Local Government Energy Audit Report

Smith Elementary School

October 14, 2022

Prepared for:
Tenafly Public Schools
101 Downey Drive
Tenafly, New Jersey 07670

Prepared by:
TRC
317 George Street
New Brunswick, New Jersey 08901

Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities and help prioritize specific measures for implementation. 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 reviewed the energy conservation measures and estimates of energy savings 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 material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on selected products and installers. TRC and NJBPU do not guarantee cost estimates and shall in no event be held liable should actual installed costs vary from these material and labor estimates.

Incentive values provided in this report are estimated based of previously run state efficiency programs. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available utility 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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Energy Efficiency Incentive & Rebate Transition

For the purposes of your LGEA, estimated incentives and rebates are included as placeholders for planning purposes. New Jersey utilities are rolling out their own energy efficiency programs, which your project may be eligible for depending on individual measures, quantities, and size of the building.

In 2018, Governor Murphy signed into law the landmark legislation known as the Clean Energy Act. The law called for a significant overhaul of New Jersey's clean energy systems by building sustainable infrastructure in order to fight climate change and reduce carbon emissions, which will in turn create well-paying local jobs, grow the state's economy, and improve public health while ensuring a cleaner environment for current and future residents.

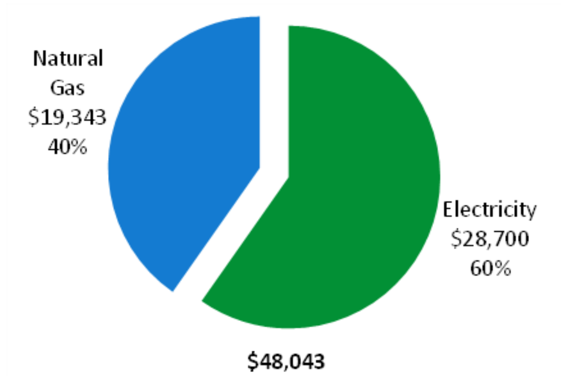
These next generation energy efficiency programs feature new ways of managing and delivering programs historically administered by New Jersey's Clean Energy Program™ (NJCEP). All of the investor-owned gas and electric utility companies will now also offer complementary energy efficiency programs and incentives directly to customers like you. NJCEP will still offer programs for new construction, renewable energy, the Energy Savings Improvement Program (ESIP), and large energy users.

New utility programs are under development. Keep up to date with developments by visiting the NJCEP website.

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Smith Elementary 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 conducted this study as part of a comprehensive effort to assist New Jersey school districts and local governments in controlling their energy costs and to help protect our environment by reducing statewide energy consumption.

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $48,043 Electricity: 196,807 kWh Natural Gas: 24,606 Therms	

ENERGY STAR® Benchmarking Score	55 *(1-100 scale)*	Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance, and lower your energy bills even more.

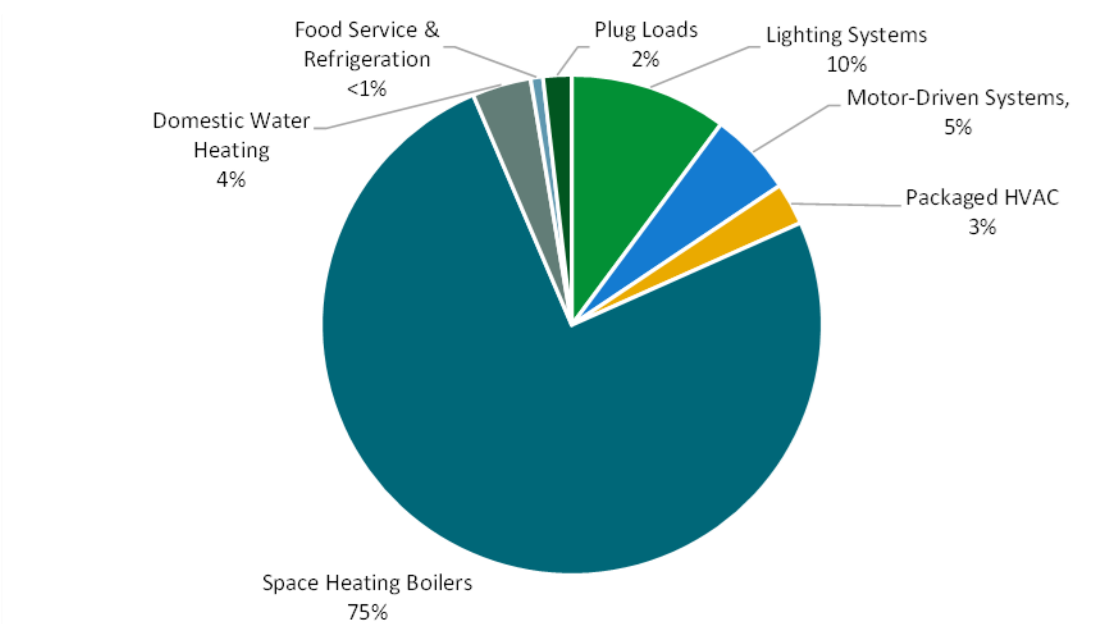


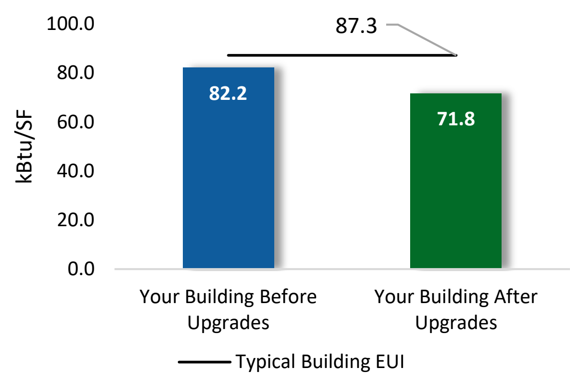
Figure 1 - Energy Use by System

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.

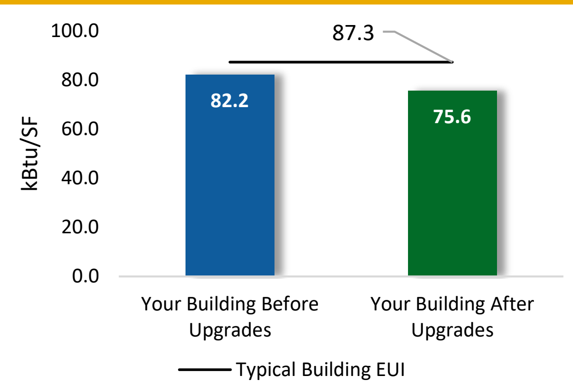
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$160,861
Potential Rebates & Incentives[1]	$18,736
Annual Cost Savings	$12,404
Annual Energy Savings	Electricity: 78,111 kWh Natural Gas: 1,289 Therms
Greenhouse Gas Emission Savings	47 Tons
Simple Payback	11.5 Years
Site Energy Savings (All Utilities)	13%



Scenario 2: Cost Effective Package[2]

Installation Cost	$57,438
Potential Rebates & Incentives	$11,260
Annual Cost Savings	$11,030
Annual Energy Savings	Electricity: 76,170 kWh Natural Gas: -98 Therms
Greenhouse Gas Emission Savings	38 Tons
Simple Payback	4.2 Years
Site Energy Savings (all utilities)	8%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	None

[1] Incentives are based on previously run state rebate programs. Contact your utility provider for current program incentives that 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	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**50,487**	**14.2**	**-10**	**$7,281**	**$28,009**	**$6,136**	**$21,873**	**3.0**	**49,624**
ECM 1	Install LED Fixtures	Yes	648	0.0	0	$95	$412	$100	$312	3.3	653
ECM 2	Retrofit Fixtures with LED Lamps	Yes	49,839	14.2	-10	$7,186	$27,597	$6,036	$21,561	3.0	48,972
Lighting Control Measures			**14,235**	**4.0**	**-3**	**$2,053**	**$13,502**	**$3,780**	**$9,722**	**4.7**	**13,986**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	11,980	3.5	-3	$1,727	$10,802	$1,435	$9,367	5.4	11,770
ECM 4	Install High/Low Lighting Controls	Yes	2,256	0.5	0	$325	$2,700	$2,345	$355	1.1	2,216
Variable Frequency Drive (VFD) Measures			**8,757**	**2.0**	**0**	**$1,277**	**$14,482**	**$1,300**	**$13,182**	**10.3**	**8,818**
ECM 5	Install VFDs on Constant Volume (CV) Fans	Yes	2,824	0.9	0	$412	$3,884	$200	$3,684	8.9	2,844
ECM 6	Install VFDs on Heating Water Pumps	Yes	5,933	1.1	0	$865	$10,598	$1,100	$9,498	11.0	5,974
Unitary HVAC Measures			**1,940**	**1.9**	**0**	**$283**	**$23,199**	**$735**	**$22,464**	**79.4**	**1,954**
ECM 7	Install High Efficiency Air Conditioning Units	No	1,940	1.9	0	$283	$23,199	$735	$22,464	79.4	1,954
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**139**	**$1,091**	**$80,225**	**$6,741**	**$73,484**	**67.4**	**16,250**
ECM 8	Install High Efficiency Hot Water Boilers	No	0	0.0	139	$1,091	$80,225	$6,741	$73,484	67.4	16,250
Domestic Water Heating Upgrade			**229**	**0.0**	**4**	**$61**	**$158**	**$44**	**$114**	**1.9**	**642**
ECM 9	Install Low-Flow DHW Devices	Yes	229	0.0	4	$61	$158	$44	$114	1.9	642
Custom Measures			**2,462**	**0.0**	**0**	**$359**	**$1,287**	**$0**	**$1,287**	**3.6**	**2,479**
ECM 10	Install Heat Pump Water Heater	Yes	2,462	0.0	0	$359	$1,287	$0	$1,287	3.6	2,479
TOTALS (COST EFFECTIVE MEASURES)			**76,170**	**20.1**	**-10**	**$11,030**	**$57,438**	**$11,260**	**$46,178**	**4.2**	**75,550**
TOTALS (ALL MEASURES)			**78,111**	**22.1**	**129**	**$12,404**	**$160,861**	**$18,736**	**$142,125**	**11.5**	**93,754**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

Figure 2 – Evaluated Energy Improvements

For more detail on each evaluated energy improvement and a break out of cost-effective improvements, see **Section 4: Energy Conservation Measures.**

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

Utility-run energy efficiency programs, such as New Jersey's 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.

For details on these programs please visit New Jersey's Clean Energy Program website or contact your utility provider.

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 and Power (CHP)

The CHP program provides incentives for combined heat and power (i.e., 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.

Successor Solar Incentive Program (SuSI)

New Jersey is committed to supporting solar energy. Solar projects help the state reach the renewable goals outlined in the state's Energy Master Plan. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available, but certified solar projects are able to earn one SREC II (Solar Renewable Energy Certificates II) for each megawatt-hour of solar electricity produced from a qualifying solar facility.

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 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.

Large Energy User Program (LEUP)

LEUP designed to promote self-investment in energy efficiency and combined heat and power or fuel cell projects. It incentivizes owners/users of buildings to upgrade or install energy conserving measures in existing buildings to help offset the capital costs associated with the project. The efficiency upgrades are customized to meet the requirements of the customers' existing facilities, while advancing the State's energy efficiency, conservation, and greenhouse gas reduction goals.

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Smith Elementary 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.

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 July 7, 2022, TRC performed an energy audit at Smith Elementary School located in Tenafly, New Jersey. TRC met with Mario Cofini to review the facility operations and help focus our investigation on specific energy-using systems.

Smith Elementary School is a one-story, 38,125 square foot building built in 1958. Spaces include classrooms, offices, gymnasium, library, lounges, kitchen, corridors, restrooms, storage rooms, electrical and mechanical space.

Lighting for the facility is provided mainly by linear fluorescent T8 fixtures. Window air conditioning units and boilers provide cooling and heating to most spaces.

2.2 Building Occupancy

The facility is occupied from September to July, with the school year ending for students in July and restarting in September. The building has limited use on the weekends, and the facility closes at 11:30 PM on weekdays. During a typical day, the facility is occupied by 62 staff and 350 students.

Building Name	Weekday/Weekend	Operating Schedule
Smith Elementary School - General Operating Hours	Weekday	6:30 AM - 11:30 PM
	Weekend	Limited Use
Smith Elementary School - Classes Hours	Weekday	8:30 AM - 3:10 PM
	Weekend	Closed

Figure 3 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are concrete block over structural steel with a brick facade. The roof is flat and partially covered with pebbles over a gray membrane. The roof is in good condition.

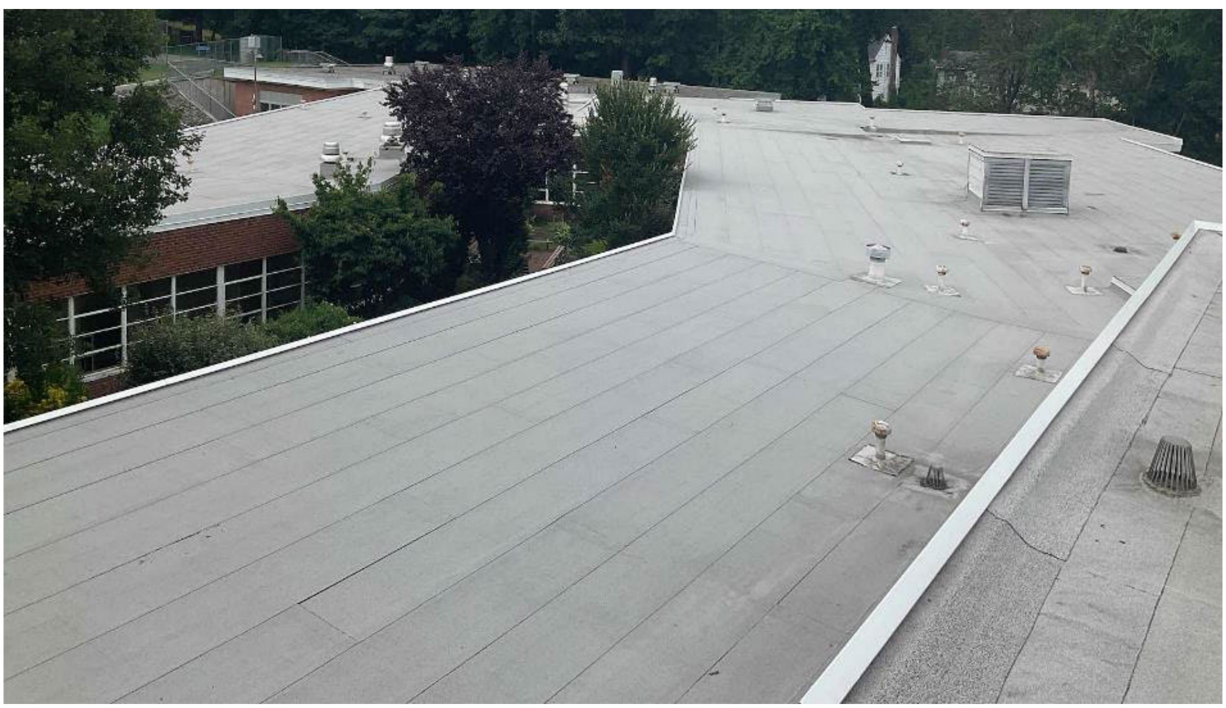
The windows are single glazed and have aluminum frames with thermal breaks. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition, showing little evidence of excessive wear. Exterior doors use a mix of wooden frames for older doors that are in fair condition and metal frames for newer doors that are in good condition. Door seals are mainly worn. Degraded window and door seals increase drafts and outside air infiltration. Overall, the building envelope appears in fair condition.

Building Walls

Building Windows

Entrance Doors


Exit Door

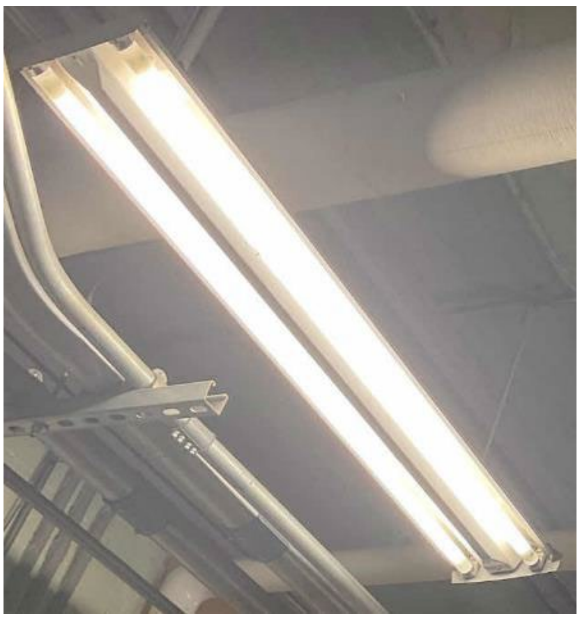

Roof

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt fluorescent T8 lamps. Fixture types include 1-lamp, 2-lamp, 3-lamp, and 4-lamp, 2-foot and 4-foot long recessed, surface mounted, and pendant fixtures with linear and U-bend tube lamps. Typically, T8 fluorescent lamps use electronic ballasts.

Additionally, compact fluorescent lamps (CFL), incandescent, and LED lamps are also used in some spaces. Typically, CFLs at this site use 13-Watts and 23-Watts, and the incandescent lamps draw 40-Watts to 60-Watts each. Gymnasium fixtures have manually controlled high-bay LED lamps, and there are LED fixtures in Classroom 33. Exit signs use LED technology.

Interior light fixtures are controlled by manual wall switches. All light fixtures are in good condition. Interior lighting levels were generally sufficient. Exterior fixtures use LED, CFL, and MH lamps. Exterior fixtures are photocell controlled.


Fluorescent T8 Fixtures


Fluorescent T8 Fixtures


Incandescent Lamp


Incandescent Lamp

Exit Sign

Gymnasium High-Bay Fixture

Exterior MH Fixture

2.5 Air Handling Systems

Unit Ventilators

Unit ventilators (UV) provide heating and ventilation to the classrooms. Each UV is equipped with hot water heating coils, supply fan motors, and pneumatically controlled outside air dampers. Some of the units can be monitored through the onsite building energy management system (EMS).

Unit Ventilator

Unitary Electric HVAC Equipment

Various areas of the building are conditioned using window air conditioning (AC) units, one mini-split AC unit, and three split AC systems. The unit's range in cooling capacity from 1.5 tons to 3.5 tons, with efficiencies ranging from 10.0 EER to 10.4 EER. The units are in fair to good condition; the older units are recommended for replacement. One split AC system (RTU-1) serves the special education area and can be monitored by the onsite EMS.

Split System

Window AC Unit

RTU-1 – Special Education

Air Handling Unit (AHU)

Areas of the building are conditioned using an air handling unit (AHU). The AHU is equipped with hot water heating coils and an estimated 3 hp constant speed supply fan. The unit is in fair condition and is thermostatically controlled.

Air Handling Unit

2.6 Heating Hot Water Systems

The building's heating system consists of two gas-fired hot water boilers, each with an output capacity of 2,247 MBh. The burners are fully modulating with a nominal efficiency of 80%. The boilers are configured in a lead/lag control scheme and controlled by the facility's energy management system (EMS). Both boilers are required under high load conditions. The boilers are in good condition. There is a service contract in place.

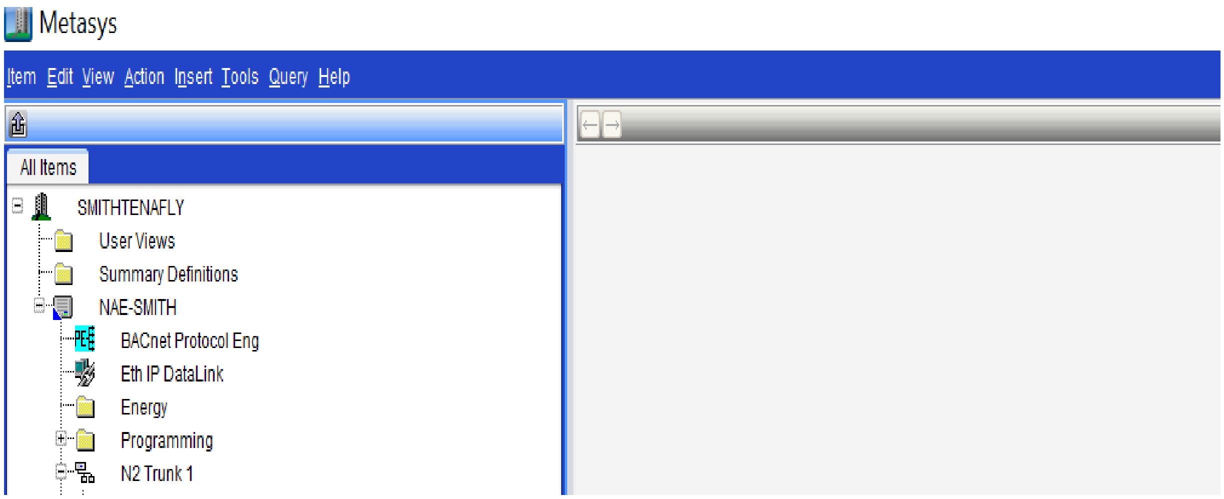
The boilers are configured in a constant flow primary distribution with two, 2 hp and one, 5 hp constant speed hot water pumps (HWP-1, HWP-2 and HWP-3) operating in a lead-lag control scheme. The boilers provide hot water to radiators, unit ventilators, and air handling units.

Hot Water Boilers


Heating Hot Water Pumps

2.7 Building Energy Management Systems (EMS)

A Johnson Controls Metasys EMS controls the HVAC equipment, boilers, one rooftop unit, and some unit ventilators. The EMS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, and heating water loop temperatures. The site staff expressed an interest in expanding the level of control provided by the EMS, as it currently only operates for the new wing.



Building Energy Management System for Smith Elementary School

2.8 Domestic Hot Water

Hot water for the original building is produced by a 75.1 MBh, 75-gallon gas-fired Rheem storage water heater, installed in 2022. The new wing is served by a 2 kW Rheem electric storage water heater with a 15-gallon capacity, installed in 2008. The units are in good condition.

Two fractional circulation pumps distribute water to end uses. The circulation pumps operate continuously. The domestic hot water pipes are insulated, and the insulation is in good condition.

Water Heater

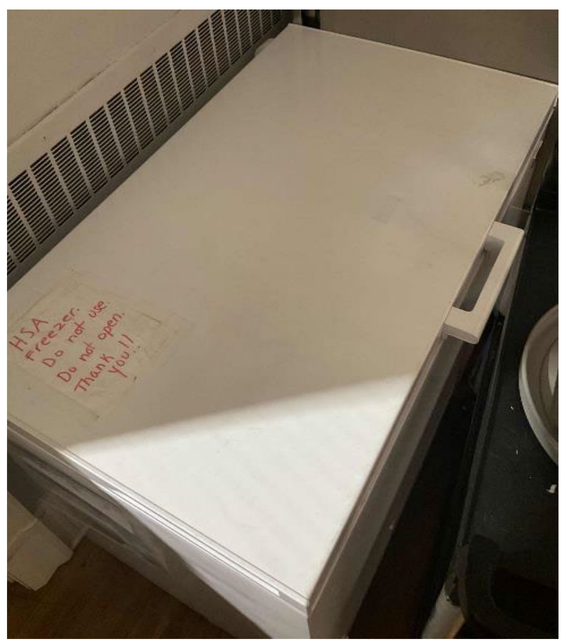
Circulation Pump

2.9 Refrigeration

The kitchen has one stand-up refrigerator with solid doors and one freezer chest. Equipment is standard efficiency and in good condition.

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

Stand-up Refrigerator



Freezer Chest

2.10 Plug Load and Vending Machines

The location is doing a great job managing their electrical plug loads. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

Plug loads throughout the building include general cafe and office equipment. There are classroom typical loads such as smart boards and projectors, and typical office loads such as computers, copiers, printers, microwaves, coffee machines, and mini fridges.

There are two residential-style refrigerators that are used to store food and drinks. These vary in condition and efficiency.

Copier Machine

Copier Machine

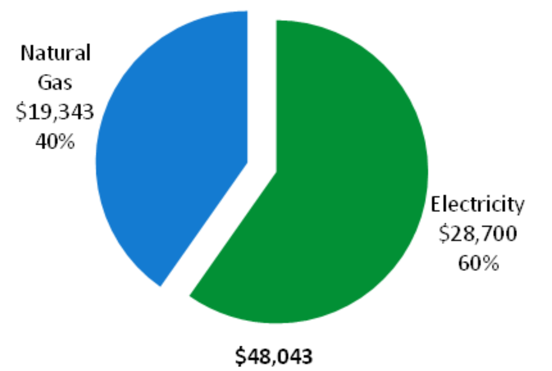
2.11 Water-Using Systems

There are 15 restrooms with toilets, urinals, and sinks. Faucet flow rates are at 2.2 gallons per minute (gpm) or higher.

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	196,807 kWh	$28,700
Natural Gas	24,606 Therms	$19,343
Total		**$48,043**



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.

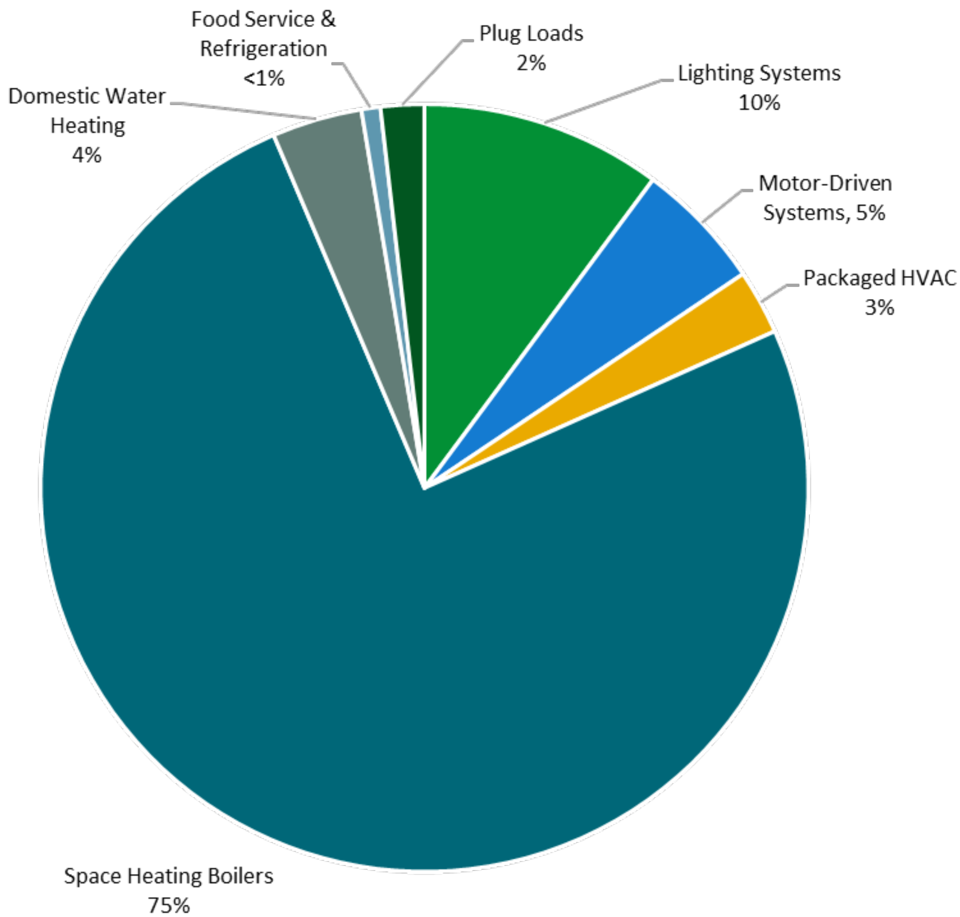
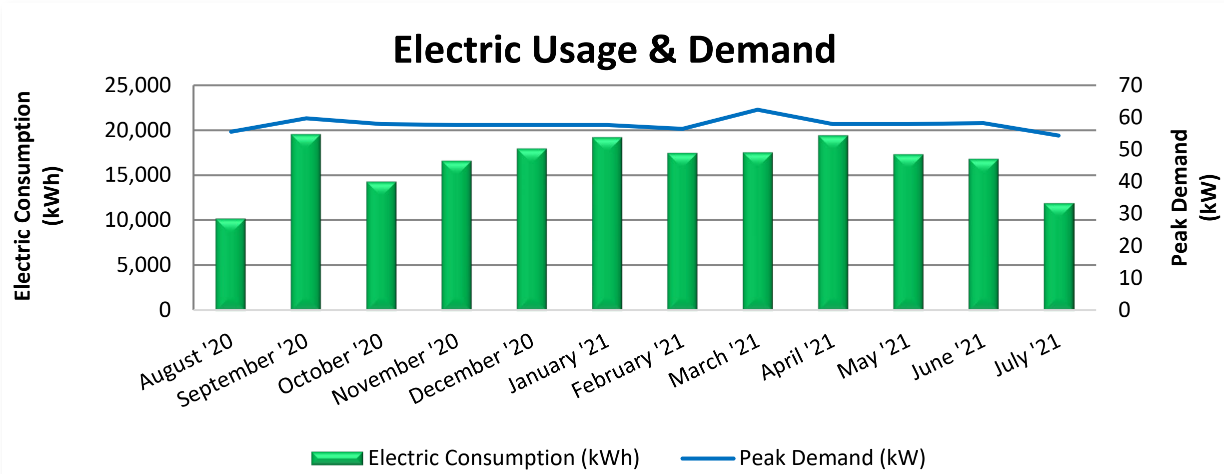


Figure 4 - Energy Balance

3.1 Electricity

PSE&G delivers electricity under rate class General Lighting & Power (GLP), with electric production provided by Constellation Energy, a third-party supplier.



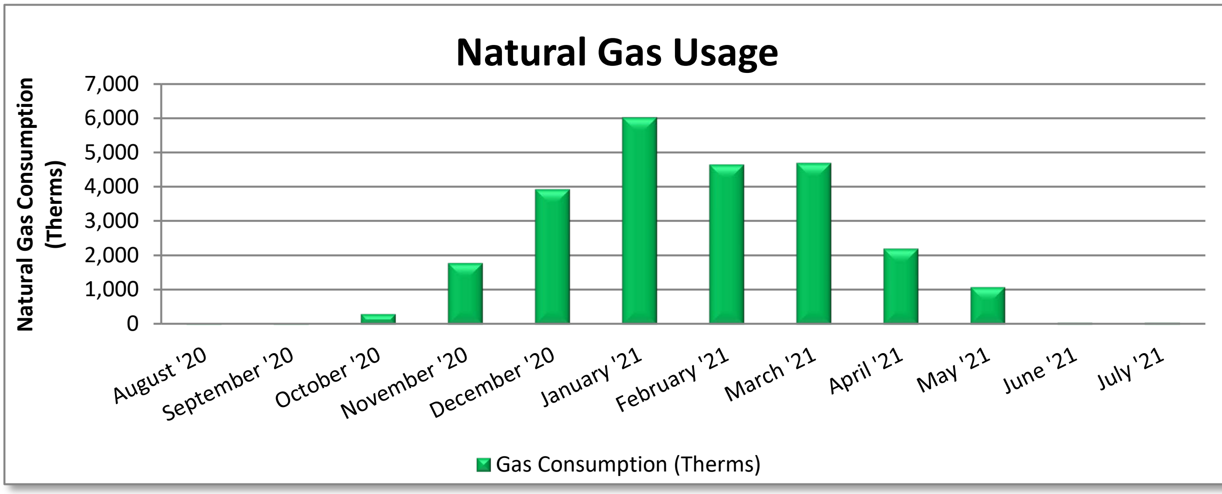
Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**
8/18/20	32	10,235	56	$767	$2,028
9/17/20	30	19,560	60	$825	$2,934
10/16/20	29	14,310	58	$228	$2,042
11/16/20	31	16,620	58	$227	$2,248
12/18/20	32	17,970	58	$227	$2,369
1/20/21	33	19,200	58	$227	$2,528
2/18/21	29	17,460	56	$222	$2,308
3/19/21	29	17,550	62	$246	$2,341
4/20/21	32	19,410	58	$228	$2,544
5/19/21	29	17,340	58	$229	$2,312
6/22/21	34	16,830	58	$808	$2,916
7/20/21	28	11,940	54	$754	$2,366
Totals	**368**	**198,425**	**62**	**$4,985**	**$28,936**
Annual	**365**	**196,807**	**62**	**$4,945**	**$28,700**

Notes:

- Peak demand of 62 kW occurred in March 2021.
- Average demand over the past 12 months was 58 kW.
- The average electric cost over the past 12 months was $0.146/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 Large Volume Gas (LVG), with natural gas supply provided by UGI Energy, a third-party supplier.



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
8/18/20	32	3	$151
9/17/20	30	17	$156
10/16/20	29	313	$331
11/16/20	31	1,787	$1,800
12/16/20	30	3,924	$3,043
1/20/21	35	6,014	$4,246
2/17/21	28	4,645	$3,564
3/19/21	30	4,692	$3,602
4/20/21	32	2,210	$1,447
5/19/21	29	1,088	$792
6/17/21	29	61	$186
7/20/21	33	54	$185
Totals	**368**	**24,808**	**$19,502**
Annual	**365**	**24,606**	**$19,343**

Notes:

- The average gas cost for the past 12 months is $0.786/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 (EPA) *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	55

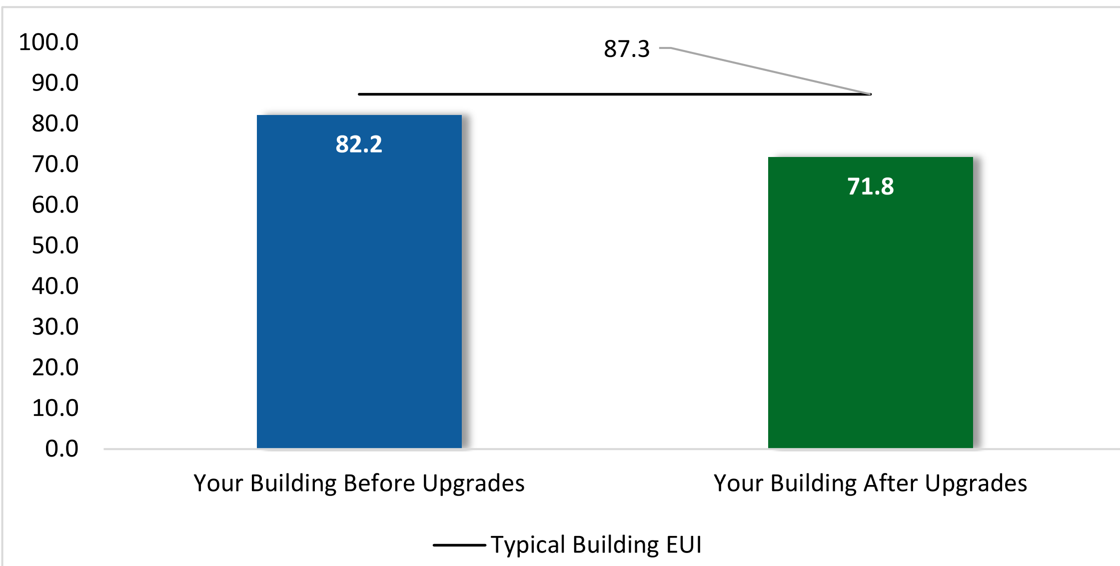


Figure 5 - Energy Use Intensity Comparison[3]

Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance, and lower your energy bills even more.

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 a building to vary from 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.

[3] Based on all evaluated ECMs

Tracking Your Energy Performance

Keeping track of your energy use on a monthly basis 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 have 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.

4 Energy Conservation Measures

The goal of this audit report is to identify and evaluate potential energy efficiency improvements and provide information about the cost effectiveness of those improvements. Most energy conservation measures have received preliminary analysis of feasibility, which identifies expected ranges of savings. 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's 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 previously run state rebate programs. New utility programs are expected to start rolling out in the spring and summer of 2021. Keep up to date with developments by visiting the NJCEP website. Some measures and proposed upgrades may be eligible for higher incentives than those shown below.

For a detailed list of the locations and recommended energy conservation measures for all inventoried equipment, see **Appendix A: Equipment Inventory & Recommendations.**

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**50,487**	**14.2**	**-10**	**$7,281**	**$28,009**	**$6,136**	**$21,873**	**3.0**	**49,624**
ECM 1	Install LED Fixtures	Yes	648	0.0	0	$95	$412	$100	$312	3.3	653
ECM 2	Retrofit Fixtures with LED Lamps	Yes	49,839	14.2	-10	$7,186	$27,597	$6,036	$21,561	3.0	48,972
Lighting Control Measures			**14,235**	**4.0**	**-3**	**$2,053**	**$13,502**	**$3,780**	**$9,722**	**4.7**	**13,986**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	11,980	3.5	-3	$1,727	$10,802	$1,435	$9,367	5.4	11,770
ECM 4	Install High/Low Lighting Controls	Yes	2,256	0.5	0	$325	$2,700	$2,345	$355	1.1	2,216
Variable Frequency Drive (VFD) Measures			**8,757**	**2.0**	**0**	**$1,277**	**$14,482**	**$1,300**	**$13,182**	**10.3**	**8,818**
ECM 5	Install VFDs on Constant Volume (CV) Fans	Yes	2,824	0.9	0	$412	$3,884	$200	$3,684	8.9	2,844
ECM 6	Install VFDs on Heating Water Pumps	Yes	5,933	1.1	0	$865	$10,598	$1,100	$9,498	11.0	5,974
Unitary HVAC Measures			**1,940**	**1.9**	**0**	**$283**	**$23,199**	**$735**	**$22,464**	**79.4**	**1,954**
ECM 7	Install High Efficiency Air Conditioning Units	No	1,940	1.9	0	$283	$23,199	$735	$22,464	79.4	1,954
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**139**	**$1,091**	**$80,225**	**$6,741**	**$73,484**	**67.4**	**16,250**
ECM 8	Install High Efficiency Hot Water Boilers	No	0	0.0	139	$1,091	$80,225	$6,741	$73,484	67.4	16,250
Domestic Water Heating Upgrade			**229**	**0.0**	**4**	**$61**	**$158**	**$44**	**$114**	**1.9**	**642**
ECM 9	Install Low-Flow DHW Devices	Yes	229	0.0	4	$61	$158	$44	$114	1.9	642
Custom Measures			**2,462**	**0.0**	**0**	**$359**	**$1,287**	**$0**	**$1,287**	**3.6**	**2,479**
ECM 10	Install Heat Pump Water Heater	Yes	2,462	0.0	0	$359	$1,287	$0	$1,287	3.6	2,479
TOTALS			**78,111**	**22.1**	**129**	**$12,404**	**$160,861**	**$18,736**	**$142,125**	**11.5**	**93,754**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

Figure 6 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**50,487**	**14.2**	**-10**	**$7,281**	**$28,009**	**$6,136**	**$21,873**	**3.0**	**49,624**
ECM 1	Install LED Fixtures	648	0.0	0	$95	$412	$100	$312	3.3	653
ECM 2	Retrofit Fixtures with LED Lamps	49,839	14.2	-10	$7,186	$27,597	$6,036	$21,561	3.0	48,972
Lighting Control Measures		**14,235**	**4.0**	**-3**	**$2,053**	**$13,502**	**$3,780**	**$9,722**	**4.7**	**13,986**
ECM 3	Install Occupancy Sensor Lighting Controls	11,980	3.5	-3	$1,727	$10,802	$1,435	$9,367	5.4	11,770
ECM 4	Install High/Low Lighting Controls	2,256	0.5	0	$325	$2,700	$2,345	$355	1.1	2,216
Variable Frequency Drive (VFD) Measures		**8,757**	**2.0**	**0**	**$1,277**	**$14,482**	**$1,300**	**$13,182**	**10.3**	**8,818**
ECM 5	Install VFDs on Constant Volume (CV) Fans	2,824	0.9	0	$412	$3,884	$200	$3,684	8.9	2,844
ECM 6	Install VFDs on Heating Water Pumps	5,933	1.1	0	$865	$10,598	$1,100	$9,498	11.0	5,974
Domestic Water Heating Upgrade		**229**	**0.0**	**4**	**$61**	**$158**	**$44**	**$114**	**1.9**	**642**
ECM 9	Install Low-Flow DHW Devices	229	0.0	4	$61	$158	$44	$114	1.9	642
Custom Measures		**2,462**	**0.0**	**0**	**$359**	**$1,287**	**$0**	**$1,287**	**3.6**	**2,479**
ECM 10	Install Heat Pump Water Heater	2,462	0.0	0	$359	$1,287	$0	$1,287	3.6	2,479
TOTALS		**76,170**	**20.1**	**-10**	**$11,030**	**$57,438**	**$11,260**	**$46,178**	**4.2**	**75,550**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

Figure 7 – 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 ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**50,487**	**14.2**	**-10**	**$7,281**	**$28,009**	**$6,136**	**$21,873**	**3.0**	**49,624**
ECM 1	Install LED Fixtures	648	0.0	0	$95	$412	$100	$312	3.3	653
ECM 2	Retrofit Fixtures with LED Lamps	49,839	14.2	-10	$7,186	$27,597	$6,036	$21,561	3.0	48,972

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 is 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 fixtures containing high-intensity discharge (HID) 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 fixtures.

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 MH fixtures.

ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent, CFL, 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. Be sure to specify replacement lamps that are compatible with existing dimming controls, where applicable. In some circumstances, you may need to upgrade your dimming system for optimum performance.

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 CFL or incandescent lamps, and fluorescent fixtures with T8 tubes.

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**14,235**	**4.0**	**-3**	**$2,053**	**$13,502**	**$3,780**	**$9,722**	**4.7**	**13,986**
ECM 3	Install Occupancy Sensor Lighting Controls	11,980	3.5	-3	$1,727	$10,802	$1,435	$9,367	5.4	11,770
ECM 4	Install High/Low Lighting Controls	2,256	0.5	0	$325	$2,700	$2,345	$355	1.1	2,216

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 that 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: classrooms, offices, lounges, gymnasium, library, kitchen, and restrooms.

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 code requirements for egress. 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. In parking lots and parking garages with significant ambient lighting, this control can sometimes be combined with photocell controls to turn the lights off when there is sufficient daylight.

The controller lowers the light level by dimming the fixture output. Therefore, the controlled fixtures need to have a dimmable ballast or driver. This will need to be considered when selecting retrofit lamps and bulbs for the areas proposed for high/low control.

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 occupants approach the area.

This measure provides energy savings by reducing the light fixture power draw when reduced light output is appropriate.

Affected Building Areas: hallways.

4.3 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**8,757**	**2.0**	**0**	**$1,277**	**$14,482**	**$1,300**	**$13,182**	**10.3**	**8,818**
ECM 5	Install VFDs on Constant Volume (CV) Fans	2,824	0.9	0	$412	$3,884	$200	$3,684	8.9	2,844
ECM 6	Install VFDs on Heating Water Pumps	5,933	1.1	0	$865	$10,598	$1,100	$9,498	11.0	5,974

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 inverter duty rated motor to conservatively account for the cost of an inverter duty rated motor.

ECM 5: 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.

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. Prior to implementation, verify minimum fan speed in cooling mode with the manufacturer. Note that savings will vary depending on the operating characteristics of each AHU.

Energy savings result from reducing the fan speed (and power) when conditions allow for reduced air flow.

Affected Air Handlers: air handling unit supply fan

ECM 6: 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.

Affected Pumps: HWP-1, HWP-2, and HWP-3.

4.4 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**1,940**	**1.9**	**0**	**$283**	**$23,199**	**$735**	**$22,464**	**79.4**	**1,954**
ECM 7	Install High Efficiency Air Conditioning Units	1,940	1.9	0	$283	$23,199	$735	$22,464	79.4	1,954

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 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 split systems and mini-split air conditioning unit is eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 7: Install High Efficiency Air Conditioning Units

We evaluated replacing 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 and heating load, and the estimated annual operating hours.

Affected Units: split systems and mini-split AC unit.

4.5 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**139**	**$1,091**	**$80,225**	**$6,741**	**$73,484**	**67.4**	**16,250**
ECM 8	Install High Efficiency Hot Water Boilers	0	0.0	139	$1,091	$80,225	$6,741	$73,484	67.4	16,250

ECM 8: Install High Efficiency Hot Water Boilers

We evaluated replacing 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. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load. 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.

Replacing the boilers has a long payback and may not be justifiable based simply on energy considerations. However, the boilers are nearing the end of their normal useful life. Typically, the marginal cost of purchasing high efficiency boilers can be justified by the marginal savings from the improved efficiency. When the boiler is eventually replaced, consider purchasing boilers that exceed the minimum efficiency required by building codes. 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.

4.6 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**229**	**0.0**	**4**	**$61**	**$158**	**$44**	**$114**	**1.9**	**642**
ECM 9	Install Low-Flow DHW Devices	229	0.0	4	$61	$158	$44	$114	1.9	642

ECM 9: Install Low-Flow DHW Devices

Install low-flow devices to reduce overall hot water demand. The following low-flow devices are recommended to reduce hot water usage:

Device	Flow Rate
Faucet aerators (lavatory)	0.5 gpm
Faucet aerator (kitchen)	1.5 gpm
Showerhead	2.0 gpm
Pre-rinse spray valve (kitchen)	1.28 gpm

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing. Additional cost savings may result from reduced water usage.

4.7 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**2,462**	**0.0**	**0**	**$359**	**$1,287**	**$0**	**$1,287**	**3.6**	**2,479**
ECM 10	Install Heat Pump Water Heater	2,462	0.0	0	$359	$1,287	$0	$1,287	3.6	2,479

ECM 10: Install Heat Pump Water Heater

A typical electric water heater uses electric resistance coils to heat water at a coefficient of performance (COP) of 1. Heat pump water heaters (HPWH) use a refrigeration cycle to transfer heat from the air to the domestic water. The typical average COP for a HPWH is about 2.5, so they require significantly less electricity to produce the same amount of hot water as a traditional electric water heater. HPWH also reject cold air. As such, they need to be in an unconditioned space with good ventilation. Ideal locations are garages or large enclosed, unconditioned storage areas.

Most HPWH operate effectively down to an air temperature of 40 °F. Below that temperature, an electric resistance booster heater is typically required to achieve full heating capacity. It is critical that the HPWH controls are set up so that the electric resistance heat only engages when the air temperature is too cold for the HPWH to extract heat from it. HPWHs have a slow recovery. During periods of high demand, the recommended electric resistance heating element, if enabled, may be energized to maintain set point, thus reducing the overall efficiency of the unit. It is recommended that a careful analysis of the hot water demand be conducted to determine if the application makes economic sense, and the HPWH heating capacity and storage are properly sized.

HPWH operate most effectively when the temperature difference between the incoming and outgoing water is high. Generally, this means that cold make-up water should be piped to the bottom of the tank and return water should be piped to the top of the tank in order to maintain stratification within the storage tank. Water should be drawn from the bottom of the tank to be heated. If there is a DHW recirculation pump, it should only be operated during high hot water demand periods.

4.8 Measures for Future Consideration

There are additional opportunities for improvement that Tenafly Public Schools may wish to consider. These potential upgrades typically require further analysis, involve substantial capital investment, and/or include significant system reconfiguration. These measures are therefore beyond the scope of this energy audit. These measures are described here to support a whole building approach to energy efficiency and sustainability.

Tenafly Public Schools may wish to consider the Energy Savings Improvement Program (ESIP) or other whole building approach. With interest in implementing comprehensive, largescale and/or complex system wide projects, these measures may be pursued during development of a future energy savings plan. We recommend that you work with your energy service company (ESCO) and/or design team to:

- Evaluate these measures further.
- Develop firm costs.
- Determine measure savings.
- Prepare detailed implementation plans.

Other modernization or capital improvement funds may be leveraged for these types of refurbishments. As you plan for capital upgrades, be sure to consider the energy impact of the building systems and controls being specified.

Upgrade/Replace Energy Management System

Based on our site survey and on conversations with facility staff, it appears that the existing energy management system (EMS) is substantially limited in its capabilities, means of control, monitoring/ reporting function, or condition relative to new systems available in the marketplace. A substantial upgrade to your site's EMS could increase the efficiency of your building HVAC system operation.

The current generation EMS typically provides building systems with a network of temperature and pressure sensors that obtain feedback about field conditions and provide signals to control systems to adjust system operation for optimal functioning. Thirty years ago, most control systems were pneumatic systems driven by compressed air, with pneumatic thermostats and air driven actuators for valves and dampers. Pneumatics controls have largely been replaced by direct digital control (DDC) systems, but many pneumatic systems remain. Contemporary DDC systems afford tighter controls and enhanced monitoring and trending capabilities as compared to the older systems.

A controls upgrade would enable automated equipment start and stop times, temperature setpoints, and lockouts and deadbands to be programmed remotely using a graphic interface. Controls can be configured to optimize ventilation and outside air intake by adjusting economizer position, damper function, and fan speed. Existing chilled and hot water distribution system controls are typically tied in, including associated pumps and valves. Coordinated control of HVAC systems is dependent on a network of sensors and status points. A comprehensive building control system provides monitoring and control for all HVAC systems, so operators can adjust system programming for optimal comfort and energy savings.

It is recommended that an HVAC engineer or contractor who specializes in EMS be contacted for a detailed evaluation and implementation costs. A controls expert will be able to tell you to what extent an existing system can be refurbished or expanded, what sensors should be replaced, what additional HVAC systems could be controlled, and what monitoring and graphic capabilities can be added. For the purposes of this report, the potential energy savings and measure costs were estimated based on industry standards and previous project experience. Further analysis should be conducted for the feasibility of this measure. This is not an investment grade analysis, nor should be used as a basis for design and construction.

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.

Operation and maintenance (O&M) plans enhance the operational efficiency of HVAC and other energy intensive systems and could save 5% –20% of the energy usage in your building without substantial capital investment. A successful plan includes your records of energy usage trends and costs, building equipment lists, current maintenance practices, and planned capital upgrades, and it incorporates your ideas for improved building operation. Your plan will address goals for energy-efficient operation, provide detail on how to reach the goals, and outline procedures for measuring and reporting whether goals have been achieved.

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 cannot manage what you do not 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

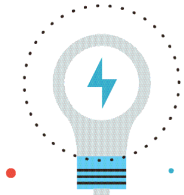
Caulk or weather strip leaky doors and windows to reduce drafts and loss of heated or cooled air. Sealing cracks and openings can reduce heating and cooling costs, improve building durability, and create a healthier indoor environment. Materials used may include caulk, polyurethane foam, and other weather-stripping materials. There is an energy savings opportunity by reducing the uncontrolled air exchange between the outside and inside of the building. Blower door assisted comprehensive building air sealing will reduce the amount of air exchange, which will in turn reduce the load on the buildings heating and cooling equipment, providing energy savings and increased occupant comfort.

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 can lead to increased occupant comfort as well as heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

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

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.

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.

Lighting Controls

As part of a lighting maintenance schedule, test lighting controls to ensure proper functioning. For occupancy sensors, this requires triggering the sensor and verifying that the sensor's timer settings are correct. For daylight and photocell sensors, maintenance involves cleaning sensor lenses and confirming that setpoints and sensitivity are configured properly. Adjust exterior lighting time clock controls seasonally as needed to match your lighting requirements.

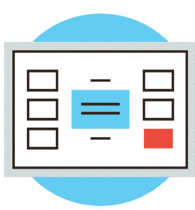
Motor Maintenance

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.

Thermostat Schedules and Temperature Resets



Use thermostat setback temperatures and schedules to reduce heating and cooling energy use during periods of low or no occupancy. Thermostats should be programmed for a setback of 5°F-10°F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced by increasing the facility's occupied setpoint temperature. In general, during the cooling season, thermostats should be set as high as possible without sacrificing occupant comfort.

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.

Ductwork Maintenance

Duct maintenance has two primary goals: keep the ducts clean to avoid air quality problems and seal leaks to save energy. Check for cleanliness, obstructions that block airflow, water damage, and leaks. Ducts should be inspected at least every two years.

The biggest symptoms of clogged air ducts are differing temperatures throughout the building and areas with limited airflow from supply registers. If a particular air duct is clogged, then air flow will only be cut off to some rooms in the building—not all of them. The reduced airflow will make it more difficult for those areas to reach the temperature setpoint, which will cause the HVAC system to run longer to cool or heat that area properly. If you suspect clogged air ducts, ensure that all areas in front of supply registers are clear of items that may block or restrict air flow, and you should check for fire dampers or balancing dampers that have failed closed.

Duct leakage in commercial buildings can account for 5%–25% of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building wasting conditioned air. Check ductwork for leakage. Eliminating duct leaks can improve ventilation system performance and reduce heating and cooling system operation.

Distribution system losses are dependent on-air system temperature, the size of the distribution system, and the level of insulation of the ductwork. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is missing or worn, the system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

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 and efficiently. Boilers should be cleaned according to the manufacturer's instructions to remove soot and scale from the boiler tubes to improve heat transfer.

Optimize HVAC Equipment Schedules

Energy management systems (EMS) typically provide advanced controls for building HVAC systems, including chillers, boilers, air handling units, rooftop units and exhaust fans. The EMS monitors and reports operational status, schedules equipment start and stop times, locks out equipment operation based on outside air or space temperature, and often optimizes damper and valve operation based on complex algorithms. These EMS features, when in proper adjustment, can improve comfort for building occupants and save substantial energy.

Know your EMS scheduling capabilities. Regularly monitor HVAC equipment operating schedules and match them to building operating hours in order to eliminate unnecessary equipment operation and save energy. Monitoring should be performed often at sites with frequently changing usage patterns – daily in some cases. We recommend using the *optimal start* feature of the EMS (if available) to optimize the building warmup sequence. Most EMS scheduling programs provide for holiday schedules, which can be used during reduced use or shutdown periods. Finally, many systems are equipped with a one-time override function, which can be used to provide additional space conditioning due to a one-time, special event. When available this override feature should be used rather than changing the base operating schedule.

Water Heater Maintenance

The lower the supply water temperature that is used for hand washing sinks, the less energy is needed to heat the water. Reducing the temperature results in energy savings and the change is often unnoticeable to users. Be sure to review the domestic water temperature requirements for sterilizers and dishwashers as you investigate reducing the supply water temperature.

Also, 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.

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[5] or download a copy of EPA's "WaterSense™ at Work: Best Management Practices for Commercial and Institutional Facilities"[6] 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.

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.

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

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

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, 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.

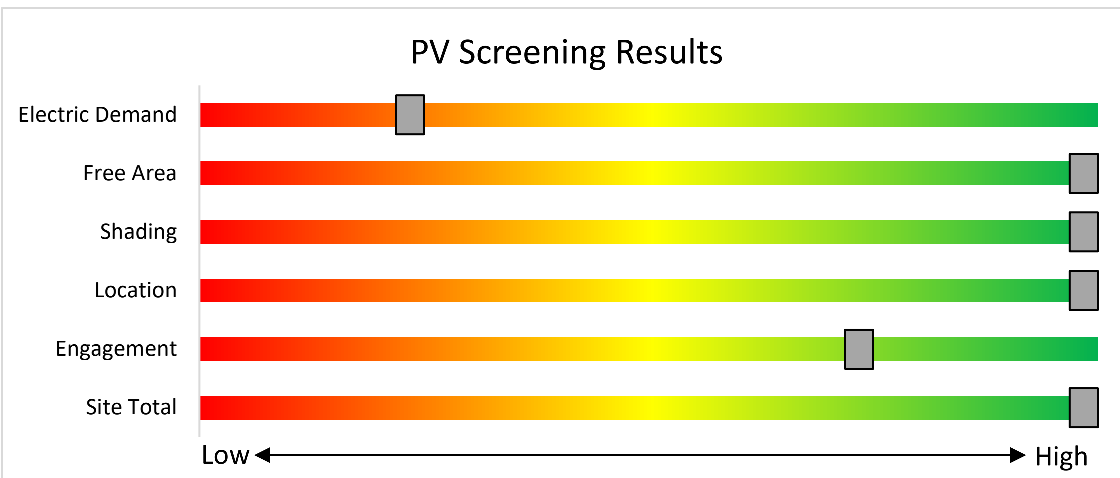
6.1 Solar Photovoltaic

Photovoltaic (PV) panels convert sunlight into electricity. Individual panels are combined into an array that produces direct current (DC) electricity. The DC current 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 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.



Potential	High	
System Potential	58	kW DC STC
Electric Generation	69,099	kWh/yr
Displaced Cost	$10,080	/yr
Installed Cost	$150,800	

Figure 8 - Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available for solar projects. Solar projects may qualify to earn SREC- IIs (Solar Renewable Energy Certificates-II), however, the project owners *must* register their solar projects prior to the start of construction to establish the project's eligibility.

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:

Successor Solar Incentive Program (SuSI): https://www.njcleanenergy.com/renewable-energy/programs/susi-program

- **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.

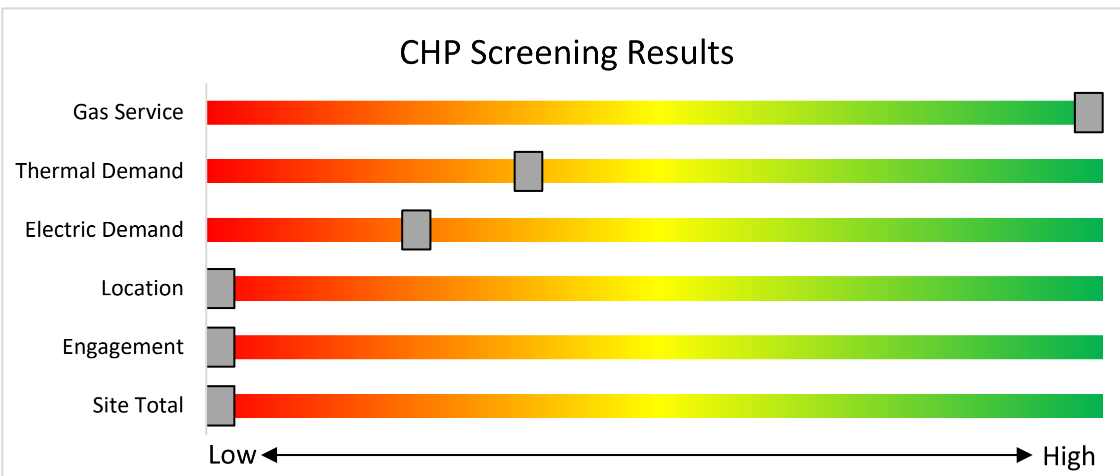


Figure 9 - Combined Heat and Power Screening

Find a qualified firm that specializes in commercial CHP cost assessment and installation: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/

7 Project Funding and Incentives

Ready to improve your building's performance? Your utility provider may be able to help.

7.1 Utility Energy Efficiency Programs

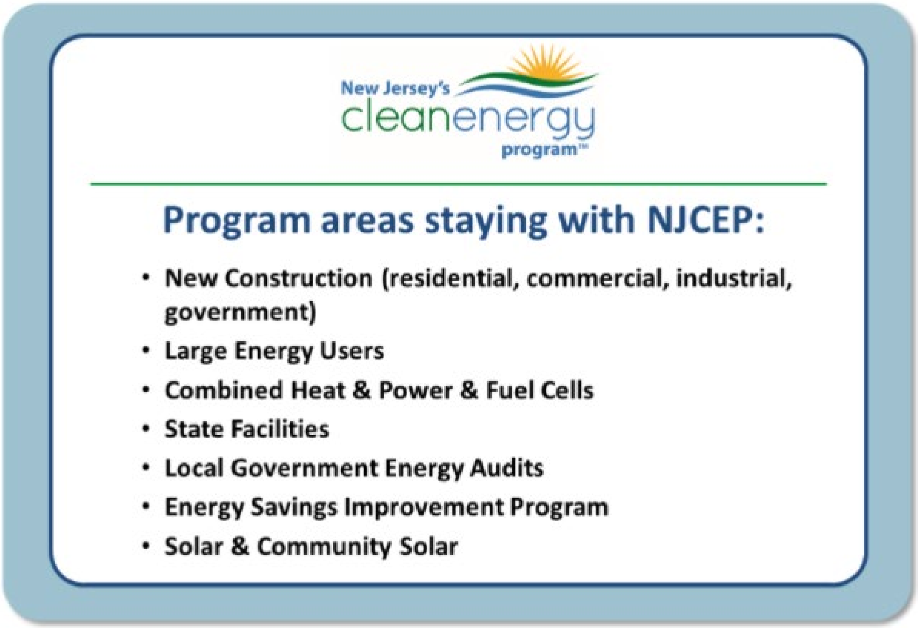
The Clean Energy Act, signed into law by Governor Murphy in 2018, requires New Jersey's investor-owned gas and electric utilities to reduce their customers' use by set percentages over time. To help reach these targets the New Jersey Board of Public Utilities approved a comprehensive suite of energy efficiency programs to be run by the utility companies.

These new utility programs are rolling out in the spring and summer of 2021. Keep up to date with developments by visiting:

https://www.njcleanenergy.com/transition

8 New Jersey's Clean Energy Programs

New Jersey's Clean Energy Program will continue to offer some energy efficiency programs.



8.1 Large Energy Users

The Large Energy Users Program (LEUP) is designed to foster self-directed investment in energy projects. This program is offered to New Jersey's largest energy customers that annually contribute at least $200,000 to the NJCEP aggregate of all buildings/sites. This equates to roughly $5 million in energy costs in the prior fiscal year.

Incentives

Incentives are based on the specifications below. The maximum incentive per entity is the lesser of:

- $4 million
- 75% of the total project(s) cost
- 90% of total NJCEP fund contribution in previous year
- $0.33 per projected kWh saved; $3.75 per projected Therm saved annually

How to Participate

To participate in LEUP, you will first need submit an enrollment application. This program requires all qualified and approved applicants to submit an energy plan that outlines the proposed energy efficiency work for review and approval. Applicants may submit a Draft Energy Efficiency Plan (DEEP), or a Final Energy Efficiency Plan (FEEP). Once the FEEP is approved, the proposed work can begin.

Detailed program descriptions, instructions for applying, and applications can be found at www.njcleanenergy.com/LEUP.

8.2 Combined Heat and Power

The Combined Heat & Power (CHP) program provides incentives for eligible CHP or waste heat to power (WHP) projects. Eligible CHP or WHP projects must achieve an annual system efficiency of at least 65% (lower heating value, or LHV), based on total energy input and total utilized energy output. Mechanical energy may be included in the efficiency evaluation.

Incentives

Eligible Technologies	Size (Installed Rated Capacity)[1]	Incentive ($/kW)	% of Total Cost Cap per Project[3]	$ Cap per Project[3]
Powered by non-renewable or renewable fuel source[4]	≤500 kW	$2,000	30-40%[2]	$2 million
Gas Internal Combustion Engine	>500 kW - 1 MW	$1,000		
Gas Combustion Turbine	> 1 MW - 3 MW	$550	30%	$3 million
Microturbine	>3 MW	$350		
Fuel Cells with Heat Recovery				
Waste Heat to Power*	<1 MW	$1,000	30%	$2 million
	> 1MW	$500		$3 million

*Waste Heat to Power: Powered by non-renewable fuel source, heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine).

Check the NJCEP website for details on program availability, current incentive levels, and requirements.

How to Participate

You will work with a qualified developer or consulting firm to complete the CHP application. Once the application is approved the project can be installed. Information about the CHP program can be found at www.njcleanenergy.com/CHP.

8.3 Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The program is used to register and certify 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 SREC-IIs (Solar Renewable Energy Certificates-II). SuSI consists of two sub-programs. The Administratively Determined Incentive (ADI) Program and the Competitive Solar Incentive (CSI) Program.

Administratively Determined Incentive (ADI) Program

The ADI Program provides administratively set incentives for net metered residential projects, net metered non-residential projects 5 MW or less, and all community solar projects.

After the registration is accepted, construction is complete, and a complete final as-built packet has been submitted, the project is issued a New Jersey certification number, which enables it to generate New Jersey SREC- IIs.

Market Segments	Size MW dc	Incentive Value ($/SREC II)	Public Entities Incentive Value - $20 Adder ($/SRECII)
Net Metered Residential	All types and sizes	$90	N/A
Small Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects smaller than 1 MW	$100	$120
Large Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects 1 MW to 5 MW	$90	$110
Small Net Metered Non-Residential Ground Mount	Projects smaller than 1 MW	$85	$105
Large Net Metered Non-Residential Ground Mount	Projects 1 MW to 5 MW	$80	$100
LMI Community Solar	Up to 5 MW	$90	N/A
Non-LMI Community Solar	Up to 5 MW	$70	N/A
Interim Subsection (t)	All types and sizes	$100	N/A

Eligible projects may generate SREC-IIs for 15 years following the commencement of commercial operations which is defined as permission to operate (PTO) from the Electric Distribution Company. After 15 years, projects may be eligible for a NJ Class I REC.

SREC-IIs will be purchased monthly by the SREC-II Program Administrator who will allocate the SREC-IIs to the Load Serving Entities (BGS Providers and Third-Party Suppliers) annually based on their market share of retail electricity sold during the relevant Energy Year.

The ADI Program online portal is now open to new registrations effective August 28, 2021.

Competitive Solar Incentive Program

The Competitive Solar Incentive (CSI) Program will provide competitively set incentives for grid supply projects and net metered non-residential projects greater than 5MW. The program is currently under development with the goal of holding the first solicitation by early-to-mid 2022. For updates, please continue to check the Solar Proceedings page on the New Jersey's Clean Energy Program website.

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan.

If you are considering installing solar photovoltaics on your building, visit the following link for more information: https://njcleanenergy.com/renewable-energy/programs/susi-program.

8.4 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 into contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the energy conservation measures (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 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.

9 Project Development

Energy conservation measures (ECMs) have been identified for your site, and their energy and economic analyses are provided within this LGEA report. Note that some of the identified projects may be mutually exclusive, such as replacing equipment versus upgrading motors or controls. The next steps with project development are to set goals and create a comprehensive project plan. The graphic below provides an overview of the process flow for a typical energy efficiency or renewable energy project. We recommend implementing as many ECMs as possible prior to undertaking a feasibility study for a renewable project. The cyclical nature of this process flow demonstrates the ongoing work required to continually improve building energy efficiency over time. If your building(s) scope of work is relatively simple to implement or small in scope, the measurement and verification (M&V) step may not be required. It should be noted through a typical project cycle, there will be changes in costs based on specific scopes of work, contractor selections, design considerations, construction, etc. The estimated costs provided throughout this LGEA report demonstrate the unburdened turn-key material and labor cost only. There will be contingencies and additional costs at the time of implementation. We recommend comprehensive project planning that includes the review of multiple bids for project work, incorporates potential operations and maintenance (O&M) cost savings, and maximizes your incentive potential.

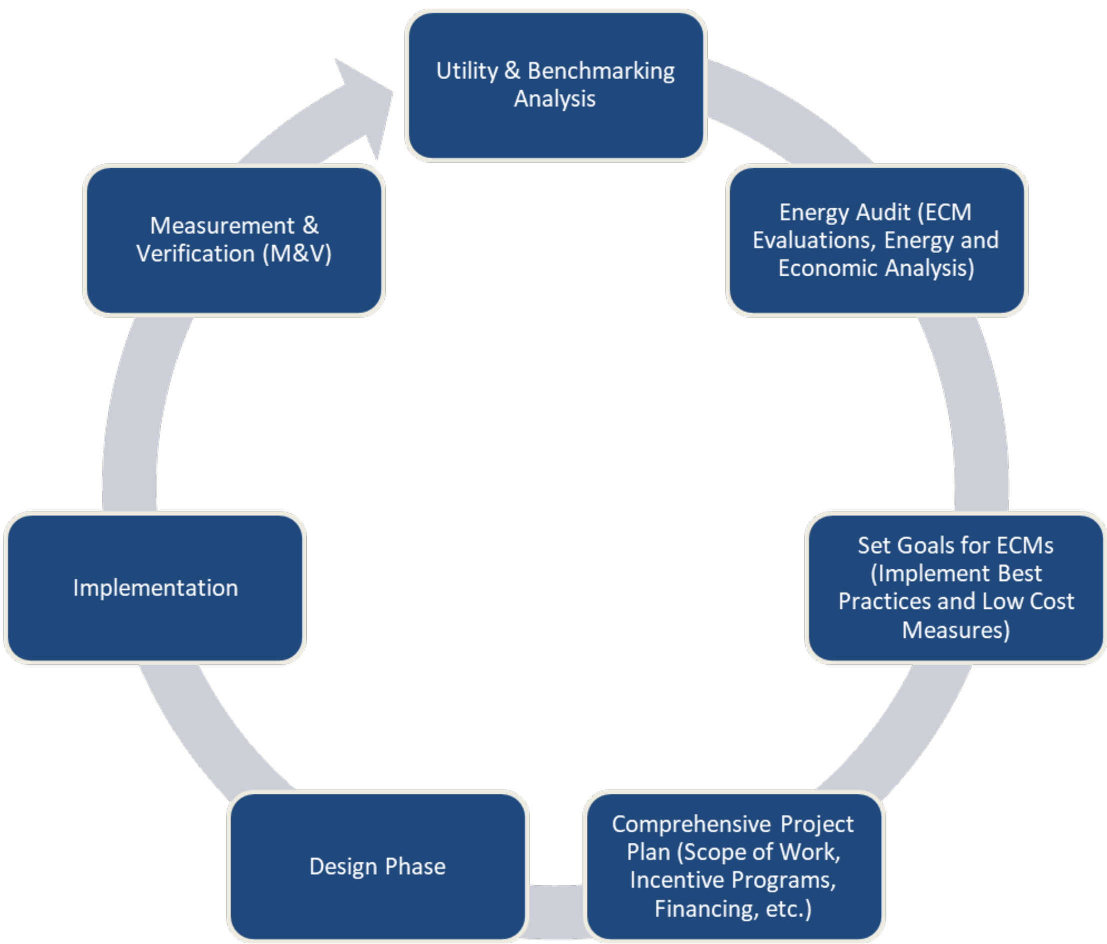


Figure 10 – Project Development Cycle

10 Energy Purchasing and Procurement Strategies

10.1 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. 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[7].

10.2 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 fluctuate monthly. The utility provides basic gas supply service 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[8].

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

[8] 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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	1,760	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,760	0.0	34	0	$5	$18	$5	2.7
Boiler Room	5	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	1,760	2	Relamp	No	5	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,760	0.1	169	0	$24	$91	$25	2.7
Boiler Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,760	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,760	0.0	128	0	$18	$73	$20	2.9
Boiler Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,760	2	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,760	0.1	383	0	$55	$219	$60	2.9
Classroom 1	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,244	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,244	0.0	126	0	$18	$17	$1	0.9
Classroom 1	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.7	2,332	0	$336	$1,092	$260	2.5
Classroom 10	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.6	2,177	0	$314	$1,037	$245	2.5
Classroom 11	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,548	0.4	1,451	0	$209	$781	$175	2.9
Classroom 12	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,548	0.4	1,451	0	$209	$781	$175	2.9
Classroom 13	22	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	22	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,548	0.7	2,280	0	$329	$1,343	$290	3.2
Classroom 14	28	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	28	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	1.3	4,353	-1	$628	$2,074	$490	2.5
Classroom 15	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,548	0.3	1,036	0	$149	$635	$135	3.3
Classroom 16	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,548	0.0	104	0	$15	$37	$10	1.8
Classroom 16	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,548	0.1	387	0	$56	$560	$75	8.7
Classroom 17	10	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2, 3	Relamp	Yes	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,548	0.5	1,826	0	$263	$1,000	$235	2.9
Classroom 17	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,548	0.1	194	0	$28	$261	$40	7.9
Classroom 18	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2, 3	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,548	0.5	1,644	0	$237	$927	$215	3.0
Classroom 18	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,548	0.1	194	0	$28	$261	$40	7.9
Classroom 19	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2, 3	Relamp	Yes	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,548	0.6	2,009	0	$290	$1,073	$255	2.8
Classroom 19	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,548	0.0	97	0	$14	$72	$10	4.5
Classroom 2	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,244	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,244	0.0	126	0	$18	$17	$1	0.9
Classroom 2	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.6	2,177	0	$314	$1,037	$245	2.5
Classroom 20	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2, 3	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,548	0.5	1,644	0	$237	$927	$215	3.0
Classroom 20	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,548	0.0	97	0	$14	$72	$10	4.5
Classroom 21	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2, 3	Relamp	Yes	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,548	0.1	183	0	$26	$73	$20	2.0

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Classroom 21	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2, 3	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,548	0.5	1,644	0	$237	$927	$215	3.0
Classroom 22	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2, 3	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,548	0.2	730	0	$105	$562	$115	4.2
Classroom 23	1	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	S	63	2,244	2	Relamp	No	1	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	2,244	0.0	72	0	$10	$65	$12	5.1
Classroom 23	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,244	0.0	138	0	$20	$73	$20	2.7
Classroom 26	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.1	311	0	$45	$226	$50	3.9
Classroom 27	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.2	622	0	$90	$489	$95	4.4
Classroom 28	1	Compact Fluorescent: (1) 23W Spiral Plug-In Lamp	Wall Switch	S	23	2,244	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	17	2,244	0.0	15	0	$2	$17	$1	7.6
Classroom 28	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,548	0.2	581	0	$84	$705	$95	7.3
Classroom 3	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,244	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,244	0.0	126	0	$18	$17	$1	0.9
Classroom 3	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.6	2,177	0	$314	$1,037	$245	2.5
Classroom 33	3	LED - Fixtures: Ambient - 4' - Direct/Indirect Fixture	Wall Switch	S	20	2,244	3	None	Yes	3	LED - Fixtures: Ambient - 4' - Direct/Indirect Fixture	Occupancy Sensor	20	1,548	0.0	46	0	$7	$270	$35	35.5
Classroom 4	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,244	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,244	0.0	126	0	$18	$17	$1	0.9
Classroom 4	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.6	2,177	0	$314	$1,037	$245	2.5
Classroom 5	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,244	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,244	0.0	126	0	$18	$17	$1	0.9
Classroom 5	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.6	2,177	0	$314	$1,037	$245	2.5
Classroom 6	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.6	2,177	0	$314	$1,037	$245	2.5
Classroom 7	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.6	2,177	0	$314	$1,037	$245	2.5
Classroom 8	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.6	2,177	0	$314	$1,037	$245	2.5
Classroom 9	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.6	2,177	0	$314	$1,037	$245	2.5
Corridor - 1st Floor	8	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	8	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor - 1st Floor	50	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,992	2, 4	Relamp	Yes	50	LED - Linear Tubes: (2) U-Lamp	High/Low Control	33	2,064	1.4	6,456	-1	$931	$5,648	$2,250	3.7
Corridor - New Wing	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor - New Wing	17	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,992	2, 4	Relamp	Yes	17	LED - Linear Tubes: (2) U-Lamp	High/Low Control	33	2,064	0.5	2,195	0	$316	$1,907	$765	3.6
Electrical - Server	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,760	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,760	0.0	64	0	$9	$37	$10	2.9
Stage	84	Compact Fluorescent: (1) 23W Spiral Plug-In Lamp	Wall Switch	S	23	1,760	2	Relamp	No	84	LED Lamps: A19 Lamps	Wall Switch	16	1,760	0.4	1,138	0	$164	$1,447	$84	8.3

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Gymnasium	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stage	2	LED Lamps: (1) 14W A19 Screw-In Lamp	Wall Switch	S	14	1,760		None	No	2	LED Lamps: (1) 14W A19 Screw-In Lamp	Wall Switch	14	1,760	0.0	0	0	$0	$0	$0	0.0
Gymnasium	6	LED - Fixtures: High-Bay	Wall Switch	S	120	2,244	3	None	Yes	6	LED - Fixtures: High-Bay	Occupancy Sensor	120	1,548	0.2	551	0	$79	$270	$35	3.0
Janitor Closet - New Wing #1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,760	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,760	0.0	64	0	$9	$37	$10	2.9
Janitor Closet - New Wing #2	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,760	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,760	0.0	64	0	$9	$37	$10	2.9
Janitor Closet - Old Wing #1	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	1,760	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,760	0.0	34	0	$5	$18	$5	2.7
Janitor Closet - Old Wing #2	1	Compact Fluorescent: (1) 23W Spiral Plug-In Lamp	Wall Switch	S	23	1,760	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	16	1,760	0.0	14	0	$2	$17	$1	8.3
Kitchen	8	Halogen Incandescent: (1) 40W PAR20 Screw-In Lamp	Wall Switch	S	40	2,244	2, 3	Relamp	Yes	8	LED Lamps: PAR20 Lamps	Occupancy Sensor	6	1,548	0.2	708	0	$102	$446	$51	3.9
Library	4	Compact Fluorescent: (2) 13W Biaxial Plug-In Lamps	Wall Switch	S	26	2,244	2, 3	Relamp	Yes	4	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	19	1,548	0.0	127	0	$18	$370	$43	17.8
Library	2	Compact Fluorescent: (1) 23W Spiral Plug-In Lamp	Wall Switch	S	23	2,244	2, 3	Relamp	Yes	2	LED Lamps: A19 Lamps	Occupancy Sensor	16	1,548	0.0	59	0	$9	$150	$22	15.1
Library	24	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,548	0.7	2,324	0	$335	$2,279	$310	5.9
Lounge - Staff	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,244	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,244	0.0	81	0	$12	$37	$10	2.3
Lounge - Staff	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,244	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,244	0.0	81	0	$12	$37	$10	2.3
Lounge - Staff	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,548	0.1	387	0	$56	$560	$75	8.7
Main Office	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,244	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,244	0.0	126	0	$18	$17	$1	0.9
Main Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.1	466	0	$67	$434	$80	5.3
Main Office	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.3	933	0	$135	$599	$125	3.5
Main Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,244	2, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,548	0.1	466	0	$67	$434	$80	5.3
Office - 24	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,244	0.0	138	0	$20	$73	$20	2.7
Office 31 - Behind Gym	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,244	2, 3	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,548	0.2	548	0	$79	$489	$95	5.0
Restroom - Boys #1	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,244	2, 3	Relamp	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,548	0.0	109	0	$16	$153	$30	7.8
Restroom - Girls #1	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,244	2, 3	Relamp	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,548	0.0	109	0	$16	$153	$30	7.8
Restroom - Girls New Wing	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,244	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,548	0.1	207	0	$30	$189	$40	5.0
Restroom - Staff #1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,244	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,244	0.0	81	0	$12	$37	$10	2.3
Restroom - Staff #2	1	LED Lamps: (1) 14W A19 Screw-In Lamp	Wall Switch	S	14	2,244		None	No	1	LED Lamps: (1) 14W A19 Screw-In Lamp	Wall Switch	14	2,244	0.0	0	0	$0	$0	$0	0.0

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Exterior Wall Pack	2	Metal Halide: (1) 70W Lamp	Photocell		95	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	21	4,380	0.0	648	0	$95	$412	$100	3.3
Exterior Lighting	2	Compact Fluorescent: (2) 23W A19 Screw-In Lamps	Photocell		46	4,380	2	Relamp	No	2	LED Lamps: A19 Lamps	Photocell	33	4,380	0.0	114	0	$17	$69	$4	3.9
Exterior Lighting	1	Compact Fluorescent: (2) 23W A19 Screw-In Lamps	Photocell		46	4,380	2	Relamp	No	1	LED Lamps: A19 Lamps	Photocell	33	4,380	0.0	57	0	$8	$34	$2	3.9
Exterior Lighting	2	LED - Fixtures: Ambient 2x2 Fixture	Photocell		32	4,380		None	No	2	LED - Fixtures: Ambient 2x2 Fixture	Photocell	32	4,380	0.0	0	0	$0	$0	$0	0.0

Motor Inventory & Recommendations

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Air Compressor	1	Air Compressor	0.5	75.0%	No	Dayton		W	730		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	School Building	2	Exhaust Fan	0.5	75.0%	No			W	2,745		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	School Building	9	Exhaust Fan	0.3	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	School Building	2	Exhaust Fan	1.0	82.5%	No			W	2,745		No	82.5%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Heating System	2	Heating Hot Water Pump	2.0	80.0%	No	Lincoln		B	1,825	6	No	86.5%	Yes	2	0.5	2,898	0	$423	$6,522	$200	15.0
Boiler Room	Heating System	1	Heating Hot Water Pump	5.0	87.5%	No	Dayton		B	1,825	6	No	89.5%	Yes	1	0.5	3,035	0	$443	$4,076	$900	7.2
Boiler Room	Domestic Hot Water	1	DHW Circulation Pump	0.1	60.0%	No	Taco		W	8,760		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Janitor Closet - New Wing	Domestic Hot Water	1	DHW Circulation Pump	0.1	60.0%	No	Taco		W	8,760		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Boilers	2	Combustion Air Fan	2.0	77.0%	No	Dayton		B	1,825		No	77.0%	No		0.0	0	0	$0	$0	$0	0.0
Classrooms	Unit Ventilators	25	Supply Fan	0.3	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Air Handler	School Building	1	Supply Fan	3.0	86.5%	No			B	2,745	5	No	89.5%	Yes	1	0.9	2,824	0	$412	$3,884	$200	8.9
Roof	Special Education	1	Supply Fan	0.3	65.0%	No	Trane		B	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

Packaged HVAC Inventory & Recommendations

		Existing Conditions									Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Classrooms	Classrooms	23	Window AC	1.50		10.40		Friedrich		W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Special Education	1	Split-System	2.00		10.00		Trane	TCC024F100BG	B	7	Yes	1	Split-System	2.00		16.00		0.5	450	0	$66	$5,922	$210	87.0
Exterior HVAC	School Building	1	Split-System	1.50		10.00		ICP	C2A318GKA100	B	7	Yes	1	Split-System	1.50		16.00		0.3	338	0	$49	$5,678	$158	112.2
Roof	Classroom 22	1	Ductless Mini-Split AC	1.50		10.40		Fujitsu	AOU18CL	B	7	Yes	1	Ductless Mini-Split AC	1.50		18.00		0.4	365	0	$53	$5,193	$0	97.5
Roof	Library	1	Split-System	3.50		10.00		Trane	TTA042D300B0	B	7	Yes	1	Split-System	3.50		16.00		0.8	788	0	$115	$6,407	$368	52.6

Space Heating Boiler Inventory & Recommendations

		Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Heating System	2	Non-Condensing Hot Water Boiler	2,247	HB Smith	28-S/W-11	W	8	Yes	2	Non-Condensing Hot Water Boiler	2,247	85.00%	Et	0.0	0	139	$1,091	$80,225	$6,741	67.4

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Original Building - Domestic Hot Water	1	Storage Tank Water Heater (> 50 Gal)	Rheem	PRO+G75-76N RH	N		No						0.0	0	0	$0	$0	$0	0.0
Janitor Closet - New Wing	New Wing - Domestic Hot Water	1	Storage Tank Water Heater (≤ 50 Gal)	Rheem	81VP15S	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Smith Elementary School	9	18	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	4	$28	$129	$36	3.4
Smith Elementary School	9	4	Faucet Aerator (Kitchen)	2.20	1.50	0.0	229	0	$33	$29	$8	0.6

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Freezer Chest			No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	Summit		No		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?	Manufacturer	Model
Smith Elementary School	2	Coffee Machine	800	No		
Smith Elementary School	9	Desktop	120	No		
Smith Elementary School	31	Fan (Portable)	200	No		
Smith Elementary School	1	Kiln	5,000	No		
Smith Elementary School	3	Microwave	1,000	No		
Smith Elementary School	32	Printer (Medium/Small)	450	No		
Smith Elementary School	2	Printer/Copier (Large)	600	No		
Smith Elementary School	3	Refrigerator (Mini)	174	No		
Smith Elementary School	2	Refrigerator (Residential)	340	No		
Smith Elementary School	30	Smart Board	215	Yes		
Smith Elementary School	1	Toaster Oven	800	No		
Smith Elementary School	1	Residential Oven	2,000	No		

Custom (High Level) Measure Analysis

Heat Pump Water Heater

Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis										
Description	Area(s)/System(s) Served	SF of Area Served	Fuel Type	Input Capacity per Unit (kW)	Tank Capacity per Unit (Gal)	Description	COP	Tank Capacity per Unit (Gal)	Estimated Unit Cost	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Base Incentives	Enhanced Incentives	Total Incentives	Total Net Cost	Payback w/o Incentives in Years	Payback w/ Incentives in Years
Storage Tank Water Heater (≤50 Gal)	Domestic Hot Water	2,000	Electric	2	15	Heat Pump Water Heater	2.5	15	$1,286.72	0.00	2,462	0	$359	$1,287	$0	$0	$0	$1,287	3.58	3.58

Appendix B: ENERGY STAR® Statement of Energy Performance

Energy use intensity (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]

J. Spencer Smith Elementary School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 38,125
Built: 1958

For Year Ending: June 30, 2021
Date Generated: August 10, 2022

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	Property Owner	Primary Contact
J. Spencer Smith Elementary School 101 Downey Drive Tenafly, New Jersey 07670	Tenafly Public Schools 500 Tenafly Road Tenafly, NJ 07670 201-816-4504	Victor Annaya 500 Tenafly Road Tenafly, NJ 07670 201-816-4504 vanaya@tenafly.k12.nj.us

Property ID: 20935434

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
82.6 kBtu/ft²

Source EUI
117.6 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	671,858 (21%)
Natural Gas (kBtu)	2,478,074 (79%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	87.3
National Median Source EUI (kBtu/ft²)	124.3
% Diff from National Median Source EUI	-5%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	194

Signature & Stamp of Verifying Professional

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

LP Signature: ______________________Date: ___________

Licensed Professional

____ ________
,
(____)____-______
____

Professional Engineer or Registered Architect Stamp (if applicable)

APPENDIX C: GLOSSARY

TERM	DEFINITION
Blended Rate	Used to calculate fiscal savings associated with measures. 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	*British thermal unit*: a unit of energy equal to the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
CHP	*Combined heat and power*. Also referred to as cogeneration.
COP	*Coefficient of performance*: a measure of efficiency in terms of useful energy delivered divided by total energy input.
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.
DCV	*Demand control ventilation*: a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need.
US DOE	*United States Department of Energy*
EC Motor	*Electronically commutated motor*
ECM	*Energy conservation measure*
EER	*Energy efficiency ratio*: a measure of efficiency in terms of cooling energy provided divided by electric input.
EUI	*Energy Use Intensity:* measures energy consumption per square foot and is a standard metric for comparing buildings' energy performance.
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 the operation of energy use systems. Unlike conservation, which involves some reduction of service, energy efficiency provides energy reductions without sacrifice of service.
ENERGY STAR®	ENERGY STAR® is the government-backed symbol for energy efficiency. The ENERGY STAR® program is managed by the EPA.
EPA	*United States Environmental Protection Agency*
Generation	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
GHG	*Greenhouse gas* gases that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface.
gpf	*Gallons per flush*

gpm	*Gallon per minute*
HID	*High intensity discharge:* high-output lighting lamps such as high-pressure sodium, metal halide, and mercury vapor.
hp	*Horsepower*
HPS	*High-pressure sodium*: a type of HID lamp.
HSPF	*Heating seasonal performance factor:* a measure of efficiency typically applied to heat pumps. Heating energy provided divided by seasonal energy input.
HVAC	*Heating, ventilating, and air conditioning*
IHP 2014	US DOE Integral Horsepower rule. The current ruling regarding required electric motor efficiency.
IPLV	*Integrated part load value:* a measure of the part load efficiency usually applied to chillers.
kBtu	One thousand British thermal units
kW	*Kilowatt*: equal to 1,000 Watts.
kWh	*Kilowatt-hour*: 1,000 Watts of power expended over one hour.
LED	*Light emitting diode*: a high-efficiency source of light with a long lamp life.
LGEA	*Local Government Energy Audit*
Load	The total power a building or system is using 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.
MH	*Metal halide*: a type of HID lamp.
MBh	*Thousand Btu per hour*
MBtu	*One thousand British thermal units*
MMBtu	*One million British thermal units*
MV	*Mercury Vapor:* a type of HID lamp.
NJBPU	*New Jersey Board of Public Utilities*
NJCEP	*New Jersey's Clean Energy Program:* NJCEP is a statewide program that offers financial incentives, programs and services for New Jersey residents, business owners and local governments to help them save energy, money, and the environment.
psig	Pounds per square inch gauge
Plug Load	Refers to the amount of power used in a space by products that are powered by means of an ordinary AC plug.
PV	*Photovoltaic:* refers to an electronic device capable of converting incident light directly into electricity (direct current).

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR® Portfolio Manager®.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC	*Solar renewable energy credit*: a credit you can earn from the state for energy produced from a photovoltaic array.
TREC	*Transition Incentive Renewable Energy Certificate:* a factorized renewable energy certificate you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of 1/8th of an inch.
Temperature Setpoint	The temperature at which a temperature regulating device (thermostat, for example) has been set.
therm	100,000 Btu. Typically used as a measure of natural gas consumption.
tons	A unit of cooling capacity equal to 12,000 Btu/hr.
Turnkey	Provision of a complete product or service that is ready for immediate use.
VAV	*Variable air volume*
VFD	*Variable frequency drive*: a controller used to vary the speed of an electric motor.
WaterSense™	The symbol for water efficiency. The WaterSense™ program is managed by the EPA.
Watt (W)	Unit of power commonly used to measure electricity use.