Local Government Energy Audit Report

Wilson School

February 8, 2019

Prepared for:
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Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information about financial incentives that may be available. Most energy conservation measures have received preliminary analysis of feasibility that identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to establish a basis for further discussion and to help prioritize energy measures.

TRC Energy Services (TRC) reviewed the energy conservation measures and estimates of energy savings were reviewed for technical accuracy. Actual, achieved energy savings depend on behavioral factors and other uncontrollable variables and, therefore, estimates of final energy savings are not guaranteed. TRC and the New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy savings vary.

TRC bases estimated installation costs on our experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from RS Means. We encourage the owner of the facility is encouraged to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on individual measures and conditions. TRC and NJBPU do not guarantee installed cost estimates and shall in no event be held liable should actual installed costs vary from estimates.

The New Jersey Clean Energy Program (NJCEP) incentive values provided in this report are estimates based on program information available at the time of the report. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state and federal requirements.

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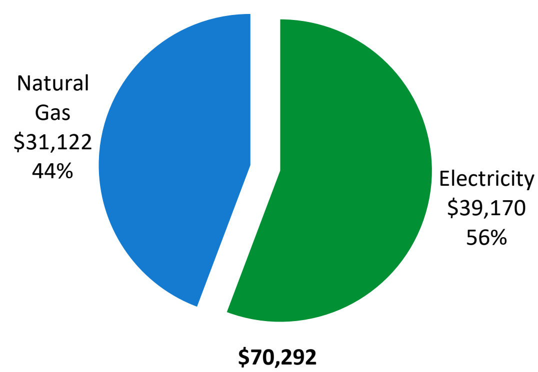
1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Wilson School. This report provides you with information about your facility's energy use, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help make changes in your facility. TRC Energy Services (TRC) conducted this study as part of a comprehensive effort to assist New Jersey school districts and local governments in controlling their energy costs and help protect our environment by reducing statewide energy consumption.

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $70,292 Electricity: 322,813 kWh Natural Gas: 36,032 Therms	
ENERGY STAR® Benchmarking Score	17 *(1-100 scale)*	This building performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

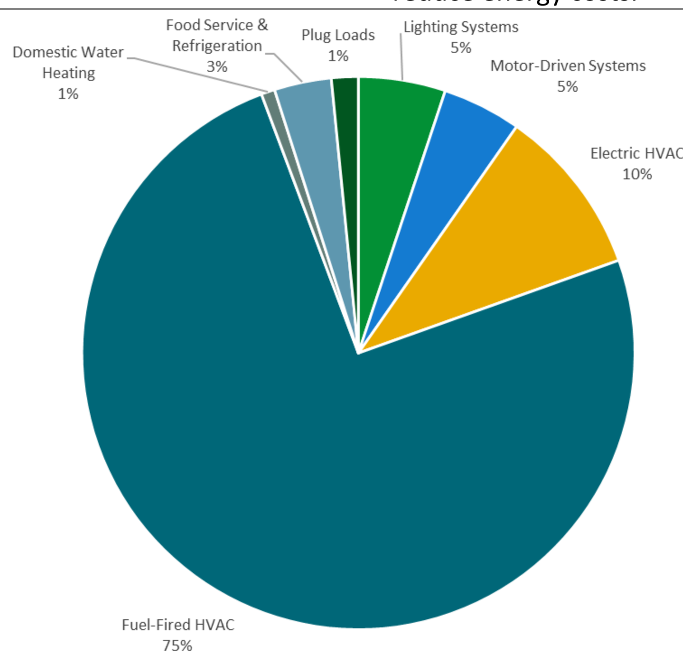


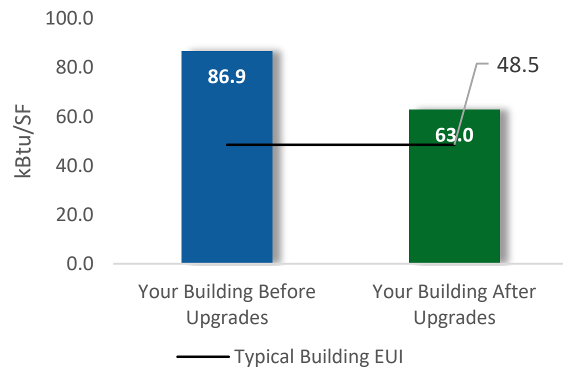
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

This energy audit considered a range of potential energy improvements in your building. Costs and savings will vary between improvements. Presented below are two potential scopes of work for your consideration.

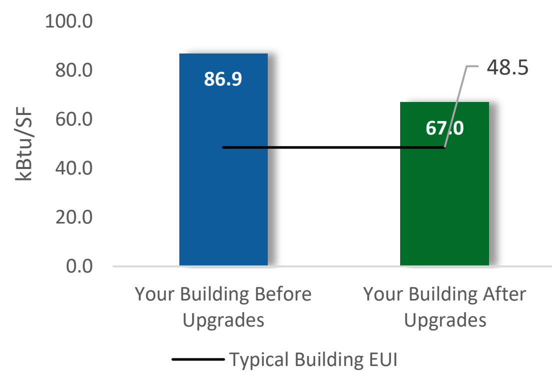
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$198,105
Potential Rebates & Incentives[1]	$18,570
Annual Cost Savings	$25,263
Annual Energy Savings	Electricity: 153,262 kWh Natural Gas: 7,718 Therms
Greenhouse Gas Emission Savings	122 Tons
Simple Payback	7.1 Years
Site Energy Savings (all utilities)	28%



Scenario 2: Cost Effective Package[2]

Installation Cost	$149,390
Potential Rebates & Incentives	$17,620
Annual Cost Savings	$22,145
Annual Energy Savings	Electricity: 139,835 kWh Natural Gas: 5,994 Therms
Greenhouse Gas Emission Savings	105 Tons
Simple Payback	6.0 Years
Site Energy Savings (all utilities)	23%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	None

[1] Incentives are based on current SmartStart Prescriptive incentives. Other program incentives may apply.

[2] A cost-effective measure is defined as one where the simple payback does not exceed two-thirds of the expected proposed equipment useful life. Simple payback is based on the net measure cost after potential incentives.

#	Energy Conservation Measure	*Recommend?*	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**27,938**	**11.6**	**-8**	**$3,319**	**$49,789**	**$22,910**	**$5,219**	**$17,691**	**5.3**	**27,175**
ECM 1	Install LED Fixtures	Yes	2,667	0.0	0	$324	$4,855	$1,761	$120	$1,641	5.1	2,686
ECM 2	Retrofit Fixtures with LED Lamps	Yes	25,270	11.6	-8	$2,996	$44,934	$21,149	$5,099	$16,050	5.4	24,489
Lighting Control Measures			**5,045**	**1.7**	**-2**	**$598**	**$4,784**	**$9,076**	**$1,000**	**$8,076**	**13.5**	**4,889**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	4,461	1.5	-1	$529	$4,230	$7,676	$1,000	$6,676	12.6	4,323
ECM 4	Install High/Low Lighting Controls	Yes	584	0.2	0	$69	$554	$1,400	$0	$1,400	20.2	566
Motor Upgrades			**1,089**	**0.5**	**0**	**$132**	**$1,982**	**$7,235**	**$0**	**$7,235**	**54.8**	**1,096**
ECM 5	Premium Efficiency Motors	Yes	1,089	0.5	0	$132	$1,982	$7,235	$0	$7,235	54.8	1,096
Variable Frequency Drive (VFD) Measures			**28,420**	**11.9**	**0**	**$3,448**	**$51,726**	**$21,281**	**$2,800**	**$18,481**	**5.4**	**28,618**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	18,075	10.0	0	$2,193	$32,898	$13,665	$2,800	$10,865	5.0	18,201
ECM 7	Install VFDs on Heating Water Pumps	Yes	10,345	1.9	0	$1,255	$18,829	$7,616	$0	$7,616	6.1	10,417
Electric Unitary HVAC Measures			**82,801**	**6.4**	**0**	**$10,047**	**$150,706**	**$42,609**	**$2,136**	**$40,473**	**4.0**	**83,380**
	Install High Efficiency Air Conditioning Units	No	7,069	4.1	0	$858	$12,867	$17,894	$951	$16,944	19.8	7,119
ECM 8	Install High Efficiency Heat Pumps	Yes	75,732	2.3	0	$9,189	$137,840	$24,714	$1,185	$23,529	2.6	76,262
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**775**	**$6,695**	**$133,907**	**$84,181**	**$7,366**	**$76,815**	**11.5**	**90,764**
ECM 9	Install High Efficiency Hot Water Boilers	Yes	0	0.0	609	$5,262	$105,240	$63,945	$7,366	$56,579	10.8	71,333
	Install High Efficiency Furnaces	No	0	0.0	166	$1,433	$28,667	$20,236	$0	$20,236	14.1	19,431
Domestic Water Heating Upgrade			**0**	**0.0**	**6**	**$55**	**$832**	**$2,813**	**$50**	**$2,763**	**49.8**	**752**
	Install High Efficiency Gas-Fired Water Heater	No	0	0.0	6	$55	$832	$2,813	$50	$2,763	49.8	752
Food Service & Refrigeration Measures			**7,969**	**0.9**	**0**	**$967**	**$10,234**	**$8,002**	**$0**	**$8,002**	**8.3**	**8,025**
	Replace Refrigeration Equipment	No	6,357	0.7	0	$771	$9,257	$7,772	$0	$7,772	10.1	6,402
ECM 10	Vending Machine Control	Yes	1,612	0.2	0	$196	$978	$230	$50	$180	0.9	1,623
TOTALS			**153,262**	**33.1**	**772**	**$25,263**	**$403,962**	**$198,105**	**$18,570**	**$179,535**	**7.1**	**244,700**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Figure 2 – Evaluated Energy Improvements

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decisions to make, such as:

- How will the project be funded and/or financed?
- Is it best to pursue individual ECMs, groups of ECMs, or use a comprehensive approach where all ECMs are installed together?
- Are there other facility improvements that should happen at the same time?

Pick Your Installation Approach

New Jersey Clean Energy Programs give you the flexibility to do a little or a lot. Rebates, incentives, and financing are available to help reduce both your installation costs and your energy bills. If you are planning to take advantage of these programs, make sure to review incentive program guidelines before proceeding. This is important because in most cases you will need to submit applications for the incentives before purchasing materials or starting installation.

The potential ECMs identified for this building likely qualify for multiple incentive and funding programs. Based on current program rules and requirements, your measures are likely to qualify for the following programs:

Energy Conservation Measure		SmartStart	Direct Install	Pay For Performance
ECM 1	Install LED Fixtures	x	x	
ECM 2	Retrofit Fixtures with LED Lamps	x	x	
ECM 3	Install Occupancy Sensor Lighting Controls	x	x	
ECM 4	Install High/Low Lighting Controls			
ECM 5	Premium Efficiency Motors	x		
ECM 6	Install VFDs on Constant Volume (CV) HVAC	x		
ECM 7	Install VFDs on Hot Water Pumps	x	x	
ECM 8	Install High Efficiency Heat Pumps	x	x	
ECM 9	Install High Efficiency Hot Water Boilers	x		
ECM 10	Vending Machine Control	x	x	

Figure 3 – Funding Options

New Jersey Clean Energy Programs At-A-Glance

	SmartStart Flexibility to install at your own pace	**Direct Install** Turnkey installation	**Pay for Performance** Whole building upgrades
Who should use it?	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together. Peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. Peak demand should be over 200 kW.
How does it work?	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
What are the Incentives?	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to $125,000 per project. You pay the remaining 30% directly to the contractor.	Up to 25% of installation cost, calculated based on level of energy savings per square foot.
How do I participate?	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified partner to develop your energy reduction plan and set your energy savings targets.

Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor.

Individual Measures with SmartStart

For facilities wishing to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the SmartStart program. To participate, you can use internal resources or an outside firm or contractor to perform the final design of the ECM(s) and install the equipment. Program pre-approval is required for some SmartStart incentives, so only after receiving pre-approval should you proceed with ECM installation.

Turnkey Installation with Direct Install

The Direct Install program provides turnkey installation of multiple measures through an authorized network of participating contractors. This program can provide substantially higher incentives than SmartStart, up to 70% of the cost of selected measures. Direct Install contractors will assess and verify individual measure eligibility and, in most cases, they perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

Whole Building Approach with Pay for Performance

Pay for Performance can be a good option for medium to large sized facilities to achieve deep energy savings. Pay for Performance allows you to install as many measures as possible under a single project as well as address measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program (ESIP) loan also use this program. Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures resulting in at least 15% energy savings, where lighting cannot make up the majority of the savings.

More Options from Around the State

Financing and Planning Support with the Energy Savings Improvement Program (ESIP)

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the ESIP. Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. You have already taken the first step as an LGEA customer, because this report is required to participate in ESIP.

Resiliency with Return on Investment through Combined Heat & Power (CHP)

The CHP program provides incentives for combined heat and power (aka cogeneration) and waste heat to power projects. Combined heat and power systems generate power on-site and recover heat from the generation system to meet on-site thermal loads. Waste heat to power systems use waste heat to generate power. You will work with a qualified developer who will design a system that meets your building’s heating and cooling needs.

Ongoing Electric Savings with Demand Response

The Demand Response Energy Aggregator program reduces electric loads at commercial facilities when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak power demand. By enabling commercial facilities to reduce their electric demand during times of peak demand, the grid is made more reliable and overall transmission costs are reduced for all ratepayers. Curtailment service providers provide regular payments to medium and large consumers of electric power for their participation in demand response (DR) programs. Program participation is voluntary, and facilities receive payments regardless of whether they are called upon to curtail their load during times of peak demand.

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Wilson School. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs. This report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing ECMs.

TRC conducted this study as part of a comprehensive effort to assist New Jersey educational and local government facilities in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

2.1 Site Overview

On August 28, 2018, TRC performed an energy audit at Wilson School located in Sayreville, NJ. TRC met with Kenny to review the facility operations and help focus our investigation on specific energy-using systems.

Wilson School is a three-story, 54,150 square foot building built in 1928. Spaces include: classrooms, gymnasium, cafeteria, kitchen, auditorium, offices, library, corridors, stairwells and mechanical space. The building is 100% heated and less than 5% cooled. A couple offices, classrooms and library are cooled and there are split AC systems for server rooms.

Heating space temperatures are usually 72°F during occupied hours and set back to 55°F during unoccupied periods of time. The rooftop units (RTUs) are about 15 years old and reported to be programmed with the existing Trane energy management system (EMS). Space temperatures are said to be maintained at 74°F and systems turned off when unoccupied. There is no parking lot lighting, only building-mounted which is on the main meter and is a mixture of technologies.

Facility concerns include: The main operational and maintenance concerns include the original Nesbit unit ventilators, the Trane HVAC controls and old light fixtures in the gymnasium. The boilers, which are approximately 10 years old, are said to be inefficient. Boilers were converted from steam to hot water eight years ago. They are supposed to operate with an outside air temperature reset, but this is not confirmed.

2.2 Building Occupancy

The facility is occupied year-round, with peak occupancy from September through June. Typical peak building occupancy includes about 400 students and 52 staff members. Summer occupancy includes summer school and continuing maintenance and custodial activities. The gymnasium is used on Saturday mornings.

Building Name	Weekday/Weekend	Operating Schedule
Normal School Day (Whole Building)	Weekday	8:30AM-2:45PM
	Weekend	No Use
Gym	Weekday	7:00AM-7:00PM
	Weekend	8:00AM-12:00PM
After Hours Cleaning	Weekday	3:00PM-11:00PM
	Weekend	No Use
Summer School (Whole Building) Monday through Thursday	Weekday	7:00AM-3:30PM
	Weekend	No Use

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are concrete block with a brick facade. The roof is part flat and part pitched appearing in fair condition. There are skylights which appear in fair condition as well. The walls are made of concrete masonry units (CMUs) with a brick veneer.

Most of the windows are double pane, operable with metal frames, clear glass and internal shading. The window frame seals are in poor condition. Exterior doors are metal with metal frames and in fair condition, however they are typically missing or have worn weather-stripping materials. Degraded window and door seals increase drafts and outside air infiltration.

Building facade

Exterior door with no weather-stripping

Air gap under AC unit

Roof and skylights

2.4 Lighting Systems

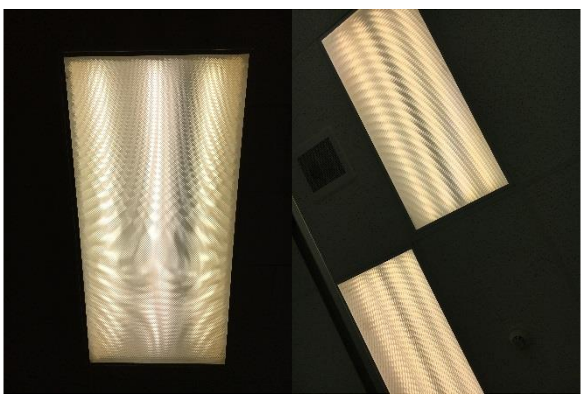
The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are incandescent lamps in the library and stage. Fixture types include 2- 3- or 4-lamp, 2- or 4-foot long recessed troffer and surface mounted wrap fixtures and 2-foot fixtures with U-bend tube lamps. Most fixtures are in good condition. The recently renovated restrooms are lit by 2-lamp, 4-foot recessed troffer fixtures with linear LED lamps and are controlled by occupancy sensors. These are over lit, however since equipment is likely still under warranty, these are not recommended for further upgrades.

Gymnasium fixtures have linear fluorescent fixtures which each have six T8 lamps, which are manually controlled. All exit signs are LED. Light fixtures throughout the facility, besides the aforementioned restrooms, are controlled manually via wall switches.

Interior lighting levels were range from generally sufficient to over lit. The classrooms are lit by 2-lamp or 4-lamp fixtures and have inboard/outboard bi-level switching. During the energy audit, the following light levels, in footcandles (FC), were taken:

- Classroom with 6 fixtures, 4 Lamp – 40 FC
- Classroom with 8 fixtures, 2 Lamp – 35-70 FC
- Classroom with 12 fixtures, 2 Lamp – 45-55 FC

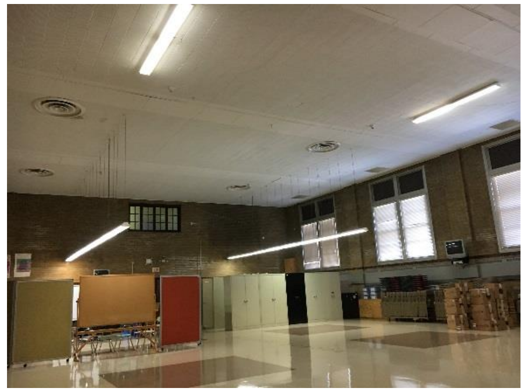
The minimum light levels required for classroom space by IES standards is 30 FC. However, additional considerations must be investigated during design to determine the cost effectiveness of reducing the number of lamps. With bi-level switching, it is uncertain as to how often these fixtures operate at each level of switching (number of lamps). Reducing the light output would require a level of design, beyond the scope of this energy audit, to determine the feasibility. Options may include upgrading to 1-LED lamp fixtures, 2x4 LED retrofit kits, changing the number of fixtures, etc. The options range too much to provide an analysis and cost would vary drastically on the proposed approach. We recommend that this be investigated further by an electrical contractor if lighting upgrades move forward to implementation.



Recessed troffer fixtures

Pendant mounted wrap fixtures

Continuous row lighting



Multipurpose room lighting

Stage lighting

Hallway lighting

Classroom lighting

Gymnasium lighting

Wall switch occupancy sensor in recently renovated restroom

Manual wall switch

Exterior fixtures include wall packs and flood fixtures which are either LED or have high intensity discharge (HID) lamps. Exterior light fixtures are controlled by time clocks which are set to operate from 7:00 PM to 7:00 AM, every day.

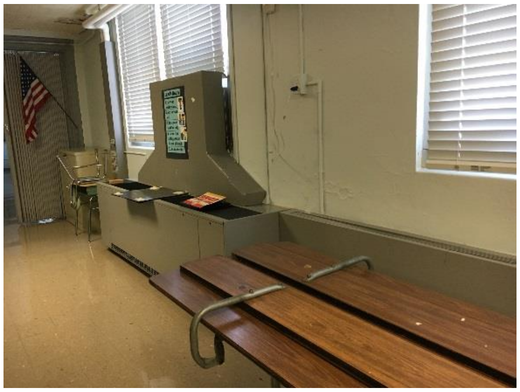
Wall Mounted Flood Fixture

Flood Fixture with Photocell Sensor

2.5 Air Handling Systems

Unit Ventilators

Unit ventilators have fractional horsepower supply fan motors, electronically controlled outside air dampers and zone valves that operate with the EMS. This system is dated and it has reported operational issues and concerns.



Unit Ventilator

Ceiling Hung Unit Ventilator

Packaged Units

There are three TRANE roof top units (RTUs) that are either beyond or nearing the end of their useful life. Each provide cooling only by direct-expansion (DX) and two of them a direct gas-fired RTUs. One of them provides heat with an electric duct heater. These packaged RTUs are controlled by the EMS. Some are equipped with economizers; however, we were unable to verify the current operational condition of the economizers. For the purposes of this report, the energy efficiency of these units has been de-rated due to the age of the equipment.

The packaged roof top units are summarized in the table below:

Unit (Make & Model)	Size (Tons)	Efficiency (EER)	Heating Capacity	Heating Efficiency	Supply Fan Motor
TRANE TCH181C30BBA	15	9.78	3.6 kW	-	5 HP
TRANE GRAA60PDNF0L7GU306U0CDEKLPQV56	5	9.90	480 MBH	72%	15 HP
TRANE GRAA40PDMF0L6GU305U0CDEKLPQV56	3	9.90	320 MBH	72%	15 HP

Packaged roof top unit (RTU)

Packaged roof top unit (RTU)

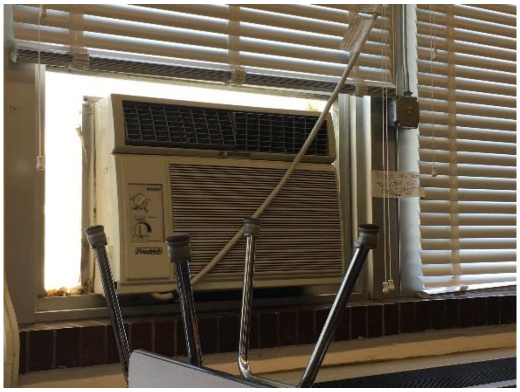
Packaged roof top unit (RTU)

Packaged roof top unit (RTU)

Air Conditioners

The server room is cooled by a split air conditioning (AC) system that was inaccessible during the audit but is estimated to be 2 tons in cooling capacity and with an energy efficiency ratio of 9 EER. Some offices, classrooms and the library and lounge are cooled by window AC units. These vary in capacity between 1.5 and 2 tons. They range in condition and efficiencies are between 8.5 to 10.5 EER.

Portable AC unit



Older window AC unit

Split AC system – outdoor condensing unit

Newer AC unit

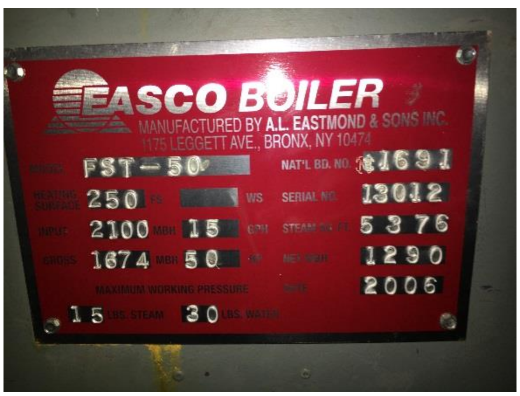
2.6 Heating Hot Water System

There are two EastCo (Model: FST-50) cast iron sectional, 1674 MBH, non-condensing hot water boilers which serve the building heating load. They were installed in 2006. The burners are non-modulating with a nominal efficiency of 72%. For the purposes of this analysis, heating efficiency has been derated based on the age and condition of the boilers. The boilers are configured in an automated control scheme. The hydronic distribution system is a 2-pipe heating only system.

The boilers are configured in a constant flow primary distribution with two 10 HP constant speed hot water pumps operating with an automated control scheme. The boilers provide hot water to fin tube radiators and unit ventilators throughout the building. Hot water is supplied at 180°F when the outside air temperature is low, and the setpoint is adjusted linearly to 130°F when the outside air is high.

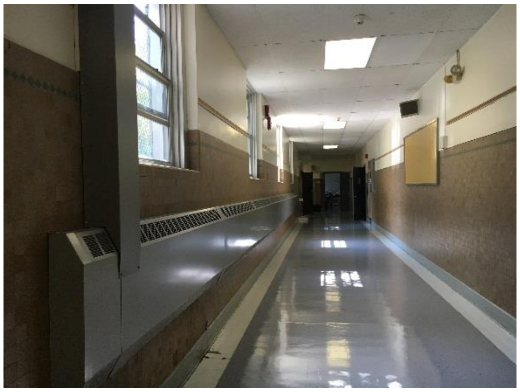
Space heating boilers

Mechanical linkage burner controls



Boiler nameplate

Hot water pumps and motors



Perimeter radiators

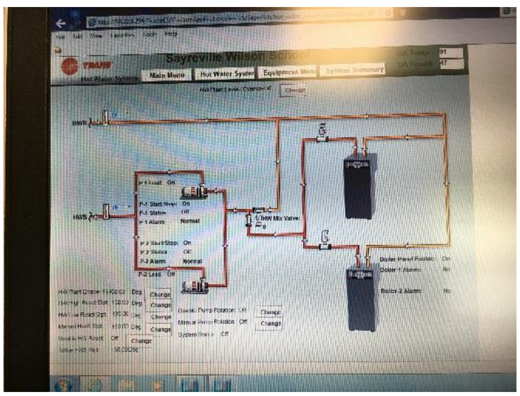
Trane heating controls in Boiler Room

2.7 Building Energy Management Systems (EMS)

A Trane Tracer EMS controls the HVAC equipment, boilers, RTUs, radiators, unit ventilators and exhaust fans. The EMS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures and heating water loop temperatures. The site staff expressed an interest in replacing the EMS.

The classroom schedule is Monday through Friday between 6:00 AM and 6:00 PM. The gymnasium schedule is Monday between 6:00 AM and 5:00 PM and Tuesday through Friday between 6:00 AM and 9:00 PM. The temperature set points and schedules vary depending on the area or zone. The range is as follows:

- Occupied Cooling Temperature Set point is 68°F -76°F
- Unoccupied Cooling Temperature Set point is 78°F
- Occupied Heating Temperature Set point is 68°F -74°F
- Unoccupied Heating Temperature Set point is 65°F

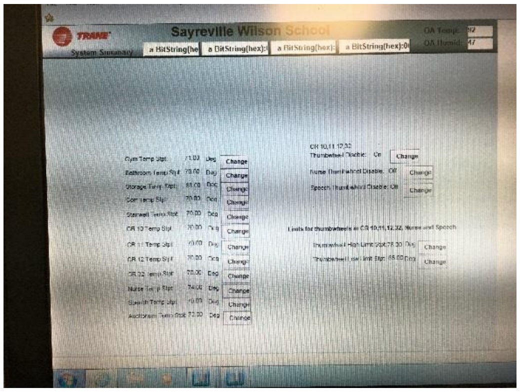


Heating system graphic

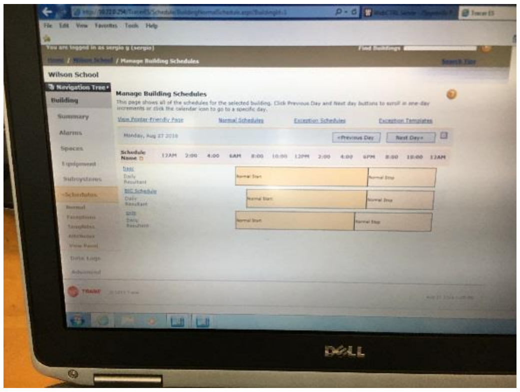
Thermostats

Exhaust fan graphic

Roof top unit graphic



Average temperature set point is 70°F



Equipment schedules

2.8 Domestic Hot Water

Hot water is produced with an American (Model: G101-40T34-3N) 40-gallon, 40 MBH gas-fired storage water heater with an estimated 72% efficiency. For the purposes of this analysis the efficiency has been derated based on age and condition. This storage tank water heater is beyond its useful life and the hot water piping is uninsulated. There is a fractional horsepower water supply pump and motor.

The renovated restrooms each have their own 2.4 kW instantaneous electric water heater which serves the restroom sink.

Typical electric tank-less water heater located in recently renovated restrooms

Gas-fired storage tank water heater with no pipe insulation

2.9 Food Service Equipment

The kitchen has mixed gas and electric equipment that is used to prepare lunches for students. Most cooking is done using a convection gas-fired oven and conventional electric oven. Bulk prepared foods are held in an electric holding cabinet. Equipment is high efficiency and is in good condition.

Visit https://www.energystar.gov/products/commercial_food_service_equipment for the latest information on high efficiency food service equipment.

Cooking equipment

Nameplate

2.10 Refrigeration

The kitchen has several refrigerator chests, a freezer chest as well as a stand-up solid door refrigerator and stand up solid door freezer. These vary in condition and efficiency. There is no walk-in refrigeration equipment.

Visit https://www.energystar.gov/products/commercial_food_service_equipment for the latest information on high efficiency food service equipment.

Stand Up Refrigerator

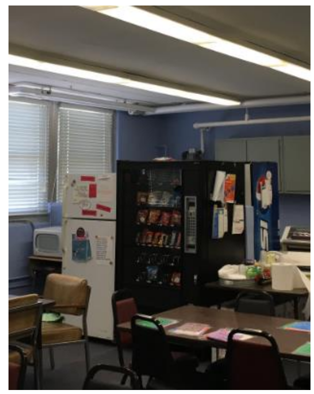
Stand up Freezer

2.11 Plug Load & Vending Machines

The utility bill analysis indicates that plug loads consume approximately 1.57% percent of total building energy use. This is lower than a typical building. You seem to already be doing a great job managing your electrical plug loads. This report makes additional suggestions for ECMs in this area as well as Energy Efficient Best Practices.

There are approximately 38 desktop computer work stations throughout the facility as well as a large number of laptops. Plug loads throughout the building include general café and office equipment. There are classroom typical loads such as smart boards, projectors, and fans. There are several residential style refrigerators throughout the building. These vary in condition and efficiency. There is a refrigerated beverage vending machine and a non-refrigerated vending machine in the lounge. Vending machines are not equipped with occupancy-based controls.

General office equipment



General café equipment and vending machines

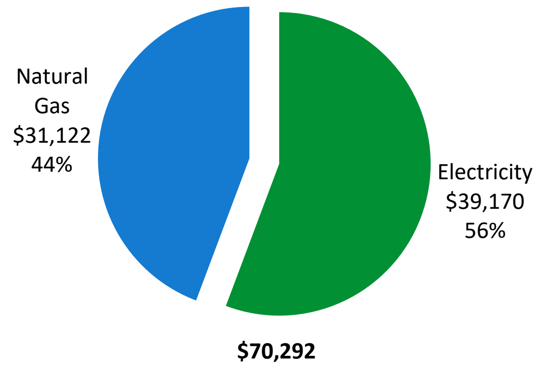
2.12 Water-Using Systems

There are restrooms with toilets, urinals, and sinks. Faucet flow rates are low at 0.5 gallons per minute (gpm).

3 Energy Use and Costs

Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	322,813 kWh	$39,170
Natural Gas	36,032 Therms	$31,122
Total		**$70,292**



An energy balance identifies and quantifies energy use in your various building systems. This can highlight areas with the most potential for improvement. This energy balance was developed using calculated energy use for each of the end uses noted in the figure.

The energy auditor collects information regarding equipment operating hours, capacity, efficiency and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated energy use is then compared to the historical energy use and the initial inputs are revised, as necessary, to balance the calculated energy use to the historical energy use.

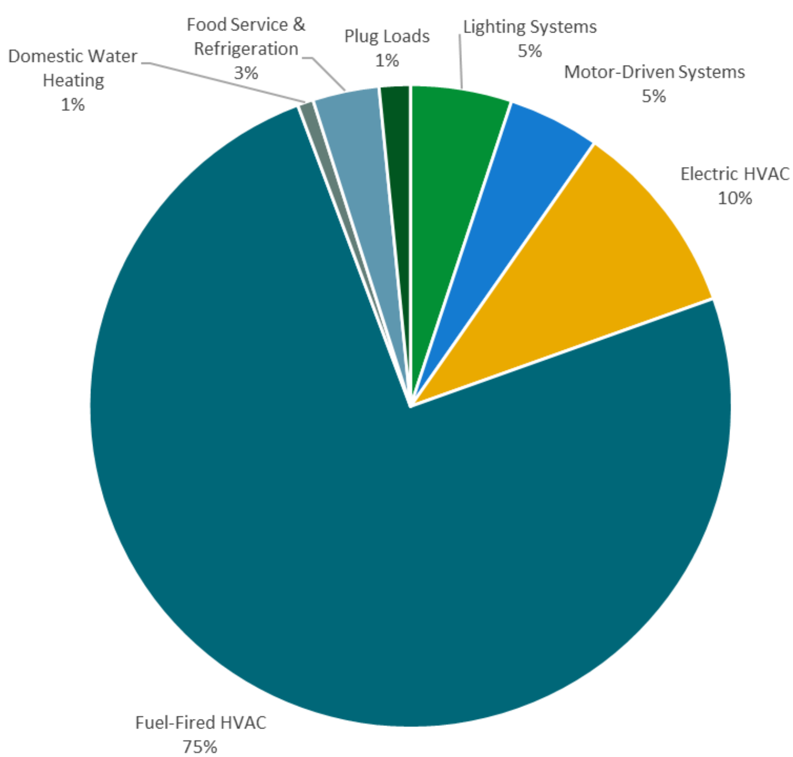
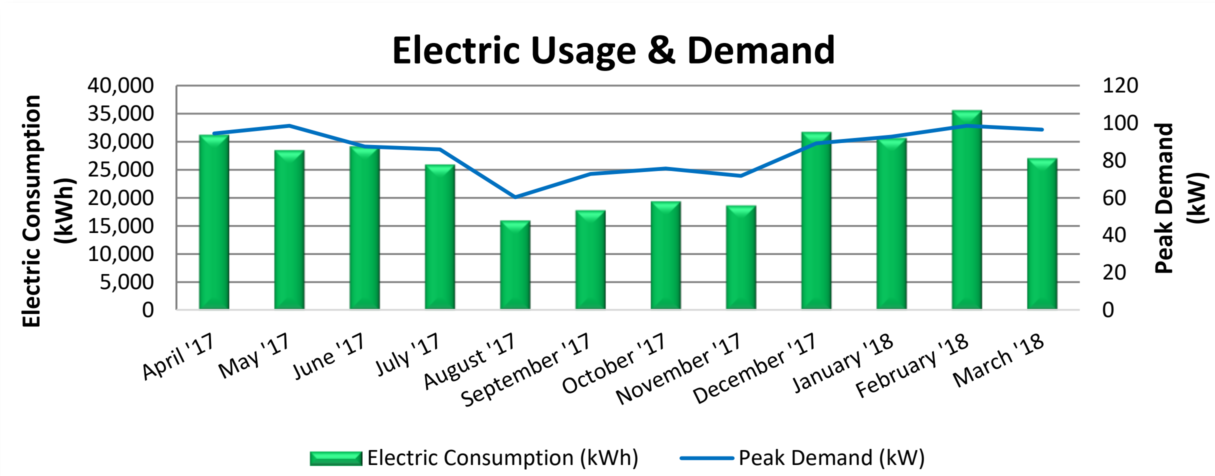


Figure 5 - Energy Balance

3.1 Electricity

JCP&L supplies and delivers electricity under rate class General Service Secondary 3 Phase.



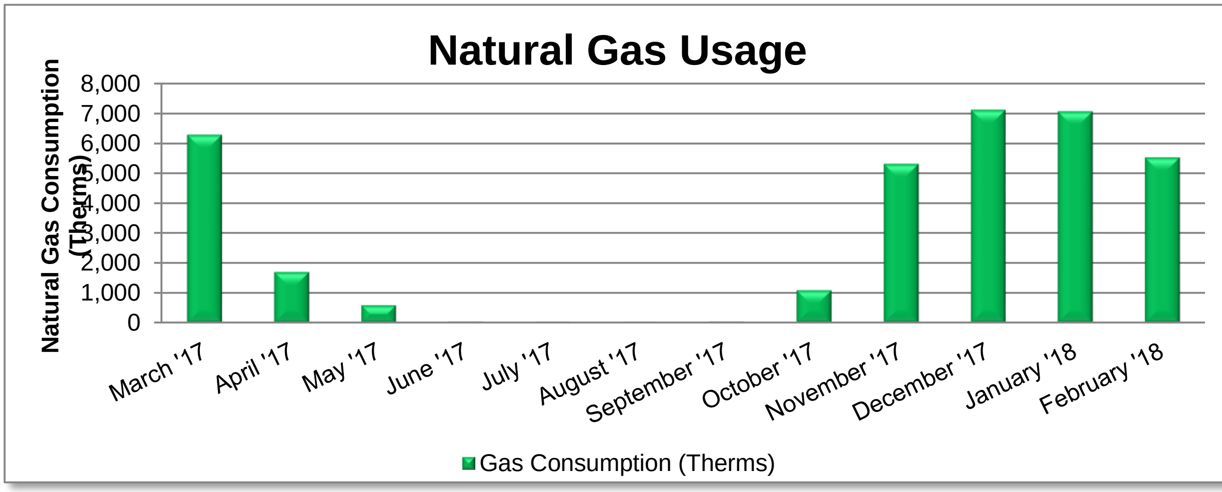
Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**
4/17/17	27	31,280	94	$559	$3,852
5/18/17	30	28,520	99	$593	$3,603
6/20/17	32	29,240	87	$650	$3,605
7/20/17	29	25,960	86	$654	$3,253
8/21/17	31	16,040	60	$374	$2,015
9/20/17	29	17,840	73	$446	$2,280
10/20/17	29	19,440	76	$435	$2,475
11/16/17	26	18,680	72	$408	$2,363
12/20/17	33	31,760	89	$524	$3,776
1/19/18	29	30,680	93	$546	$3,491
2/19/18	30	35,640	99	$584	$3,991
3/20/18	28	27,120	97	$571	$3,178
Totals	**353**	**312,200**	**99**	**$6,344**	**$37,882**
Annual	**365**	**322,813**	**99**	**$6,559**	**$39,170**

Notes:

- Peak demand of 99 kW occurred in February 2018.
- The average electric cost over the past 12 months was $0.121/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

PSE&G delivers natural gas under rate class General Service Gas (GSG), with natural gas supply provided by Direct Energy, a third-party supplier.



Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
4/4/17	28	6,287	$4,059
5/4/17	29	1,701	$1,198
6/5/17	31	590	$504
7/5/17	29	49	$161
8/3/17	28	36	$145
9/1/17	28	30	$139
10/3/17	31	51	$163
11/1/17	28	1,089	$967
12/4/17	32	5,311	$4,727
1/3/18	29	7,114	$6,417
2/2/18	29	7,059	$6,374
3/6/18	31	5,530	$5,245
Totals	**353**	**34,848**	**$30,098**
Annual	**365**	**36,032**	**$31,122**

Notes:

- The average gas cost for the past 12 months is $0.864/therm, which is the blended rate used throughout the analysis.

3.3 Benchmarking

Your building was benchmarked using the United States Environmental Protection Agency's Portfolio Manager® software. Benchmarking compares your building's energy use to that of similar buildings across the country, while neutralizing variations due to location, occupancy and operating hours. Some building types can be scored with a 1-100 ranking of a building's energy performance relative to the national building market. A score of 50 represents the national average and a score of 100 is best.

This ENERGY STAR® benchmarking score provides a comprehensive snapshot of your building's energy performance. It assesses the building's physical assets, operations, and occupant behavior, which is compiled into a quick and easy-to-understand score.

Benchmarking Score	17

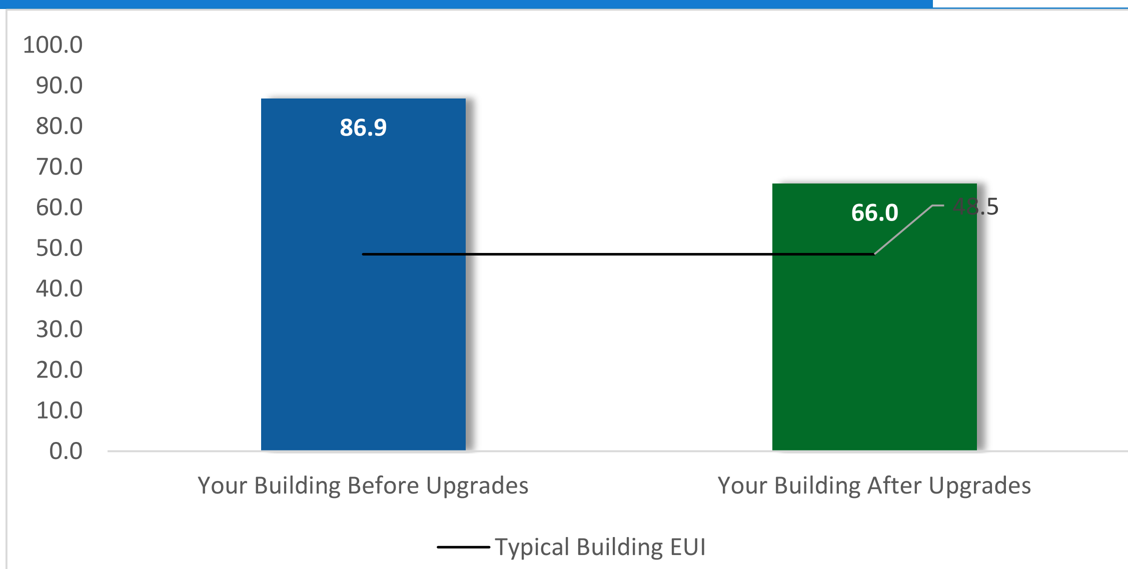


Figure 6 - Energy Use Intensity Comparison

This building performs at, or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. Several factors can cause as building to vary from the "typical" energy usage. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and occupant behavior all contribute to a building's energy use and the benchmarking score.

Tracking Your Energy Performance

Keeping track of your energy use monthly is one of the best ways to keep energy costs in check. Update your utility information in Portfolio Manager® regularly, so that you can keep track of your building's performance.

We created a Portfolio Manager® account for your facility and we have already entered the monthly utility data shown above for you. Account login information for your account will be sent via email.

Free online training is available to help you use ENERGY STAR® Portfolio Manager® to track your building's performance at: https://www.energystar.gov/buildings/training. For more information on ENERGY STAR® and Portfolio Manager®, visit their website[3].

[3] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

4 ENERGY CONSERVATION MEASURES

The goal of this audit report is to identify and evaluate potential energy efficiency improvements, provide information about the cost effectiveness of those improvements, and recognize potential financial incentives from NJBPU. Most energy conservation measures have received preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is typically sufficient to demonstrate project cost-effectiveness and help prioritize energy measures.

Calculations of energy use and savings are based on the current version of the *New Jersey Clean Energy Program Protocols to Measure Resource Savings*, which is approved by the NJBPU. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances.

Operation and maintenance costs for the proposed new equipment will generally be lower than the current costs for the existing equipment—especially if the existing equipment is at or past its normal useful life. We have conservatively assumed there to be no impact on overall maintenance costs over the life of the equipment.

Financial incentives are based on the current NJCEP prescriptive SmartStart program. A higher level of investigation may be necessary to support any SmartStart Custom, Pay for Performance, or Direct Install incentive applications. Some measures and proposed upgrades may be eligible for higher incentives than those shown below through other NJCEP programs described in a following section of this report.

Appendix A: Equipment Inventory & Recommendations

provides a detailed list of the locations and recommended upgrades for each energy conservation measure.

#	Energy Conservation Measure	*Recommend?*	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**27,938**	**11.6**	**-8**	**$3,319**	**$49,789**	**$22,910**	**$5,219**	**$17,691**	**5.3**	**27,175**
ECM 1	Install LED Fixtures	Yes	2,667	0.0	0	$324	$4,855	$1,761	$120	$1,641	5.1	2,686
ECM 2	Retrofit Fixtures with LED Lamps	Yes	25,270	11.6	-8	$2,996	$44,934	$21,149	$5,099	$16,050	5.4	24,489
Lighting Control Measures			**5,045**	**1.7**	**-2**	**$598**	**$4,784**	**$9,076**	**$1,000**	**$8,076**	**13.5**	**4,889**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	4,461	1.5	-1	$529	$4,230	$7,676	$1,000	$6,676	12.6	4,323
ECM 4	Install High/Low Lighting Controls	Yes	584	0.2	0	$69	$554	$1,400	$0	$1,400	20.2	566
Motor Upgrades			**1,089**	**0.5**	**0**	**$132**	**$1,982**	**$7,235**	**$0**	**$7,235**	**54.8**	**1,096**
ECM 5	Premium Efficiency Motors	Yes	1,089	0.5	0	$132	$1,982	$7,235	$0	$7,235	54.8	1,096
Variable Frequency Drive (VFD) Measures			**28,420**	**11.9**	**0**	**$3,448**	**$51,726**	**$21,281**	**$2,800**	**$18,481**	**5.4**	**28,618**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	18,075	10.0	0	$2,193	$32,898	$13,665	$2,800	$10,865	5.0	18,201
ECM 7	Install VFDs on Heating Water Pumps	Yes	10,345	1.9	0	$1,255	$18,829	$7,616	$0	$7,616	6.1	10,417
Electric Unitary HVAC Measures			**82,801**	**6.4**	**0**	**$10,047**	**$150,706**	**$42,609**	**$2,136**	**$40,473**	**4.0**	**83,380**
	Install High Efficiency Air Conditioning Units	No	7,069	4.1	0	$858	$12,867	$17,894	$951	$16,944	19.8	7,119
ECM 8	Install High Efficiency Heat Pumps	Yes	75,732	2.3	0	$9,189	$137,840	$24,714	$1,185	$23,529	2.6	76,262
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**775**	**$6,695**	**$133,907**	**$84,181**	**$7,366**	**$76,815**	**11.5**	**90,764**
ECM 9	Install High Efficiency Hot Water Boilers	Yes	0	0.0	609	$5,262	$105,240	$63,945	$7,366	$56,579	10.8	71,333
	Install High Efficiency Furnaces	No	0	0.0	166	$1,433	$28,667	$20,236	$0	$20,236	14.1	19,431
Domestic Water Heating Upgrade			**0**	**0.0**	**6**	**$55**	**$832**	**$2,813**	**$50**	**$2,763**	**49.8**	**752**
	Install High Efficiency Gas-Fired Water Heater	No	0	0.0	6	$55	$832	$2,813	$50	$2,763	49.8	752
Food Service & Refrigeration Measures			**7,969**	**0.9**	**0**	**$967**	**$10,234**	**$8,002**	**$0**	**$8,002**	**8.3**	**8,025**
	Replace Refrigeration Equipment	No	6,357	0.7	0	$771	$9,257	$7,772	$0	$7,772	10.1	6,402
ECM 10	Vending Machine Control	Yes	1,612	0.2	0	$196	$978	$230	$50	$180	0.9	1,623
TOTALS			**153,262**	**33.1**	**772**	**$25,263**	**$403,962**	**$198,105**	**$18,570**	**$179,535**	**7.1**	**244,700**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Figure 7 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**27,938**	**11.6**	**-8**	**$3,319**	**$22,910**	**$5,219**	**$17,691**	**5.3**	**27,175**
ECM 1	Install LED Fixtures	2,667	0.0	0	$324	$1,761	$120	$1,641	5.1	2,686
ECM 2	Retrofit Fixtures with LED Lamps	25,270	11.6	-8	$2,996	$21,149	$5,099	$16,050	5.4	24,489
Lighting Control Measures		**5,045**	**1.7**	**-2**	**$598**	**$9,076**	**$1,000**	**$8,076**	**13.5**	**4,889**
ECM 3	Install Occupancy Sensor Lighting Controls	4,461	1.5	-1	$529	$7,676	$1,000	$6,676	12.6	4,323
ECM 4	Install High/Low Lighting Controls	584	0.2	0	$69	$1,400	$0	$1,400	20.2	566
Motor Upgrades		**1,089**	**0.5**	**0**	**$132**	**$7,235**	**$0**	**$7,235**	**54.8**	**1,096**
ECM 5	Premium Efficiency Motors	1,089	0.5	0	$132	$7,235	$0	$7,235	54.8	1,096
Variable Frequency Drive (VFD) Measures		**28,420**	**11.9**	**0**	**$3,448**	**$21,281**	**$2,800**	**$18,481**	**5.4**	**28,618**
ECM 6	Install VFDs on Constant Volume (CV) Fans	18,075	10.0	0	$2,193	$13,665	$2,800	$10,865	5.0	18,201
ECM 7	Install VFDs on Heating Water Pumps	10,345	1.9	0	$1,255	$7,616	$0	$7,616	6.1	10,417
Electric Unitary HVAC Measures		**75,732**	**2.3**	**0**	**$9,189**	**$24,714**	**$1,185**	**$23,529**	**2.6**	**76,262**
ECM 8	Install High Efficiency Heat Pumps	75,732	2.3	0	$9,189	$24,714	$1,185	$23,529	2.6	76,262
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**609**	**$5,262**	**$63,945**	**$7,366**	**$56,579**	**10.8**	**71,333**
ECM 9	Install High Efficiency Hot Water Boilers	0	0.0	609	$5,262	$63,945	$7,366	$56,579	10.8	71,333
Food Service & Refrigeration Measures		**1,612**	**0.2**	**0**	**$196**	**$230**	**$50**	**$180**	**0.9**	**1,623**
ECM 10	Vending Machine Control	1,612	0.2	0	$196	$230	$50	$180	0.9	1,623
TOTALS		**139,835**	**28.2**	**599**	**$22,145**	**$149,390**	**$17,620**	**$131,770**	**6.0**	**210,996**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Figure 8 – Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**27,938**	**11.6**	**-8**	**$3,319**	**$22,910**	**$5,219**	**$17,691**	**5.3**	**27,175**
ECM 1	Install LED Fixtures	2,667	0.0	0	$324	$1,761	$120	$1,641	5.1	2,686
ECM 2	Retrofit Fixtures with LED Lamps	25,270	11.6	-8	$2,996	$21,149	$5,099	$16,050	5.4	24,489

When considering lighting upgrades, we suggest using a comprehensive design approach that simultaneously upgrades lighting fixtures and controls to maximize energy savings and improve occupant lighting. Comprehensive design will also consider appropriate lighting levels for different space types to make sure that the right amount of light is delivered where needed. If conversion to LED light sources are proposed, we suggest converting all of a specific lighting type (e.g. linear fluorescent) to LED lamps to minimize the number of lamp types in use at the facility, which should help reduce future maintenance costs.

ECM 1: Install LED Fixtures

Replace existing exterior fixtures containing metal halide and high pressure sodium lamps with new LED light fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output.

In some cases, HID fixtures can be retrofit with screw-based LED lamps. Replacing an existing HID fixture with a new LED fixture will generally provide better overall lighting optics; however, replacing the HID lamp with a LED screw-in lamp is typically a less expensive retrofit. We recommend you work with your lighting contractor to determine which retrofit solution is best suited to your needs and will be compatible with the existing fixture(s).

Maintenance savings may also be achieved since LED lamps last longer than other light sources and therefore do not need to be replaced as often.

Affected building areas: exterior fixtures

ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent and incandescent lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies.

This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space. Maintenance savings may also be available, as longer-lasting LEDs lamps will not need to be replaced as often as the existing lamps.

Affected building areas: all areas with fluorescent fixtures with T8 tubes

Considerations/Sensitivities: light levels were over lit in some classrooms. Over lit classrooms have 2-lamp or 4-lamp fixtures and have bi-level switching. The classroom light levels ranged between 35 FC and 75 FC. The minimum light levels required for classroom space by IES standards is 30 FC. However, additional considerations must be investigated during design to determine the cost effectiveness of reducing the number of lamps. Reducing the light output would require a level of design, beyond the scope of this energy audit, to determine the feasibility.

Options may include upgrading to 1-LED lamp fixtures, 2x4 LED retrofit kits, changing the number of fixtures, etc. The options range too much to provide an analysis and cost would vary drastically on the proposed approach. We recommend that this be investigated further by an electrical contractor if lighting upgrades move forward to implementation.

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**5,045**	**1.7**	**-2**	**$598**	**$9,076**	**$1,000**	**$8,076**	**13.5**	**4,889**
ECM 3	Install Occupancy Sensor Lighting Controls	4,461	1.5	-1	$529	$7,676	$1,000	$6,676	12.6	4,323
ECM 4	Install High/Low Lighting Controls	584	0.2	0	$69	$1,400	$0	$1,400	20.2	566

Lighting controls reduce energy use by turning off or lowering lighting fixture power levels when not in use. A comprehensive approach to lighting design should upgrade the lighting fixtures and the controls together for maximum energy savings and improved lighting for occupants.

ECM 3: Install Occupancy Sensor Lighting Controls

Install occupancy sensors to control lighting fixtures in areas that are frequently unoccupied, even for short periods. For most spaces, we recommend lighting controls use dual technology sensors, which reduce the possibility of lights turning off unexpectedly.

Occupancy sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Most occupancy sensor lighting controls allow users to manually turn fixtures on/off, as needed. Some controls can also provide dimming options.

Occupancy sensors can be mounted on the wall at existing switch locations, mounted on the ceiling, or in remote locations. In general, wall switch replacement sensors are best suited to single occupant offices and other small rooms. Ceiling-mounted or remote mounted sensors are used in large spaces, locations without local switching, and where wall switches are not in the line-of-sight of the main work area.

This measure provides energy savings by reducing the lighting operating hours.

Affected building areas: offices, cafeteria, classrooms, gymnasium and library

ECM 4: Install High/Low Lighting Controls

Install occupancy sensors to provide dual level lighting control for lighting fixtures in spaces that are infrequently occupied but may require some level of continuous lighting for safety or security reasons.

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety requirements. Sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Fixtures automatically switch back to low level after a predefined period of vacancy. This measure provides energy savings by reducing the light fixture power draw when reduced light output is appropriate.

Affected building areas: hallways

Considerations/Sensitivities: For this type of measure the occupancy sensors will generally be ceiling or fixture mounted. Sufficient sensor coverage must be provided to ensure that lights turn on in each area as an occupant approaches.

4.3 Motors

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Motor Upgrades		**1,089**	**0.5**	**0**	**$132**	**$7,235**	**$0**	**$7,235**	**54.8**	**1,096**
ECM 5	Premium Efficiency Motors	1,089	0.5	0	$132	$7,235	$0	$7,235	54.8	1,096

ECM 5: Premium Efficiency Motors

Replace standard efficiency motors with IHP 2014 efficiency motors. This evaluation assumes that existing motors will be replaced with motors of equivalent size and type. In some cases, additional savings may be possible by downsizing motors to better meet the motor's current load requirements.

Affected motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor
Boiler Room	Hydronic Heating	1	Heating Hot Water Pump	10.0
Boiler Room	Hydronic Heating	1	Heating Hot Water Pump	10.0
Roof	Gas Fired RTUs	2	Supply Fan	15.0
Roof	RTU w/Electric Heat	1	Supply Fan	5.0

Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours. The base case motor energy consumption is estimated using the efficiencies found on nameplates or estimated based on the age of the motor and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the current *New Jersey's Clean Energy Program Protocols to Measure Resource Savings*.

4.4 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**28,420**	**11.9**	**0**	**$3,448**	**$21,281**	**$2,800**	**$18,481**	**5.4**	**28,618**
ECM 6	Install VFDs on Constant Volume (CV) Fans	18,075	10.0	0	$2,193	$13,665	$2,800	$10,865	5.0	18,201
ECM 7	Install VFDs on Heating Water Pumps	10,345	1.9	0	$1,255	$7,616	$0	$7,616	6.1	10,417

Variable frequency drives control motors for fans, pumps, and process equipment based on the actual output required of the driven equipment. Energy savings result from more efficient control of motor energy usage when equipment operates at partial load. The magnitude of energy savings depends on the estimated amount of time that the motor would operate at partial load. For equipment with proposed VFDs, we have included replacing the controlled motor with a new motor —unless the existing motor meets or exceeds IHP 2014 standards—to conservatively account for the cost of an inverter duty rated motor. The savings and cost associated with the new motor are presented with the Premium Efficiency Motor measures. If the proposed VFD measure is not selected for implementation the motor replacement should be reevaluated.

ECM 6: Install VFDs on Constant Volume (CV) Fans

Install VFDs to control constant volume fan motor speeds. This converts a constant-volume, single-zone air handling system into a variable-air-volume (VAV) system. A separate VFD is usually required to control the return fan motor or dedicated exhaust fan motor, if the air handler has one.

Zone thermostats signal the VFD to adjust fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature. Energy savings result from reducing the fan speed (and power) when conditions allow for reduced air flow.

This measure is part of a measure to replace motors and as such must be considered in combination with ECM 5: Premium Efficiency Motors.

Considerations/Sensitivities: VAV system controls should not raise the supply air temperature at the expense of the fan power. A common mistake is to reset the supply air temperature to achieve chiller energy savings, which can lead to additional air flow requirements. Supply air temperature should be kept low (e.g. 55°F) until the minimum fan speed (typically about 50%) is met. At this point, it is efficient to raise the supply air temperature as the load decreases, but not such that additional air flow and thus fan energy is required.

For air handlers with direct expansion (DX) cooling systems, the minimum air flow across the cooling coil required to prevent the coil from freezing must be determined during the final project design. The control system programming should maintain the minimum air flow whenever the compressor is operating.

ECM 7: Install VFDs on Heating Water Pumps

Install variable frequency drives (VFD) to control heating water pumps. Two-way valves must serve the hot water coils and the hot water loop must have a differential pressure sensor installed. If three-way valves or a bypass leg are used in the hot water distribution they will need to be modified when this measure is implemented. As the hot water valves close, the differential pressure increases and the VFD modulates the pump speed to maintain a differential pressure setpoint.

Energy savings result from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

This measure is part of a measure to replace motors and as such must be considered in combination with ECM 5: Premium Efficiency Motors.

4.5 Electric Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		**82,801**	**6.4**	**0**	**$10,047**	**$42,609**	**$2,136**	**$40,473**	**4.0**	**83,380**
	Install High Efficiency Air Conditioning Units	7,069	4.1	0	$858	$17,894	$951	$16,944	19.8	7,119
ECM 8	Install High Efficiency Heat Pumps	75,732	2.3	0	$9,189	$24,714	$1,185	$23,529	2.6	76,262

Replacing the unitary HVAC units has a long payback period and may not be justifiable based simply on energy considerations. However, most of the units at this facility are nearing or have reached the end of their normal useful life. Typically, the marginal cost of purchasing a high efficiency unit can be justified by the marginal savings from the improved efficiency. When the equipment is eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

Install High Efficiency Air Conditioning Units

Replace standard efficiency packaged air conditioning units with high efficiency packaged air conditioning units. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average cooling load, and the estimated annual operating hours. This includes the split system AC, window AC units and the packaged air-conditioning RTUs.

Reasons for not Recommending as a High Priority Measure: The projected payback period for this measure based on the energy savings exceeds the expected useful life of the replacement equipment. The upgrade to high efficiency is not justified by energy savings alone.

Considerations: If the school district moves forward toward implementation of a comprehensive project under the ESIP, we would recommend including this measure.

ECM 8: Install High Efficiency Heat Pumps

Replace standard efficiency heat pumps with high efficiency heat pumps. A higher EER or SEER rating indicates a more efficient cooling system and a higher HPSF rating indicates more efficient heating mode. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average heating and cooling loads, and the estimated annual operating hours. This measure evaluates the potential impact of replacing the RTU with electric heat duct with a packaged air-source heat pump.

4.6 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**775**	**$6,695**	**$84,181**	**$7,366**	**$76,815**	**11.5**	**90,764**
ECM 9	Install High Efficiency Hot Water Boilers	0	0.0	609	$5,262	$63,945	$7,366	$56,579	10.8	71,333
	Install High Efficiency Furnaces	0	0.0	166	$1,433	$20,236	$0	$20,236	14.1	19,431

ECM 9: Install High Efficiency Hot Water Boilers

Replace older inefficient hot water boilers with high efficiency hot water boilers. Energy savings results from improved combustion efficiency and reduced standby losses at low loads. For the purposes of this analysis, we evaluated the replacement of boilers on a one-for-one basis with equipment of the same capacity.

The most notable efficiency improvement is condensing hydronic boilers which can achieve over 90% efficiency under the proper conditions. Condensing hydronic boilers typically operate at efficiencies between 85% and 87% (comparable to other high efficiency boilers) when the return water temperature is above 130°F. The boiler efficiency increases as the return water temperature drops below 130°F. Therefore, condensing hydronic boilers are evaluated when the return water temperature is less than 130°F during most of the operating hours.

Considerations/Sensitivities: We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load at this facility. In many cases installing multiple modular boilers rather than one or two large boilers will result in higher overall plant efficiency while providing additional system redundancy. We also recommend working with your mechanical design team to determine whether the heating system can operate with return water temperatures below 130°F, which would allow the use of condensing boilers.

Install High Efficiency Furnaces

Replace standard efficiency furnaces with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases which can significantly improve furnace efficiency. Savings result from improved system efficiency.

Note: these units produce acidic condensate that requires proper drainage.

This measure is part of a measure to replace package units at this site and as such must be considered in combination with ECM: Install High Efficiency Air Conditioning Units.

Reasons for not Recommending as a High Priority Measure: The projected payback period for this measure based on the energy savings exceeds the expected useful life of the replacement equipment. The upgrade to high efficiency is not justified by energy savings alone.

Considerations: If the school district moves forward toward implementation of a comprehensive project under the ESIP, we would recommend including this measure.

4.7 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**6**	**$55**	**$2,813**	**$50**	**$2,763**	**49.8**	**752**
	Install High Efficiency Gas-Fired Water Heater	0	0.0	6	$55	$2,813	$50	$2,763	49.8	752

Install High Efficiency Gas-Fired Water Heater

Replace the existing tank water heater with a high efficiency tank water heater. Energy savings result from the increased efficiency of the unit, which uses less gas to heat water, and fewer operating hours to maintain the tank water temperature.

Reasons for not Recommending as a High Priority Measure: The projected payback period for this measure based on the energy savings exceeds the expected useful life of the replacement equipment. The upgrade to high efficiency is not justified by energy savings alone.

Considerations: If the school district moves forward toward implementation of a comprehensive project under the ESIP, we would recommend including this measure.

4.8 Food Service & Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**7,969**	**0.9**	**0**	**$967**	**$8,002**	**$0**	**$8,002**	**8.3**	**8,025**
	Replace Refrigeration Equipment	6,357	0.7	0	$771	$7,772	$0	$7,772	10.1	6,402
ECM 10	Vending Machine Control	1,612	0.2	0	$196	$230	$50	$180	0.9	1,623

Replace Refrigeration Equipment

Replace existing refrigerator and freezer chests with new ENERGY STAR® rated equipment. The energy savings associated with this measure come from reduced energy usage, due to more efficient technology, and reduced run times.

Reasons for not Recommending as a High Priority Measure: The projected payback period for this measure based on the energy savings exceeds the expected useful life of the replacement equipment. The upgrade to high efficiency is not justified by energy savings alone.

Considerations: If the school district moves forward toward implementation of a comprehensive project under the ESIP, we would recommend including this measure.

ECM 10: Vending Machine Control

Vending machines operate continuously, even during unoccupied hours. Install occupancy sensor controls to reduce energy use. These controls power down vending machines when the vending machine area has been vacant for some time, and, they power up the machines at necessary regular intervals or when the surrounding area is occupied. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines.

5 Energy Efficient Best Practices

A whole building maintenance plan will extend equipment life; improve occupant comfort, health, and safety; and reduce energy and maintenance costs. You may already be doing some of these things— see our list below for potential additions to your maintenance plan. Be sure to consult with qualified equipment specialists for details on proper maintenance and system operation.

Energy Tracking with ENERGY STAR® Portfolio Manager®

You've heard it before - you can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions.[4] Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Weatherization

Caulk or weather strip leaky doors and windows to reduce drafts and loss of heated or cooled air. Sealing cracks and openings can reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

Doors and Windows

Close exterior doors and windows in heated and cooled areas. Leaving doors and windows open leads to a loss of heat during the winter and chilled air during the summer. Reducing air changes per hour (ACH) can lead to increased occupant comfort as well as heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

Window Treatments/Coverings

Use high-reflectivity films or cover windows with shades or shutters to reduce solar heat gain and reduce the load on cooling and heating systems. Older, single pane windows and east or west-facing windows are especially prone to solar heat gain. In addition, use shades or shutters at night during cold weather to reduce heat loss.

Lighting Maintenance

Clean lamps, reflectors and lenses of dirt, dust, oil, and smoke buildup every six to twelve months. Light levels decrease over time due to lamp aging, lamp and ballast failure, and buildup of dirt and dust. Together, this can reduce total light output by up to 60% while still drawing full power.

[4] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager.

In addition to routine cleaning, developing a maintenance schedule can ensure that maintenance is performed regularly, and it can reduce the overall cost of fixture re-lamping and re-ballasting. Group re-lamping and re-ballasting maintains lighting levels and minimizes the number of site visits by a lighting technician or contractor, decreasing the overall cost of maintenance.

Motor Maintenance

Motors have many moving parts. As these parts degrade over time, the efficiency of the motor is reduced. Routine maintenance prevents damage to motor components. Routine maintenance should include cleaning surfaces and ventilation openings on motors to prevent overheating, lubricating moving parts to reduce friction, inspecting belts and pulleys for wear and to ensure they are at proper alignment and tension, and cleaning and lubricating bearings. Consult a licensed technician to assess these and other motor maintenance strategies.

Fans to Reduce Cooling Load

Install ceiling fans to supplement your cooling system. Thermostat settings can typically be increased by 4°F with no change in overall occupant comfort due to the wind chill effect of moving air.

Destratification Fans

For areas with high ceilings, destratification fans f air balance the air temperature from floor to ceiling. They help reduce the recovery time needed to warm the space after nightly temperature setbacks and will increase occupants' the comfort level.

Areas with high ceilings require the heating system to heat a larger volume of space than that which is occupied. As the warm air rises, the warmest space is at the ceiling level, rather than floor level. Higher temperatures at the ceiling accelerate heat loss through the roof, which requires additional energy consumption by the heating equipment to compensate for this accelerated heat transfer.

Economizer Maintenance

Economizers can significantly reduce cooling system load. A malfunctioning economizer can increase the amount of heating and mechanical cooling required by introducing excess amounts of cold or hot outside air. Common economizer malfunctions include broken outdoor thermostat or enthalpy control, or dampers that are stuck or improperly adjusted.

Periodic inspection and maintenance will keep economizers working in sync with the heating and cooling system. This maintenance should be part of annual system maintenance, and it should include proper setting of the outdoor thermostat/enthalpy control, inspection of control and damper operation, lubrication of damper connections, and adjustment of minimum damper position.

AC System Evaporator/Condenser Coil Cleaning

Dirty evaporator and condenser coils restrict air flow and restrict heat transfer. This increases the loads on the evaporator and condenser fan, and decreases overall cooling system performance. Keeping the coils clean allows the fans and cooling system to operate more efficiently.

HVAC Filter Cleaning and Replacement

Air filters should be checked regularly (often monthly) and cleaned or replaced when appropriate. Air filters reduce indoor air pollution, increase occupant comfort, and help keep equipment operating efficiently. If the building has a building management system, consider installing a differential pressure switch across filters to send an alarm about premature fouling or overdue filter replacement. Over time, filters become less and less effective as particulate buildup increases. Dirty filters also restrict air flow through the air conditioning or heat pump system, which increases the load on the distribution fans.

Duct Sealing

Duct leakage in commercial buildings can account for five to twenty-five percent of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building wasting conditioned air. Eliminating duct leaks can improve ventilation system performance and reduce heating and cooling system operation.

Boiler Maintenance

Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to keeping the heating system running efficiently and preventing expensive repairs. Annual tune-ups should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is operating safely. Boilers should be cleaned according to the manufacturer's instructions to remove soot and scale from the water side or fire side of the boiler.

Furnace Maintenance

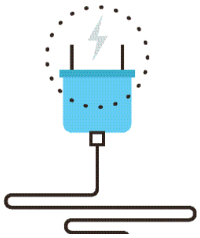
Preventative maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. Following the manufacturer's instructions, a yearly tune-up should: check for gas / carbon monoxide leaks; change the air and fuel filters; check components for cracks, corrosion, dirt, or debris build-up; ensure the ignition system is working properly; test and adjust operation and safety controls; inspect electrical connections; and lubricate motors and bearings.

Water Heater Maintenance

Preventative maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. At least once a year, follow manufacturer instructions to drain a few gallons out of the water heater using the drain valve. If there is a lot of sediment or debris, then a full flush is recommended. Turn the temperature down and then completely drain the tank. Annual checks should include checks for:

- Leaks or heavy corrosion on the pipes and valves.
- Corrosion or wear on the gas line and on the piping. If you noticed any black residue, soot, or charred metal, this is a sign you may be having combustion issues and you should have the unit serviced by a professional.
- For electric water heaters, look for signs of leaking such as rust streaks or residue around the upper and lower panels covering the electrical components on the tank.
- For water heaters more than three years old, have a technician inspect the sacrificial anode annually.

Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips[5]. Your local utility may offer incentives or rebates for this equipment.

Computer Power Management Software

Many computers consume power during nights, weekends, and holidays. Screen savers are commonly confused as a power management strategy. This contributes to avoidable, excessive electrical energy consumption. There are innovative power management software packages available that are designed to deliver significant energy saving and provide ongoing tracking measurements. A central power management platform helps enforce energy savings policies as well as identify and eliminate underutilized devices

Water Conservation

Installing dual flush or low-flow toilets and low-flow/waterless urinals are ways to reduce water use. The EPA WaterSense™ ratings for urinals is 0.5 gallons per flush (gpf) and for flush valve toilets is 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

For more information regarding water conservation go to the EPA's WaterSense™ website[6] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[7] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Water conservation devices that do not reduce hot water consumption will not provide energy savings at the site level, but they may significantly affect your water and sewer usage costs. Any reduction in water use does however ultimately reduce grid-level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users.

If the facility has detached buildings with a master water meter for the entire campus, check for unnatural wet areas in the lawn or water seeping in the foundation at water pipe penetrations through the foundation. Periodically check overnight meter readings when the facility is unoccupied, and there is no other scheduled water usage.

Manage irrigation systems to use water more effectively outside the building. Adjust spray patterns so that water lands on intended lawns and plantings and not on pavement and walls. Consider installing an evapotranspiration irrigation controller that will prevent over-watering.

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[5] For additional information refer to "Plug Load Best Practices Guide" http://www.advancedbuildings.net/plug-load-best-practices-guide-offices.

[6] https://www.epa.gov/watersense.

[7] https://www.epa.gov/watersense/watersense-work-0.

Procurement Strategies

Purchasing efficient products reduces energy costs without compromising quality. Consider modifying your procurement policies and language to require ENERGY STAR® or WaterSense™ products where available.

6 On-site Generation

You don't have to look far in New Jersey to see one of the thousands of solar electric systems providing clean power to homes, businesses, schools, and government buildings. On-site generation includes both renewable (e.g., solar, wind) and non-renewable (e.g., fuel cells) technologies that generate power to meet all or a portion of the facility's electric energy needs. Also referred to as distributed generation, these systems contribute to greenhouse gas (GHG) emission reductions, demand reductions and reduced customer electricity purchases reduction, which results in improved electric grid reliability through better use of transmission and distribution systems.

Preliminary screenings were performed to determine if an on-site generation measure could be a cost-effective solution for your facility. Before deciding to install an on-site generation system, we recommend conducting a feasibility study to analyze existing energy profiles, siting, interconnection, and the costs associated with the generation project including interconnection costs, departing load charges, and any additional special facilities charges.

6.1 Solar Photovoltaic

Photovoltaic (PV) panels convert sunlight into electricity. Individual panels are combined into an array that produces direct current (DC) electricity. The DC is converted to alternating current (AC) through an inverter. The inverter is then connected to the building's electrical distribution system.

A preliminary screening based on the facility's electric demand, size and location of free area, and shading elements shows that the facility has a **high** potential for installing a PV array.

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the high potential. A PV array located on the roof may be feasible. If you are interested in pursuing the installation of PV, we recommend conducting a full feasibility study.

The graphic below displays the results of the PV potential screening conducted as a part of this audit. The position of each slider indicates the potential (potential increases to the right) that each factor contributes to the overall site potential.

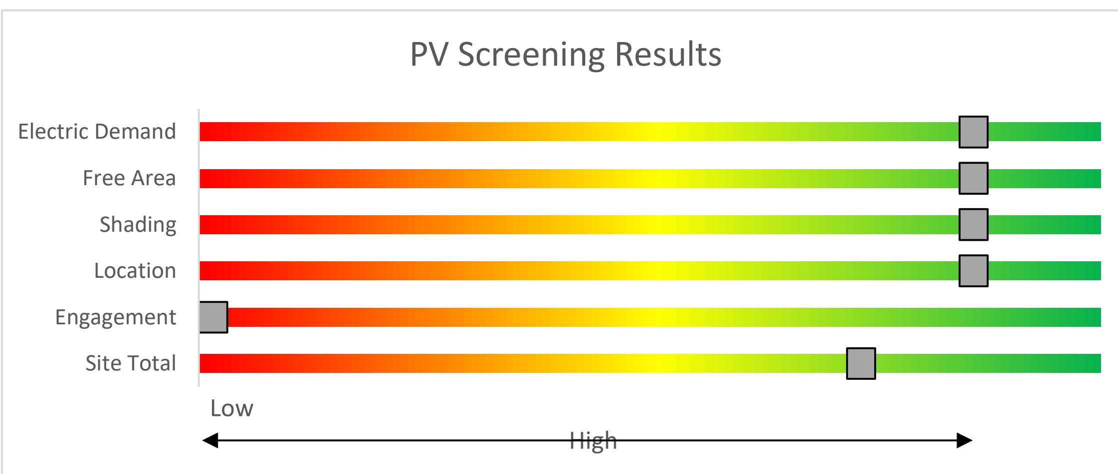

Figure 9 - Photovoltaic Screening

Solar Renewable Energy Certificate (SREC) Registration Program (SRP)

Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the SREC Registration Program (SRP) before starting construction. Once your PV system is up and running, you periodically earn credits, which can then be sold on the open market for up to 15 years.

If you are considering installing solar photovoltaics on your building, visit www.njcleanenergy.com/srec for more information about the SREC Registration Program.

Get more information about solar power in New Jersey or find a qualified solar installer who can help you decide if solar is right for your building:

- **Basic Info on Solar PV in NJ**: www.njcleanenergy.com/whysolar
- **NJ Solar Market FAQs**: www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs
- **Approved Solar Installers in the NJ Market**: www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/?id=60&start=1

6.2 Combined Heat and Power

Combined heat and power (CHP) generates electricity at the facility and puts waste heat energy to good use. Common types of CHP systems are reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines.

CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for space cooling.

The key criteria used for screening is the amount of time that the CHP system would operate at full load and the facility's ability to use the recovered heat. Facilities with a continuous need for large quantities of waste heat are the best candidates for CHP.

A preliminary screening based on heating and electrical demand, siting, and interconnection shows that the facility has **no** potential for installing a cost-effective CHP system.

Based on a preliminary analysis, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation. The lack of gas service, low or infrequent thermal load, and lack of space for siting the equipment are the most significant factors contributing to the lack of CHP potential.

The graphic below displays the results of the CHP potential screening conducted as a part of this audit. The position of each slider indicates the potential (potential increases to the right) that each factor contributes to the overall site potential.

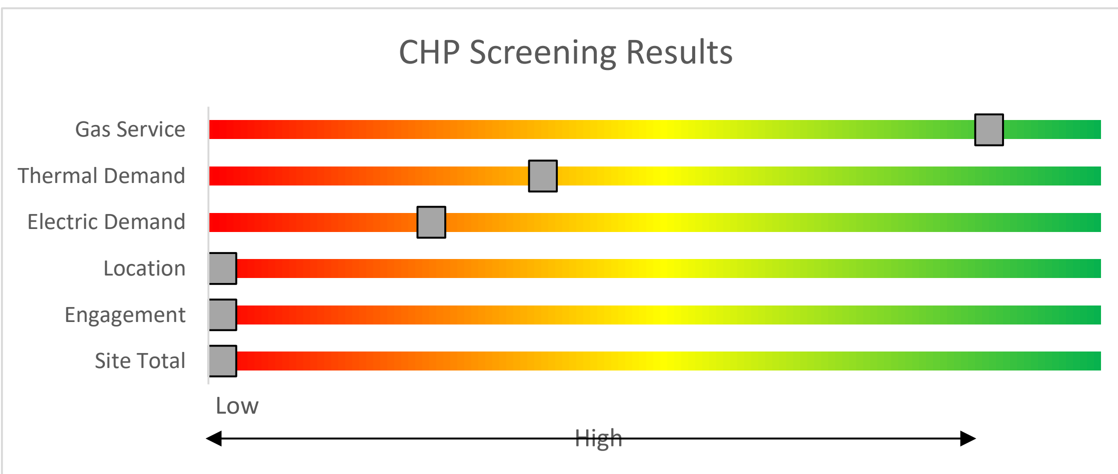

Figure 10 - Combined Heat and Power Screening

7 Project Funding and Incentives

Ready to improve your building's performance? NJ Clean Energy Programs can help. Pick the program that works best for you. Incentive programs that may apply to this facility are identified in the Executive Summary. This section provides an overview of currently available NJ Clean Energy Programs.

	SmartStart *Flexibility to install at your own pace*	**Direct Install** *Turnkey installation*	**Pay for Performance** *Whole building upgrades*
Who should use it?	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together. Average peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. Peak demand should be over 200 kW.
How does it work?	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
What are the Incentives?	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to $125,000 per project. You pay the remaining 30% directly to the contractor.	Up to 25% of installation cost, calculated based on level of energy savings per square foot.
How do I participate?	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified Partner to develop your Energy Reduction Plan and set your energy savings targets.
Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor.			

7.1 SmartStart

SmartStart offers incentives for installing prescriptive and custom energy efficiency measures at your facility. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades. This program serves most common equipment types and sizes.

SmartStart routinely adds, removes, or modifies incentives from year-to-year for various energy efficiency equipment based on market trends and new technologies.

Equipment with Prescriptive Incentives Currently Available:

Electric Chillers
Electric Unitary HVAC
Gas Cooling
Gas Heating
Gas Water Heating
Ground Source Heat Pumps
Lighting
Lighting Controls
Refrigeration Doors
Refrigeration Controls
Refrigerator/Freezer Motors
Food Service Equipment
Variable Frequency Drives

Incentives

The SmartStart Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type.

SmartStart Custom provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives. Custom incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings. Incentives are capped at 50% of the total installed incremental project cost, or a project cost buy down to a one-year payback (whichever is less). Program incentives are capped at $500,000 per electric account and $500,000 per natural gas account, per fiscal year.

How to Participate

Submit an application for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. You can work with your preferred contractor or use internal staff to install measures.

Visit www.njcleanenergy.com/SSB for a detailed program description, instructions for applying, and applications.

7.2 Direct Install

Direct Install is a turnkey program available to existing small to medium-sized facilities with an average peak electric demand that does not exceed 200 kW over the recent 12-month period. You work directly with a pre-approved contractor who will perform a free energy assessment at your facility, identify specific eligible measures, and provide a clear scope of work for installation of selected measures. Energy efficiency measures may include lighting and lighting controls, refrigeration, HVAC, motors, variable speed drives and controls.

Incentives

The program pays up to 70% of the total installed cost of eligible measures, up to $125,000 per project. Each entity is limited to incentives up to $250,000 per fiscal year.

How to Participate

To participate in Direct Install, you will need to contact the participating contractor assigned to the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the Direct Install website linked below. The contractor will be paid the measure incentives directly by the program which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

Detailed program descriptions and applications can be found at: www.njcleanenergy.com/DI.

7.3 Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) serves New Jersey's government agencies by financing energy projects. An ESIP is a type of performance contract, whereby school districts, counties, municipalities, housing authorities and other public and state entities enter in to contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive for the life of the contract.

ESIP provides government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources. NJCEP incentive programs described above can also be used to help further reduce the total project cost of eligible measures.

How to Participate

This LGEA report is the first step to participating in ESIP. Next, you will need to select an approach for implementing the desired ECMs:

(1) Use an energy services company or "ESCO."

(2) Use independent engineers and other specialists, or your own qualified staff, to provide and manage the requirements of the program through bonds or lease obligations.

(3) Use a hybrid approach of the two options described above where the ESCO is used for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

After adopting a resolution with a chosen implementation approach, the development of the Energy Savings Plan (ESP) can begin. The ESP demonstrates that the total project costs of the ECMs are offset by the energy savings over the financing term, not to exceed 15 years. The verified savings will then be used to pay for the financing.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Carefully consider all alternatives to develop an approach that best meets your needs. A detailed program descriptions and application can be found at: www.njcleanenergy.com/ESIP.

ESIP is a program delivered directly by the NJBPU and is not an NJCEP incentive program. As mentioned above, you can use NJCEP incentive programs to help further reduce costs when developing the energy savings plan. Refer to the ESIP guidelines at the link above for further information and guidance on next steps.

7.4 SREC Registration Program

The SREC (Solar Renewable Energy Certificate) Registration Program (SRP) is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects *must* register their projects prior to the start of construction to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing.

After the registration is accepted, construction is complete, and final paperwork has been submitted and is deemed complete, the project is issued a New Jersey certification number, which enables it to generate New Jersey SRECs. SREC's are generated once the solar project has been authorized to be energized by the Electric Distribution Company (EDC).

Each time a solar installation generates 1,000 kilowatt-hours (kWh) of electricity, an SREC is earned. Solar project owners report the energy production to the SREC Tracking System. This reporting allows SREC's to be placed in the customer's electronic account. SRECs can then be sold on the SREC Tracking System, providing revenue for the first 15 years of the project's life.

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar Renewable Portfolio Standard. Purchasing SRECs can help them meet those requirements. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period fluctuates depending on supply and demand.

Information about the SRP can be found at: www.njcleanenergy.com/srec.

8 Energy Purchasing and Procurement Strategies

8.1 Retail Electric Supply Options

Energy deregulation in New Jersey has increased energy buyers' options by separating the function of electricity distribution from that of electricity supply. So, though you may choose a different company from which to buy your electric power, responsibility for your facility's interconnection to the grid and repair to local power distribution will still reside with the traditional utility company serving your region.

If your facility is not purchasing electricity from a third-party supplier, consider shopping for a reduced rate from third-party electric suppliers. If your facility already buys electricity from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party electric suppliers is available at the NJBPU website[8].

8.2 Retail Natural Gas Supply Options

The natural gas market in New Jersey is also deregulated. Most customers that remain with the utility for natural gas service pay rates that are market-based and that fluctuate monthly. The utility provides basic gas supply service (BGSS) to customers who choose not to buy from a third-party supplier for natural gas commodity.

A customer's decision about whether to buy natural gas from a retail supplier typically depends on whether a customer prefers budget certainty and/or longer-term rate stability. Customers can secure longer-term fixed prices by signing up for service through a third-party retail natural gas supplier. Many larger natural gas customers may seek the assistance of a professional consultant to assist in their procurement process.

If your facility does not already purchase natural gas from a third-party supplier, consider shopping for a reduced rate from third-party natural gas suppliers. If your facility already purchases natural gas from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party natural gas suppliers is available at the NJBPU website[9].

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[8] www.state.nj.us/bpu/commercial/shopping.html.

[9] www.state.nj.us/bpu/commercial/shopping.html.

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Main Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	97	0	$12	$73	$20	4.6
Basement	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	1,000	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,000	0.0	12	0	$1	$18	$5	9.0
Boiler Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.0	47	0	$6	$73	$20	9.5
Boiler Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	1,000	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,000	0.0	12	0	$1	$18	$5	9.0
Storage	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,000	2	Relamp	No	8	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,000	0.2	318	0	$38	$584	$160	11.3
Stock Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	2	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.1	141	0	$17	$219	$60	9.5
Stairwell	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.1	244	0	$29	$183	$50	4.6
Cafeteria	10	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,080	2, 3	Relamp	Yes	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,435	0.3	930	0	$110	$818	$185	5.7
Kitchen	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.1	195	0	$23	$146	$40	4.6
Vestibule	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,080	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,080	0.0	26	0	$3	$18	$5	4.3
Hallway	30	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,080	2	Relamp	No	30	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,080	0.3	775	0	$92	$548	$150	4.3
Lounge	18	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	O	32	2,080	2	Relamp	No	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,080	0.2	465	0	$55	$329	$90	4.3
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	97	0	$12	$73	$20	4.6
Restroom	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,080	0.0	43	0	$5	$72	$10	12.3
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	97	0	$12	$73	$20	4.6
Restroom	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,080	0.0	43	0	$5	$72	$10	12.3
Classroom #9	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	496	0	$59	$562	$115	7.6
Auditoriuim	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,080	2	Relamp	No	8	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,080	0.2	585	0	$69	$438	$120	4.6
Auditoriuim	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.3	780	0	$92	$584	$160	4.6
Stage	128	Incandescent: Screw in Lamp	Wall Switch	S	60	500	2	Relamp	No	128	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	500	3.3	2,317	-1	$275	$2,205	$128	7.6
Hallway	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 4	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,435	0.3	868	0	$103	$911	$140	7.5
Classroom #8	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	496	0	$59	$562	$115	7.6
Classroom #7	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.1	372	0	$44	$489	$95	8.9
Office #6B	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.1	186	0	$22	$380	$65	14.3
Classroom #6	30	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	30	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.6	1,860	-1	$221	$1,635	$370	5.7

Location	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restroom	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	O	29	1,435		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.0	0	0	$0	$0	$0	0.0
Restroom	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	O	29	1,435		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.0	0	0	$0	$0	$0	0.0
Classroom #5	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	O	62	2,080	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.3	744	0	$88	$708	$155	6.3
Classroom #4	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	O	62	2,080	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.1	248	0	$29	$416	$75	11.6
Classroom #3	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	O	62	2,080	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	620	0	$74	$635	$135	6.8
Classroom #2	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	O	62	2,080	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	620	0	$74	$635	$135	6.8
Classroom #1	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	O	62	2,080	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	496	0	$59	$562	$115	7.6
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	1,000	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,000	0.0	12	0	$1	$18	$5	9.0
Gym	16	Linear Fluorescent - T8: 4' T8 (32W) - 6L	Wall Switch	S	176	2,080	2, 3	Relamp	Yes	16	LED - Linear Tubes: (6) 4' Lamps	Occupancy Sensor	87	1,435	0.9	2,740	-1	$325	$2,293	$550	5.4
Office/Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.0	23	0	$3	$37	$10	9.5
Hallway	4	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,080	2	Relamp	No	4	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,080	0.0	103	0	$12	$73	$20	4.3
Speech Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.1	372	0	$44	$335	$80	5.8
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	49	0	$6	$37	$10	4.6
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	S	22	2,080	2	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	2,080	0.0	20	0	$2	$16	$3	5.6
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	S	22	2,080	2	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	2,080	0.0	20	0	$2	$16	$3	5.6
Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,000	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,000	0.0	40	0	$5	$73	$20	11.3
Nurse's Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	97	0	$12	$73	$20	4.6
Classroom #10	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	88	2,080	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.1	425	0	$50	$708	$155	11.0
Classroom #11	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	88	2,080	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.1	425	0	$50	$708	$155	11.0
Hallway	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 4	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,435	0.1	310	0	$37	$383	$50	9.0
Server Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	1,000	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,000	0.0	12	0	$1	$18	$5	9.0
Restroom	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	O	29	1,435		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.0	0	0	$0	$0	$0	0.0
Restroom	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	O	29	1,435		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.0	0	0	$0	$0	$0	0.0
2nd Floor Hallway	25	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 4	Relamp	Yes	25	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,435	0.5	1,550	-1	$184	$1,713	$250	8.0
Library	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.4	1,240	0	$147	$1,000	$235	5.2

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Library	17	Incandescent: Screw in Lamp	Wall Switch	S	90	1,000	2	Relamp	No	17	LED Screw-In Lamps: Screw in Lamp	Wall Switch	14	1,000	0.6	917	0	$109	$823	$34	7.3
Storage	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	S	22	2,080	2	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	2,080	0.0	20	0	$2	$16	$3	5.6
Classroom #21	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.3	744	0	$88	$708	$155	6.3
Art Classroom #22	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.3	744	0	$88	$708	$155	6.3
Classroom #23	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	620	0	$74	$635	$135	6.8
Classroom #24	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	620	0	$74	$635	$135	6.8
Classroom #25	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	620	0	$74	$635	$135	6.8
Classroom #26	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	620	0	$74	$635	$135	6.8
Restroom	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	O	58	1,435		None	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.0	0	0	$0	$0	$0	0.0
Restroom	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	O	58	1,435		None	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.0	0	0	$0	$0	$0	0.0
Entrance	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	97	0	$12	$73	$20	4.6
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	97	0	$12	$73	$20	4.6
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	S	22	2,080	2	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	2,080	0.0	20	0	$2	$16	$3	5.6
Classroom #27	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.2	656	0	$78	$708	$155	7.1
Classroom #28	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.2	656	0	$78	$708	$155	7.1
Classroom #29	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.2	656	0	$78	$708	$155	7.1
Classroom #30	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.2	656	0	$78	$708	$155	7.1
Classroom #31	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.2	656	0	$78	$708	$155	7.1
Stairwell	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.1	244	0	$29	$183	$50	4.6
Transition Spaces	20	Exit Signs: LED - 2 W Lamp	None	S	6	8,760		None	No	20	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Exterior	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	S	21	4,380		None	No	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	21	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior	1	High-Pressure Sodium: (1) 400W Lamp	Timeclock	S	465	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	120	4,380	0.0	1,511	0	$183	$966	$100	4.7
Exterior	2	High-Pressure Sodium: (1) 70W Lamp	Timeclock	S	95	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Other	Timeclock	29	4,380	0.0	578	0	$70	$397	$10	5.5
Exterior	2	Metal Halide: (1) 70W Lamp	Timeclock	S	95	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Other	Timeclock	29	4,380	0.0	578	0	$70	$397	$10	5.5

Motor Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Remaining Useful Life	Annual Operating Hours	Proposed Conditions: ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Hydronic Heating	1	Heating Hot Water Pump	10.0	91.7%	No	W	1,696	5, 7	Yes	91.7%	Yes	1	1.0	5,172	0	$628	$5,152	$0	8.2
Boiler Room	Hydronic Heating	1	Heating Hot Water Pump	10.0	91.7%	No	W	1,696	5, 7	Yes	91.7%	Yes	1	1.0	5,172	0	$628	$5,152	$0	8.2
Boiler Room	Boiler Burners	2	Combustion Air Fan	0.5	74.0%	No	W	1,373		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Gas Fired RTUs	2	Supply Fan	15.0	91.0%	No	W	1,696	5, 6	Yes	93.0%	Yes	2	8.8	16,242	0	$1,971	$14,082	$2,400	5.9
Roof	RTU w/Electric Heat	1	Supply Fan	5.0	78.8%	No	B	1,373	5, 6	Yes	88.5%	Yes	1	1.7	2,921	0	$354	$4,130	$400	10.5
Cafeteriia	Unit Ventilators	6	Supply Fan	0.2	74.0%	No	W	2,745		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Classrooms & Offices	Unit Ventilators	26	Supply Fan	0.1	74.0%	No	W	2,745		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0

Electric HVAC Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Remaining Useful Life	Proposed Conditions: ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof	Few Rooms	1	Packaged Air-Source HP	15.00	122.94	B	8	Yes	1	Packaged Air-Source HP	15.00	122.94	13.00	3.60	2.3	75,732	0	$9,189	$24,714	$1,185	2.6
Roof	Few Rooms	1	Packaged AC	5.00		W	NR	Yes	1	Packaged AC	5.00		14.00		0.9	1,233	0	$150	$667	$460	1.4
Roof	Few Rooms	1	Packaged AC	3.33		W	NR	Yes	1	Packaged AC	3.33		14.00		0.6	822	0	$100	$444	$307	1.4
Roof	Split AC System for Server Room	1	Split-System AC	2.00		B	NR	Yes	1	Split-System AC	2.00		14.00		0.5	1,985	0	$241	$2,992	$184	11.7
Main Office	Main Office	1	Window AC	2.00			NR	Yes	1	Window AC	2.00		12.00		0.4	572	0	$69	$2,178	$0	31.4
Lounge	Lounge	1	Window AC	2.00			NR	Yes	1	Window AC	2.00		12.00		0.1	198	0	$24	$2,178	$0	90.4
Office	Office	1	Window AC	1.50			NR	Yes	1	Window AC	1.50		12.00		0.3	429	0	$52	$1,633	$0	31.4
Library	Library	1	Window AC	2.00			NR	Yes	1	Window AC	2.00		12.00		0.5	695	0	$84	$2,178	$0	25.8
Office	Office	1	Window AC	1.50			NR	Yes	1	Window AC	1.50		12.00		0.3	429	0	$52	$1,633	$0	31.4
Classroom	Classroom	1	Window AC	1.83			NR	Yes	1	Window AC	1.83		12.00		0.1	182	0	$22	$1,996	$0	90.4
Classroom	Classroom	1	Window AC	1.83			NR	Yes	1	Window AC	1.83		12.00		0.4	524	0	$64	$1,996	$0	31.4

Fuel Heating Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	System Type	Output Capacity per Unit (MBh)	Remaining Useful Life	Proposed Conditions: ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Hydronic Heating System	1	Non-Condensing Hot Water Boiler	######	W	9	Yes	1	Condensing Hot Water Boiler	######	91.00%	Et	0.0	0	305	$2,631	$31,972	$3,683	10.8
Boiler Room	Hydronic Heating System	1	Non-Condensing Hot Water Boiler	######	W	9	Yes	1	Condensing Hot Water Boiler	######	91.00%	Et	0.0	0	305	$2,631	$31,972	$3,683	10.8
Roof	Gas Fired RTU	1	Furnace	480.00	W	NR	Yes	1	Furnace	480.00	95.00%	AFUE	0.0	0	100	$860	$12,142	$0	14.1
Roof	Gas Fired RTU	1	Furnace	320.00	W	NR	Yes	1	Furnace	320.00	95.00%	AFUE	0.0	0	66	$573	$8,094	$0	14.1

DHW Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	System Type	Remaining Useful Life	Proposed Conditions: ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	Original Restrooms and Kitchen	1	Storage Tank Water Heater (≤ 50 Gal)	B	NR	Yes	1	Storage Tank Water Heater (≤ 50 Gal)	Natural Gas	95.00%	EF	0.0	0	6	$55	$2,813	$50	49.8
Rennovated Restrooms	Rennovated Restrooms	6	Tankless Water Heater	N		No						0.0	0	0	$0	$0	$0	0.0

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Cafeteria	2	Refrigerator Chest	No	NR	Yes	0.2	2,013	0	$244	$4,233	$0	17.3
Cafeteria	1	Refrigerator Chest	No	NR	Yes	0.1	1,020	0	$124	$1,554	$0	12.6
Kitchen	1	Stand-Up Freezer, Solid Door (16 - 30 cu. ft.)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Freezer Chest	No	NR	Yes	0.4	3,324	0	$403	$1,985	$0	4.9

Cooking Equipment Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	High Efficiency Equipement?	ECM #	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Gas Convection Oven (Full Size)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Combination Oven/Steam Cooker (<15 Pans)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (1/2 Size)	Yes		No	0.0	0	0	$0	$0	$0	0.0

Plug Load Inventory

	Existing Conditions			
Location	**Quantity**	**Equipment Description**	**Energy Rate (W)**	**ENERGY STAR Qualified?**
Wilson School	38	Desktop Computer	120.0	
Wilson School	30	Laptops	90.0	
Wilson School	38	Fan	100.0	
Wilson School	29	TV	150.0	
Wilson School	24	Smart Board / Projector	300.0	
Wilson School	4	Small Office Printers	50.0	
Wilson School	2	Large Xerox- Type Printers	515.0	
Wilson School	3	Coffee Maker	400.0	
Wilson School	3	Microwave	1,100.0	
Wilson School	1	Residential Refrigerator	690.0	
Wilson School	2	Mini Fridge	260.0	
Wilson School	3	Large Floor Fans	185.0	
Wilson School	4	Speakers	100.0	
Wilson School	1	Misc. Sound Equipment	3,500.0	
Wilson School	1	Misc. IT Equipment	4,500.0	

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Lounge	1	Refrigerated	10	Yes	0.2	1,612	0	$196	$230	$50	0.9
Lounge	1	Non-Refrigerated	N/A	No	0.0	0	0	$0	$0	$0	0.0

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

EUI is presented in terms of *site energy* and *source energy*. Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

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ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Wilson School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 54,150
Built: 1929

For Year Ending: February 28, 2018
Date Generated: October 02, 2018

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address
Wilson School
65 Dane Street
Sayreville, New Jersey 08872

Property Owner
Sayreville Board of Education
3198 Washington Rd
Sayreville, NJ 08871
(___)____-______

Primary Contact
Erin Hill
3198 Washington Rd
Sayreville, NJ 08871
732-525-5204
Erin.Hill@sayrevillek12.net

Property ID: 6563195

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
85.3 kBtu/ft²

Source EUI
124.6 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	3,532,881 (76%)
Electric - Grid (kBtu)	1,084,267 (24%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	59.7
National Median Source EUI (kBtu/ft²)	87.2
% Diff from National Median Source EUI	43%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	298

Signature & Stamp of Verifying Professional

I ________________ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: ____________________ Date: __________

Licensed Professional

____ ________

,
(___)____-______

____

Professional Engineer Stamp
(if applicable)

Appendix C: Glossary

TERM	DEFINITION
Blended Rate	Used to calculate financial savings. The blended rate is calculated by dividing the amount of your bill by the total energy use. For example, if your bill is $22,217.22, and you used 266,400 kilowatt-hours, your blended rate is 8.3 cents per kilowatt-hour.
BTU	A British thermal unit is the amount of heat required to increase the temperature of one pound water by one-degree Fahrenheit. Commonly used to measure natural gas consumption.
Demand Response	Demand response reduces or shifts electricity usage at or among participating buildings/sites during peak energy use periods in response to time-based rates or other forms of financial incentives.
Energy Efficiency	Reducing the amount of energy necessary to provide comfort and service to a building/area. Achieved through the installation of new equipment and/or optimizing energy management systems.
Generation	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
HVAC	Heating, ventilation, and air conditioning.
kW	Kilowatt. Equal to 1,000 Watts.
Load	The total amount of power used by a building system at any given time.
Measure	A single activity, or installation of a single type of equipment, that is implemented in a building system to reduce total energy consumption.
MMBtu	One million British thermal units.
psig	Pounds per square inch.
Plug Load	Refers to the amount of energy used in a space by products that are powered by means of an ordinary AC plug.
Simple Payback	The amount of time needed to recoup the funds expended in an investment, or to reach the break-even point.
Temperature Setpoint	The temperature at which a temperature regulating device (thermostat, for example) has been set.
Turnkey	Provision of a complete product or service that is ready for immediate use
Watt (W)	Unit of power commonly used to measure electricity use.