provider monitors the PV installation to ensure performance and for ease of billing. The client has the capability to track output and environmental benefits online.

Management
The solar provider handles all compliance and reporting requirements for the client. They will file documentation with federal and state agencies and participate in state and utility REC markets.

Scope of Work

- Savings estimates are calculated from proposals received during the Ridgefield Public Schools Solar PPA RFP process
- Installation of the Solar PV System shall be in accordance with NFPA 70. NEC 2011. ARTICLE 690.Solar Photovoltaic (PV) Systems
- PPA Firm will receive any incentives available

Solar Photovoltaic Arrays

Ridgefield Public Schools roof mounted solar opportunities are show below:

Slocum Skews School

Memorial High School

Shaler Academy

Bergen Boulevard School

ECM Calculations

The energy savings shown below are a result of the reduced electrical cost from the PPA for the kWh generated by the solar panels. Actual rates and solar generation estimates were taken from the proposals received during the Ridgefield Public Schools Solar PPA RFP process. A comparison was done to ensure the generated kWh did not exceed the post-project estimated energy consumption. In cases where the generated kWh exceeded the post-project electrical consumption, the generation numbers were reduced to ensure the site would not generate more electric than it consumes. The PPA term is 15 years.

PPA RATE ($/kWh)	ANNUAL ESCALATION RATE	ANNUAL PANEL DERATING	PPA CONTRACT TERM (YRS)	END OF PPA REMOVAL COST
$0.0877	0.00%	0.50%	15	$0

INSTALLED CAPACITY (kWdc)	REQ'D ROOFING UPGRADES	TOTAL ECM YEAR 1 SAVINGS
603	$1,202,476	$54,230

Solar PPA - Rates & Savings

BUILDING	SQFT	MOUNTING CATEGORY	INSTALL? (Y/N)	INITIAL ARRAY kWdc	INSTALLED ARRAY (kW)	EFLH
Slocum Skews School	92,147	Canopy			0.0	
Slocum Skews School		Roof	Y	301.74	301.7	1,179
Slocum Skews School		Ground			0.0	
Slocum Skews School		BrightCore				
Slocum Skews School						
Slocum Skews School						
Memorial High School	87,850	Canopy			0.0	
Memorial High School		Roof	Y	282.84	282.8	1,166
Memorial High School		Ground			0.0	
Memorial High School		BrightCore				
Memorial High School						
Memorial High School						
Shaler Academy	47,368	Canopy				
Shaler Academy		Roof	Y	76.61	76.6	1,179
Shaler Academy						
Bergen Blvd School	29,954	Canopy				
Bergen Blvd School		Roof	Y	83.19	83.2	1,182
Bergen Blvd School						
Central Office	2,952	Roof				
Central Office		Roof	Y	46.53	46.5	1,230
Central Office		Canopy				

Solar PPA - Rates & Savings

BUILDING	SQFT	POTENTIAL kWh GENERATION	95% Post ESIP Usage	INSTALLED kWh GENERATION	$/kWh RATES		SAVINGS	TOTAL SAVINGS
					UTILITY	SOLAR PPA		
Slocum Skews School	92,147			0	$0.157	$0.0877	$0	$16,407
Slocum Skews School		355,751	235,510	235,510	$0.157	$0.0877	$16,407	
Slocum Skews School				0	$0.157	$0.0877	$0	
Slocum Skews School				0	$0.157	$0.0877	$0	
Slocum Skews School				0	$0.157	$0.0877	$0	
Slocum Skews School				0	$0.157	$0.0877	$0	
Memorial High School	87,850			0	$0.146	$0.0877	$0	$13,331
Memorial High School		329,908	255,319	229,575	$0.146	$0.0877	$13,331	
Memorial High School				0	$0.146	$0.0877	$0	
Memorial High School				0	$0.146	$0.0877	$0	
Memorial High School					$0.146	$0.0877	$0	
Memorial High School					$0.146	$0.0877	$0	
Shaler Academy	47,368			0	$0.166	$0.0877	$0	$7,096
Shaler Academy		90,323	197,790	90,323	$0.166	$0.0877	$7,096	
Shaler Academy				0	$0.166	$0.0877	$0	
Bergen Blvd School	29,954			0	$0.172	$0.0877	$0	$8,255
Bergen Blvd School		98,331	237,217	98,331	$0.172	$0.0877	$8,255	
Bergen Blvd School				0	$0.172	$0.0877	$0	
Central Office	2,952			0	$0.123	$0.0877	$0	$1,810
Central Office		50,595	44,533	50,595	$0.123	$0.0877	$1,810	
Central Office				0	$0.123	$0.0877	$0	

YEAR	PPA kWh PRODUCTION	UTILITY SAVINGS	PPA COST	NET SOLAR SAVINGS
1	704,335	$116,007	($61,777)	$54,230
2	700,813	$117,966	($61,468)	$56,498
3	697,309	$119,959	($61,161)	$58,798
4	693,822	$121,985	($60,855)	$61,129
5	690,353	$124,045	($60,551)	$63,494
6	686,902	$126,140	($60,248)	$65,892
7	683,467	$128,271	($59,947)	$68,324
8	680,050	$130,437	($59,647)	$70,790
9	676,650	$132,640	($59,349)	$73,291
10	673,266	$134,880	($59,052)	$75,828
11	669,900	$137,159	($58,757)	$78,402
12	666,550	$139,475	($58,463)	$81,012
13	663,218	$141,831	($58,171)	$83,660
14	659,902	$144,226	($57,880)	$86,347
15	656,602	$146,662	($57,591)	$89,072

Slocum Skews School							
YEAR	$$/kWh RATES			SOLAR kWh	UTILITY SAVINGS	PPA COST	SAVINGS
	UTILITY	SOLAR PPA	MAINT. ($/W(dc))				
1	$0.168	$0.0877	$0	235,510	$39,564	($20,657)	$18,907
2	$0.172	$0.0877	$0	234,333	$40,232	($20,553)	$19,679
3	$0.175	$0.0877	$0	233,161	$40,911	($20,451)	$20,461
4	$0.179	$0.0877	$0	231,995	$41,602	($20,348)	$21,254
5	$0.183	$0.0877	$0	230,835	$42,305	($20,247)	$22,059
6	$0.187	$0.0877	$0	229,681	$43,020	($20,145)	$22,874
7	$0.191	$0.0877	$0	228,533	$43,746	($20,045)	$23,702
8	$0.196	$0.0877	$0	227,390	$44,485	($19,944)	$24,541
9	$0.200	$0.0877	$0	226,253	$45,236	($19,845)	$25,392
10	$0.204	$0.0877	$0	225,122	$46,001	($19,745)	$26,255
11	$0.209	$0.0877	$0	223,996	$46,777	($19,647)	$27,131
12	$0.213	$0.0877	$0	222,876	$47,568	($19,548)	$28,019
13	$0.218	$0.0877	$0	221,762	$48,371	($19,451)	$28,920
14	$0.223	$0.0877	$0	220,653	$49,188	($19,353)	$29,834
15	$0.228	$0.0877	$0	219,550	$50,019	($19,257)	$30,762

Memorial High School							
YEAR	$$/kWh RATES			SOLAR kWh	UTILITY SAVINGS	PPA COST	SAVINGS
	UTILITY	SOLAR PPA	MAINT. ($/W(dc))				
1	$0.156	$0.0877	$0	229,575	$35,725	($20,136)	$15,588
2	$0.159	$0.0877	$0	228,428	$36,328	($20,035)	$16,293
3	$0.163	$0.0877	$0	227,285	$36,942	($19,935)	$17,006
4	$0.166	$0.0877	$0	226,149	$37,565	($19,836)	$17,730
5	$0.170	$0.0877	$0	225,018	$38,200	($19,736)	$18,464
6	$0.173	$0.0877	$0	223,893	$38,845	($19,638)	$19,207
7	$0.177	$0.0877	$0	222,774	$39,501	($19,539)	$19,962
8	$0.181	$0.0877	$0	221,660	$40,168	($19,442)	$20,727
9	$0.185	$0.0877	$0	220,552	$40,847	($19,345)	$21,502
10	$0.189	$0.0877	$0	219,449	$41,537	($19,248)	$22,289
11	$0.193	$0.0877	$0	218,352	$42,238	($19,152)	$23,087
12	$0.198	$0.0877	$0	217,260	$42,952	($19,056)	$23,896
13	$0.202	$0.0877	$0	216,174	$43,677	($18,961)	$24,717
14	$0.206	$0.0877	$0	215,093	$44,415	($18,866)	$25,549
15	$0.211	$0.0877	$0	214,017	$45,165	($18,771)	$26,394

Shaler Academy							
YEAR	$$/kWh RATES			SOLAR kWh	UTILITY SAVINGS	PPA COST	SAVINGS
	UTILITY	SOLAR PPA	MAINT. ($/W(dc))				
1	$0.177	$0.0877	$0	90,323	$16,031	($7,922)	$8,109
2	$0.181	$0.0877	$0	89,871	$16,302	($7,883)	$8,419
3	$0.185	$0.0877	$0	89,422	$16,577	($7,843)	$8,734
4	$0.189	$0.0877	$0	88,975	$16,857	($7,804)	$9,053
5	$0.194	$0.0877	$0	88,530	$17,142	($7,765)	$9,377
6	$0.198	$0.0877	$0	88,087	$17,431	($7,726)	$9,705
7	$0.202	$0.0877	$0	87,647	$17,726	($7,688)	$10,038
8	$0.207	$0.0877	$0	87,209	$18,025	($7,649)	$10,376
9	$0.211	$0.0877	$0	86,773	$18,329	($7,611)	$10,719
10	$0.216	$0.0877	$0	86,339	$18,639	($7,573)	$11,066
11	$0.221	$0.0877	$0	85,907	$18,954	($7,535)	$11,419
12	$0.225	$0.0877	$0	85,478	$19,274	($7,497)	$11,777
13	$0.230	$0.0877	$0	85,050	$19,600	($7,460)	$12,140
14	$0.236	$0.0877	$0	84,625	$19,931	($7,422)	$12,508
15	$0.241	$0.0877	$0	84,202	$20,267	($7,385)	$12,882

Bergen Blvd School							
YEAR	$$/kWh RATES			SOLAR kWh	UTILITY SAVINGS	PPA COST	SAVINGS
	UTILITY	SOLAR PPA	MAINT. ($/W(dc))				
1	$0.183	$0.0877	$0	98,331	$18,018	-8624.61201	$9,394
2	$0.187	$0.0877	$0	97,839	$18,323	($8,581)	$9,741
3	$0.191	$0.0877	$0	97,350	$18,632	($8,539)	$10,093
4	$0.196	$0.0877	$0	96,863	$18,947	($8,496)	$10,451
5	$0.200	$0.0877	$0	96,379	$19,267	($8,453)	$10,813
6	$0.204	$0.0877	$0	95,897	$19,592	($8,411)	$11,181
7	$0.209	$0.0877	$0	95,418	$19,923	($8,369)	$11,554
8	$0.213	$0.0877	$0	94,941	$20,260	($8,327)	$11,932
9	$0.218	$0.0877	$0	94,466	$20,602	($8,286)	$12,316
10	$0.223	$0.0877	$0	93,994	$20,950	($8,244)	$12,706
11	$0.228	$0.0877	$0	93,524	$21,304	($8,203)	$13,101
12	$0.233	$0.0877	$0	93,056	$21,663	($8,162)	$13,501
13	$0.238	$0.0877	$0	92,591	$22,029	($8,121)	$13,908
14	$0.243	$0.0877	$0	92,128	$22,401	($8,081)	$14,321
15	$0.249	$0.0877	$0	91,667	$22,780	($8,040)	$14,740

Central Office							
YEAR	$$/kWh RATES			SOLAR kWh	UTILITY SAVINGS	PPA COST	SAVINGS
	UTILITY	SOLAR PPA	MAINT. ($/W(dc))				
1	$0.132	$0.0877	$0	50,595	$6,669	($4,438)	$2,232
2	$0.135	$0.0877	$0	50,342	$6,782	($4,415)	$2,366
3	$0.138	$0.0877	$0	50,090	$6,896	($4,393)	$2,503
4	$0.141	$0.0877	$0	49,840	$7,013	($4,371)	$2,642
5	$0.144	$0.0877	$0	49,591	$7,131	($4,350)	$2,782
6	$0.147	$0.0877	$0	49,343	$7,252	($4,328)	$2,924
7	$0.150	$0.0877	$0	49,096	$7,374	($4,306)	$3,068
8	$0.154	$0.0877	$0	48,851	$7,499	($4,285)	$3,214
9	$0.157	$0.0877	$0	48,606	$7,626	($4,263)	$3,362
10	$0.160	$0.0877	$0	48,363	$7,754	($4,242)	$3,512
11	$0.164	$0.0877	$0	48,121	$7,885	($4,221)	$3,665
12	$0.167	$0.0877	$0	47,881	$8,018	($4,200)	$3,819
13	$0.171	$0.0877	$0	47,641	$8,154	($4,179)	$3,975
14	$0.175	$0.0877	$0	47,403	$8,292	($4,158)	$4,134
15	$0.179	$0.0877	$0	47,166	$8,432	($4,137)	$4,295

ECM 13 – Combined Heat & Power Unit

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
13	Combined Heat & Power Unit		✔			

Background

CHP offers energy and environmental benefits over electric-only and thermal-only systems in both central and distributed power generation applications. CHP systems have the potential for a wide range of applications and the higher efficiencies result in lower emissions than separate heat and power generation.

The simultaneous production of useful thermal and electrical energy in CHP systems lead to increased fuel efficiency. CHP units can be strategically located at the point of energy use. Such onsite generation avoids the transmission and distribution losses associated with electricity purchased via the grid from central stations. CHP is versatile and can be coupled with existing and planned technologies for many different applications in the industrial, commercial, and residential sectors.

Scope of Work

The following CHP will be installed at Ridgefield Memorial High School:

Combined Heat & Power Scope of Work			
BUILDING	SQFT	CATEGORY	QUANTITY
Memorial High School	92,147	Yanmar CP35D1-TNUG – Non-Black Start Capable - 35kW	1
		Structual	1

ECM Calculations

The CHP will act as the first stage of heating for the hot water heating loop and pool heating loop. The CHP is estimated to run at full load for over 2,899 hours per year. Run hours were verified to be achievable using BPU Protocols where a 35 kW CHP was proposed at a similar building. Non-displaceable gas use is associated with other gas loads at the building - (kitchen appliances, gas-fired RTUs, etc. The remaining load is available for the CHP. The installed CHP will be available year-round and will be designed to run the CHP when full electric and heat loads exist simultaneously.

CHP Input Data		
Number of units	1	
Electrical output	35	kW
Thermal output	204,040	BTU/hr
Gas input (HHV)	407,144	Btu/hr
Overall efficiency	79.4%	

Runtime Analysis	
Run hours	2,817
Full load heat and electric hours	2,817
% Boiler load displaced by CHP	22%
% Heat dump (if applicable)	0%
Run CHP 24/7 with Heat Dump?	N

		Fuel Usage Without CHP				
Month	Days	Total Gas - Post ECMs (Baseline reduced by 30%)	Proposed Boiler Efficiency	Non-Displaceable Gas Therms (30%), Boilers OFF May-Sept	Displaceable Gas Therms	Displaceable Heat Therms
Jan	31	9,676	80%	2,903	6,773	5,418
Feb	28	7,506	80%	2,252	5,254	4,203
Mar	31	4,075	80%	1,223	2,853	2,282
Apr	30	934	80%	280	654	523
May	31	420	80%	126	294	235
Jun	30	256	80%	256	0	0
Jul	31	259	80%	259	0	0
Aug	31	219	80%	219	0	0
Sep	30	336	80%	336	0	0
Oct	31	865	80%	259	605	484
Nov	30	5,508	80%	1,652	3,855	3,084
Dec	31	6,647	80%	1,994	4,653	3,722
Total:	**365**	**36,699**		**11,759**	**24,940**	**19,952**

35 kW Cogen Plant Thermal Operation									
Combined Cogen Run Hours	% Heat Load Displaced by CHP	Cogen Dump Hours	Total Cogen Hours w/ Heat Dump	Utilized Cogen Heat Therms	Dumped Cogen Heat Therms	Max Cogen Heat Therms	Avoided Boiler Gas Therms	Full Load Run Hours	System Operating Efficiency
606	18%	0	606	973	0	1,236	1,217	606	69%
517	19%	0	517	816	0	1,055	1,020	517	68%
430	28%	0	430	640	0	877	800	430	66%
252	65%	0	252	339	0	514	424	252	62%
63	36%	0	63	85	0	128	106	63	62%
0	0%	0	0	0	0	0	0	0	-
0	0%	0	0	0	0	0	0	0	-
0	0%	0	0	0	0	0	0	0	-
0	0%	0	0	0	0	0	0	0	-
83	26%	0	83	124	0	169	156	83	66%
332	16%	0	332	498	0	677	622	332	66%
534	22%	0	534	819	0	1,090	1,023	534	67%
2,817	**21.5%**	**0**	**2,817**	**4,295**	**0**	**5,747**	**5,368**	**2,817**	**67%**

		Fuel Usage With CHP			Electric Savings With CHP			
Month	Days	Supplemental Boiler Gas Therms	Cogen Gas Therms	Total Gas	Run Hours	Avg Cogen Plant kW Output	kW Demand Savings	Cogen Electric Generation kWh
Jan	31	5,556	2,467	10,926	606	35	35	21,210
Feb	28	4,234	2,105	8,591	517	35	35	18,095
Mar	31	2,053	1,751	5,026	430	35	35	15,050
Apr	30	229	1,025	1,534	252	35	35	8,811
May	31	188	256	570	63	35	35	2,203
Jun	30	0	0	256	0	0	0	0
Jul	31	0	0	259	0	0	0	0
Aug	31	0	0	219	0	0	0	0
Sep	30	0	0	336	0	0	0	0
Oct	31	450	338	1,047	83	35	35	2,905
Nov	30	3,233	1,352	6,237	332	35	35	11,620
Dec	31	3,629	2,174	7,797	534	35	35	18,690
Total:	**365**	**19,572**	**11,468**	**42,799**	**2,817**		**35**	**98,584**

The NJ Protocol is to follow the National Renewable Energy Laboratory's Combined Heat and Power, The Uniform Methods Project: Methods for Determining Energy-Efficiency Savings for Specific Measures [1]. The product should be all of the below outputs, as applicable:

a. Annual energy input to the generator, HHV basis (MMBtu/yr)
b. Annual electricity generated, net of all parasitic loads (kWh/yr)
c. Annual fossil fuel energy savings from heat recovery (MMBtu/yr)
d. Annual electric energy savings from heat recovery, including absorption chiller sourced savings if chiller installation is included as part of the system installation (kWh/yr)
e. Annual overall CHP fuel conversion efficiency, HHV basis (%)
f. Annual electric conversion efficiency, net of parasitics, HHV basis (%)

CHP Emissions Reduction Associated with PJM Grid

(Assuming that the useful thermal output will displace natural gas)

Algorithms

CO_2 ER (lbs) = (CO_2 EF_{elec} – CO_2 EF_{CHP}) * Net Electricity Generation (MWh) + CO_2 EF_{elec} * Electric Energy Savings (MWh) + CO_2 EF_{NG} * Gas Energy Savings (MMBtu) * 10

NO_x ER (tons) = (NO_x EF_{elec} – NO_x EF_{CHP}) * Net Electricity Generation (MWh) + NO_x EF_{elec} * Electric Energy Savings (MWh) + NO_x EF_{NG} * Gas Energy Savings (MMBtu) * 10

SO_2 ER (lbs) = (SO_2 EF_{elec} – SO_2 EF_{CHP}) * Net Electricity Generation (MWh) + SO_2 EF_{elec} * Electric Energy Savings (MWh)

Hg (grams) = (Electric Energy Savings (MWh) * Hg EF_{elec})/1,000

Definition of Variables

CO_2 EF_{elec} = CO_2 Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

NO_x EF_{elec} = NO_x Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

SO_2 EF_{elec} = SO_2 Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

Hg EF_{elec} = Hg Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

CO_2 EF_{CHP} = CO_2 Emissions Factor of the CHP system (in lbs/MWh), which will vary with different projects based on the types of prime movers and emission control devices used

NO_x EF_{CHP} = NO_x Emissions Factor of the CHP system (in lbs/MWh), which will vary with different projects based on the types of prime movers and emission control devices used

SO_2 EF_{CHP} = SO_2 Emissions Factor of the CHP system (in lbs/MWh), which will vary with different projects based on the types of prime movers and emission control devices used

CO_2 EF_{NG} = CO_2 Natural Gas Emissions Factor associated with boiler fuel displacement – see emissions tables summarized in Introduction section of Protocols

NO_x EF_{NG} = NO_x Natural Gas Emissions Factor associated with boiler fuel displacement – see emissions tables summarized in Introduction section of Protocols

10 = Conversion from MMBtu to therms (1 MMBtu = 10 therms)

Calculation of Clean Air Impacts

The amount of air emission reductions resulting from the energy savings is calculated using the energy savings at the system level and multiplying them by factors provided by the New Jersey Department of Environmental Protection, Office of Air and Energy Advisor, on June 25, 2019.

Using Weighted Average of 2018 PJM On-Peak and Off-Peak annual data:

Electric Emission Factors

Emissions Product	Pounds per MWh[7]
CO_2	1,292
NOx	0.83
SO_2	0.67
Hg	1.1 mg/MWh[8]

Natural Gas Emission Factors

Emissions Product	Current
CO_2	11.7 lbs per therm saved
NOx	0.0092 lbs per therm saved

Combined Heat & Power Emission Reduction

BUILDING	Install?	kW	Equivalent Full Load Electric Hours	NET GENERATION MWh	FUEL INPUT MMBTU	FOSSIL FUEL SAVINGS FROM HEAT RECOVERY MMBTU
Memorial High School	Y	35	2,817	98.6	281.7	-2,284.7

Combined Heat & Power Emission Reduction

BUILDING	CO2 EF GAS	CO2 EMISSION REDUCTION LBS	NOx EF ELECTRIC	NOx EF CHP	NOx EF GAS	NOx EMISSION REDUCTION LBS	SO2 EF ELECTRIC	SO2 EF CHP	SO2 EMISSION REDUCTION LBS	Hg EF ELECTRIC	Hg EMISSION REDUCTION LBS
Memorial High School	117.0	-274,112.8	0.83	1.07	0.092	-233.9	0.67	0.00	66.1	0.67	0.00

Note: CHP emission factors for CO2 and NOx were calculated using nameplate electric generation and natural gas input capacity as seen in the ECM calculation. Per BPU Protocols, natural gas does not require SO2 or Hg emission factors.

The NJ Protocol is to follow the National Renewable Energy Laboratory's Combined Heat and Power, The Uniform Methods Project: Methods for Determining Energy-Efficiency Savings for Specific Measures [1]. The product should be all of the below outputs, as applicable:

a. Annual energy input to the generator, HHV basis (MMBtu/yr)
b. Annual electricity generated, net of all parasitic loads (kWh/yr)
c. Annual fossil fuel energy savings from heat recovery (MMBtu/yr)
d. Annual electric energy savings from heat recovery, including absorption chiller sourced savings if chiller installation is included as part of the system installation (kWh/yr)
e. Annual overall CHP fuel conversion efficiency, HHV basis (%)
f. Annual electric conversion efficiency, net of parasitics, HHV basis (%)

SO_2 ER (lbs) = (SO_2 EF_{elec} – SO_2 EF_{CHP}) * Net Electricity Generation (MWh) + SO_2 EF_{elec} * Electric Energy Savings (MWh)
Hg (grams) = (Electric Energy Savings (MWh) * Hg EF_{elec})/1,000

Definition of Variables

CO_2 EF_{elec} = CO_2 Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

NO_x EF_{elec} = NO_x Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

SO_2 EF_{elec} = SO_2 Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

Hg EF_{elec} = Hg Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

CO_2 EF_{CHP} = CO_2 Emissions Factor of the CHP system (in lbs/MWh), which will vary with different projects based on the types of prime movers and emission control devices used

NO_x EF_{CHP} = NO_x Emissions Factor of the CHP system (in lbs/MWh), which will vary with different projects based on the types of prime movers and emission control devices used

SO_2 EF_{CHP} = SO_2 Emissions Factor of the CHP system (in lbs/MWh), which will vary with different projects based on the types of prime movers and emission control devices used

CO_2 EF_{NG} = CO_2 Natural Gas Emissions Factor associated with boiler fuel displacement – see emissions tables summarized in Introduction section of Protocols

NO_x EF_{NG} = NO_x Natural Gas Emissions Factor associated with boiler fuel displacement – see emissions tables summarized in Introduction section of Protocols

10 = Conversion from MMBtu to therms (1 MMBtu = 10 therms)

Calculation of Clean Air Impacts

The amount of air emission reductions resulting from the energy savings is calculated using the energy savings at the system level and multiplying them by factors provided by the New Jersey Department of Environmental Protection, Office of Air and Energy Advisor, on June 25, 2019.

Using Weighted Average of 2018 PJM On-Peak and Off-Peak annual data:

Electric Emission Factors

Emissions Product	Pounds per MWh[7]
CO_2	1,292
NOx	0.83
SO_2	0.67
Hg	1.1 mg/MWh[8]

Natural Gas Emission Factors

Emissions Product	Current
CO_2	11.7 lbs per therm saved
NOx	0.0092 lbs per therm saved

CHP Emissions Reduction Associated with PJM Grid

(Assuming that the useful thermal output will displace natural gas)

Algorithms

CO_2 ER (lbs) = (CO_2 EF_{elec} – CO_2 EF_{CHP}) * Net Electricity Generation (MWh) + CO_2 EF_{elec} * Electric Energy Savings (MWh) + CO_2 EF_{NG} * Gas Energy Savings (MMBtu) * 10

NO_x ER (tons) = (NO_x EF_{elec} – NO_x EF_{CHP}) * Net Electricity Generation (MWh) + NO_x EF_{elec} * Electric Energy Savings (MWh) + NO_x EF_{NG} * Gas Energy Savings (MMBtu) * 10

Capital Improvement Measure 14 – Add AC to Gym

RIDGEFIELD PUBLIC SCHOOLS		Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
✔ ECM evaluated but not included						
✔ ECM included in the project						
ECM #	**ECM DESCRIPTION**					
14	Add AC to Gym		✔			

Background

Ridgefield Public Schools has expressed interest in the addition of cooling to the main gym which is currently uncooled at Memorial High School. DCO Energy has explored an array of options to cool these specific spaces, including the installation of new direct expansion rooftop units

Existing Conditions

Existing Gym layout at Memorial High School

Scope of Work

- Furnish and install two (2) new 15 Ton packaged rooftop units (Gym).
- RTU's shall have DX cooling with gas fired heat
- Provide all roof and structural modifications required for installation of new RTU including curb adapters (if required).
- Provide new electrical power for rooftop units, including new breakers, conduit, wiring, disconnect, service receptacle, etc as required.

ECM Calculations

Addition of Cooling - Energy Usage														
BUILDING	SYSTEM	Areas Served	Existing Qty	Tons Per Unit	Total Existing Tons	EERb	Proposed Qty	Tons Per Unit	Total Proposed Tons	EERq	CF	EFLH Cooling	Demand Savings (kW)	Energy Savings (kWh)
Memorial High School	(2) 15 ton RTUs	Gym	0	0	0.00	0.0	2	15	30.00	10.8	0.5	466	-17	-15,533

This ECM cost has been calculated to be within 15% of the total project allowance for non-energy saving measure

Proposed Preliminary Energy Savings Plan		Estimated Installed Hard Costs[(1)] $	Estimated Annual Savings $	Est. Simple Payback (Years)	Percentage of Total Project (Not to Exceed 15%)
ECM Numbe	Energy Conservation Measure				
14	Add AC to Gym	$701,239	-$3,689	-	13%

(5.4 tons), SEER and HSPF/3.412 should be used in place of COP * 3.412 for cooling and heating savings, respectively.

CF = Coincidence Factor – This value represents the percentage of the total load which is on during electric system's Peak Window. This value is based on existing measured usage and determined as the average number of operating hours during the peak window period.

$EFLH_{c\ or\ h}$ = Equivalent Full Load Hours – This represents a measure of energy use by season during the on-peak and off-peak periods.

Summary of Inputs

HVAC and Heat Pumps

Component	Type	Value	Source
Tons	Variable	Rated Capacity, Tons	Application
EER_b	Variable	See Table below	1
EER_q	Variable	ARI/AHRI or AHAM Values	Application
CF	Fixed	50%	2
$EFLH_{(c\ or\ h)}$	Variable	See Tables below	3

Definition of Variables

N = Number of units

Tons = Rated cooling capacity of unit.This value comes from ARI/AHRI or AHAM rating or manufacturer data.

EER_b = Energy Efficiency Ratio of the baseline unit. This data is found in the HVAC and Heat Pumps table below. For units < 65,000 BtuH (5.4 tons), SEER should be used in place of EER.

COP_b = Coefficient of Performance of the baseline unit. This data is found in the HVAC and Heat Pumps table below. For units < 65,000 BtuH (5.4 tons), SEER and HSPF/3.412 should be used in place of COP * 3.412 for cooling and heating savings, respectively.

EER_q = Energy Efficiency Ratio of the high efficiency unit. This value comes from the ARI/AHRI or AHAM directories or manufacturer data. For units < 65,000 (5.4 tons) BtuH, SEER should be used in place of EER.

COP_q = Coefficient of Performance of the high efficiency unit. This value comes from the ARI/AHRI or AHAM directories or manufacturer data. For units < 65,000 BtuH

HVAC Baseline Efficiencies Table – New Construction/EUL/RoF

Equipment Type	Baseline = ASHRAE Std. 90.1 – 2016
Unitary HVAC/Split Systems and Single Package, Air Cooled	
<=5.4 tons, split	14 SEER
<=5.4 tons, single	14 SEER
>5.4 to 11.25 tons	11.0 EER, 12.7 IEER
>11.25 to 20 tons	10.8 EER, 12.2 IEER
> 21 to 63 tons	9.8 EER, 11.4 IEER
>63 Tons	9.5 EER, 11.0 IEER
Air Cooled Heat Pump Systems, Split System and Single Package	
<=5.4 tons, split	14 SEER, 8.2 HSPF
<=5.4 tons, single	14 SEER, 8.0 HSPF
>5.4 to 11.25 tons	10.8 EER, 12 IEER, 3.3 heating COP
>11.25 to 20 tons	10.4 EER, 11.4 IEER, 3.2 heating COP
>= 21	9.3 EER, 10.4 IEER, 3.2 heating COP

Equipment Type	Baseline = ASHRAE Std. 90.1 – 2016
Water Source Heat Pumps (water to air, water loop)	
<=1.4 tons	12.2 EER, 4.3 heating COP
>1.4 to 5.4 tons	13.0 EER, 4.3 heating COP
>5.4 to 11.25 tons	13.0 EER, 4.3 heating COP
Ground Water Source Heat Pumps <=11.25 tons	18.0 EER, 3.7 heating COP
Ground Source Heat Pumps (brine to air, ground loop) <=11.25 tons	14.1 EER, 3.2 heating COP
Package Terminal Air Conditioners[37]	14.0 – (0.300 * Cap/1,000), EER
Package Terminal Heat Pumps	14.0 – (0.300 * Cap/1,000), EER 3.7 – (0.052 * Cap/1,000), heating COP
Single Package Vertical Air Conditioners	
<=5.4 tons	10.0 EER
>5.4 to 11.25 tons	10.0 EER
>11.25 to 20 tons	10.0 EER
Single Package Vertical Heat Pumps	
<=5.4 tons	10.0 EER, 3.0 heating COP
>5.4 to 11.25 tons	10.0 EER, 3.0 heating COP
>11.25 to 20 tons	10.0 EER, 3.0 heating COP

EFLH Table

Facility Type	Heating EFLH$_h$	Cooling EFLH$_c$
Assembly	603	669
Auto repair	1910	426
Dormitory	465	800
Hospital	3366	1424
Light industrial	714	549
Lodging – Hotel	1077	2918
Lodging – Motel	619	1233
Office – large	2034	720
Office – small	431	955

Facility Type	Heating EFLH$_h$	Cooling EFLH$_c$
Other	681	736
Religious worship	722	279
Restaurant – fast food	813	645
Restaurant – full service	821	574
Retail – big box	191	1279
Retail – Grocery	191	1279
Retail – small	545	882
Retail – large	2101	1068
School – Community college	1431	846
School – postsecondary	1191	1208
School – primary	840	394
School – secondary	901	466
Warehouse	452	400

ECM 16 – Roofing Refurbishment

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
15	Roof Refurbishment	✔	✔	✔	✔	✔

Single Ply Membrane Roof Restoration

Year after year, reflective elastomeric coatings continue to be used as a viable option for many roofing substrates, and single-ply membranes are no different. This system addresses all seams and penetrations that could potentially be a leak point while protective elastomeric coating maintains and restores the membrane. Single ply membrane restorations include the following benefits:

Single Ply Membrane Roof Restoration

Performance

Watertight	Addresses all sources of roof leaks by sealing all seams and fasteners.
Durable	Resistant to damage from roof traffic and storm damage.
UV Resistant	Designed for the harshest UV conditions.
Light Weight	Very low impact on your overall roof weight-load.
High Reflectivity	Nearly 85% of all UV light is reflected and the High Emissivity gives the coating and Emissivity the ability to release any heat that is absorbed

	which keeps the roof surface +/- 10 degrees from ambient temperature.
Disruption Free	Installation is completed without bothering building occupants.
Extends Building Life	Cool roof surface will reduce expansion and contraction stresses on the building.

Value

Energy Savings	Reduced solar heat gain will cut summer energy costs by up to 30%.
No Tear Off	Typically no costly tear off required.
Low Cost	Keeps more money in your pocket compared to replacement systems.
Low Life Cycle Cost	With no tear-off and by simply maintaining the protective surface coating on your roof every 10-15 years, your roof can last indefinitely.
Rebates	Many local and federal rebates are available.
Tax Benefits	Can often be fully expensed in the year of installation.

Environment

No Tear Off	Typically no need to remove roof and fill our land-fills with roof waste.
Water-based	Non-hazardous, non-flammable and easy cleanup.
Low VOC	Meets the most stringent VOC requirements in the U.S.
Low Odor	Can be installed in situations where rooftop air handlers cannot be turned off.
Sustainable	Simply maintaining the protective surface coating on your roof every 10-15 years, your roof will last indefinitely.

Scope of Work

The current scope of work has solar and roof upgrades for the following schools:
See Appendix G for Existing Roof layouts

Roof Refurbishment Scope of Work			
BUILDING	**SQFT**	**NOTES**	**QUANTITY (SF)**
Slocum Skews School	92,147	Coating to 15 year Warranty	31,307
Memorial High School	87,850	Coating to 15 year Warranty	47,438
Shaler Academy	47,368	Coating to 15 year Warranty	26,402
Bergen Blvd School	29,954	Coating to 15 year Warranty	18,424
Central Office	2,952	Coating to 15 year Warranty	4,191

ECM Calculations

BUILDING	ROOF SQFT	R VALUE (BEFORE)	U VALUE (BEFORE)	R VALUE (AFTER)	U VALUE (AFTER)	ANNUAL HEATING DEGREE DAYS	AVERAGE ANNUAL HEATING DELTA T	Q BEFORE (BTUH)	Q AFTER (BTUH)	BTUH SAVINGS	ANNUAL HEATING SAVINGS (BTU)	GAS HEATING EFFICIENCY (%AFUE)	TOTAL HEATING SAVINGS (Therms)
Slocum Skews School	31,307	15	0.067	15.3	0.065	4,615	17.6	36,825	36,032	793	6,944,113	77%	90
Memorial High School	47,438	15	0.067	15.3	0.065	4,615	17.6	55,799	54,598	1,201	10,522,126	77%	137
Shaler Academy	26,402	15	0.067	15.3	0.065	4,615	17.6	31,056	30,387	669	5,856,181	87%	67
Bergen Blvd School	18,424	15	0.067	15.3	0.065	4,615	17.6	21,671	21,205	467	4,086,595	77%	53
Central Office	4,191	15	0.067	15.3	0.065	4,615	17.6	4,930	4,824	106	929,598	73%	13

ECM 17 – Building Envelope Improvements

RIDGEFIELD PUBLIC SCHOOLS		Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
✔ ECM evaluated but not included						
✔ ECM included in the project						
ECM #	**ECM DESCRIPTION**					
17	Building Envelope Improvements	✔	✔	✔	✔	✔

An on-site survey of the existing air barrier continuity was conducted at Ridgefield Public Schools buildings. During the on-site inspection, several areas of the facilities were inspected for effective air barriers at the building envelope. Temperature, relative humidity, CO2 levels, smoke pencil testing and Infrared imaging was used to determine areas of uncontrolled air leakage into and out of the buildings.

Each of these facilities had varying degrees of uncontrolled air leakage into and out of the buildings. Typically, the exterior doors were found to have failed, missing or worn weather-seals and in some cases the exterior caulking had failed. Many of the facilities had insulation materials installed at the exterior roof/wall intersections. This can increase thermal values, however, the air leakage around the insulation and through the roof/wall joint was significant and results in increased energy costs.

Existing Conditions at Ridgefield Memorial HS, Slocum Skewes, and Shaler Academy

Scope of Work

BUILDING ENVELOPE WORK SUMMARY						
Task	Bergen Boulevard School	Central Office	Ridgefield Memorial High School	Shaler Academy	Slocum/ Skewes School	Total Quantity
Buck Frame Air Sealing (LF)	44	13	163		16	236
Caulking (LF)	9	36			3,529	3,574
Door - Install Jamb Spacer (Units)			2	1		3
Door Weather Striping - Doubles (Units)	3		12	2	17	34
Door Weather Stripping - Singles (Units)	8	2	11	4	6	31
Overhang Air Sealing (LF)			24	20		44
Overhang Air Sealing (SF)				12		12
Overhead Door Weather Stripping (Units)			1			1
Penetration Air Sealing (Units)			4			4
Roof-Wall Intersection Air Sealing (LF)	96		755	479	294	1,624
Wall Air Sealing (SF)		18				18

- Buck Frame Air Sealing
- Caulking
- Door Weather Stripping
- Overhang Air Sealing
- Overhead Door Weather Stripping
    - Weather Strip – install heavy-duty aluminum carrier with oversized vinyl insert gasket at the sides: install heavy-duty aluminum carrier with an oversized bottom U-style gasket at bottom.
- Penetration Air Sealing
    - Block, Seal Exposed – install rigid exterior-grade material to the outdoors and seal in place; install Thermax Sheathing rigid insulation at the interior for insulation; seal perimeter with polyurethane sealant for an air-tight seal.
- Roof-Wall Intersection Air Sealing
- Wall Air Sealing

ECM Calculations

The Central Office is not included in the project due to poor financial payback.
Energy Savings from Building Envelope Improvements are calculated on the following pages.

Heat Efficiency Factor
The derivation of the Efficiency Factor is based on sensible heat constant (1.08 * 24 Hours per Day) and an assumed efficiency percentage for the heating plant in the building. The efficiency of the heating plant is captured as a percentage of the total energy output of the heating system.

Calculation is = 1.08 * 24 hours per day = 25.92; in order to get the Efficiency Factor in the denominator and account for system efficiency = 1/ (25.92 / (1,000,000 Btus * **Heating** Plant Efficiency Percent).

Infiltration Heating Savings (therm) = Infiltration Reduction (CFM) * Heating Degree Days (HDD) / Heat Efficiency Factor

Thermal Insulation Savings (therm) = Existing Heat Loss (therm) - Proposed Heat Loss (therm)

Existing Heat Loss (therm) = (Existing U-Value * (Hours/Day * Heating Degree Days (HDD)) * Surface Area (Sqft)) / Heating Efficiency (%) / 100,000 Btu/Therm

Proposed Heat Loss (therm) = (Proposed U-Value * (Hours/Day * Heating Degree Days (HDD)) * Surface Area (Sqft)) / Heating Efficiency (%) / 100,000 Btu/Therm

Enthalpy
Based on Interior Relative Humidity of 40% and temperature of 72 degrees F = 24.55 btu/lb. Exterior Enthalpy based on outside relative humidity estimate of 75% and the below NOAA summer temperature data.

Infiltration Cooling Savings (kWh) = Tons * Efficiency (kW/ton) *Cooling Degree Days (CDD)*12000 btu/hr *0.000293071

Tons = Inflitration Reduction (CFM) * Total Heat Constant * Enthalpy / 12,0000 Btu/hr

Insulation Savings (kWh) = Existing Cooling Loss (kWh) - Proposed Cooling Loss (kWh)

Existing Cooling Loss (kWh) = (Existing U-Value) * (Hours/Day) * (Cooling Degree Days (CDD)) * (Surface Area (Sqft)) * (Cooling Efficiency (kWh/ton-hr)) * (1 Ton-hr/12,000 Btu)

Proposed Cooling Loss (kWh) = (Proposed U-Value) * (Hours/Day) * (Cooling Degree Days (CDD)) * (Surface Area (Sqft)) * (Cooling Efficiency (kWh/ton-hr)) * (1 Ton-hr/12,000 Btu)

Building Envelope - Heating Savings

BUILDING	SQFT	TYPE	SUBTYPE	BE RETROFIT INFILTRATION REDUCTION (CFM)	INFILTRATION REDUCTION (CFM)	HEATING FUEL	HEATING EFFICIENCY (%)
Slocum Skews School	92,147	Caulking	Interior Seal (LF)	310	310	Natural Gas	76.97%
Slocum Skews School	92,147	Caulking	Interior Seal (LF)	132	132	Natural Gas	76.97%
Slocum Skews School	92,147	Roof-Wall Intersection Air Sealing	Seal (LF)	144	144	Natural Gas	76.97%
Slocum Skews School	92,147	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	156	156	Natural Gas	76.97%
Slocum Skews School	92,147	Roof-Wall Intersection Air Sealing	Block, Seal Paint (LF)	62	62	Natural Gas	76.97%
Slocum Skews School	92,147	Buck Frame Air Sealing	Seal (LF)	13	13	Natural Gas	76.97%
Slocum Skews School	92,147	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	494	494	Natural Gas	76.97%
Slocum Skews School	92,147	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	25	25	Natural Gas	76.97%
Slocum Skews School	92,147	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	112	112	Natural Gas	76.97%
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	306	306	Natural Gas	76.58%
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Block, Seal Paint (LF)	225	225	Natural Gas	76.58%
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Seal Paint (LF)	18	18	Natural Gas	76.58%
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Seal (LF)	12	12	Natural Gas	76.58%
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	567	567	Natural Gas	76.58%
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Seal (LF)	32	32	Natural Gas	76.58%
Memorial High School	87,850	Buck Frame Air Sealing	Seal (LF)	60	60	Natural Gas	76.58%
Memorial High School	87,850	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	150	150	Natural Gas	76.58%
Memorial High School	87,850	Door Weather Stripping	Single Door - Sides, Sweep (UT)	48	48	Natural Gas	76.58%
Memorial High School	87,850	Door Weather Stripping	Install Door Jamb Spacer (UT)	0	0	Natural Gas	76.58%
Memorial High School	87,850	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	371	371	Natural Gas	76.58%
Memorial High School	87,850	Penetration Air Sealing	Block, Seal Exposed (UT)	75	75	Natural Gas	76.58%
Memorial High School	87,850	Overhang Air Sealing	Block, Seal (LF)	28	28	Natural Gas	76.58%
Memorial High School	87,850	Buck Frame Air Sealing	Seal (LF)	105	105	Natural Gas	76.58%
Memorial High School	87,850	Garage Door Weather Stripping	Overhead Door Weather Strip - Sides, Top, Bottom	25	25	Natural Gas	76.58%
Shaler Academy	47,368	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	339	339	Natural Gas	82.28%
Shaler Academy	47,368	Roof-Wall Intersection Air Sealing	Seal (LF)	148	148	Natural Gas	82.28%
Shaler Academy	47,368	Overhang Air Sealing	Block, Seal (SF)	28	28	Natural Gas	82.28%
Shaler Academy	47,368	Overhang Air Sealing	Block, Seal (LF)	31	31	Natural Gas	82.28%
Shaler Academy	47,368	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	75	75	Natural Gas	82.28%
Shaler Academy	47,368	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	62	62	Natural Gas	82.28%
Shaler Academy	47,368	Door Weather Stripping	Install Door Jamb Spacer (UT)	0	0	Natural Gas	82.28%
Bergen Blvd School	29,954	Roof-Wall Intersection Air Sealing	Block, Seal Paint (LF)	74.90	75	Natural Gas	76.52%
Bergen Blvd School	29,954	Roof-Wall Intersection Air Sealing	Seal Paint (LF)	74.90	75	Natural Gas	76.52%
Bergen Blvd School	29,954	Buck Frame Air Sealing	Seal (LF)	51.90	52	Natural Gas	76.52%
Bergen Blvd School	29,954	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	92.70	93	Natural Gas	76.52%
Bergen Blvd School	29,954	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	149.80	150	Natural Gas	76.52%
Bergen Blvd School	29,954	Caulking	Interior Block, Seal (LF)	5.30	5	Natural Gas	76.52%
Central Office	2,952	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	2	2	Natural Gas	73.27%
Central Office	2,952	Wall Air Sealing	Block, Seal (SF)	18	18	Natural Gas	73.27%
Central Office	2,952	Buck Frame Air Sealing	Block, Seal Exposed (LF)	13	13	Natural Gas	73.27%
Central Office	2,952	Caulking	Interior Block, Seal (LF)	36	36	Natural Gas	73.27%

Building Envelope - Heating Savings

BUILDING	SQFT	TYPE	SUBTYPE	SENSIABLE HEAT CONSTANT	HOURS (HR/DAY)	HEAT EFFICIENCY FACTOR	HEATING DEGREE DAYS	INFILTRATION HEATING SAVINGS (THERM)	TOTAL HEATING SAVINGS (THERM)
Slocum Skews School	92,147	Caulking	Interior Seal (LF)	1.08	24	2969	5367	560	560
Slocum Skews School	92,147	Caulking	Interior Seal (LF)	1.08	24	2969	5367	239	239
Slocum Skews School	92,147	Roof-Wall Intersection Air Sealing	Seal (LF)	1.08	24	2969	5367	261	261
Slocum Skews School	92,147	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	1.08	24	2969	5367	282	282
Slocum Skews School	92,147	Roof-Wall Intersection Air Sealing	Block, Seal Paint (LF)	1.08	24	2969	5367	113	113
Slocum Skews School	92,147	Buck Frame Air Sealing	Seal (LF)	1.08	24	2969	5367	23	23
Slocum Skews School	92,147	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	1.08	24	2969	5367	894	894
Slocum Skews School	92,147	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	1.08	24	2969	5367	46	46
Slocum Skews School	92,147	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	1.08	24	2969	5367	203	203
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	1.08	24	2954	5367	556	556
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Block, Seal Paint (LF)	1.08	24	2954	5367	408	408
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Seal Paint (LF)	1.08	24	2954	5367	32	32
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Seal (LF)	1.08	24	2954	5367	21	21
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	1.08	24	2954	5367	1029	1,029
Memorial High School	87,850	Roof-Wall Intersection Air Sealing	Seal (LF)	1.08	24	2954	5367	57	57
Memorial High School	87,850	Buck Frame Air Sealing	Seal (LF)	1.08	24	2954	5367	108	108
Memorial High School	87,850	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	1.08	24	2954	5367	272	272
Memorial High School	87,850	Door Weather Stripping	Single Door - Sides, Sweep (UT)	1.08	24	2954	5367	87	87
Memorial High School	87,850	Door Weather Stripping	Install Door Jamb Spacer (UT)	1.08	24	2954	5367	0	0
Memorial High School	87,850	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	1.08	24	2954	5367	674	674
Memorial High School	87,850	Penetration Air Sealing	Block, Seal Exposed (UT)	1.08	24	2954	5367	136	136
Memorial High School	87,850	Overhang Air Sealing	Block, Seal (LF)	1.08	24	2954	5367	51	51
Memorial High School	87,850	Buck Frame Air Sealing	Seal (LF)	1.08	24	2954	5367	191	191
Memorial High School	87,850	Garage Door Weather Stripping	Overhead Door Weather Strip - Sides, Top, Bottom	1.08	24	2954	5367	45	45
Shaler Academy	47,368	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	1.08	24	3174	5367	574	574
Shaler Academy	47,368	Roof-Wall Intersection Air Sealing	Seal (LF)	1.08	24	3174	5367	249	249
Shaler Academy	47,368	Overhang Air Sealing	Block, Seal (SF)	1.08	24	3174	5367	48	48
Shaler Academy	47,368	Overhang Air Sealing	Block, Seal (LF)	1.08	24	3174	5367	53	53
Shaler Academy	47,368	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	1.08	24	3174	5367	127	127
Shaler Academy	47,368	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	1.08	24	3174	5367	104	104
Shaler Academy	47,368	Door Weather Stripping	Install Door Jamb Spacer (UT)	1.08	24	3174	5367	0	0
Bergen Blvd School	29,954	Roof-Wall Intersection Air Sealing	Block, Seal Paint (LF)	1.08	24	2952	5367	136	136
Bergen Blvd School	29,954	Roof-Wall Intersection Air Sealing	Seal Paint (LF)	1.08	24	2952	5367	136	136
Bergen Blvd School	29,954	Buck Frame Air Sealing	Seal (LF)	1.08	24	2952	5367	94	94
Bergen Blvd School	29,954	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	1.08	24	2952	5367	169	169
Bergen Blvd School	29,954	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	1.08	24	2952	5367	272	272
Bergen Blvd School	29,954	Caulking	Interior Block, Seal (LF)	1.08	24	2952	5367	10	10
Central Office	2,952	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	1.08	24	2827	5367	4	4
Central Office	2,952	Wall Air Sealing	Block, Seal (SF)	1.08	24	2827	5367	34	34
Central Office	2,952	Buck Frame Air Sealing	Block, Seal Exposed (LF)	1.08	24	2827	5367	25	25
Central Office	2,952	Caulking	Interior Block, Seal (LF)	1.08	24	2827	5367	68	68

Building Envelope Savings - Cooling Savings

BUILDING	TYPE	SUBTYPE	INFILTRATION REDUCTION (CFM)	TOTAL HEAT CONSTANT	INTERIOR DRY BULB TEMP (F)	EXTERIOR DRY BULB TEMP (F)	INTERIOR DRY RELATIVE HUMIDITY (%)	EXTERIOR RELATIVE HUMIDITY (%)
Slocum Skews School	Door Weather Stripping	Single Door - Sides, Sweep (UT)	310	4.5	72.0	75.0	40.0	75.0
Slocum Skews School	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	132	4.5	72.0	75.0	40.0	75.0
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	144	4.5	72.0	75.0	40.0	75.0
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	156	4.5	72.0	75.0	40.0	75.0
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	62	4.5	72.0	75.0	40.0	75.0
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	13	4.5	72.0	75.0	40.0	75.0
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	494	4.5	72.0	75.0	40.0	75.0
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	25	4.5	72.0	75.0	40.0	75.0
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	112	4.5	72.0	75.0	40.0	75.0
Memorial High School	Caulking	Interior Seal (LF)	306	4.5	72.0	75.0	40.0	75.0
Memorial High School	Buck Frame Air Sealing	Seal (LF)	225	4.5	72.0	75.0	40.0	75.0
Memorial High School	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	18	4.5	72.0	75.0	40.0	75.0
Memorial High School	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	12	4.5	72.0	75.0	40.0	75.0
Memorial High School	Door Weather Stripping	Double Door - Sweep, Center (UT)	567	4.5	72.0	75.0	40.0	75.0
Memorial High School	Door Weather Stripping	Single Door - Sides, Sweep (UT)	32	4.5	72.0	75.0	40.0	75.0
Memorial High School	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	60	4.5	72.0	75.0	40.0	75.0
Memorial High School	Door Weather Stripping	Single Door - Sweep (UT)	150	4.5	72.0	75.0	40.0	75.0
Memorial High School	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	48	4.5	72.0	75.0	40.0	75.0
Memorial High School	Roof-Wall Intersection Air Sealing	Seal (LF)	0	4.5	72.0	75.0	40.0	75.0
Memorial High School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	371	4.5	72.0	75.0	40.0	75.0
Memorial High School	Wall Air Sealing	Block, Seal (SF)	75	4.5	72.0	75.0	40.0	75.0
Memorial High School	Wall Air Sealing	Block, Seal (SF)	28	4.5	72.0	75.0	40.0	75.0
Memorial High School	Wall Air Sealing	Block, Seal (SF)	105	4.5	72.0	75.0	40.0	75.0
Memorial High School	Wall Air Sealing	Block, Seal (SF)	25	4.5	72.0	75.0	40.0	75.0
Shaler Academy	Caulking	Interior Seal (LF)	339	4.5	72.0	75.0	40.0	75.0
Shaler Academy	Buck Frame Air Sealing	Seal (LF)	20	4.5	72.0	75.0	40.0	75.0
Shaler Academy	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	4	4.5	72.0	75.0	40.0	75.0
Shaler Academy	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	4	4.5	72.0	75.0	40.0	75.0
Shaler Academy	Door Weather Stripping	Single Door - Sides, Sweep (UT)	75	4.5	72.0	75.0	40.0	75.0
Shaler Academy	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	62	4.5	72.0	75.0	40.0	75.0
Shaler Academy	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	0	4.5	72.0	75.0	40.0	75.0
Bergen Blvd School	Caulking	Interior Seal (LF)	75	4.5	72.0	75.0	40.0	75.0
Bergen Blvd School	Buck Frame Air Sealing	Seal (LF)	75	4.5	72.0	75.0	40.0	75.0
Bergen Blvd School	Buck Frame Air Sealing	Seal Exposed (LF)	52	4.5	72.0	75.0	40.0	75.0
Bergen Blvd School	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	93	4.5	72.0	75.0	40.0	75.0
Bergen Blvd School	Door Weather Stripping	Double Door - Sweep, Center (UT)	150	4.5	72.0	75.0	40.0	75.0
Bergen Blvd School	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	5	4.5	72.0	75.0	40.0	75.0
Central Office	Caulking	Interior Seal (LF)	2	4.5	72.0	75.0	40.0	75.0
Central Office	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	18	4.5	72.0	75.0	40.0	75.0
Central Office	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	13	4.5	72.0	75.0	40.0	75.0
Central Office	Door Weather Stripping	Single Door - Sides, Sweep (UT)	36	4.5	72.0	75.0	40.0	75.0

Building Envelope Savings - Cooling Savings								
BUILDING	TYPE	SUBTYPE	INTERIOR ENTHALPY (SUMMER)	EXTERIOR ENTHALPY (SUMMER)	ENTHALPY	TONS	EFFICIENCY (kW/TON)	COOLING DEGREE DAYS (CDD)
Slocum Skews School	Door Weather Stripping	Single Door - Sides, Sweep (UT)	24.55	33.27	8.72	1.01	1.31	882
Slocum Skews School	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	24.55	33.27	8.72	0.43	1.31	882
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.47	1.31	882
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.51	1.31	882
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.20	1.31	882
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.04	1.31	882
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	1.62	1.31	882
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.08	1.31	882
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.37	1.31	882
Memorial High School	Caulking	Interior Seal (LF)	24.55	33.27	8.72	1.00	1.21	882
Memorial High School	Buck Frame Air Sealing	Seal (LF)	24.55	33.27	8.72	0.73	1.21	882
Memorial High School	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	24.55	33.27	8.72	0.06	1.21	882
Memorial High School	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	24.55	33.27	8.72	0.04	1.21	882
Memorial High School	Door Weather Stripping	Double Door - Sweep, Center (UT)	24.55	33.27	8.72	1.85	1.21	882
Memorial High School	Door Weather Stripping	Single Door - Sides, Sweep (UT)	24.55	33.27	8.72	0.10	1.21	882
Memorial High School	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	24.55	33.27	8.72	0.20	1.21	882
Memorial High School	Door Weather Stripping	Single Door - Sweep (UT)	24.55	33.27	8.72	0.49	1.21	882
Memorial High School	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	24.55	33.27	8.72	0.16	1.21	882
Memorial High School	Roof-Wall Intersection Air Sealing	Seal (LF)	24.55	33.27	8.72	0.00	1.21	882
Memorial High School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	1.21	1.21	882
Memorial High School	Wall Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.24	1.21	882
Memorial High School	Wall Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.09	1.21	882
Memorial High School	Wall Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.34	1.21	882
Memorial High School	Wall Air Sealing	Block, Seal (SF)	24.55	33.27	8.72	0.08	1.21	882
Shaler Academy	Caulking	Interior Seal (LF)	24.55	33.27	8.72	1.11	1.48	882
Shaler Academy	Buck Frame Air Sealing	Seal (LF)	24.55	33.27	8.72	0.07	1.48	882
Shaler Academy	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	24.55	33.27	8.72	0.01	1.48	882
Shaler Academy	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	24.55	33.27	8.72	0.01	1.48	882
Shaler Academy	Door Weather Stripping	Single Door - Sides, Sweep (UT)	24.55	33.27	8.72	0.24	1.48	882
Shaler Academy	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	24.55	33.27	8.72	0.20	1.48	882
Shaler Academy	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	24.55	33.27	8.72	0.00	1.48	882
Bergen Blvd School	Caulking	Interior Seal (LF)	24.55	33.27	8.72	0.24	0.00	882
Bergen Blvd School	Buck Frame Air Sealing	Seal (LF)	24.55	33.27	8.72	0.24	0.00	882
Bergen Blvd School	Buck Frame Air Sealing	Seal Exposed (LF)	24.55	33.27	8.72	0.17	0.00	882
Bergen Blvd School	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	24.55	33.27	8.72	0.30	0.00	882
Bergen Blvd School	Door Weather Stripping	Double Door - Sweep, Center (UT)	24.55	33.27	8.72	0.49	0.00	882
Bergen Blvd School	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	24.55	33.27	8.72	0.02	0.00	882
Central Office	Caulking	Interior Seal (LF)	24.55	33.27	8.72	0.01	1.48	882
Central Office	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	24.55	33.27	8.72	0.06	1.48	882
Central Office	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	24.55	33.27	8.72	0.04	1.48	882
Central Office	Door Weather Stripping	Single Door - Sides, Sweep (UT)	24.55	33.27	8.72	0.12	1.48	882

Building Envelope Savings - Cooling Savings						
BUILDING	TYPE	SUBTYPE	INFILTRATION ELECTRIC SAVINGS (kW)	INFILTRATION ELECTRIC SAVINGS (kWh)	THERMAL INSULATION SAVINGS (kWh)	TOTAL COOLING SAVINGS (kWh)
Slocum Skews School	Door Weather Stripping	Single Door - Sides, Sweep (UT)	1	1,168	0	1,168
Slocum Skews School	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	1	499	0	499
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	1	544	0	544
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	1	589	0	589
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	0	235	0	235
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	0	47	0	47
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	2	1,865	0	1,865
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	0	95	0	95
Slocum Skews School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	0	424	0	424
Memorial High School	Caulking	Interior Seal (LF)	1	1,066	0	1,066
Memorial High School	Buck Frame Air Sealing	Seal (LF)	1	783	0	783
Memorial High School	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	0	61	0	61
Memorial High School	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	0	41	0	41
Memorial High School	Door Weather Stripping	Double Door - Sweep, Center (UT)	2	1,974	0	1,974
Memorial High School	Door Weather Stripping	Single Door - Sides, Sweep (UT)	0	110	0	110
Memorial High School	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	0	208	0	208
Memorial High School	Door Weather Stripping	Single Door - Sweep (UT)	1	522	0	522
Memorial High School	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	0	167	0	167
Memorial High School	Roof-Wall Intersection Air Sealing	Seal (LF)	0	0	0	0
Memorial High School	Roof-Wall Intersection Air Sealing	Block, Seal (SF)	1	1,292	0	1,292
Memorial High School	Wall Air Sealing	Block, Seal (SF)	0	261	0	261
Memorial High School	Wall Air Sealing	Block, Seal (SF)	0	98	0	98
Memorial High School	Wall Air Sealing	Block, Seal (SF)	0	366	0	366
Memorial High School	Wall Air Sealing	Block, Seal (SF)	0	87	0	87
Shaler Academy	Caulking	Interior Seal (LF)	2	1,447	0	1,447
Shaler Academy	Buck Frame Air Sealing	Seal (LF)	0	86	0	86
Shaler Academy	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	0	16	0	16
Shaler Academy	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	0	18	0	18
Shaler Academy	Door Weather Stripping	Single Door - Sides, Sweep (UT)	0	319	0	319
Shaler Academy	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	0	263	0	263
Shaler Academy	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	0	0	0	0
Bergen Blvd School	Caulking	Interior Seal (LF)	0	0	0	0
Bergen Blvd School	Buck Frame Air Sealing	Seal (LF)	0	0	0	0
Bergen Blvd School	Buck Frame Air Sealing	Seal Exposed (LF)	0	0	0	0
Bergen Blvd School	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	0	0	0	0
Bergen Blvd School	Door Weather Stripping	Double Door - Sweep, Center (UT)	0	0	0	0
Bergen Blvd School	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	0	0	0	0
Central Office	Caulking	Interior Seal (LF)	0	9	0	9
Central Office	Door Weather Stripping	Double Door - Sides, Sweep, Center (UT)	0	77	0	77
Central Office	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	0	55	0	55
Central Office	Door Weather Stripping	Single Door - Sides, Sweep (UT)	0	153	0	153

ECM 18 – Pipe and Valve Insulation

RIDGEFIELD PUBLIC SCHOOLS

✔	ECM evaluated but not included
✔	ECM included in the project

ECM #	ECM DESCRIPTION	Slocum Skews School	Memorial High School	Shaler Academy	Bergen Blvd School	Central Office
18	Pipe and Valve Insulation	✔	✔	✔	✔	✔

Piping insulation is a critical part of energy management. It controls condensation, pipe freezing, and noise amongst other things. A percentage of heating (or cooling) can be lost through conduction if a pipe is not properly insulated.

Higher operational costs are a direct result of this for both heating and cooling systems. This ECM entails wrapping the existing bare metal pipe with an approved high-performance fiberglass insulation jacketing material.

Uninsulated pipe and valve insulation at Shaler Academy, Ridgefield Memorial HS, and Bergen Blvd.

Scope of Work

MECHANICAL INSULATION WORK SUMMARY						
Task	Bergen Boulevard School	Central Office	Ridgefield Memorial High School	Shaler Academy	Slocum/ Skewes School	Total Quantity
Ball Valve Insulation (Units)				2		2
Bonnet Inuslation (Units)	8		11		9	28
Butterfly Valve Insulation (Units)				2		2
Control Valve Insulation (Units)				1		1
End Cap Insulation (Units)			6	3	5	14
Flange Insulation (Units)	4	1	16	2	5	28
Flex Fitting Insulation (UT)	4		10		4	18
Gate Valve Insulation (Units)		2		4	4	10
Pipe Fitting Insulation (Units)	4	7	24	14	39	88
Pipe Reducer Insulation (Units)	2					2
Pump Insulation (Units)				4		4
Straight Pipe Insulation (LF)	31	31	87	39	156	344
Strainer Insulation (Units)		1				1
Suction Diffuser Insulation (Units)	2		5	2	2	11
Tank Insulation (Units)					3	3
Triple Duty Valve Insulation (Units)			3			3

Insulation will be installed on exposed pipes and valves. Failed insulation will be replaced. Poorly insulated pipes in the heating and cooling distribution system is leading to unnecessary distribution losses and wasted energy. The scope of work will include

- Installation of pipe insulation to meet the insulation requirements of the fluid temperature in the pipe
- Utilize and install pipe wrap covering and jackets to protect the insulation material as required in the work area
- Materials will vary by the application and workspace
    - Fiberglass
    - Mineral wool
    - Foamglass
    - Styrofoam
    - Urethane
    - Closed cell rubber

ECM Calculations

The Central Office is not included in the project due to poor financial payback.
Energy Savings from Building Envelope Improvements can be found in Appendix G..

Pipe and Valve Insulation Savings		
BUILDING	**SQFT**	**THERMS SAVINGS**
Slocum Skews School	92,147	3,517
Memorial High School	87,850	3,576
Shaler Academy	47,368	1,076
Bergen Blvd School	29,954	1,014
Central Office	2,952	558

Algorithms

Fossil Fuel Source:

Fuel Savings (MMBtu/yr) = SF * L * Oper Hrs / EFF

Electric Source:

Energy Savings (kWh/yr) = SF * L * Oper Hrs / EFF / C

Scaling: Only applicable if differential between the fluid temperature and space temperature is significantly different than 130°F. If this is the case, the fuel or electric savings calculated with the above formulas should be multiplied by the resulting scaling factor deroived as:

Scaling Factor (unitless) = (FT – ST)/130

Fuel or electric savinsg calculated using the derived savings factors should be multiplied by the acaling factor.

Scaled Savings (MMBtu/year or kWh/yr) = Calculated Savings * Savings Factor

Definition of Variables

SF = Savings factor derived from #E Plus Version 4.1 tool, Btu/hr-ft see table below

L = Length of pipe from water heating source to hot water application, ft

Oper Hrs = hours per year fluid flows in pipe, hours

EFF = Efficiency of equipment providing heat to the fluid

C (kWh) = Conversion factor from Btu to kWh = 3,413 for electric water heating

FT = Fluid Temperature (°F)

ST = Space temperature (°F)

Summary of Inputs

Pipe Insulation

Component	Type	Value	Source
SF	Fixed	See Table Below	1
L	Variable		Application
Oper Hrs	Fixed	4,282 hrs/year (default value reflects average heating season hours)	2
EFF	Fixed	98% electric 80% natural gas	3
FT	Variable		Application
ST	Variable		Application

Savings Factor

	Savings, Btu/hr-ft			
Nominal Pipe Size, Inches	0.5" Insulation	1.0" Insulation	1.5" Insulation	2.0" Insulation
0.50	47	53	56	57
0.75	58	64	68	70
1.00	72	82	85	87
1.25	89	100	107	108
1.50	100	115	120	125
2.00	128	143	148	153
2.50	153	171	182	185
3.00	195	221	230	236
3.50	224	241	248	253
4.00	232	263	274	281

Mechanical Insulation Savings Calculations

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

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

Methodology

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

Energy Use

Existing and proposed energy use are computed as follows:

Pipes & Fittings

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

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

Energy Savings

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

Fuel Savings (MMBTU/yr) = (Existing Fuel Loss) – (Proposed Fuel Loss)
Electric Savings (MMBTU/yr) = (Existing Electric Loss) – (Proposed Electric Loss)
Cost Savings ($/yr) = (Fuel Savings MMBTU/yr) * (Fuel Rate $/MMBTU) +
(Electric Savings kWh/yr) * (Electric Rate $/kWh)

Heat Transfer: Bare Systems

Bare systems are subject to convection and radiation heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible as compared to heat transfer through insulation and air convection.

Pipes & Fittings

This section describes the heat transfer calculations for pipes and fittings for indoor systems subject to natural convection (no wind). The calculations for outdoor systems subject to forced convection (wind) are similar except that the formulas are more complicated. These methods are presented following this section.

For fittings (valves, elbows, strainers, etc.), we estimate heat loss based on equivalent length of straight pipe, which is the ratio of the area of the fitting to the area of 1 linear foot of pipe of the same size (fitting equivalent length = Area of fitting, ft^2 / Area of pipe of equivalent diameter, ft^2).

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{1}{h * \left(D_{outer}/_2\right)}}$$

Where:

q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$h = total\ convective\ heat\ transfer\ factor = h_{convection} + h_{radiation}$

$$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

$\Delta T = T_{surface} - T_{air}$

$\Delta T = T_{surface} - T_{air}$

D = Outer diameter

$$h_{radiation} = \varepsilon * \sigma * \left(T_{surface}^4 - T_{air}^4\right) / \left(T_{surface} - T_{air}\right)$$

e = emissivity of surface

s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)

$T_{surface} = Temperature\ of\ surface$

$T_{air} = Average\ ambient\ air\ temperature$

Heat Transfer: Insulated Systems

Insulated systems are subject to convection, radiation, and conductive heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible when compared to heat transfer through insulation and air convection.

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{ln\left(D_{outer}/D_{inner}\right)}{k} + \frac{1}{h * \left(D_{outer}/2\right)}}$$

Where:

q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

$T = T_{surface} - T_{air}$

$\Delta T = T_{surface} - T_{air}$

D = Outer diameter

$$h_{radiation} = \varepsilon * \sigma * \left(T_{surface}^4 - T_{air}^4\right) / \left(T_{surface} - T_{air}\right)$$

e = emissivity of surface

s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)

$T_{surface}$ = *Temperature of surface*

T_{air} = *Average ambient air temperature*

L = Pipe length or fitting equivalent length

The temperature at any interface location "x" can be calculated from:

$$\frac{R_x}{R_{total}} = \frac{\left(T_{inside} - T_x\right)}{T_{inside} - T_{outside}}$$

$$T_x = T_{inside} - \frac{R_x}{R_{total}}\left(T_{inside} - T_{outside}\right)$$

ENERGY SAVINGS PLAN

SECTION 4 – FINANCIAL ANALYSIS

Form V – ESCO Construction and Service Fees

FORM V - 20 Years @ 4.00% Interest		
ESCO's ENERGY SAVINGS PLAN (ESP): ESCOs PROPOSED FINAL PROJECT COST FORM RIDGEFIELD PUBLIC SCHOOLS ENERGY SAVING IMPROVEMENT PROGRAM		
ESCO Name: DCO Energy PROPOSED CONSTRUCTION FEES:		
Fee Category	**Fees (1) Dollar ($) Value**	**Percentage of Hard Costs**
Estimated Value of Hard Costs (2)	$ 3,475,806	
ECM Contingency	$ 173,790	
PSEG Engineering Cost		
Total Value of Hard Costs	$ 3,649,597	
Project Service Fees		
Investment Grade Energy Audit	$ 91,240	2.50%
Design Engineering Fees	$ 209,852	5.75%
Construction Management & Project Administration	$ 228,100	6.25%
System Commissioning	$ 27,372	0.75%
Equipment Initial Training Fees	$ 36,496	1.00%
ESCO Overhead	$ 145,984	4.00%
ESCO Profit	$ 109,488	3.00%
Project Service Fees Subtotal	$ 593,059	16.25%
TOTAL FINANCED PROJECT COSTS:	$ 4,498,128	23.25%
PROPOSED ANNUAL SERVICE FEES		
First Year Annual Service Fees	**Fees (1) Dollar ($) Value**	**Percentage of Hard Costs**
SAVINGS GUARANTEE *(OPTION)*	$0	0.00%
Measurement & Verification *(Associated w/ Savings Guarantee Option)*	$33,941	0.93%
ENERGY STAR Services *(optional)*	$0	0.00%
Post Construction Services *(if applicable)*	$51,094	1.40%
Performance Monitoring	w/ M&V	0.00%
On-going Training Services	w/ M&V	0.00%
Verification Reports	w/ M&V	0.00%
TOTAL FIRST YEAR ANNUAL SERVICES	$85,036	2.33%

NOTES:
(1) Fees should include all mark-ups, overhead, and profit. Figures stated as a range will NOT be accepted.
(2) The total value of Hard Costs is defined in accordance with standard AIA definitions that include: Labor Costs, Subcontractor Costs, Cost of Materials and Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds Taxes, Insurance, Mark-ups, Overhead and Profit, etc.

DCO Energy Efficiency Division
100 Lenox Drive
Lawrenceville, NJ 08648

Form VI – Project Cash Flow Analysis

FORM VI - 20 Years @ 4.00% Interest

ESCO's ENERGY SAVINGS PLAN (ESP):
ESCO's ANNUAL CASH FLOW ANALYSIS FORM
RIDGEFIELD PUBLIC SCHOOLS - ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: DCO Energy

Miscellaneous Costs Financed:	
Cost of Issuance	$50,000
Total	$50,000

Note: Respondents must use the following assumptions in all financial calculations:
(a) The cost of all types of energy should be assumed to inflate at **2.4% gas, 2.2%** electric per year and
1. Term of Agreement: **19** Years
2. Construction Period [2] (months): 12 Months
3. Cash Flow Analysis Format:

Project Cost[1]: **$4,498,128**
Capital Contribution **-$1,000,000**
Cost of Issuance **$50,000**
Financed Amount: **$3,548,128**

Interest Rate: **4.00%**

Year	Annual Energy Savings	Solar PPA Savings	Annual Operational Savings	Energy Rebates / Incentives	Total Annual Savings	Annual Project Costs	Net Cash-Flow to Client	Cumulative Cash Flow
Installation[4]	$ 92,400		$ -		$ 92,400	$ (85,155)	$ -	$ -
Year 1	$ 166,531	$ 54,230	$ 59,447	$ 62,087	$ 342,294	$ (346,924)	$ 2,615	$ 2,615
Year 2	$ 170,246	$ 56,498	$ 60,814	$ -	$ 287,558	$ (284,942)	$ 2,615	$ 5,231
Year 3	$ 174,044	$ 58,798	$ 4,998	$ -	$ 237,840	$ (235,225)	$ 2,615	$ 7,846
Year 4	$ 177,927	$ 61,129	$ 5,113	$ -	$ 244,170	$ (241,555)	$ 2,615	$ 10,462
Year 5	$ 181,897	$ 63,494	$ 5,231	$ -	$ 250,622	$ (248,007)	$ 2,615	$ 13,077
Year 6	$ 185,956	$ 65,892			$ 251,848	$ (249,232)	$ 2,615	$ 15,693
Year 7	$ 190,105	$ 68,324			$ 258,429	$ (255,813)	$ 2,615	$ 18,308
Year 8	$ 194,347	$ 70,790			$ 265,137	$ (262,521)	$ 2,615	$ 20,924
Year 9	$ 198,683	$ 73,291			$ 271,974	$ (269,359)	$ 2,615	$ 23,539
Year 10	$ 203,117	$ 75,828			$ 278,945	$ (276,329)	$ 2,615	$ 26,155
Year 11	$ 207,649	$ 78,402			$ 286,051	$ (283,435)	$ 2,615	$ 28,770
Year 12	$ 212,283	$ 81,012			$ 293,295	$ (290,679)	$ 2,615	$ 31,386
Year 13	$ 217,020	$ 83,660			$ 300,680	$ (298,065)	$ 2,615	$ 34,001
Year 14	$ 221,863	$ 86,347			$ 308,209	$ (305,594)	$ 2,615	$ 36,617
Year 15	$ 226,814	$ 89,072			$ 315,886	$ (313,271)	$ 2,615	$ 39,232
Year 16	$ 231,876				$ 231,876	$ (229,261)	$ 2,615	$ 41,848
Year 17	$ 237,051				$ 237,051	$ (234,435)	$ 2,615	$ 44,463
Year 18	$ 242,342				$ 242,342	$ (239,726)	$ 2,615	$ 47,079
Year 19	$ 247,750				$ 247,750	$ (245,135)	$ 2,615	$ 49,694
Totals	$ 3,979,901	$ 1,066,766	$ 135,603	$ 62,087	$ 5,244,357	$ (5,194,663)	$ 49,694	

NOTES:
(1) Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"
(2) No payments are made by Ridgefield Public Schools during the construction period.
(3) As of July 1, 2021, all of former NJ Clean Energy Program incentive programs transitioned over to the investor-owned gas and electric utility companies. Subsequently, the BPU is requiring that all ESIP projects consult with the DCA and follow all DCA guidance regarding the procurement of all subcontractors.
(4) Installation Year Total Annual Savings are added to Year 1 Net Cash Flow to Client

Utility Inflation Details

Per Form VI, the annual inflation rate is 2.2% for electric and 2.4% for natural gas. The solar PPA rate escalates at 0.0% annually. See PPA savings in Section 3 for additional details. Year 1 ESIP savings are escalated three years from the baseline year of 2021 to reflect a 12-month construction term.

Utility Inflation Worksheet						
Year	TOTAL ANNUAL ELECTRIC COST SAVINGS (INCLUDING SOLAR PPA SAVINGS)	NET ANNUAL ELECTRIC COST SAVINGS (EXCLUDING SOLAR PPA SAVINGS)	ANNUAL NATURAL GAS COST SAVINGS	ANNUAL Fuel Oil #2 (Gal) COST SAVINGS	Net Solar Savings	ANNUAL Water & Sewer (Gal) COST SAVINGS
1		$140,727.60	$25,803.16	$0.00	$54,229.56	$0.00
2		$143,823.61	$26,422.43	$0.00	$56,497.80	$0.00
3		$146,987.72	$27,056.57	$0.00	$58,797.59	$0.00
4		$150,221.45	$27,705.93	$0.00	$61,129.49	$0.00
5		$153,526.33	$28,370.87	$0.00	$63,494.09	$0.00
6		$156,903.91	$29,051.77	$0.00	$65,891.96	$0.00
7		$160,355.79	$29,749.02	$0.00	$68,323.71	$0.00
8		$163,883.62	$30,462.99	$0.00	$70,789.93	$0.00
9		$167,489.06	$31,194.10	$0.00	$73,291.25	$0.00
10		$171,173.82	$31,942.76	$0.00	$75,828.29	$0.00
11		$174,939.64	$32,709.39	$0.00	$78,401.68	$0.00
12		$178,788.31	$33,494.41	$0.00	$81,012.08	$0.00
13		$182,721.66	$34,298.28	$0.00	$83,660.13	$0.00
14		$186,741.53	$35,121.44	$0.00	$86,346.51	$0.00
15		$190,849.85	$35,964.35	$0.00	$89,071.89	$0.00
16		$195,048.54	$36,827.50	$0.00		$0.00
17		$199,339.61	$37,711.36	$0.00		$0.00
18		$203,725.08	$38,616.43	$0.00		$0.00
19		$208,207.04	$39,543.23	$0.00		$0.00
20		$212,787.59	$40,492.26	$0.00		$0.00

ENERGY SAVINGS PLAN

SECTION 5 – RISK, DESIGN, & COMPLIANCE

Assessment of Risks, Design & Compliance Issues

Moving from a conceptual design to engineered documents DCO has identified areas of the project that could change during the detailed design. The table below represents potential conceptual areas of concern that will need to be investigated further with a corresponding party responsible for the compliance of each item.

Issue	Category	Responsible Party
Alteration of expected Maintenance and Operational Savings	Risk	Ridgefield Public Schools
Disposition of Abandoned Equipment (Steam Piping, Condensate Piping, Oil Tanks, etc.)	Risk	Ridgefield Public Schools
New Natural Gas Distribution	Risk	Ridgefield Public Schools
Integrity of re-used Infrastructure	Risk	Ridgefield Public Schools
Life Safety System Coordination	Risk	Ridgefield Public Schools
Coordination with Ridgefield Public Schools Information Technology Department	Risk	Ridgefield Public Schools
Ventilation Compliance with Code	Compliance	Consulting Engineer
Temperature, Humidity and Air Change Compliance with Code	Compliance	Consulting Engineer
Boiler Capacity and Turndown	Design	Consulting Engineer
Natural Gas Regulator Compliance with Code	Compliance	Consulting Engineer
Undocumented Underground Utilities	Risk	Consulting Engineer
Code Compliance of Existing Electrical Infrastructure	Compliance	Consulting Engineer
Lighting Levels	Compliance	Consulting Engineer
Design Light Consortium rating for bulbs	Compliance	Consulting Engineer

Underwriters Laboratory Testing for retrofitted LED Lighting Systems	Compliance	Consulting Engineer
Lighting Retrofits within hard ceilings for fixtures and occupancy sensors	Risk	Consulting Engineer
Street/Parking Lot Pole Structural Integrity	Risk	Consulting Engineer
Unrealized Energy Savings 1. Energy Modeling 2. Performance Monitoring 3. Capacity of Equipment 4. Efficiency of Equipment 5. Run Hours of Equipment	Risk	DCO/ Consulting Engineer 1. DCO 2. DCO 3. Consulting Engineer / Basis of Design Vendor 4. Consulting Engineer / Basis of Design Vendor 5. Ridgefield Public Schools
Existing Plumbing Infrastructure with New Low Flow Devices	Design	Consulting Engineer
Adaptation to New RTUs (Curb, Electric, Ductwork, Condensate)	Design	Consulting Engineer / Basis of Design Manufacture
Structural Loads for Rooftop Equipment Replacement	Design	Consulting Engineer
Transformer Loading	Risk	Consulting Engineer
Site Work for Equipment	Design	Consulting Engineer
Condition of Roof Under Units	Risk	Consulting Engineer
Adequate Crane Lifts & Clearances	Design	Consulting Engineer / Rigger
Physical Space Constraints and Clearance for Equipment Replacement	Design	Consulting Engineer
Refrigerant Reclaim / Refrigerant Disposal	Compliance	Contractor
Existing Tie in Locations	Design	Consulting Engineer

Schedule Oversight	Risk	DCO Energy
Impact of Boiler Flue	Design	Consulting Engineer
Impact of Space Usage During Construction	Risk	Consulting Engineer & Ridgefield Public Schools
Scope changes relating to requests by Authorities Having Jurisdiction.	Risk	Ridgefield Public Schools (via contingency)
Department of Environmental Protection Permitting	Risk	Consulting Engineer
Modifications of Energy Saving Control Sequences and Setpoints impacting Energy Savings and Incentives	Risk	Ridgefield Public Schools
Post Construction Calibration of Sensors, Meters, & Safety Devices	Risk	Ridgefield Public Schools
Adequate time and access for bidding contractor site surveys	Risk	Ridgefield Public Schools
Utility Interconnection approval for the CHP Unit	Risk	Ridgefield Public Schools

Measurement & Verification (M&V) Plan

Our approach to M&V of energy savings aligns with the International Performance Measurement & Verification Protocol. More detailed information may be found below. It's most cost-effective to perform M&V using the least costly option that still adequately documents system performance and permits analysis of savings. This approach lowers the total cost of the program leaving more dollars available to perform more facility improvements. Depending upon which ECMs are implemented by Ridgefield Public Schools, the M&V plan proposed by DCO would incorporate one or more of the following options which outlines the four most common approaches for M&V:

Option A – Retrofit Isolation with Key Parameter Measurement	This option is based on a combination of measured and estimated factors when variations in factors are not expected. Measurements are spot or short-term and are taken at the component or system level, both in the baseline and post-installation cases. Measurements should include the key performance parameter(s) which define the energy use of the ECM. Estimated factors are supported by historical or manufacturer's data. Savings are determined by means of engineering calculations of baseline and post-installation energy use based on measured and estimated values.	Direct measurements and estimated values, engineering calculations and/or component or system models often developed through regression analysis. Adjustments to models are not typically required.
Option B – Retrofit Isolation with Parameter Measurement	This option is based on periodic or continuous measurements of energy use taken at the component or system level when variations in factors are expected. Energy or proxies of energy use are measured continuously. Periodic spot or short-term measurements may suffice when variations in factors are not expected. Savings are determined form analysis of baseline and reporting period energy use of proxies of energy use.	Direct measurements, engineering calculations, and/or component or system models often developed through regression analysis. Adjustments to models may be required.
Option C – Utility Data Analysis	This option is based on long-term, continuous, whole-building utility meter, facility level, or sub-meter energy (or water) data. Savings are determined from analysis of baseline and reporting period energy data. Typically, regression analysis is conducted to correlate with and adjust energy use to independent variables such as weather, but simple comparisons may also be used.	Based on regression analysis of utility meter data to account for factors that drive energy use. Adjustments to models are typically required.
Option D – Calibrated	Computer simulation software is used to model energy performance of a whole-facility (or sub-facility). Models must be calibrated with actual hourly or monthly billing data from the facility. Implementation of simulation modeling requires	Based on computer simulation model calibrated with whole-building or end-use

Computer Simulation	engineering expertise. Inputs to the model include facility characteristics; performance specifications of new and existing equipment or systems; engineering estimates, spot-, short-term, or long-term measurements of system components; and long-term whole-building utility meter data. After the model has been calibrated, savings are determined by comparing a simulation of the baseline with either a simulation of the performance period or actual utility data	metered data or both. Adjustments to models are required.

Each of the options can be used for a wide array of energy efficiency upgrades and each has different costs and complexities associated with it. When selecting an M&V approach, the following general rule of thumb can be applied:

OPTION A

- When magnitude of savings is low for the entire project or a portion of the project
- The risk for not achieving savings is low

OPTION B

- For simple equipment replacement projects
- When energy savings values per individual measure are desired
- When interactive effects are to be ignored or are estimated using estimating methods that do not involve long term measurements
- When sub-meters already exist that record the energy use of subsystems under consideration

OPTION C

- For complex equipment replacement and controls projects
- When predicted energy savings are in excess of 10 to 20 percent as compared with the record energy use
- When energy savings per individual measure are not desired
- When interactive effects are to be included
- When the independent variables that affect energy, use are complex and excessively difficult or expensive

OPTION D

- When new construction projects are involved
- When energy savings values per measure are desired
- When Option C tools cannot cost effectively evaluate particular measures or their interactions with the building when complex baseline adjustments are anticipated

DCO will perform measurement and verification of the energy units savings at the conclusion of each month in the first year of the energy units guarantee. After the first year, M&V will be performed and presented within 30 days of year end. Ridgefield Public Schools will work with DCO to provide necessary information and provide access to any buildings to allow DCO to properly verify and measure energy savings. DCO's energy guarantee will be based on units of energy saved as determined from the baseline provided in the RFP, or adjusted baseline if original baseline is determined by both parties to be inaccurate.

Adjustments to the baseline and associated savings will be taken for weather, hours of operation, building usage, utility rate increases, code or statute changes, requirements listed in Table 1, and any other actions that adversely affect the savings beyond the control of DCO. Any savings discrepancies will be resolved to the satisfaction of both the Ridgefield Public Schools and DCO in a timely manner.

As part of the optional energy guarantee, DCO uses weather normalization procedures to correct for the effect of weather variance on energy savings in subsequent years. Baseline energy and weather data are used to establish an algorithm to predict how the baseline building uses energy as a function of weather. The algorithm is then applied to subsequent years to correct for the impact weather may have on future building energy use. The weather normalization procedure and algorithms will be covered in detail as part of the optional energy guarantee contract provided to Ridgefield Public Schools.

Maintenance Plan

Owner Tasks and Responsibilities:

As a general statement, Ridgefield Public Schools or its 3rd party service providers shall be responsible for providing ongoing maintenance through the duration of the M&V period. DCO will review operational procedures and schedules associated with such things as the building automation/control upgrades as well as the manufacturers' published requirements for all installed equipment be it: quarterly, semi-annually or annually. In most cases, Ridgefield Public Schools is already aware of or self-implementing similar maintenance practices on campus or has contracted a 3rd party for such services. Failure to properly maintain the equipment may cause energy savings goals to fall short.

Specific Areas of Consideration:

In order to sustain energy savings Ridgefield Public Schools's Staff will be required to implement new maintenance tasks and even modify existing policies and practices. Outlined are two examples of specific instances.

Example 1. Advanced Building Operations Programming:

Ridgefield Public Schools will be given specific training on the changes and advancements in the environmental operations and energy savings strategies. Ridgefield Public Schools will be responsible for following the agreed upon guidelines associated with programmed schedules and any use of override functions.

Example 2. Verification of Proper Operations: Mechanical Equipment

Ridgefield Public Schools will be required to assure that proper mechanical maintenance continues to be implemented on its mechanical equipment. Example: outside air dampers will require proper operation with the appropriate seals in order to maintain ECM(s) such as demand ventilation. DCO will periodically spot check system operations to verify the Owner or its 3rd party representative is implementing proper maintenance. Any deficiencies that may be identified will be brought to Ridgefield Public Schools's attention for correction.

ENERGY SAVINGS PLAN

SECTION 6 – OPERATION & MAINTENANCE

It is critical to the success of achieving continued energy savings that Ridgefield Public Schools develop and implement an Operation and Maintenance Plan. In this section are some recommendations for Ridgefield Public Schools and/or 3rd party maintenance contractors.

Air Handling Units

Comprehensive Annual Inspection

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
   a) Inspect the unit for cleanliness.
   b) Inspect the fan wheel and shaft for wear and clearance.
   c) Check the sheaves and pulleys for wear and alignment.
   d) Check the belts for tension, wear, cracks, and glazing.
   e) Verify tight bolts, set screws, and locking collars.
   f) Check dampers for wear, security and linkage adjustment.
   g) Verify clean condensate pan.
   h) Verify proper operation of the condensate drain.
   i) Verify clean air filters.
   j) Verify clean coils.
   k) Verify proper operation of the spray pump, if applicable.
   l) Verify smooth fan operation.
   m) Log operating conditions after system has stabilized.
   n) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.
4. Lubrication
   a) Lubricate the fan shaft bearings, if applicable.
   b) Lubricate the motor bearings, if applicable.
5. Controls and Safeties
   a) Test the operation of the low temperature safety device, if applicable.
   b) Test the operation of the high static pressure safety device, if applicable.
   c) Test the operation of the low static pressure safety device, if applicable.
   d) Check the thermal cutout on electric heaters, if applicable.
   e) Check the step controller, if applicable.

f) Check and record supply air and control air pressure, if applicable.
g) Verify the operation of the control system and dampers while the fan is operating.

6. Motor and Starter
   a) Clean the starter and cabinet.
   b) Inspect the wiring and connections for tightness and signs of overheating and discoloration. This includes wiring to the electric heat, if applicable.
   c) Check the condition of the contacts for wear and pitting.
   d) Check the contactors for free and smooth operation.
   e) Meg the motor and record readings.

Heating Inspection

1. Gas Heat Option
   a) Visually inspect the heat exchanger.
   b) Inspect the combustion air blower fan, and clean, if required.
   c) Lubricate the combustion air blower fan motor, if applicable.
   d) Verify the operation of the combustion air flow-proving device.
   e) Test the operation of the high gas pressure safety device, if applicable. Calibrate, if necessary.
   f) Test the operation of the low gas pressure safety device, if applicable. Calibrate, if necessary.
   g) Verify the operation of the flame detection device.
   h) Test the operation of the high temperature limit switch.
   i) Verify the integrity of the flue system.
   j) Verify the operation of the operating controls.
   k) Verify the burner sequence of operation.
   l) Verify proper gas pressure to the unit and/or at the manifold, if applicable.
   m) Perform combustion test. Make adjustments as necessary.
2. Electric Heat Option
   a) Inspect wiring and connections for tightness and signs of overheating and discoloration.
   b) Check and calibrate operating and safety controls, if applicable.
   c) Verify the operation of the heating elements.
   d) Check voltage and amperage and compare readings with the watt rating on the heater.
3. Hot Water / Steam Heat Option
   a) Inspect control valves and traps.
   b) Check and calibrate all operating and safety controls.
   c) Verify the operation of the heating coils.
   d) Verify the operation of the unit low temperature safety device.

Scheduled Running Inspection

1. Check the general condition of the fan.
2. Verify smooth fan operation.
3. Check and record supply and control air pressure, if applicable.
4. Verify the operation of the control system.
5. Log the operating conditions after the system has stabilized.
6. Review operating procedures with operating personnel.
7. Provide a written report of completed work, operating log, and indicate uncorrected deficiencies detected.

Oil Sample/Spectrographic Analysis

1. Pull oil sample for spectrographic analysis

Refrigerant Sample/Analysis

1. Pull refrigerant sample for spectrographic analysis for contaminants (oil, water, and acid), using approved containers

Boilers

Comprehensive Annual Inspection

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
   a) Secure and drain the boiler.
   b) Open the fire and water side for cleaning and inspection.
   c) Check heating surfaces and water side for corrosion, pitting, scale, blisters, bulges, and soot.
   d) Inspect refractory.
   e) Clean fire inspection glass.
   f) Check blow-down valve packing, and lubricate.
   g) Check and test boiler blow-down valve.

h) Perform hydrostatic test, if required.
i) Verify proper operation of the level float.
j) Gas Train Burner Assembly
    1. Check the gas train isolation valves for leaks.
    2. Check the gas supply piping for leaks.
    3. Check the gas pilot solenoid valve for wear and leaks.
    4. Check the main gas and the pilot gas regulators for wear and leaks.
    5. Test the low gas pressure switch. Calibrate and record setting.
    6. Test the high gas pressure switch. Calibrate and record setting.
    7. Verify the operation of the burner fan air flow switch.
    8. Inspect and clean the burner assembly.
    9. Inspect and clean the pilot igniter assembly.
    10. Inspect and clean the burner fan.
    11. Run the fan and check for vibration.
    12. Inspect the flue and flue damper.
    13. Burner Control Panel:
        a) Inspect the panel for cleanliness.
        b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
k) Clean burner fan wheel and air dampers. Check fan for vibration.
l) Verify tightness on linkage set screws.
m) Check gas valves for leakage (where test cocks are provided).
n) Verify proper operation of the feed water pump.
o) Verify proper operation of the feed water treating equipment.

4. Controls and Safeties
    a) Disassemble and inspect low water cutoff safety device.
    b) Reassemble boiler low water cutoff safety device with new gaskets.
    c) Clean contacts in program timer, if applicable.
    d) Check the operation of the low water cutoff safety device and feed controls.
    e) Verify the setting and test the operation of the operating and limit controls.
    f) Verify the operation of the water level control.

Startup/Checkout Procedure

1. Verify proper water level in the boiler
2. Test the safety/relief valve after startup (full pressure test).
3. Clean or replace fuel filters.

4. Clean fuel nozzles.
5. Inspect clean, and functionally test the flame scanner and flame safeguard relay.
6. Clean and adjust the ignition electrode.
7. Replace the vacuum tube in the flame safeguard control, if applicable.
8. Perform pilot turn down test.
9. Verify proper steam pressure.
10. Perform combustion test and adjust the burner for maximum efficiency.
11. Test the following items:
    a) Firing rate
    b) Fuel/air ratio
    c) CO2
    d) CO
    e) NOX
    f) Perform smoke test.
12. Review operating procedures
13. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Mid-Season Running Inspection

1. Check the general condition of the unit.
2. Inspect the burner.
3. Adjust the burner controls to obtain proper combustion.
4. Check the operation of the pressure relief valve.
5. Check the operation of the low water cutoff and feed controls.
6. Check the setting and test the operation of the operating and limit controls.
7. Check the operation of the modulating motor.
8. Lift the safety/relief valves with at least 70% of rated pressure.
9. Blow down and try gauge cocks to confirm glass water level.
10. Check and test boiler blow down valve.
11. Log operating conditions after the system has stabilized.
12. Review operating procedures
13. Provide a written report of completed work, operating log, and indicate uncorrected deficiencies detected.

Seasonal Shut-down Procedure

1. Shut down boiler at boiler controls.
2. Shut off fuel lines at main valves.
3. Review operating procedures
4. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Burners

Gas Train

1. Check the gas train isolation valves for leaks.
2. Check the gas supply piping for leaks.
3. Check the gas pilot solenoid valve for wear and leaks.
4. Check the main gas and the pilot gas regulators for wear and leaks.
5. Test the low gas pressure switch. Calibrate and record setting.
6. Test the high gas pressure switch. Calibrate and record setting.
7. Verify the operation of the burner fan air flow switch.
8. Inspect and clean the burner assembly.
9. Inspect and clean the pilot ignitor assembly.
10. Inspect and clean the burner fan.
11. Run the fan and check for vibration.
12. Inspect the flue and flue damper.
13. Burner Control Panel:
    a) Inspect the panel for cleanliness.
    b) Inspect wiring and connections for tightness and signs of overheating.
14. Clean burner fan wheel and air dampers. Check the fan for vibration.
15. Verify tightness of the linkage set screws.
16. Check the gas valves against leakage (where test cocks are provided

Oil Train

1. Check the gas train isolation valves for leaks.
2. Check the gas supply piping for leaks.
3. Check the gas pilot solenoid valve for wear and leaks.
4. Check the main gas and the pilot gas regulators for wear and leaks.

5. Test the low gas pressure switch. Calibrate and record setting.
6. Test the high gas pressure switch. Calibrate and record setting.
7. Verify the operation of the burner fan air flow switch.
8. Inspect and clean the burner assembly.
9. Inspect and clean the pilot ignitor assembly.
10. Inspect and clean the burner fan.
11. Run the fan and check for vibration.
12. Inspect the flue and flue damper.
13. Burner Control Panel:
    a) Inspect the panel for cleanliness.
    b) Inspect wiring and connections for tightness and signs of overheating.
14. Clean burner fan wheel and air dampers. Check the fan for vibration.
15. Verify tightness of the linkage set screws.
16. Check the gas valves against leakage (where test cocks are provided).

Dual Fuel Train

1. Check the gas train isolation valves for leaks.
2. Check the gas supply piping for leaks.
3. Check the gas pilot solenoid valve for wear and leaks.
4. Check the main gas and the pilot gas regulators for wear and leaks.
5. Test the low gas pressure switch. Calibrate and record setting.
6. Test the high gas pressure switch. Calibrate and record setting.
7. Verify the operation of the burner fan air flow switch.
8. Inspect and clean the burner assembly.
9. Inspect and clean the pilot ignitor assembly.
10. Inspect and clean the burner fan.
11. Run the fan and check for vibration.
12. Inspect the flue and flue damper.
13. Burner Control Panel:
    a) Inspect the panel for cleanliness.
    b) Inspect wiring and connections for tightness and signs of overheating.
14. Clean burner fan wheel and air dampers. Check the fan for vibration.
15. Verify tightness of the linkage set screws.
16. Check the gas valves against leakage (where test cocks are provided)

Cooling Towers

Startup/Checkout Procedure

1. Fill the basin and verify the float level.
2. Verify the operation of the basin heaters
3. Verify the operation, setpoint, and sensitivity of the basin heater temperature control device.
4. Start the condenser water pumps.
5. Verify the balance of the return water through the distribution boxes.
6. Verify proper operation of the bypass valve(s), if applicable.
7. Operate fan and verify smooth operation.
8. Log operation after system has stabilized.
9. Review operating procedures
10. Provide a written report of completed work, operating log, and indicate uncorrected deficiencies detected.

Comprehensive Bi-Annual Inspection

1. Perform following inspection and cleaning before starting the tower for the cooling season and during shutdown at end of season.
2. Record and report abnormal conditions, measurements taken, etc.
3. Review logs for operational problems and trends.
4. General Assembly
   a) Structure
      1. Disassemble all screens and access panels for inspection.
      2. Inspect the conditions of the slats, if applicable.
      3. Inspect the condition of the tower fill.
      4. Inspect the condition of the support structure.
      5. Inspect the condition of the basins (upper and lower) and/or spray nozzles.
      6. Verify clean basins and strainer(s).
      7. Verify the condition and operation of the basin fill valve system.
   b) Mechanical
      1. Inspect belts for wear, cracks, and glazing.
      2. Verify correct belt tension. Adjust the tension as necessary.
      3. Inspect sheaves and pulleys for wear, condition, and alignment.

4. Inspect fan shaft and bearings for condition.
5. Inspect fan assembly for condition, security, and clearances. (e.g. blade tip clearance).

4. Lubrication System
   a) Lubricate motor bearings.
   b) Lubricate fan shaft bearings.
5. Motor And Starter
   a) Clean the starter and cabinet.
   b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
   c) Check the condition of the contacts for wear and pitting.
   d) Check the contactor(s) for free and smooth operation.
   e) Meg the motor(s) and record readings.
   f) Check disconnect terminal block for wear, tightness and signs of overheating and discoloration.
   g) Check the condition and operation of the basin heater contactor(s).

Shut-Down Procedure

1. Check the general condition of the tower.
2. Turn off electrical power to basin heaters, tower fans, and pipe heaters as necessary.
3. Drain tower and condenser water piping.
4. Review operating procedures
5. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Energy Management System

Maintenance Inspection

1. Review reports for operational problems and trends.
2. Make a back-up copy of the BAS program.
3. Check for loose or damaged parts or wiring.
4. Check for any accumulation of dirt or moisture. Clean if required.
5. Verify proper electrical grounding.

6. Verify control panel power supplies for proper output voltages.
7. Inspect interconnecting cables and electrical connections.
8. Verify that manual override switches are in the desired positions.
9. Check the operation of all binary and analog outputs, if applicable.
10. Calibrate control devices, if applicable.
11. Verify the correct time and date.
12. Check and update the holiday schedules and daylight savings time.
13. Via terminal mode, view the event log and input/output points for any unusual status or override conditions.
14. Clean the external surfaces of the panel enclosure.
15. Review operating program and parameters.
16. Check cable connections for security.
17. Review operating procedures
18. Provide a written report of completed work, and indicate any uncorrected deficiencies detected.

Maintenance Inspection (Control Panels)

1. Control Panel
   a) Verify secure connections on all internal wiring, LAN, and communication links.
   b) Check for loose or damaged parts or wiring.
   c) Check for any accumulation of dirt or moisture. Clean if required.
   d) Remove excessive dust from heat sink surfaces
   e) Verify proper system electrical grounding.
   f) Verify proper output voltages on control panel power supplies.
   g) Check LED Indications to verify proper operation
   h) Verify LAN communications
   i) Verify that cards are seated and secured.
   j) Check wiring trunks and check for possible Error Code Indications
   k) Check voltage level of
   l) Verify the proper operation of critical control processes and points associated with this unit an make adjustments if necessary.
   m) Check Volatile memory available
   n) Cheek Non volatile memory available
   o) Check Processor idle time
   p) Clean external surfaces of the panel enclosure.
   q) Check modem operation, if applicable.

r) View the event log and input/output points for any unusual status or override conditions.
s) Verify correct time and date.
t) Check and update holiday schedules, if applicable, and daylight savings time.
u) Review operating procedures with operating personnel.
v) Provide a written report of completed work, and indicate any uncorrected deficiencies detected.

Maintenance Inspection (EMS - Sequence of Operations)

Central Plant

In order to assure effective environmental conditioning while minimizing the cost to operate the equipment, technicians will review operating sequences and practices for the chiller plant. An initial survey of current equipment operating parameters will be conducted within the first 60 days of the contract term during cooling season. This survey will include:

1. Chiller(s) operation
2. Cooling tower(s) operation
3. Pump(s) operation
4. Economizer operation (where applicable)
5. Environmental safety

A detailed report of findings and recommendations for changes, if any, will be made. Agreed upon operational changes which require only adjustment of controls or programming will be made during regularly scheduled maintenance visits as part of this agreement at no additional cost. Any recommended alterations that require addition of devices or equipment will be accompanied by a guaranteed cost proposal reflecting the applicable discounts determined by this agreement.

Building Systems

In order to assure effective environmental conditioning while minimizing the cost to operate the equipment, technicians will review operating sequences and practices for covered airside systems. An initial survey of current systems operating parameters will be conducted within the first 60 days of the contract term, except seasonally operated systems, which will be surveyed during the appropriate operating season. This survey will include:

1. Time schedule(s)

2. Reset schedule(s)
3. Economizer changeover (where applicable)
4. Setpoints
5. Energy Management routines

A detailed report of findings and recommendations for changes, if any, will be made. Agreed upon operational changes which require only adjustment of controls or programming will be made during regularly scheduled maintenance visits as part of this agreement at no additional cost. Any recommended alterations that require addition of devices or equipment will be accompanied by a guaranteed cost proposal reflecting the applicable discounts determined by this agreement.

Fans

Maintenance Procedure

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
   a) Check the general condition of the unit.
   b) Verify tightness of the fan, fan guards, louvers, etc.
   c) Verify clean burner assembly.
   d) Check sheaves and pulleys for wear and alignment, if applicable.
   e) Check belts for tension, wear, cracks, and/or glazing.
4. Lubrication
   a) Lubricate the fan motor, if applicable.
   b) Lubricate the fan bearings as necessary.
5. Controls and Safeties
   a) Verify proper operation of the temperature control device.
   b) Verify proper operation of the high temperature control device.
   c) Verify proper operation of the fan switch.
   d) Verify proper operation of the pilot safety device, if applicable.
6. Electrical
   a) Inspect wiring and connections for tightness and signs of overheating and discoloration.
7. Startup and Checkout

a) Start the unit.
b) Verify proper combustion air to the burner.
c) Verify proper gas pressure to the burner.
d) Check the flame for proper combustion.

Comprehensive Annual Inspection

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
   a) Disassemble all screens and panels necessary to gain access to the fan mechanism.
   b) Disassemble the control mechanism (AVPB only).
   c) Clean all accessible rotor components to include control pitch mechanism (AVPB only).
   d) Inspect blades for wear.
   e) Inspect blade arms for wear (AVPB only).
   f) Check blade tip clearance.
   g) Check for oil leak on the blade bearing housing (AVPB only).
   h) Clean motor and fan housing.
   i) Reassemble all removed screens and plates.
4. Lubrication
   a) Lubricate the motor bearings.
   b) Lubricate the shaft bearings (AVPA only).
5. Controls and Safeties
   a) Test the operation of the high static safety device. Calibrate and record setting.
   b) Test the operation of the low static safety device. Calibrate and record setting.
   c) Test the operation of the vibration safety device. Calibrate and record setting.
   d) Verify the operation of the phase monitor, if applicable.
   e) Inspect pneumatic and electrical controls for condition and calibration.
   f) Verify proper operation.
6. Motor and Starter
   a) Clean the starter and cabinet.
   b) Clean the disconnect switch and cabinet at the fan, if applicable.
   c) Inspect the wiring and connections for tightness and signs of overheating and discoloration.
   d) Check the condition of the contacts for wear and pitting.
   e) Check the contactors for free and smooth operation.
   f) Meg the motor and record readings.

7. Startup / Checkout Procedure
   a) Start the fan.
   b) Verify the operation of the starter.
   c) Check and record supply and control air pressure.
   d) Verify the operation of the control system while the fan is operating.
   e) Log the operating conditions after the system has stabilized.
   f) Review operating procedures with operating personnel.
   g) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Scheduled Running Inspection (fans)

1. Check the general operation of the fan.
2. Check and record supply and control air pressure.
3. Verify the operation of the control system.
4. Log the operating conditions after the system has stabilized.
5. Review operating procedures with operating personnel.
6. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Comprehensive Annual Inspection (fans)

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
   a) Verify tight bolts, set screws, and locking collars.
   b) Inspect sheaves and pulleys for wear and alignment.
   c) Inspect belts for tension, wear, cracks, and glazing.
   d) Inspect dampers for wear, security, and clearances, if applicable.
   e) Verify clean air filters.
   f) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.
4. Lubrication
   a) Lubricate fan bearings.
   b) Lubricate motor bearings, if applicable.
5. Controls and Safeties
   a) Verify the operation of the control system while the fan is operating.

b) Verify the setting of the low temperature safety device, if applicable.
c) Verify the operation of the pre-heat control device, if applicable.
d) Verify the operation of the cooling control device, if applicable.
e) Verify the operation of the re-heat control device, if applicable.
f) Verify the operation of the humidity control device, if applicable.

6. Motor and Starter
   a) Clean the starter and cabinet.
   b) Inspect the wiring and connections for tightness and signs of overheating and discoloration.
   c) Check the condition of the contacts for wear and pitting.
   d) Check the contactors for free and smooth operation.
   e) Meg the motor and record readings.
   f) Check volts and amps of the motor.

Lubricate/Grease Bearings

1. Lubricate and/or grease bearings according to manufacturer's specifications

MEG Motor

1. Check the integrity of the insulation on the motor windings and the motor leads, using a megohm meter.

Coils

Maintenance Procedure

1. Record and report abnormal conditions.
2. Visually inspect the coil for leaks.
3. Inspect the coil for cleanliness.

Pumps

Annual Inspection

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
   a) Check motor shaft and pump shaft for alignment, if applicable.
   b) Inspect the coupling for wear.
   c) Verify that the shaft guard is in place and tight, if applicable.
   d) Verify water flow through the pump.
   e) Check for leaks on the mechanical pump seals, if applicable.
   f) Verify proper drip rate on the pump seal packing, if applicable.
   g) Verify smooth operation of the pump.
   h) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.
4. Lubrication
   a) Lubricate the motor bearings as necessary.
   b) Lubricate the pump bearings as necessary.
5. Motor and Starter
   a) Clean the starter and cabinet.
   b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
   c) Meg the motor.
   d) Verify tight connections on the motor terminals.
   e) Check the condition of the contacts for wear and pitting, if applicable.
   f) Check the contactors for free and smooth operation.
   g) Verify proper volts and amps.

Pump Run Inspection

1. Verify smooth operation of the pump.
2. Check for leaks on the mechanical pump seals, if applicable.
3. Verify proper drip rate on the pump seal packing, if applicable.
4. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

5.

Mechanical Starters with Electronic Controls

Comprehensive Annual Maintenance

1. Clean the starter and cabinet.
2. Inspect wiring and connections for tightness and signs of overheating and discoloration.
3. Check condition of the contacts for wear and pitting.
4. Check contactors for free and smooth operation.
5. Check the mechanical linkages for wear, security, and clearances.
6. Verify the overload settings.

VFD Starters

Comprehensive Annual Maintenance

1. Clean the starter and cabinet.
2. Inspect wiring and connections for tightness and signs of overheating and discoloration.
3. Check the tightness of the motor terminal connections.
4. Verify the operation of the cooling loop.
5. Verify proper operation of the frequency drive.

Rooftop Units

Comprehensive Annual Maintenance

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
   a) Inspect for leaks and report results.

b) Calculate refrigerant loss rate and report to the customer.
c) Repair minor leaks as required (e.g. valve packing, flare nuts).
d) Visually inspect condenser tubes for cleanliness.

4. Controls and Safeties
   a) Inspect the control panel for cleanliness.
   b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
   c) Verify the working condition of all indicator/alarm lights, if applicable.
   d) Test the low water temperature control device. Calibrate and record setting.
   e) Test the low evaporator pressure safety device. Calibrate and record setting.
   f) Test the oil pressure safety device. Calibrate and record setting, if applicable.
   g) Check programmed parameters of RCM control, if applicable.
5. Lubrication System
   a) Check oil level in the compressor.
   b) Test oil for acid content and discoloration. Make recommendations to the customer based on the results of the test.
   c) Verify the operation of the oil heater. Measure amps and compare reading with the watt rating of the heater.

6. Motor and Starter
   a) Clean the starter and cabinet.
   b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
   c) Check condition of the contacts for wear and pitting.
   d) Check the contactors for free and smooth operation.
   e) Check the tightness of the motor terminal connections.
   f) Meg the motor and record readings.
   g) Verify the operation of the electrical interlocks.
   h) Measure voltage and record. Voltage should be nominal voltage ± 10%.

Comprehensive Maintenance Inspection (RTU Heating Cycle)

1. Perform heating inspection/maintenance applicable to the unit (steam/hot water, gas, electric).
2. Verify smooth operation of the fans.
3. Check the belts for tension, wear, cracks, and glazing.
4. Verify clean air filters.
5. Gas Heat Option
   a) Visually inspect the heat exchanger.

b) Inspect the combustion air blower fan, and clean, if required.
c) Lubricate the combustion air blower fan motor, if applicable.
d) Verify the operation of the combustion air flow-proving device.
e) Test the operation of the high gas pressure safety device, if applicable. Calibrate, if necessary.
f) Test the operation of the low gas pressure safety device, if applicable. Calibrate, if necessary.
g) Verify the operation of the flame detection device.
h) Test the operation of the high temperature limit switch. i.. Verify the integrity of the flue system.
i) Verify the operation of the operating controls.
j) Verify the burner sequence of operation.
k) Verify proper gas pressure to the unit and/or at the manifold, if applicable.
l) Perform combustion test. Make adjustments as necessary.

6. Electric Heat Option
   a) Inspect wiring and connections for tightness and signs of overheating and discoloration.
   b) Check and calibrate operating and safety controls, if applicable.
   c) Verify the operation of the heating elements.
   d) Check voltage and amperage and compare readings with the watt rating on the heater.

7. Hot Water / Steam Heat Option
   a) Inspect control valves and traps.
   b) Check and calibrate all operating and safety controls.
   c) Verify the operation of the heating coils.
   d) Verify the operation of the unit low temperature safety device.

Mid-Season Cooling Inspection (RTU)

1. Check the general condition of the unit.
2. Log the operating condition after system has stabilized.
3. Verify the operation of the control circuits.
4. Analyze the recorded data. Compare the data to the original design conditions.
5. Review operating procedures with operating personnel.
6. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Comprehensive Maintenance Inspection (RTU - Cooling Cycle)

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
   a) Inspect for leaks and report results.
   b) Calculate refrigerant loss rate and report to the customer.
   c) Repair minor leaks as required (e.g. valve packing, flare nuts).
   d) Check pulleys and sheaves for wear and alignment.
   e) Check belts for tension, wear, cracks, and glazing.
   f) Verify clean evaporator coil, blower wheel, and condensate pan.
   g) Verify clean air filters.
   h) Verify proper operation of the condensate drain.
   i) Verify proper operation of the dampers and/or inlet guide vanes, if applicable.
4. Controls and Safeties
   a) Inspect the control panel for cleanliness.
   b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
   c) Verify the working condition of all indicator/alarm lights, if applicable.
   d) Test the low evaporator pressure safety device. Calibrate and record setting, if applicable.
   e) Test the high condenser pressure safety device. Calibrate and record setting, applicable.
   f) Test the oil pressure safety device, if applicable. Calibrate and record setting.
   g) Test the high static pressure safety device, if applicable. Calibrate and record setting.
   h) Verify the operation of the static pressure control device, if applicable.
5. Lubrication
   a) Verify the operation of the oil heater, if applicable.
   b) Lubricate the fan bearings as required.
   c) Lubricate the fan motor bearings as required.
   d) Lubricate the damper bearings, if applicable.
6. Motor and Starter
   a) Clean the starter and cabinet.
   b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
   c) Check the condition of the contacts for wear and pitting.
   d) Check the contactors for free and smooth operation.
7. Startup /Checkout Procedure
   a) Verify the operation of the oil heater.

b) Verify full water system, including the cooling tower and the condenser.
c) Verify clean cooling tower and strainers.
d) Test all flow-proving devices on the condenser water circuit.
e) Start the condenser water pump and the cooling tower fan(s).
f) Verify flow rate through the condenser.
g) Start the unit.
h) Verify smooth operation of the compressor(s) and fan(s).
i) Check the setpoint and sensitivity of the temperature control device.
j) Verify the operation of the condenser water temperature control device.
k) Verify clean condenser using pressure and temperature.
l) Check operation and setup of the Unit Control Module.
m) Check the superheat and subcooling on the refrigeration circuit(s).
n) Log the operating conditions after the system has stabilized.
o) Review operating procedures with operating personnel.
p) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

ENERGY SAVINGS PLAN

SECTION 7 – OPTIONAL ENERGY GUARANTEE

OPTIONAL ENERGY GUARANTEE OVERVIEW

NOTE: *The following is meant only to serve as a description of an optional energy guarantee and does not constitute any contractual obligations between the Ridgefield Public Schools and DCO. If Ridgefield Public Schools chooses to implement an energy guarantee contract, a separate document will be used based on mutual agreement and acceptance of all parties of its terms and conditions.*

A successful energy project consists of a partnership between an ESCO and Owner. Both parties have defined roles and accept their individual responsibilities as well as support any joint initiatives of the program as defined in this document. Both DCO and the Ridgefield Public Schools will have a role in ongoing maintenance and operations as defined in the agreed-upon energy guarantee contractual documents. Both parties will be required to meet their obligations for the guaranteed energy units savings (referred to as “guarantee or savings”) to be achieved and to ensure the guarantee stays intact.

DCO will guarantee Ridgefield Public Schools will achieve 100% of the total energy units savings per the provisions of the agreed-upon energy guarantee contractual documents based on the final selection of ECMs and their associated energy savings as measured and verified by the Owner’s third-party, independent firm. The energy savings will be in energy units, not dollars as DCO has no control over the costs of utilities. The energy units guarantee contract shall commence thirty (30) days after the start-up and commissioning of the last Energy Conservation Measure (ECM) and be enforced for a period of one (1) year or until terminated by Ridgefield Public Schools.

SAVINGS VERIFICATION

There are events that cause energy savings to change. Ridgefield Public Schools and DCO will agree to baseline energy consumption that represents the facility’s energy use and cost prior to the date of any Agreement (the “Base Year”) and parameters, which affect the energy usage and cost of the facility, including but not limited to, utility rates, local weather profile, facility square footage, environmental conditions, schedules (e.g., lighting, HVAC) and an inventory of equipment in the facility. Energy savings are determined by comparing measured energy use or demand before and after implementation of an energy savings program.

ECM ENERGY SAVINGS = BASELINE ENERGY USE – POST INSTALLATION ENERGY USE +/- ADJUSTMENTS

Changes in estimated energy savings fall into two categories. These categories are Routine Adjustments and Non-Routine Adjustments. Routine Adjustments are expected changes during the savings reporting period to energy governing factors (e.g. weather). DCO uses IPMVP approved mathematical techniques to determine adjustments. Non-Routine Adjustments include energy-governing factors which are not usually expected to change, such as the facility size, the design and operation of installed equipment, occupancy and the type of occupants or any physical changes to the building or equipment that impact the facilities' utility use. These factors will be monitored for change throughout the reporting period.

DCO will perform monthly utility bill analysis and audit reports which compare the current year with base year energy consumption and costs. DCO will perform periodic on-site analysis to determine whether mechanical and electrical systems are operating at optimal efficiency and to assess the occupancy and operational schedules of the buildings.

As part of the optional energy guarantee, DCO uses weather normalization procedures to correct for the effect of weather variance on energy savings in subsequent years. Baseline energy and weather data are used to establish an algorithm to predict how the baseline building uses energy as a function of weather. The algorithm is then applied to subsequent years to correct for the impact weather may have on future building energy use. The weather normalization procedure and algorithms will be covered in detail as part of the optional energy guarantee contract provided to Ridgefield Public Schools.

ENERGY SAVINGS PLAN

APPENDICIES

APPENDIX LIST	
APPENDIX A	Construction Contingency Allowance
APPENDIX B	Design Bid Build Procedures
APPENDIX C	Operations & Maintenance Savings
APPENDIX D	Project Changes in Financing
APPENDIX E	Incentives in Debt Service
APPENDIX F	ECM Breakdown by Building
APPENDIX G	Energy Savings Supplemental Information
APPENDIX H	Local Government Energy Audits

ENERGY SAVINGS PLAN

APPENDIX A – CONSTRUCTION CONTINGENCY ALLOWANCE

Appendix A – Construction Contingency Allowance

Experience shows that during the construction phase there are four major categories of potential change of scope issues that benefit from having an appropriate Construction Contingency Allowance (CCA).

- Unknown conditions
- Building inspector's modifications
- Project owner requested changes
- Design clarifications or modifications

Unknown Conditions

Renovations to older facilities have greater potential for revealing unknown. Missing or inaccurate Blueprints, deviations from the original blue prints by the original builder and unknown or undocumented modifications during the life of the facility.

Areas such as behind a wall/roof/equipment or under the slab can bring unforeseen conditions which can delay the new construction and change the anticipated scope of the work. Therefore, it is advisable to dedicate a CCA that is higher than that for new construction.

Building Inspection Modifications

A plan review for the local building jurisdiction reviews the construction documents prior to issuing a building permit. However, there remains the likelihood that the building inspector will request modifications to the plans based upon experience and their interpretation of the applicable building code.

While we can ask for code review and documentation, if you hope to get a Certificate of Occupancy under a tight schedule from this same inspector requested modifications will need to be implemented as successfully appeals take time.

Whether it is adding an extra exit sign, smoke detector or fire extinguisher, or whether it is something more significant, it may require more work from the contractor, thus added expense. The CCA is intended to be the source of funds necessary for these requested modifications.

Project Owner Requested Changes

It is nearly impossible to express your every desire during the design phase. You will always see something during construction that you would like to change.

There is nothing necessarily wrong with that.

The CCA is intended to be the source of funds necessary for these requested changes.

Design Clarifications or Modifications

No designer has ever developed the perfect set of construction documents.

There are always items that can be detailed better or more clearly. The design intent should be adequately reflected in the drawings and specifications so that the contractor can bid and build the ECM to meet the design intent.

However, there will be times during construction when the builder will not be readily able to identify the exact intent of particular details or systems. At that time the builder will submit a Request for Information (RFI) to the designer for clarification or more information. The designer will issue clarifications or directives so that the builder can continue to meet the design intent.

On occasion, the RFI will reveal that something more than was shown in the construction documents is necessary to fulfill the design intent. The clarification or modification may impact the scope of the work to a degree that additional construction costs become necessary.

As long as the design omission is not negligent, the CCA is intended to be the source of funds necessary for these design clarifications or modifications.

Allowance Method

Detailed plans, schematics and specifications for Ridgefield Public Schools were not available to deliver a cost estimate for each ECM. The budgetary costs carried in the project are based on good faith estimates, contractor supplied budgets for similar ECMs on other recent projects and a database of actual installed costs for various ECMs.

a. Allowance Amount (5.0% of Hard Costs)

BID PACKAGE ALLOWANCE SCHEDULE		
ECM #	ENERGY CONSERVATION MEASURE	CONTINGENCY AMOUNT(5%)
1	LED Lighting Replacement	$29,407
2	District Wide Energy Management System	$26,266
3	Boiler Replacement	$0
9	Unit Ventilator Replacement	$2,200
11	Plug Load Controls	$2,233
12	Solar PPA	$0
13	Combined Heat & Power Unit	$21,380
14	Add AC to Gym	$22,420
15	Roof Refurbishment	$60,124
16	Lighting Controls	$2,624
17	Building Envelope Improvements	$4,760
18	Pipe and Valve Insulation	$2,376
	TOTALS	$173,790

Project total construction contingency allowance amount is 5.0% of estimated hard costs and is agreed upon.

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ENERGY SAVINGS PLAN

APPENDIX B – DESIGN BID BUILD

Appendix B – Design Bid Build Procedures

Design–bid–build (or **design/bid/build**, and abbreviated **D–B–B** or **D/B/B** accordingly), also known as **Design–tender** (or "design/tender") **traditional method** or **hard bid** is the method of delivery for this project.

Design–bid–build is the traditional method for project delivery and differs in several substantial aspects from design–build.

There are three main sequential phases to the design–bid–build delivery method:

- The design phase
- The bidding (or tender) phase
- The construction phase

Design Phase

In this phase DCO will design and produce bid documents, including construction drawings and technical specifications, on which various contractors will in turn bid to construct the project.

The Energy Savings Plan (ESP) is intended to document owner's project requirements and provide a conceptual and/or schematic design and good faith estimates.

With the ESP DCO will bring in other design professionals including mechanical, electrical, and plumbing engineers (MEP specifications engineers), a fire protection engineer, structural engineer, sometimes a civil engineer and a landscape architect to help complete the construction drawings and technical.

The design document should reflect the intent of the energy savings plan for scope, price, savings, operations & maintenance savings, incentive and schedule.

The finished bid documents are coordinated by the DCO and owner for issuance to contractors during the bid phase.

Bid (or tender) phase

Bidding is according to NJ Public Bid Law and is "open", in which any qualified bidder may participate.

The various contractors bidding obtain bid documents, and then put them out to multiple subcontractors for bids on sub-components of the project.

Questions may arise during the bid period, and DCO will issue clarifications or corrections to the bid documents in the form of addenda.

From these elements, the contractor compiles a complete bid for submission by the established closing date and time bid date.

Bids are to be based on a base bid lump sum plus alternates, bid requirements and alternates are elucidated within the bid documents.

Once bids are received, DCO reviews the bids, seeks any clarifications required of the bidders, investigates contractor qualifications, ensures all documentation is in order (including bonding if required), and advises the owner as to the ranking of the bids.

If the bids fall in a range acceptable to the owner, the project is awarded to the contractor with the lowest reasonable bid.

In the event that all of the bids do not satisfy the needs of the owner the following options become available to DCO:

- Re-bid the construction of the project on a future when monies become available and/or construction costs go down.
- Revise the design of that ECM (at no cost to the client) so as to make the project smaller or reduce features or elements of the project to bring the cost down. The revised bid documents can then be issued again for bid.
    - DCO will provide guidance on energy savings, operation and maintenance savings and incentives to ensure the project is self-funding.
- Revise the design of future ECM(s) (at no cost to the client) so as to make the project smaller or reduce features or elements of the project to bring the cost down. The current bid package can then be contracted
    - DCO will provide guidance on energy savings, operation and maintenance savings and incentives to ensure the project is self-funding.

Construction phase

Once the construction of the project has been awarded to the contractor, the bid documents (e.g., approved construction drawings and technical specifications) may not be altered.

The necessary permits (for example, a building permit) must be achieved from all jurisdictional authorities in order for the construction process to begin.

Should design changes be necessary during construction, whether initiated by the contractor, owner, or as discovered by the architect, DCO will issue sketches or written clarifications and handle the project through allowance (See Appendix A).

The contractor may be required to document "as built" conditions to the owner.

Bidding Method

1. To achieve energy savings and fund debt service payments as rapidly as possible the bid packages will be bid in the following order:

BID METHOD SCHEDULE		
ENERGY CONSERVATION MEASURE	**COST + ALLOWANCE**	**SAVINGS**
LED Lighting Replacement	$617,555	$83,180
District Wide Energy Management System	$551,588	$31,214
Boiler Replacement	$0	$133
Solar PPA	$0	$126
Combined Heat & Power Unit	$448,980	$9,139
Lighting Controls	$55,104	$45,088
Roof Refurbishment	$1,262,600	$12,348
Add AC to Gym	$470,820	($3,689)
Building Envelope Improvements	$99,964	$501
Pipe and Valve Insulation	$49,896	$3,976
Plug Load Controls	$46,883	$11,305
Unit Ventilator Replacement	$46,206	$8,986
TOTALS	$3,649,597	$202,307

2. Bids in group 1 (Green) are within 15% of budget value they will be awarded.
3. Bids in group 2 (Yellow) may be value engineered from the project to meet budget
    a. DCO will provide the impact of ECMs value engineered:
        i. Energy Savings
        ii. Operations and Maintenance Savings
        iii. Incentive
4. Bids in group 3 (Red) may be value engineered **or removed** from the project to meet budget
    a. DCO will provide the impact of ECMs value engineered or removed:
        i. Energy Savings
        ii. Operations and Maintenance Savings
        iii. Incentive
5. As per ESIP law DCO fee will be applied to the ECM hard cost.
    a. DCO will receive no compensation for bids that are under budget
    b. DCO will receive no penalty for bids that are over budget
6. If the budget overruns make savings unachievable at the current budget, DCO will provide additional ECMs above the budget to meet the required energy savings

Project bidding strategy is agreed upon.

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ENERGY SAVINGS PLAN

APPENDIX C – OPERATIONS AND MAINTENANCE SAVINGS

Appendix C – Operation & Maintenance Savings

Operations and Maintenance and other non-energy-related cost savings are allowable in NJ ESIPs, and are defined as reduction in expenses (other than energy cost savings) related to energy and water consuming equipment:

Energy-related cost savings can result from avoided expenditures for operations, maintenance, equipment repair, or equipment replacement due to the ESIP project.

Sources of O&M savings include:

- Termination of service personnel
- Lower maintenance service contract costs
- Decrease in repair costs
    - Avoided repair and replacement costs as a result of replacing old and unreliable equipment
    - Material savings due to new equipment warranties
    - Material savings due to the longer life items not needing replacement
        - In particular, reduction in florescent bulbs due to LED

Termination of service personnel

As a result of the ESIP, a number of the client's maintenance staff members may no longer be required. If there will be a reduction in the government's maintenance staff, O&M savings can be claimed.

A problem could arise if the maintenance staff is not reduced. Then it would be necessary to determine what new O&M responsibilities the facility has taken on, or savings should not be claimed. For example, it could be that a new building was constructed. During the performance period, it is important to establish that any increased maintenance was not due to the equipment installed under the ESIP

Lower maintenance service contract costs

Prior to the implementation of the ESIP mechanical and electrical equipment was maintained by a third party under a maintenance contract. The ESIP replaces the aging equipment with newer, more efficient equipment, which can reduce the service costs to the client.

Decrease in repair costs

The client is responsible for maintenance both before and after the equipment installation. Although there is no reduction in staff for which to claim labor savings, there will be cost savings on replacement materials.

Material-related savings frequently result from lighting and lighting controls projects.

For this project, lighting maintenance savings will result from the following:

1. Reduced material requirements (e.g., lamps)
2. Reduced operating time — Control measures increase equipment life by reducing the burn time of lamps and ballasts
3. Warranty-related savings — newly installed lamps, and fixtures come with a manufacturer warranty of 10 years.

Year 1 O&M Savings

RIDGEFIELD PUBLIC SCHOOLS		ANNUAL O&M COST SAVINGS
ECM #	ENERGY CONSERVATION MEASURE	$
1	LED Lighting Replacement	$3,631
2	District Wide Energy Management System	$49,979
3	Boiler Replacement	$6,403
	TOTALS	$60,013

Project O&M Savings strategy is agreed upon.

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ENERGY SAVINGS PLAN

APPENDIX D – PROJECT CHANGES IN FINANCING

Appendix D – Project Changes in Financing

The Energy savings plan has been approved using:

Interest rate of: 4.00%
Term: ..... 20 Years
Construction Term ..... 12 Months
Construction Interest Only Payment of ..... TBD by Ridgefield Public Schools financial advisor
Annual Surplus of no less than $2,400

During financing DCO will provide assistance but does not guarantee the timing of savings or incentives.

While beneficial to the client financing changes are the responsibility of the client, bond counsel and/or financial advisor. DCO represents in no way advice on these financial items

Financial items may include but are not limited to:

- Timing of payments
- Splitting payments into bi-annual, tri-annual, etc.
- Coordination with the client's fiscal year
- Local finance board material, forms and presentations
- Multiple tiered interest rates

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ENERGY SAVINGS PLAN

APPENDIX E – INCENTIVES IN DEBT SERVICE

Appendix E – Incentives in Debt Service

As part of the Energy Savings Plan for Ridgefield Public Schools, prescriptive rebate through PSE&G were investigated. The estimated incentive amount is listed below. Upon final selection of the project scope and award of subcontractor bids, the incentive applications will be filed.

Energy Conservation Measure	Facility	Estimated Incentive
Led Lighting Upgrades	Slocum Skews School	$21,432.79
Led Lighting Upgrades	Memorial High School	$25,480.55
Led Lighting Upgrades	Shaler Academy	$7,951.78
Led Lighting Upgrades	Bergen Blvd School	$452.87
Lighting Controls	Slocum Skews School	$1,613.96
Lighting Controls	Memorial High School	$1,011.74
Lighting Controls	Shaler Academy	$529.96
Plug Loads	Slocum Skews School	$1,324.90
Plug Loads	Memorial High School	$1,361.03
Plug Loads	Shaler Academy	$566.09
Plug Loads	Bergen Blvd School	$361.34
	Total Incentive	$ 62,087.00

All estimated incentive values for Ridgefield Public Schools ESIP project were calculated using PSE&G prescriptive rebates. The total incentive amount was calculated to be $62,087

No implied and/or written guarantee is being made with respective to the receipt of incentives. All incentives estimates carry inherent risks that may jeopardize the receipt of them. Therefore, Ridgefield Public Schools acknowledges and accepts that any project proposed should not rely on the receipt of incentives as a reason to implement it.

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ENERGY SAVINGS PLAN

APPENDIX F – ECM BREAKDOWN BY BUILDING

RIDGEFIELD PUBLIC SCHOOLS % SAVINGS BY BUILDING (T.O.R.)

RIDGEFIELD PUBLIC SCHOOLS BUILDINGS/FACILITIES		UTILITY ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	ONSITE ELECTRIC SAVINGS	NATURAL GAS SAVINGS	ONSITE NATURAL GAS SAVINGS
BUILDING/FACILITY NAME	SQFT	kWh	kW	kWh	THERMS	THERMS
Slocum Skews School	92,147	51.0%	24.6%	51.0%	18.9%	18.9%
Memorial High School	87,850	61.7%	33.4%	46.8%	13.7%	26.7%
Shaler Academy	47,368	32.9%	15.4%	32.9%	28.8%	28.8%
Bergen Blvd School	29,954	3.7%	1.2%	3.7%	24.0%	24.0%
Central Office	2,952	0.0%	0.0%	0.0%	0.0%	0.0%
TOTALS	**260,271**	**43.5%**	**22.4%**	**37.9%**	**18.3%**	**22.5%**

RIDGEFIELD PUBLIC SCHOOLS SAVINGS BY BUILDING BY UTILITY FROM SMART SELECT

RIDGEFIELD PUBLIC SCHOOLS BUILDINGS/FACILITIES		ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	ONSITE ELECTRIC SAVINGS	NATURAL GAS SAVINGS	ONSITE NATURAL GAS SAVINGS
BUILDING/FACILITY NAME	SQFT	kWh	kW	kWh	THERMS	THERMS
Slocum Skews School	92,147	240,595	59	240,595	11,917	11,917
Memorial High School	87,850	409,427	101	310,843	6,454	12,553
Shaler Academy	47,368	101,218	21	101,218	3,475	3,475
Bergen Blvd School	29,954	9,604	1	9,604	4,166	4,166
Central Office	2,952	0	0	0	0	0
TOTALS	**260,271**	**760,845**	**183**	**662,261**	**26,011**	**32,111**

RIDGEFIELD PUBLIC SCHOOLS			INCLUDED IN PROJECT	INSTALLED COST	ANNUAL ELECTRIC COST SAVINGS	ANNUAL NATURAL GAS COST SAVINGS
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	"Y" OR "N"	$	$	$
1	Slocum Skews School	LED Lighting Replacement	Y	$200,432	$31,327	($308)
2	Slocum Skews School	District Wide Energy Management System	y	$126,528	$4,728	$5,333
11	Slocum Skews School	Plug Load Controls	Y	$17,521	$3,220	$0
12	Slocum Skews School	Solar PPA	y	$0	$16,407	$0
15	Slocum Skews School	Roof Refurbishment	y	$295,688	$32	$79
16	Slocum Skews School	Lighting Controls	Y	$31,141	$2,174	($22)
17	Slocum Skews School	Building Envelope Improvements	Y	$33,126	$1,387	$2,303
18	Slocum Skews School	Pipe and Valve Insulation	Y	$21,278	$0	$3,092
1	Memorial High School	LED Lighting Replacement	Y	$304,420	$38,445	($381)
2	Memorial High School	District Wide Energy Management System	Y	$243,309	$9,652	$4,644
11	Memorial High School	Plug Load Controls	Y	$14,986	$3,695	$0
12	Memorial High School	Solar PPA	y	$0	$13,331	$0
13	Memorial High School	Combined Heat & Power Unit	Y	$427,600	$17,363	($5,014)
14	Memorial High School	Add AC to Gym	y	$448,400	($3,689)	$0
15	Memorial High School	Roof Refurbishment	y	$463,856	$70	$113
16	Memorial High School	Lighting Controls	Y	$14,501	$1,100	($11)
17	Memorial High School	Building Envelope Improvements	Y	$37,876	$1,708	$3,015
18	Memorial High School	Pipe and Valve Insulation	Y	$13,711	$0	$2,940
1	Shaler Academy	LED Lighting Replacement	Y	$77,886	$13,206	($133)
2	Shaler Academy	District Wide Energy Management System	Y	$97,290	$2,467	$1,090
3	Shaler Academy	Boiler Replacement	y	$0	$0	$133
9	Shaler Academy	Unit Ventilator Replacement	Y	$22,003	$126	$0
11	Shaler Academy	Plug Load Controls	Y	$6,905	$1,666	$0
12	Shaler Academy	Solar PPA	y	$0	$7,096	$0
15	Shaler Academy	Roof Refurbishment	y	$256,133	$47	$62
16	Shaler Academy	Lighting Controls	Y	$6,838	$742	($7)
17	Shaler Academy	Building Envelope Improvements	Y	$14,086	$590	$1,062
18	Shaler Academy	Pipe and Valve Insulation	Y	$6,647	$0	$990
1	Bergen Blvd School	LED Lighting Replacement	Y	$5,409	$1,038	($14)
2	Bergen Blvd School	District Wide Energy Management System	Y	$58,196	$19	$2,783
9	Bergen Blvd School	Unit Ventilator Replacement	Y	$22,003	$129	$0
11	Bergen Blvd School	Plug Load Controls	Y	$5,239	$558	$0
12	Bergen Blvd School	Solar PPA	y	$0	$8,255	$0
15	Bergen Blvd School	Roof Refurbishment	y	$186,800	$33	$65
17	Bergen Blvd School	Building Envelope Improvements	Y	$10,116	$0	$992
18	Bergen Blvd School	Pipe and Valve Insulation	Y	$5,884	$0	$1,230
		TOTALS		$3,475,806	$176,922	$24,031

RIDGEFIELD PUBLIC SCHOOLS			INCLUDED IN PROJECT	ANNUAL ENERGY COST SAVINGS	ANNUAL O&M COST SAVINGS	TOTAL ANNUAL COST SAVINGS	SIMPLE PAYBACK WITHOUT INCENTIVES
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	"Y" OR "N"	$	$	$	YEARS
1	Slocum Skews School	LED Lighting Replacement	Y	$31,019	$1,300	$32,319	6.2
2	Slocum Skews School	District Wide Energy Management System	y	$10,061	$17,695	$27,756	4.6
11	Slocum Skews School	Plug Load Controls	Y	$3,220	$0	$3,220	5.4
12	Slocum Skews School	Solar PPA	y	$16,407	$0	$16,407	0.0
15	Slocum Skews School	Roof Refurbishment	y	$111	$0	$111	2661.0
16	Slocum Skews School	Lighting Controls	Y	$2,152	$0	$2,152	14.5
17	Slocum Skews School	Building Envelope Improvements	Y	$3,689	$0	$3,689	8.97859214
18	Slocum Skews School	Pipe and Valve Insulation	Y	$3,092	$0	$3,092	6.882061439
1	Memorial High School	LED Lighting Replacement	Y	$38,064	$1,240	$39,303	7.7
2	Memorial High School	District Wide Energy Management System	Y	$14,296	$16,870	$31,166	7.8
11	Memorial High School	Plug Load Controls	Y	$3,695	$0	$3,695	4.1
12	Memorial High School	Solar PPA	y	$13,331	$0	$13,331	0.0
13	Memorial High School	Combined Heat & Power Unit	Y	$12,348	$0	$12,348	34.6
14	Memorial High School	Add AC to Gym	y	($3,689)	$0	($3,689)	-121.6
15	Memorial High School	Roof Refurbishment	y	$183	$0	$183	2536.2
16	Memorial High School	Lighting Controls	Y	$1,089	$0	$1,089	13.3
17	Memorial High School	Building Envelope Improvements	Y	$4,723	$0	$4,723	8.0
18	Memorial High School	Pipe and Valve Insulation	Y	$2,940	$0	$2,940	4.7
1	Shaler Academy	LED Lighting Replacement	Y	$13,073	$668	$13,741	5.7
2	Shaler Academy	District Wide Energy Management System	Y	$3,557	$9,096	$12,653	7.7
3	Shaler Academy	Boiler Replacement	y	$133	$6,403	$6,535	0.0
9	Shaler Academy	Unit Ventilator Replacement	Y	$126	$0	$126	174.2
11	Shaler Academy	Plug Load Controls	Y	$1,666	$0	$1,666	4.1
12	Shaler Academy	Solar PPA	y	$7,096	$0	$7,096	0.0
15	Shaler Academy	Roof Refurbishment	y	$109	$0	$109	2356.9
16	Shaler Academy	Lighting Controls	Y	$735	$0	$735	9.3
17	Shaler Academy	Building Envelope Improvements	Y	$1,651	$0	$1,651	8.5
18	Shaler Academy	Pipe and Valve Insulation	Y	$990	$0	$990	6.7
1	Bergen Blvd School	LED Lighting Replacement	Y	$1,024	$423	$1,447	3.7
2	Bergen Blvd School	District Wide Energy Management System	Y	$2,802	$5,752	$8,554	6.8
9	Bergen Blvd School	Unit Ventilator Replacement	Y	$129	$0	$129	170.1
11	Bergen Blvd School	Plug Load Controls	Y	$558	$0	$558	9.4
12	Bergen Blvd School	Solar PPA	y	$8,255	$0	$8,255	0.0
15	Bergen Blvd School	Roof Refurbishment	y	$98	$0	$98	1905.3
17	Bergen Blvd School	Building Envelope Improvements	Y	$992	$0	$992	10.2
18	Bergen Blvd School	Pipe and Valve Insulation	Y	$1,230	$0	$1,230	4.8
		TOTALS		$200,953	$59,447	$260,399	13.3

RIDGEFIELD PUBLIC SCHOOLS			INCLUDED IN PROJECT	ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	NATURAL GAS SAVINGS
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	"Y" OR "N"	kWh	kW	THERMS
1	Slocum Skews School	LED Lighting Replacement	Y	176,051	42.7	-351
2	Slocum Skews School	District Wide Energy Management System	y	26,266	7.0	6,066
11	Slocum Skews School	Plug Load Controls	Y	20,458	0.0	0
12	Slocum Skews School	Solar PPA	y	0	0.0	0
15	Slocum Skews School	Roof Refurbishment	y	202	0	90
16	Slocum Skews School	Lighting Controls	Y	12,150	3.1	-25
17	Slocum Skews School	Building Envelope Improvements	Y	5,467	6.198856766	2,619
18	Slocum Skews School	Pipe and Valve Insulation	Y	0	0	3,517
1	Memorial High School	LED Lighting Replacement	Y	230,695	56.3	-463
2	Memorial High School	District Wide Energy Management System	Y	56,246	17.0	5,649
11	Memorial High School	Plug Load Controls	Y	25,350	0.0	0
12	Memorial High School	Solar PPA	y	0	0.0	0
13	Memorial High School	Combined Heat & Power Unit	Y	98,584	35	-6,100
14	Memorial High School	Add AC to Gym	y	-15,533	-16.7	0
15	Memorial High School	Roof Refurbishment	y	480	0	137
16	Memorial High School	Lighting Controls	Y	6,569	1.7	-14
17	Memorial High School	Building Envelope Improvements	Y	7,037	8.0	3,668
18	Memorial High School	Pipe and Valve Insulation	Y	0	0	3,576
1	Shaler Academy	LED Lighting Replacement	Y	69,334	17.6	-145
2	Shaler Academy	District Wide Energy Management System	Y	14,837	0.0	1,185
3	Shaler Academy	Boiler Replacement	y	0	0.0	144
9	Shaler Academy	Unit Ventilator Replacement	Y	700	0.1	0
11	Shaler Academy	Plug Load Controls	Y	10,019	0.0	0
12	Shaler Academy	Solar PPA	y	0	0.0	0
15	Shaler Academy	Roof Refurbishment	y	281	0.0	67
16	Shaler Academy	Lighting Controls	Y	3,897	1.0	-8
17	Shaler Academy	Building Envelope Improvements	Y	2,151	2.4	1,155
18	Shaler Academy	Pipe and Valve Insulation	Y	0	0.0	1,076
1	Bergen Blvd School	LED Lighting Replacement	Y	5,348	1.4	-11
2	Bergen Blvd School	District Wide Energy Management System	Y	112	0.0	2,293
9	Bergen Blvd School	Unit Ventilator Replacement	Y	700	0.1	0
11	Bergen Blvd School	Plug Load Controls	Y	3,251	0.0	0
12	Bergen Blvd School	Solar PPA	y	0	0.0	0
15	Bergen Blvd School	Roof Refurbishment	y	194	0.0	53
17	Bergen Blvd School	Building Envelope Improvements	Y	0	0.0	817
18	Bergen Blvd School	Pipe and Valve Insulation	Y	0	0.0	1,014
		TOTALS		760,845	182.9	26,011

RIDGEFIELD PUBLIC SCHOOLS			INCLUDED IN PROJECT	TOTAL SITE ENERGY SAVINGS	TOTAL SOURCE ENERGY SAVINGS
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	"Y" OR "N"	MMBTU	MMBTU
1	Slocum Skews School	LED Lighting Replacement	Y	566	1,645
2	Slocum Skews School	District Wide Energy Management System	y	696	888
11	Slocum Skews School	Plug Load Controls	Y	70	195
12	Slocum Skews School	Solar PPA	y	0	2,250
15	Slocum Skews School	Roof Refurbishment	y	10	11
16	Slocum Skews School	Lighting Controls	Y	39	113
17	Slocum Skews School	Building Envelope Improvements	Y	281	327
18	Slocum Skews School	Pipe and Valve Insulation	Y	352	369
1	Memorial High School	LED Lighting Replacement	Y	741	2,155
2	Memorial High School	District Wide Energy Management System	Y	757	1,130
11	Memorial High School	Plug Load Controls	Y	86	242
12	Memorial High School	Solar PPA	y	0	2,193
13	Memorial High School	Combined Heat & Power Unit	Y	-274	301
14	Memorial High School	Add AC to Gym	y	-53	-148
15	Memorial High School	Roof Refurbishment	y	15	19
16	Memorial High School	Lighting Controls	Y	21	61
17	Memorial High School	Building Envelope Improvements	Y	391	452
18	Memorial High School	Pipe and Valve Insulation	Y	358	376
1	Shaler Academy	LED Lighting Replacement	Y	222	647
2	Shaler Academy	District Wide Energy Management System	Y	169	266
3	Shaler Academy	Boiler Replacement	y	14	15
9	Shaler Academy	Unit Ventilator Replacement	Y	2	7
11	Shaler Academy	Plug Load Controls	Y	34	96
12	Shaler Academy	Solar PPA	y	0	863
15	Shaler Academy	Roof Refurbishment	y	8	10
16	Shaler Academy	Lighting Controls	Y	12	36
17	Shaler Academy	Building Envelope Improvements	Y	123	142
18	Shaler Academy	Pipe and Valve Insulation	Y	108	113
1	Bergen Blvd School	LED Lighting Replacement	Y	17	50
2	Bergen Blvd School	District Wide Energy Management System	Y	230	242
9	Bergen Blvd School	Unit Ventilator Replacement	Y	2	7
11	Bergen Blvd School	Plug Load Controls	Y	11	31
12	Bergen Blvd School	Solar PPA	y	0	939
15	Bergen Blvd School	Roof Refurbishment	y	6	7
17	Bergen Blvd School	Building Envelope Improvements	Y	82	86
18	Bergen Blvd School	Pipe and Valve Insulation	Y	101	106
		TOTALS		5,197	16,246

RIDGEFIELD PUBLIC SCHOOLS			INCLUDED IN PROJECT	Reduction of CO_2	Reduction of No_x	Reduction of SO_2	Reduction of Hg
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	"Y" OR "N"	LBS	LBS	LBS	LBS
1	Slocum Skews School	LED Lighting Replacement	Y	189,552	164	389	819
2	Slocum Skews School	District Wide Energy Management System	y	99,871	81	58	122
11	Slocum Skews School	Plug Load Controls	Y	22,504	19	45	95
12	Slocum Skews School	Solar PPA	y	259,061	224	520	1,096
15	Slocum Skews School	Roof Refurbishment	y	1,278	1	0	1
16	Slocum Skews School	Lighting Controls	Y	13,068	11	27	57
17	Slocum Skews School	Building Envelope Improvements	Y	36,661	29	12	25
18	Slocum Skews School	Pipe and Valve Insulation	Y	41,150	32	0	0
1	Memorial High School	LED Lighting Replacement	Y	248,344	215	510	1,073
2	Memorial High School	District Wide Energy Management System	Y	127,962	105	124	262
11	Memorial High School	Plug Load Controls	Y	27,885	24	56	118
12	Memorial High School	Solar PPA	y	252,533	218	507	1,068
13	Memorial High School	Combined Heat & Power Unit	Y	37,075	38	218	459
14	Memorial High School	Add AC to Gym	y	-17,087	-15	-34	-72
15	Memorial High School	Roof Refurbishment	y	2,135	2	1	2
16	Memorial High School	Lighting Controls	Y	7,065	6	15	31
17	Memorial High School	Building Envelope Improvements	Y	50,654	40	16	33
18	Memorial High School	Pipe and Valve Insulation	Y	41,843	33	0	0
1	Shaler Academy	LED Lighting Replacement	Y	74,571	65	153	323
2	Shaler Academy	District Wide Energy Management System	Y	30,188	25	33	69
3	Shaler Academy	Boiler Replacement	y	1,686	1	0	0
9	Shaler Academy	Unit Ventilator Replacement	Y	770	1	2	3
11	Shaler Academy	Plug Load Controls	Y	11,021	10	22	47
12	Shaler Academy	Solar PPA	y	99,355	86	200	420
15	Shaler Academy	Roof Refurbishment	y	1,097	1	1	1
16	Shaler Academy	Lighting Controls	Y	4,191	4	9	18
17	Shaler Academy	Building Envelope Improvements	Y	15,875	13	5	10
18	Shaler Academy	Pipe and Valve Insulation	Y	12,595	10	0	0
1	Bergen Blvd School	LED Lighting Replacement	Y	5,752	5	12	25
2	Bergen Blvd School	District Wide Energy Management System	Y	26,954	21	0	1
9	Bergen Blvd School	Unit Ventilator Replacement	Y	770	1	2	3
11	Bergen Blvd School	Plug Load Controls	Y	3,577	3	7	15
12	Bergen Blvd School	Solar PPA	y	108,164	93	217	457
15	Bergen Blvd School	Roof Refurbishment	y	838	1	0	1
17	Bergen Blvd School	Building Envelope Improvements	Y	9,562	8	0	0
18	Bergen Blvd School	Pipe and Valve Insulation	Y	11,860	9	0	0
		TOTALS		1,860,378	1,631	3,238	6,816

DCO Energy Efficiency Division
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ENERGY SAVINGS PLAN

APPENDIX G – Energy Savings Supplemental Information

*Refer to submission folder

ENERGY SAVINGS PLAN

APPENDIX H – LOCAL GOVERNMENT ENERGY AUDITS

*Refer to submission folder