Local Government Energy Audit Report

Adult School/Borough Office

December 11, 2020

Prepared for:

Union Beach Board of Education
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Union Beach, NJ 07735

Prepared by:

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Disclaimer

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

TRC 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 installation costs on our experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from RS Means. Cost estimates include material and labor pricing associated with installation of primary recommended equipment only. Cost estimates do not include demolition or removal of hazardous waste. We encourage the owner of the facility to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on individual measures and conditions. TRC and NJBPU do not guarantee installed cost estimates and shall in no event be held liable should actual installed costs vary from estimates.

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

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

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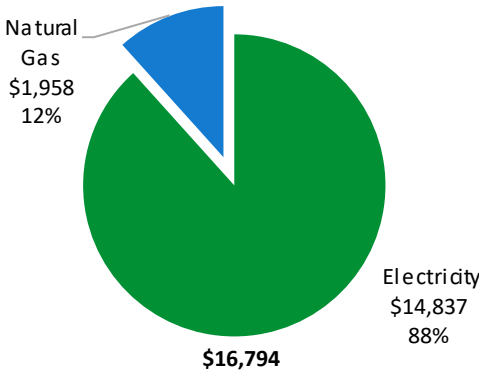
1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Adult School/Borough Office. 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: $16,794 Electricity: 78,854 kWh Natural Gas: 1,823 Therms	
ENERGY STAR® Benchmarking Score	40 *(1-100 scale)*	This building performs slightly below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

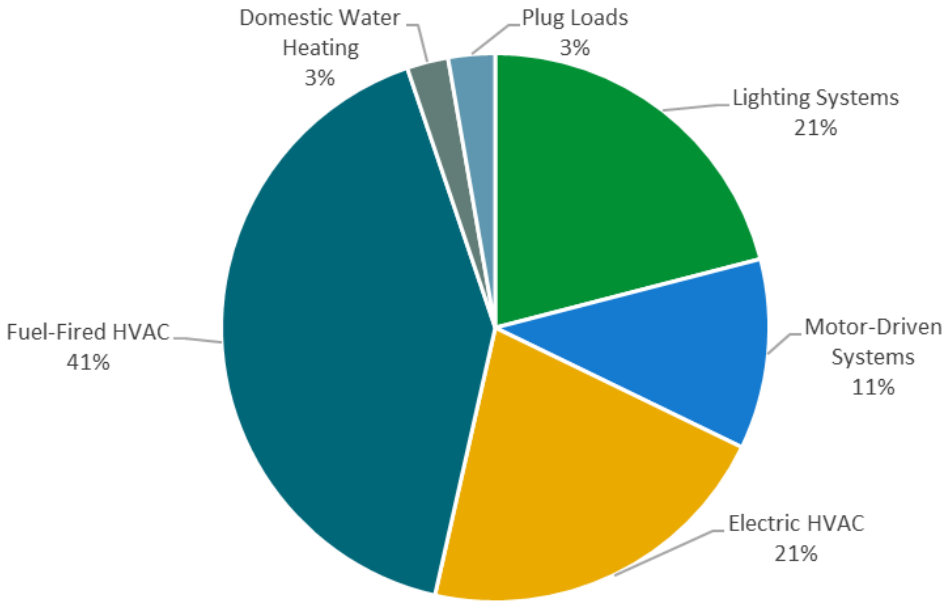


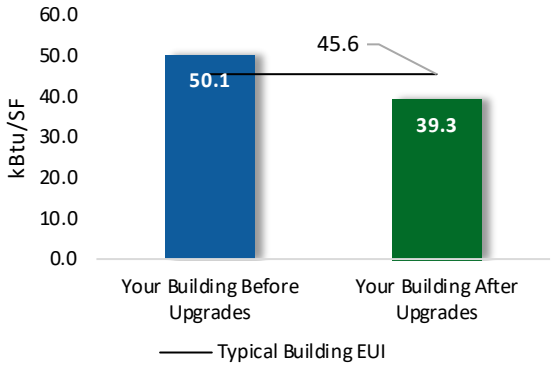
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

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

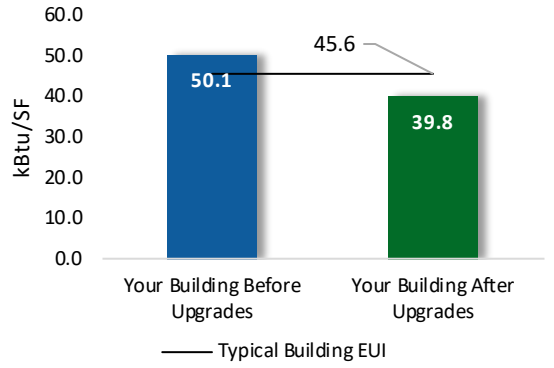
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$20,653
Potential Rebates & Incentives[1]	$3,312
Annual Cost Savings	$4,446
Annual Energy Savings	Electricity: 22,405 kWh Natural Gas: 215 Therms
Greenhouse Gas Emission Savings	13 Tons
Simple Payback	3.9 Years
Site Energy Savings (all utilities)	22%



Scenario 2: Cost Effective Package[2]

Installation Cost	$10,401
Potential Rebates & Incentives	$3,312
Annual Cost Savings	$4,175
Annual Energy Savings	Electricity: 20,963 kWh Natural Gas: 215 Therms
Greenhouse Gas Emission Savings	12 Tons
Simple Payback	1.7 Years
Site Energy Savings (all utilities)	21%



On-site Generation Potential

Photovoltaic	None
Combined Heat and Power	None

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

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**14,864**	**3.3**	**-3**	**$2,763**	**$5,080**	**$2,340**	**$2,740**	**1.0**	**14,604**
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	855	0.6	0	$159	$1,613	$500	$1,113	7.0	840
ECM 2	Retrofit Fixtures with LED Lamps	Yes	14,009	2.7	-3	$2,604	$3,467	$1,840	$1,627	0.6	13,764
Lighting Control Measures			**3,709**	**0.6**	**-1**	**$690**	**$2,302**	**$950**	**$1,352**	**2.0**	**3,644**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	2,155	0.4	0	$401	$1,620	$420	$1,200	3.0	2,117
ECM 4	Install High/Low Lighting Controls	Yes	1,555	0.2	0	$289	$682	$530	$152	0.5	1,527
Electric Unitary HVAC Measures			**1,442**	**1.0**	**0**	**$271**	**$10,252**	**$0**	**$10,252**	**37.8**	**1,452**
ECM 5	Install High Efficiency Air Conditioning Units	No	1,442	1.0	0	$271	$10,252	$0	$10,252	37.8	1,452
Domestic Water Heating Upgrade			**491**	**0.0**	**0**	**$92**	**$22**	**$22**	**$0**	**0.0**	**494**
ECM 6	Install Low-Flow DHW Devices	Yes	491	0.0	0	$92	$22	$22	$0	0.0	494
Custom Measures			**1,899**	**0.0**	**25**	**$630**	**$2,997**	**$0**	**$2,997**	**4.8**	**4,886**
ECM 7	Install Heat Pump Water Heater	Yes	1,899	0.0	0	$357	$2,970	$0	$2,970	8.3	1,912
ECM 8	Optimize Boiler Controls	Yes	0	0.0	25	$273	$27	$0	$27	0.1	2,973
TOTALS (COST EFFECTIVE MEASURES)			**20,963**	**4.0**	**22**	**$4,175**	**$10,401**	**$3,312**	**$7,089**	**1.7**	**23,628**
TOTALS (ALL MEASURES)			**22,405**	**5.0**	**22**	**$4,446**	**$20,653**	**$3,312**	**$17,342**	**3.9**	**25,080**

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

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

Figure 2 – Evaluated Energy Improvements

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

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.

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

Energy Conservation Measure		SmartStart	Direct Install	Pay For Performance
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and	X	X	
ECM 2	Retrofit Fixtures with LED Lamps	X	X	
ECM 3	Install Occupancy Sensor Lighting Controls	X	X	
ECM 4	Install High/Low Lighting Controls	X	X	
ECM 5	Install High Efficiency Air Conditioning Units		X	
ECM 6	Install Low-Flow DHW Devices	X	X	
ECM 7	Install Heat Pump Water Heater			
ECM 8	Optimize Boiler Controls			

Figure 3 – Funding Options

New Jersey's Clean Energy Programs At-A-Glance

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

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

Individual Measures with SmartStart

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

Turnkey Installation with Direct Install

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

Whole Building Approach with Pay for Performance

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

More Options from Around the State

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

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

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

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

Ongoing Electric Savings with Demand Response

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

2 EXISTING CONDITIONS

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

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

2.1 Site Overview

On September 11, 2020, TRC performed an energy audit at Adult School/Borough Office located in Union Beach, New Jersey. TRC met with Jamison Lauer to review the facility operations and help focus our investigation on specific energy-using systems. Mr. Lauer was very cooperative throughout the energy audit process.

Adult School/Borough Office is a one-story, 9,000 square foot building built in 1852 and renovated in 1995. Spaces include offices, a basement with storage space and boiler room.

2.2 Building Occupancy

The facility is occupied year-round, seven days per week. Typical weekday occupancy is 5 to 10 staff personnel.

Building Name	Weekday/Weekend	Operating Schedule
Adult Office / Borough Office	Weekday	8:00 AM - 4:00 PM
	Weekend	8:00 AM - 12:00 PM

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are concrete block over structural steel with a brick facade. The roof is pitched and covered with clay tiles.

Most of the windows are double glazed and have aluminum frames. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition. Exterior doors have metal frame and are in good condition with door seals in good condition.

Building entrance

Windows

Exterior brick wall

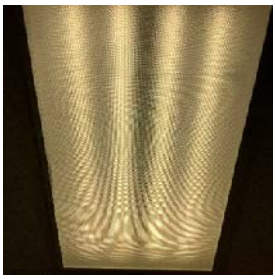
Exterior door

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several 40-Watt T12 fixtures. Additionally, there are some U-shaped fluorescent lamps. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts.

Fixture types include 2-lamp or 4-lamp, 2-foot, 4-foot, and 8-foot long troffer and surface mounted fixtures.

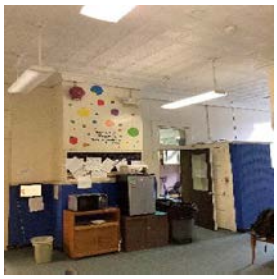
All exit signs are LED. Interior lighting levels were found to be sufficient.



2X4 T8 4-lamp fixture

2X4 T8 2-lamp fixture

8 ft T12 lamps



2X4 T8 2-lamp fixtures

All interior lighting fixtures are controlled by wall switches.

Exterior LED wall pack

Exterior fixtures are LED wall packs and are controlled by photocells.

2.5 Air Handing Systems

Unit Ventilators

Three office rooms have unit ventilators for space heating. These units are equipped with hot water coils and a blower fan for heating. The units are old and in poor condition. We recommend replacing them as part of a capital upgrade/improvement plan.

Air Conditioners

Space cooling for the offices is provided by seven window air conditioners (ACs). The nameplate for most units was either not accessible or not legible so the capacity and SEER values for the window ACs had to be estimated. We estimate the unit capacities to range from 0.5-tons to 1.5 tons with SEER values of approximately 10.0. The units are old and in poor condition.

Electric Resistance Heating

There are three electric baseboard heaters installed in the building. They are located in a couple of offices and in a small hallway between each office. Each baseboard heater has a heating capacity of 1.5 kW.

Unit ventilator

Window AC

Electric baseboard heater

Window AC in poor condition

2.6 Heating Hot Water Systems

One Aerco 707 MBh output hot water boiler serves the building space heating load. The boiler is the condensing type with a nominal efficiency of 91.0%. The boiler was installed in 2013 and is in good condition.

Heating hot water is supplied throughout the building by six small, fractional hp circulation pumps. The boilers and pumps provide hot water to hot water radiator units in the office spaces.

There is a boiler digital control module installed in the boiler room that allows users to enter a hot water supply set point. During the audit it was noticed that despite no need for space heating during the month of September, the boiler hot water supply set point was 123°F. Since running the boilers in summer is not needed in this building, shutting down the boiler during the summer would lead to natural gas cost savings. We have added more details on this opportunity in the custom ECMs section (Section 4.5) later in this report.

Condensing type hot water boiler

Hot water circulation pumps

Boiler controller

2.7 Domestic Hot Water

Hot water is produced with an 80-gallon, 9 kW electric storage water heater. The heater is in fair condition and beyond its useful life. We recommend installing a new, heat pump-type electric water heater. See Section 4.0 (Energy Conservation Measures) for further details.

The domestic hot water pipes are insulated, and the insulation is in fair condition.

Electric domestic hot water heater

2.8 Plug Load & 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.

There are 10 computer workstations throughout the facility. Plug loads throughout the building include general café and office equipment such as printers, water coolers, microwave oven, toaster oven, ceiling fans, paper shredder, and a refrigerator.

There are no vending machines in this building.

Microwave oven

Mini fridge

Large printer

Large copier/printer

2.9 Water-Using Systems

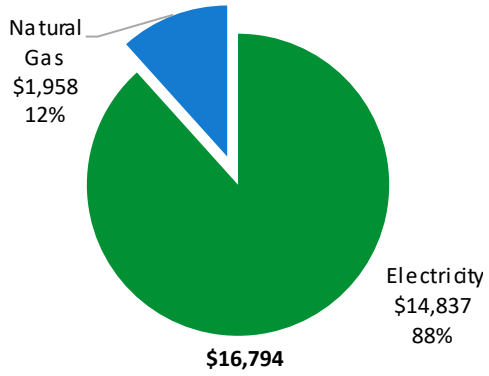
Faucet flow rate in the restroom are at 2.5 gallons per minute (gpm).

Restroom faucets

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	78,854 kWh	$14,837
Natural Gas	1,823 Therms	$1,958
Total		**$16,794**



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

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

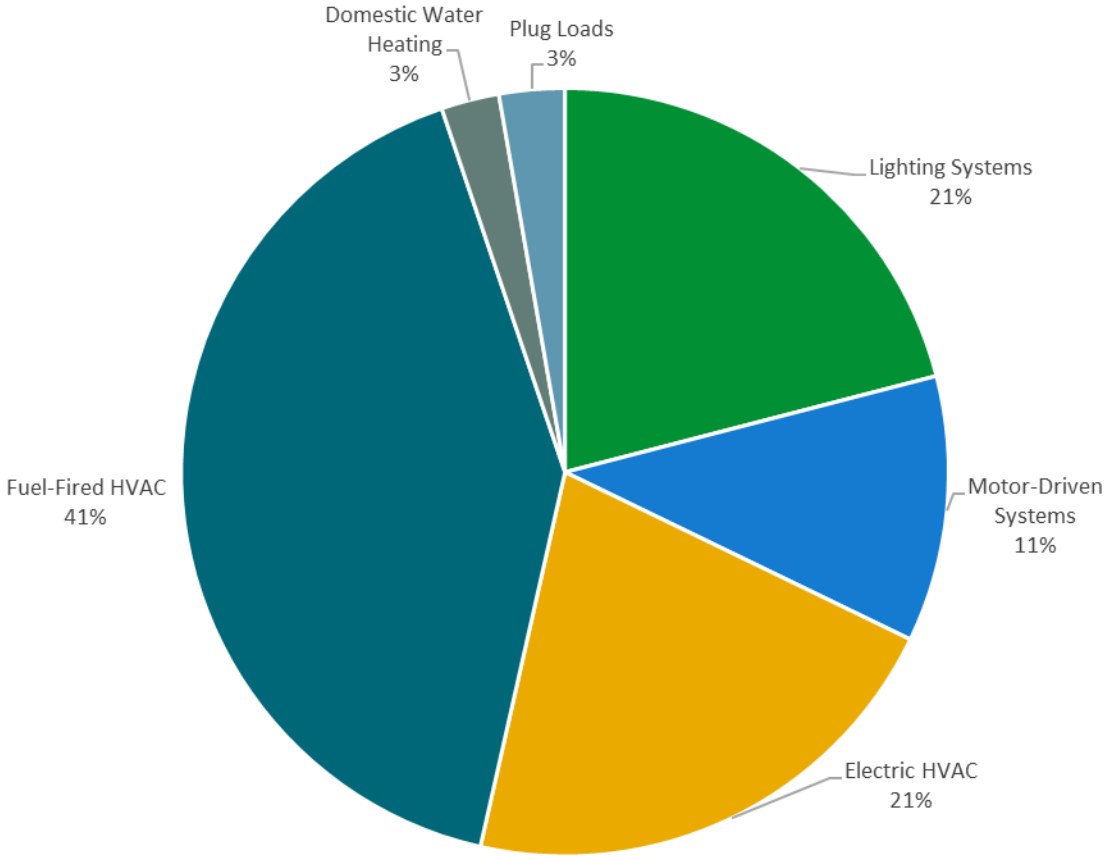
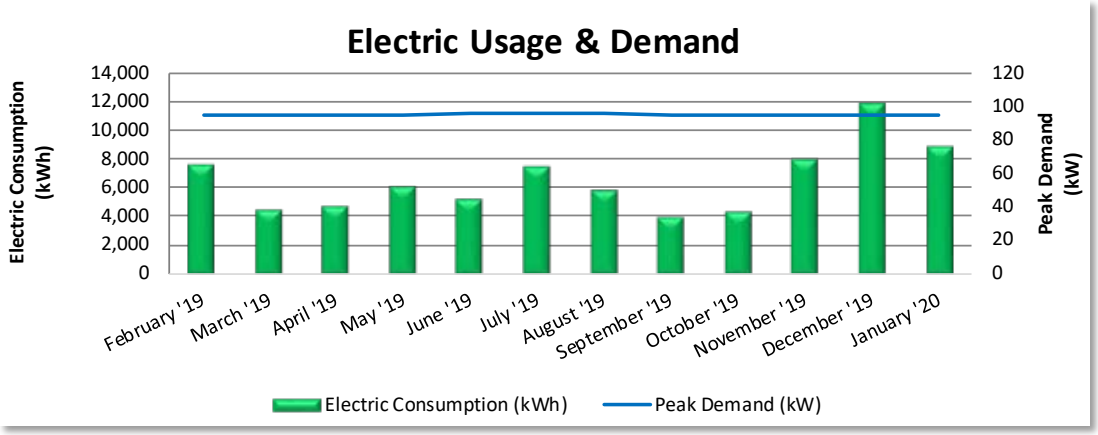


Figure 5 - Energy Balance

3.1 Electricity

JCP&L delivers electricity under rate class General Service Secondary, with electric production provided by East Coast Power and Gas of New Jersey, a third-party supplier.



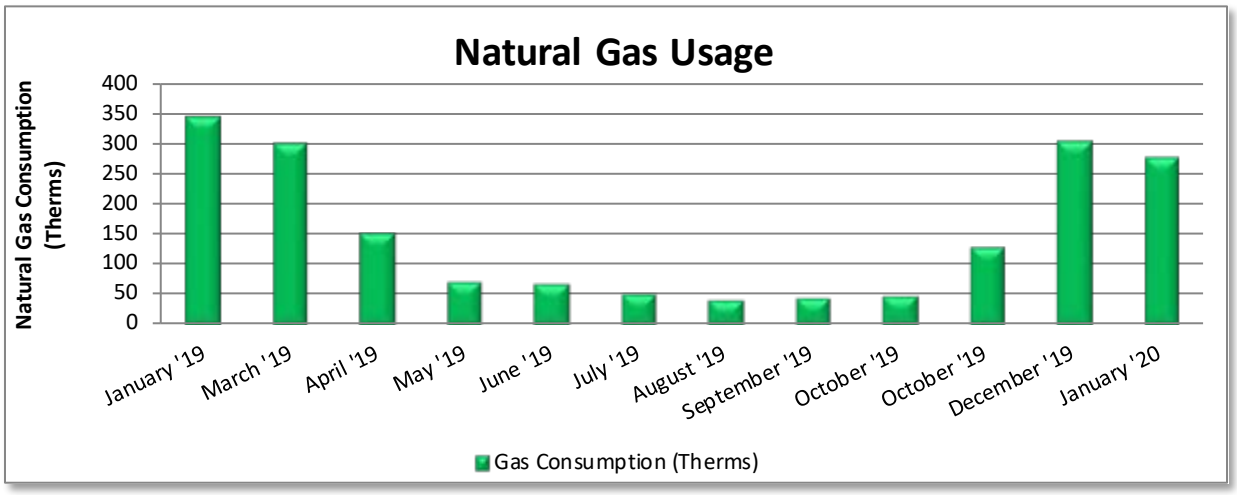
Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Billed Demand (kW)**	**Demand Cost**	**Total Electric Cost**
2/27/19	30	7,626	97	$542	$1,310
3/27/19	28	4,467	97	$542	$1,020
4/25/19	29	4,776	97	$542	$1,054
5/29/19	34	6,142	97	$542	$1,182
6/26/19	28	5,203	97	$542	$1,127
7/26/19	30	7,517	97	$542	$1,365
8/27/19	32	5,898	97	$542	$1,209
9/24/19	28	4,014	97	$542	$1,028
10/25/19	31	4,345	97	$542	$1,016
11/25/19	31	8,037	97	$542	$1,371
12/17/19	22	11,825	97	$542	$1,703
1/27/20	41	8,788	97	$542	$1,410
Totals	**364**	**78,638**	**97**	**$6,508**	**$14,796**
Annual	**365**	**78,854**	**97**	**$6,526**	**$14,837**

Notes:

- You were billed for a constant demand of 97 kW throughout the year, according to the utility data provided to us.
- The average electric cost over the past 12 months was $0.188/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.
- Your electricity cost is higher than the average electric cost in New Jersey ($0.12/kWh to 0.14/kWh). The main reason for this high cost/kWh is the high billed demand of 97 kW.
- The total connected electric demand (kW) from the equipment installed in the building is significantly lower than the billed demand of 97 kW. We recommend contacting your electric utility provider, JCP&L and discussing the reason for being charged for 97 kW demand. Also, it would be helpful to ask your utility provider for a history of billed demand and measured demand.

3.2 Natural Gas

NJ Natural Gas delivers natural gas under rate class Monthly 057CNN2G, 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**
2/14/19	28	343	$318
3/19/19	33	299	$293
4/17/19	29	151	$156
5/16/19	29	72	$87
6/19/19	34	69	$85
7/22/19	33	51	$68
8/19/19	28	41	$59
9/17/19	29	44	$62
10/17/19	30	49	$69
11/14/19	28	127	$142
12/17/19	33	302	$321
1/17/20	31	276	$298
Totals	**365**	**1,823**	**$1,958**
Annual	**365**	**1,823**	**$1,958**

Notes:

- The average gas cost for the past 12 months is $1.074/therm, which is the blended rate used throughout the analysis.
- The facility uses electric domestic water heating and has no reheat system for space cooling, however, the boiler operated unnecessarily during the mid-June to mid-October period. This helps to explain higher than expected natural gas consumption in summer. See Section 4.5 for energy and cost savings opportunity details.

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	40

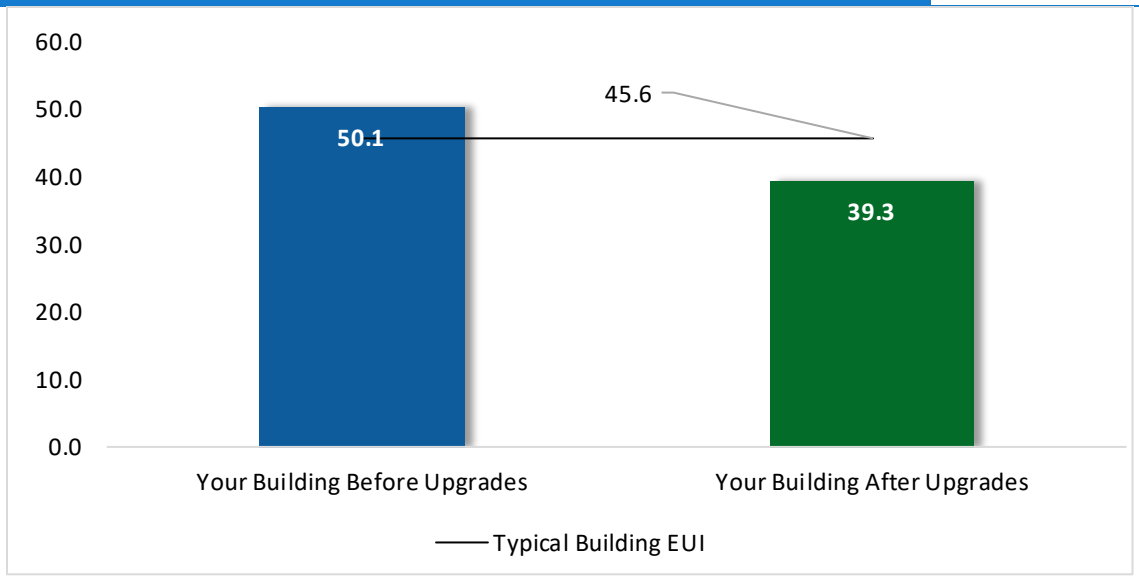


Figure 6 - Energy Use Intensity Comparison[3]

At 50.1 kBtu/ft^2, this building's energy usage slightly exceeds the national average of 45.6 kBtu/ft^2 for schools, meaning building performance is slightly below the national average.

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. A number of factors can cause a building to vary from the "typical" energy usage. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and occupant behavior all contribute to a building's energy use and the benchmarking score.

[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].

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

4 ENERGY CONSERVATION MEASURES

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

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

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 ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**14,864**	**3.3**	**-3**	**$2,763**	**$5,080**	**$2,340**	**$2,740**	**1.0**	**14,604**
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	855	0.6	0	$159	$1,613	$500	$1,113	7.0	840
ECM 2	Retrofit Fixtures with LED Lamps	Yes	14,009	2.7	-3	$2,604	$3,467	$1,840	$1,627	0.6	13,764
Lighting Control Measures			**3,709**	**0.6**	**-1**	**$690**	**$2,302**	**$950**	**$1,352**	**2.0**	**3,644**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	2,155	0.4	0	$401	$1,620	$420	$1,200	3.0	2,117
ECM 4	Install High/Low Lighting Controls	Yes	1,555	0.2	0	$289	$682	$530	$152	0.5	1,527
Electric Unitary HVAC Measures			**1,442**	**1.0**	**0**	**$271**	**$10,252**	**$0**	**$10,252**	**37.8**	**1,452**
ECM 5	Install High Efficiency Air Conditioning Units	No	1,442	1.0	0	$271	$10,252	$0	$10,252	37.8	1,452
Domestic Water Heating Upgrade			**491**	**0.0**	**0**	**$92**	**$22**	**$22**	**$0**	**0.0**	**494**
ECM 6	Install Low-Flow DHW Devices	Yes	491	0.0	0	$92	$22	$22	$0	0.0	494
Custom Measures			**1,899**	**0.0**	**25**	**$630**	**$2,997**	**$0**	**$2,997**	**4.8**	**4,886**
ECM 7	Install Heat Pump Water Heater	Yes	1,899	0.0	0	$357	$2,970	$0	$2,970	8.3	1,912
ECM 8	Optimize Boiler Controls	Yes	0	0.0	25	$273	$27	$0	$27	0.1	2,973
TOTALS			**22,405**	**5.0**	**22**	**$4,446**	**$20,653**	**$3,312**	**$17,342**	**3.9**	**25,080**

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

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

Figure 7 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**14,864**	**3.3**	**-3**	**$2,763**	**$5,080**	**$2,340**	**$2,740**	**1.0**	**14,604**
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	855	0.6	0	$159	$1,613	$500	$1,113	7.0	840
ECM 2	Retrofit Fixtures with LED Lamps	14,009	2.7	-3	$2,604	$3,467	$1,840	$1,627	0.6	13,764
Lighting Control Measures		**3,709**	**0.6**	**-1**	**$690**	**$2,302**	**$950**	**$1,352**	**2.0**	**3,644**
ECM 3	Install Occupancy Sensor Lighting Controls	2,155	0.4	0	$401	$1,620	$420	$1,200	3.0	2,117
ECM 4	Install High/Low Lighting Controls	1,555	0.2	0	$289	$682	$530	$152	0.5	1,527
Domestic Water Heating Upgrade		**491**	**0.0**	**0**	**$92**	**$22**	**$22**	**$0**	**0.0**	**494**
ECM 6	Install Low-Flow DHW Devices	491	0.0	0	$92	$22	$22	$0	0.0	494
Custom Measures		**1,899**	**0.0**	**25**	**$630**	**$2,997**	**$0**	**$2,997**	**4.8**	**4,886**
ECM 7	Install Heat Pump Water Heater	1,899	0.0	0	$357	$2,970	$0	$2,970	8.3	1,912
ECM 8	Optimize Boiler Controls	0	0.0	25	$273	$27	$0	$27	0.1	2,973
TOTALS		**20,963**	**4.0**	**22**	**$4,175**	**$10,401**	**$3,312**	**$7,089**	**1.7**	**23,628**

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

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

Figure 8 – Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**14,864**	**3.3**	**-3**	**$2,763**	**$5,080**	**$2,340**	**$2,740**	**1.0**	**14,604**
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	855	0.6	0	$159	$1,613	$500	$1,113	7.0	840
ECM 2	Retrofit Fixtures with LED Lamps	14,009	2.7	-3	$2,604	$3,467	$1,840	$1,627	0.6	13,764

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

ECM 1: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Retrofit fluorescent fixtures by removing the fluorescent tubes and ballasts and replacing them with LED tubes and LED drivers (if necessary), which are designed to be used in retrofitted fluorescent fixtures.

The measure uses the existing fixture housing but replaces the electric components with more efficient lighting technology which use less power than other lighting technologies but provides equivalent lighting output. Maintenance savings may also be achieved since LED tubes last longer than fluorescent tubes and therefore do not need to be replaced as often.

Affected building areas: all fixtures with T12 tubes in the basement.

ECM 2: Retrofit Fixtures with LED Lamps

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

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

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

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**3,709**	**0.6**	**-1**	**$690**	**$2,302**	**$950**	**$1,352**	**2.0**	**3,644**
ECM 3	Install Occupancy Sensor Lighting Controls	2,155	0.4	0	$401	$1,620	$420	$1,200	3.0	2,117
ECM 4	Install High/Low Lighting Controls	1,555	0.2	0	$289	$682	$530	$152	0.5	1,527

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: offices spaces and the restroom.

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.

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

Affected building areas: all hallway and common spaces.

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

4.3 Electric Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		**1,442**	**1.0**	**0**	**$271**	**$10,252**	**$0**	**$10,252**	**37.8**	**1,452**
ECM 5	Install High Efficiency Air Conditioning Units	1,442	1.0	0	$271	$10,252	$0	$10,252	37.8	1,452

Replacing the unitary HVAC units has a long payback period and may not be justifiable based simply on energy considerations. However, all the window ACs in this building are beyond 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 window ACs are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 5: 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 load, and the estimated annual operating hours.

Affected units: all seven window AC units.

4.4 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**491**	**0.0**	**0**	**$92**	**$22**	**$22**	**$0**	**0.0**	**494**
ECM 6	Install Low-Flow DHW Devices	491	0.0	0	$92	$22	$22	$0	0.0	494

ECM 6: 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.

4.5 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**1,899**	**0.0**	**25**	**$630**	**$2,997**	**$0**	**$2,997**	**4.8**	**4,886**
ECM 7	Install Heat Pump Water Heater	1,899	0.0	0	$357	$2,970	$0	$2,970	8.3	1,912
ECM 8	Optimize Boiler Controls	0	0.0	25	$273	$27	$0	$27	0.1	2,973

ECM 7: 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 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 such as the basement in this building.

Most HPHW 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.

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.

ECM 8: Optimize Boiler Controls

Basic boiler controls provide for setting hot water supply temperature, scheduling 'start' and 'stop' times for boiler operation and locking out equipment operation based on outside air or space temperature. Some controllers can reset hot water supply temperature based on outside air. When in proper adjustment, boiler controls can improve comfort for building occupants and save substantial energy relative to uncontrolled systems.

During the energy audit it was observed that boiler was set to provide hot water at a temperature of 123°F despite warm weather on the day of the audit. Unnecessary circulation of hot water through the heating loop can lead to line losses and excess pumping use. In cases where the valves for radiators and other terminal units are not properly shut off, cooling equipment can run longer hours to offset the additional heat gain, resulting in simultaneous heating and cooling and excess electricity and natural gas consumption.

When the boiler is properly controlled and is shutdown during summer, the facility can realize energy and costs savings from avoided gas (and pumping) consumption during summer months. We have conservatively estimated the savings to be close to $275 annually. The measure cost shown in the table above is a placeholder value. This measure is great energy and cost savings opportunity.

4.6 Measures for Future Consideration

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

Union Beach Board of Education may wish to consider the Energy Savings Improvement Program (ESIP) / a 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 to a Heat Pump System

Electric resistance heat, such as the electric baseboard heaters installed in two offices and a small corridor in this building, are cheap to install but are expensive to run for space heating. Often, there are opportunities to install ductless electric heat pumps in buildings which have baseboard electric heaters for space heating and packaged or window ACs for cooling. Electric heat pump systems provide both space heating and cooling.

Electric heat pumps have high coefficient of performance (COP) ratings and are substantially more efficient than traditional electric heating systems. Their cooling performance also can be more efficient than window ACs currently installed in the offices in this building. Further investigation will be required to determine whether installing a heat pump system is a cost-effective solution in this building.

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 between 5 to 20 percent 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, planned capital upgrades, and 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 will 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 can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[5]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

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.

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.

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.

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

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.

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.

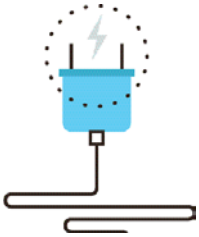
Water Heater Maintenance

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.

Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips[6]. Your local utility may offer incentives or rebates for this equipment.

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[7] or download a copy of EPA's "WaterSense® at Work: Best Management Practices for Commercial and Institutional Facilities"[8] 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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[6] For additional information refer to "Assessing and Reducing Plug and Process Loads in Office Buildings" http://www.nrel.gov/docs/fy13osti/54175.pdf, or "Plug Load Best Practices Guide" http://www.advancedbuildings.net/plug-load-best-practices-guide-offices.

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

[8] 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 no potential for installing a PV array.

This facility does not appear to meet the minimum criteria for a cost-effective solar PV installation. To be cost-effective, a solar PV array needs certain minimum criteria, such as sufficient and sustained electric demand and sufficient flat or south-facing rooftop or other unshaded space on which to place the PV panels.

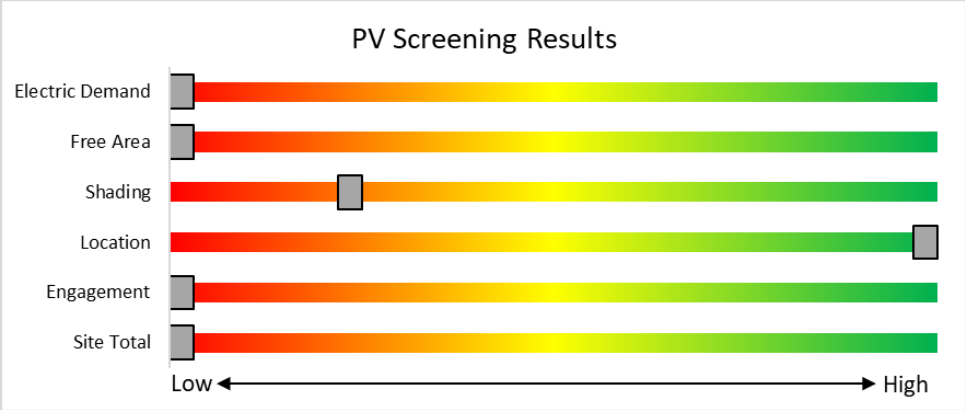

Figure 9 – Photovoltaic Screening

Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects *must* register their projects prior to the start of construction to establish the project's eligibility to earn TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installation.

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:

Transition Incentive (TI) Program: https://www.njcleanenergy.com/renewable-energy/programs/transition-incentive-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.

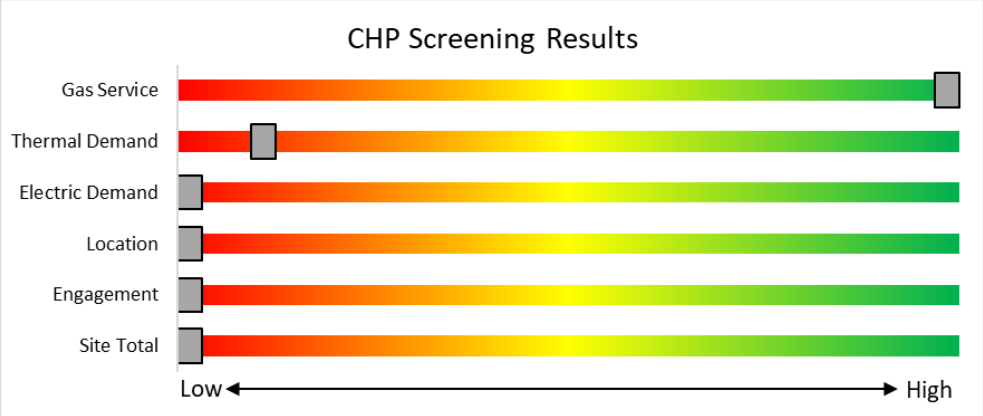

Figure 10 – Combined Heat & Power Screening

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

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

7.1 SmartStart

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

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

Equipment with Prescriptive Incentives Currently Available:

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

Incentives

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

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

How to Participate

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

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

7.2 Direct Install

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

Based on the site building and utility data provided, the facility meets the requirements of the current DI program.

Incentives

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

How to Participate

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

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

7.3 Pay for Performance - Existing Buildings

Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures that results in at least 15% source energy savings, and lighting cannot make up the majority of the savings.

P4P is a generally a good option for medium-to-large sized facilities looking to implement as many measures as possible under a single project to achieve deep energy savings. This program has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program.

The facility does not meet the requirements of the current P4P program because the peak demand is substantially lower than the required 200 kW peak demand for eligibility.

Incentives

Incentives are based on estimated and achieved energy savings ranging from $0.18-$0.22/kWh and $1.80-$2.50/therm, capped at the lesser of 50% total project cost, or $1 million per electric account and $1 million per natural gas account, per fiscal year, not to exceed $2 million per project. An incentive of $0.15/square foot is also available to offset the cost of developing the Energy Reduction Plan (see below) contingent on the project moving forward with measure installation.

How to Participate

Contact one of the pre-approved consultants and contractors ("Partners"). Under direct contract to you, they will help further evaluate the measures identified in this report through development of the energy reduction plan), assist you in implementing selected measures, and verify actual savings one year after the installation. Your Partner will also help you apply for incentives.

Approval of the final scope of work is required by the program prior to installation. Installation can be done by the contractor of your choice (some P4P Partners are also contractors) or by internal staff, but the Partner remains involved throughout construction to ensure compliance with the program requirements.

Detailed program descriptions, instructions for applying, applications and list of Partners can be found at: www.njcleanenergy.com/P4P.

7.4 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 Fuel Cells with Heat Recovery	>3 MW	$350		
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 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.

7.5 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 ECMs, ensuring that ESIP projects are cash flow positive for the life of the contract.

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

How to Participate

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

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

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

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

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

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

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

7.6 Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects *must* register their projects prior to the start of construction to establish the project's eligibility to earn TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installations. NJBPU calculates the value of a Transition Renewable Energy Certificate (TREC) by multiplying the base compensation rate ($152/MWh) by the project's assigned factor (i.e. $152 x 0.85 = $129.20/MWh). The TREC factors are defined based on the chart below:

Project Type	Factor
Subsection (t): landfill, brownfield, areas of historic fill	1.00
Grid supply (Subsection (r)) rooftop	1.00
Net metered non-residential rooftop and carport	1.00
Community solar	0.85
Grid supply (Subsection (r)) ground mount	0.60
Net metered residential ground mount	0.60
Net metered residential rooftop and carport	0.60
Net metered non-residential ground mount	0.60

After the registration is accepted, construction is complete, and final paperwork has been submitted and is deemed complete, the project is issued a New Jersey certification number, which enables it to generate New Jersey TRECs.

Eligible projects may generate TRECs for 15 years following the commencement of commercial operations (also referred to as the "Transition Incentive Qualification Life"). After 15 years, projects may be eligible for a NJ Class I REC.

TRECs will be used by the identified compliance entities to satisfy a compliance obligation tied to a new Transition Incentive Renewable Portfolio Standard ("TI-RPS"), which will exist in parallel with, and completely separate from, the existing Solar RPS for Legacy SRECs. The TI-RPS is a carve-out of the current Class I RPS requirement. The creation of TRECs is based upon metered generation supplied to PJM-EIS General Attribute Tracking System ("GATS") by the owners of eligible facilities or their agents. GATS would create one TREC for each MWh of energy produced from a qualified facility.

TRECs will be purchased monthly by a TREC Administrator who will allocate the TRECs 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.

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan. The Transition Incentive Program online portal is now open to new applications effective May 1, 2020. There are instructions on "How and When to Transfer my SRP Registration to the Transition Incentive Program". If you are considering installing solar photovoltaics on your building, visit the following link for more information:

https://www.njcleanenergy.com/renewable-energy/programs/transition-incentive-program

8 Energy Purchasing and Procurement Strategies

8.1 Retail Electric Supply Options

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

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

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

8.2 Retail Natural Gas Supply Options

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

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

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

A list of licensed third-party natural gas suppliers is available at the NJBPU website[10].

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Basement Storage area 2	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Basement Storage area 2	2	Linear Fluorescent - T12: 8' EST12 (60W) - 2L	Wall Switch	S	120	1,224	1	Relamp & Reballast	No	2	LED - Linear Tubes: (2) 8' Lamps	Wall Switch	72	1,224	0.1	129	0	$24	$257	$80	7.4
Basement Storage area 2	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,224	2	Relamp	No	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,224	0.2	302	0	$56	$292	$160	2.4
Basement Storage main area	10	Linear Fluorescent - T12: 8' EST12 (60W) - 2L	Wall Switch	S	120	1,224	1	Relamp & Reballast	No	10	LED - Linear Tubes: (2) 8' Lamps	Wall Switch	72	1,224	0.5	646	0	$120	$1,287	$400	7.4
Basement Storage main area	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,224	2	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,224	0.1	151	0	$28	$146	$80	2.4
Boiler room	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	1,224	1	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,224	0.1	79	0	$15	$69	$20	3.3
Boiler room	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,224	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,224	0.1	75	0	$14	$73	$40	2.4
Space behind office 3	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	4,896	2, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	3,378	0.1	797	0	$148	$262	$120	1.0
Space behind office 4	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	4,896	2, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	3,378	0.1	797	0	$148	$262	$120	1.0
Corridor/Kitchen	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,896	2, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,378	0.2	905	0	$168	$371	$305	0.4
Corridor/Kitchen	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	2, 4	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	High/Low Control	33	6,044	0.0	378	0	$70	$72	$20	0.7
Main entrance	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Main entrance	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	2, 4	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	High/Low Control	33	6,044	0.1	756	0	$141	$145	$40	0.7
Office hall 1	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,896	2, 4	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,378	0.6	3,166	-1	$589	$736	$505	0.4
Office hall 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,896	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,896	0.0	178	0	$33	$37	$20	0.5
Office hall 2	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,896	2, 3	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,378	0.6	3,166	-1	$589	$781	$350	0.7
Office hall 2	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,896	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,896	0.0	178	0	$33	$37	$20	0.5
Office hall 3	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,896	2, 3	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,378	0.6	3,166	-1	$589	$781	$350	0.7
Office hall 4	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,896	2, 3	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,378	0.6	3,166	-1	$589	$781	$350	0.7
Restroom 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,448	2, 3	Relamp	Yes	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,689	0.1	199	0	$37	$343	$110	6.3
Restroom 2	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,448	2, 3	Relamp	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,689	0.1	170	0	$32	$325	$100	7.1
Restroom 3	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,448	2, 3	Relamp	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,689	0.1	170	0	$32	$325	$100	7.1
Exterior Lighting	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell		40	4,380		None	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	40	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?	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	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Office hall 1	Unit Ventilator	1	Supply Fan	0.5	60.0%	No	B	6,222		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Office hall 2	Unit Ventilator	1	Supply Fan	0.5	60.0%	No	B	6,222		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Office hall 3	Unit Ventilator	1	Supply Fan	0.5	60.0%	No	B	6,222		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	HHW system	1	Heating Hot Water Pump	0.3	73.4%	No	W	6,222		No	73.4%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	HHW system	1	Heating Hot Water Pump	0.1	60.0%	No	W	6,222		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	HHW system	1	Heating Hot Water Pump	0.1	60.0%	No	W	6,222		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	HHW system	1	Heating Hot Water Pump	0.1	60.0%	No	W	6,222		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	HHW system	1	Heating Hot Water Pump	0.1	60.0%	No	W	6,222		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	HHW system	1	Heating Hot Water Pump	0.4	60.0%	No	W	6,222		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0

Electric 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)	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/EER)	Heating Mode Efficiency (COP)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Corridor behind office 3	Corridor behind office 3	1	Electric Resistance Heat		5.12	W		No							0.0	0	0	$0	$0	$0	0.0
Corridor behind office 4	Corridor behind office 4	1	Electric Resistance Heat		5.12	W		No							0.0	0	0	$0	$0	$0	0.0
Office hall 3	Office hall 3	1	Electric Resistance Heat		5.12	W		No							0.0	0	0	$0	$0	$0	0.0
Corridor behind office 3	Corridor behind office 3	1	Window Air Conditioner	1.50		B	5	Yes	1	Window AC	1.50		12.10		0.2	228	0	$43	$1,633	$0	38.1
Corridor behind office 4	Corridor behind office 4	1	Window Air Conditioner	0.42		B	5	Yes	1	Window AC	0.42		12.10		0.1	75	0	$14	$454	$0	32.3
Office hall 1	Office hall 1	2	Window Air Conditioner	1.50		B	5	Yes	2	Window AC	1.50		12.10		0.3	456	0	$86	$3,266	$0	38.1
Office hall 2	Office hall 2	1	Window Air Conditioner	1.50		B	5	Yes	1	Window AC	1.50		12.10		0.2	228	0	$43	$1,633	$0	38.1
Office hall 3	Office hall 3	1	Window Air Conditioner	1.50		B	5	Yes	1	Window AC	1.50		12.10		0.2	228	0	$43	$1,633	$0	38.1
Office hall 4	Office hall 4	1	Window Air Conditioner	1.50		B	5	Yes	1	Window AC	1.50		12.10		0.2	228	0	$43	$1,633	$0	38.1

Fuel Heating 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)	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	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	HHW System	1	Condensing Hot Water Boiler	707	W		No						0.0	0	0	$0	$0	$0	0.0

DHW Inventory & Recommendations

		Existing Conditions			Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	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	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Basement	DHW System	1	Storage Tank Water Heater (> 50 Gal)	B		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	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	6	3	Faucet Aerator (Lavatory)	2.50	0.50	0.0	491	0	$92	$22	$22	0.0

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Corridor behind office 4	1	Desktop	40	Yes
Office hall 3	5	Desktop	40	Yes
Basement Storage main area	2	Fan (Portable)	75	No
Corridor/Kitchen	1	Microwave	1,200	No
Office hall 3	1	Paper Shredder	500	No
Office hall 3	2	Printer (Medium/Small)	50	No
Corridor behind office 4	2	Printer/Copier (Large)	600	No
Office hall 3	1	Printer/Copier (Large)	600	No
Corridor/Kitchen	1	Refrigerator (Mini)	100	No

Custom ECMs

Heat Pump Water Heater

Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
Description	Area(s)/System(s) Served	Fuel Type	Input Capacity per Unit (kW)	Tank Capacity per Unit (Gal)	Total Annual kWh	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	Total Installation Cost	Total NJCEP Incentives	Payback w/ Incentives in Years
Storage Tank Water Heater (> 50 Gal)	DHW System	Electric	9.0	80	3,165	Heat Pump Water Heater	2.5	80	$2,970.00	0.00	1,899	0	$357	$2,970	$0	8.32

Optimize Boiler Controls

Existing Conditions						Proposed Conditions			Energy Impact & Financial Analysis						
Description	Area(s)/System(s) Served	Fuel Type	Boiler Capacity (MBH)	Heating Efficiency	Total Annual MMBtu	Description	Savings HVAC Fuel Usage (MMBtu)	Estimated Cost per Sqft	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total NJCEP Incentives	Payback w/ Incentives in Years
Optimize Boiler Controls	HHW System	Natural Gas	707.0	91%	182	Optimize Boiler Controls	25.4	$0.01	0.00	0	25	$273	$27	$0	0.10

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

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

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ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Union Beach Public Works Office
(Formerly Union Beach Adult School)
Primary Property Type: Office
Gross Floor Area (ft²): 9,000
Built: 1852

For Year Ending: December 31, 2019
Date Generated: September 16, 2020

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
Union Beach Public Works Office (Formerly Union Beach Adult School) 1205 Florence Avenue Union Beach, New Jersey 07735	UnionBeachBOE 221 Morningside Ave Union Beach, NJ 07735 (732) 864-4992	Union Beach Public Schools Board of Education 221 Morningside Avenue Union Beach, NJ 07735 (732) 864-4992 jlauer@unionbeachschools.org

Property ID: 12420534

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
51.5 kBtu/ft²

Source EUI
108 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	185,732 (40%)
Electric - Grid (kBtu)	277,643 (60%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	45.6
National Median Source EUI (kBtu/ft²)	95.7
% Diff from National Median Source EUI	13%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	36

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.