Local Government Energy Audit Report

Madison-Monroe School

July 31, 2019

Prepared for:

Elizabeth Public Schools

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Elizabeth, New Jersey 07201

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

TRC bases estimated installation costs on our experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from RS Means. We encourage the owner of the facility 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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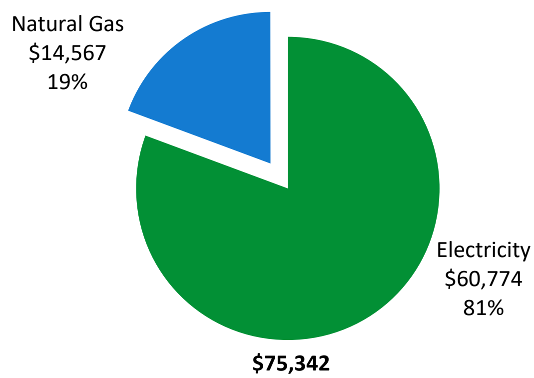
1 Executive Summary

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

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $75,342 Electricity: 391,533 kWh Natural Gas: 12,541 Therms	
ENERGY STAR® Benchmarking Score	56 *(1-100 scale)*	This building performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

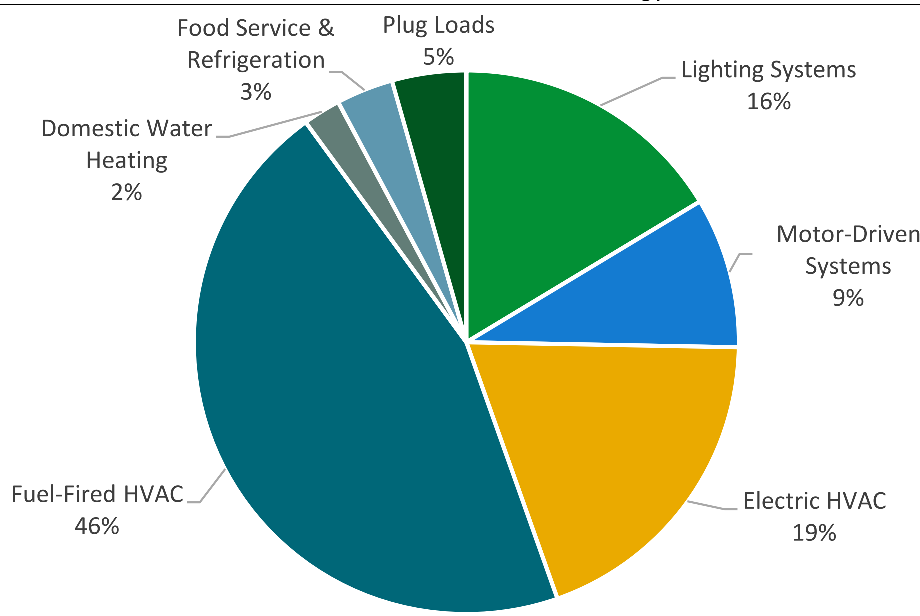


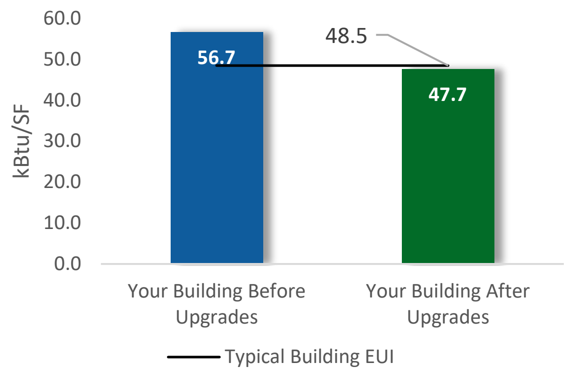
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

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

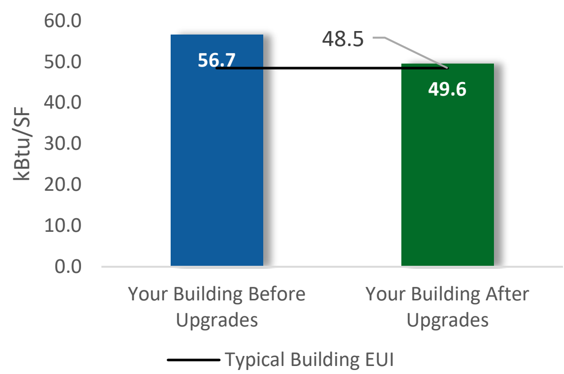
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$264,827
Potential Rebates & Incentives[1]	$20,860
Annual Cost Savings	$17,602
Annual Energy Savings	Electricity: 111,577 kWh Natural Gas: 328 Therms
Greenhouse Gas Emission Savings	58 Tons
Simple Payback	13.9 Years
Site Energy Savings (all utilities)	16%



Scenario 2: Cost Effective Package[2]

Installation Cost	$64,172
Potential Rebates & Incentives	$10,564
Annual Cost Savings	$15,402
Annual Energy Savings	Electricity: 100,114 kWh
Greenhouse Gas Emission Savings	49 Tons
Simple Payback	3.5 Years
Site Energy Savings (all utilities)	13%



On-site Generation Potential

Photovoltaic	Medium
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	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**70,972**	**17.7**	**-14**	**$10,897**	**$163,449**	**$40,041**	**$8,929**	**$31,112**	**2.9**	**69,842**
ECM 1	Install LED Fixtures	15,480	3.2	-2	$2,382	$35,728	$15,919	$2,500	$13,419	5.6	15,303
ECM 2	Retrofit Fixtures with LED Lamps	55,222	14.5	-11	$8,473	$127,100	$23,977	$6,429	$17,548	2.1	54,274
ECM 3	Install LED Exit Signs	270	0.0	0	$41	$621	$145	$0	$145	3.5	265
Lighting Control Measures		**10,121**	**2.4**	**-2**	**$1,553**	**$12,422**	**$6,750**	**$795**	**$5,955**	**3.8**	**9,944**
ECM 4	Install Occupancy Sensor Lighting Controls	9,244	2.2	-2	$1,418	$11,345	$5,750	$795	$4,955	3.5	9,082
ECM 5	Install High/Low Lighting Controls	877	0.2	0	$135	$1,077	$1,000	$0	$1,000	7.4	862
Variable Frequency Drive (VFD) Measures		**18,494**	**4.2**	**0**	**$2,871**	**$43,060**	**$16,775**	**$840**	**$15,935**	**5.6**	**18,623**
ECM 6	Install VFDs on Constant Volume (CV) Fans	9,365	3.1	0	$1,454	$21,804	$8,622	$840	$7,782	5.4	9,430
ECM 7	Install VFDs on Heating Water Pumps	9,129	1.1	0	$1,417	$21,256	$8,152	$0	$8,152	5.8	9,193
Electric Unitary HVAC Measures		**11,463**	**5.7**	**0**	**$1,779**	**$26,691**	**$68,694**	**$3,036**	**$65,658**	**36.9**	**11,544**
ECM 8	Install High Efficiency Air Conditioning Units	11,463	5.7	0	$1,779	$26,691	$68,694	$3,036	$65,658	36.9	11,544
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**41**	**$356**	**$7,127**	**$129,361**	**$6,960**	**$122,401**	**343.5**	**4,837**
ECM 9	Install High Efficiency Steam Boilers	0	0.0	41	$356	$7,127	$129,361	$6,960	$122,401	343.5	4,837
Domestic Water Heating Upgrade		**0**	**0.0**	**7**	**$64**	**$1,288**	**$2,601**	**$300**	**$2,301**	**35.7**	**874**
ECM 10	Install Tankless Water Heater	0	0.0	7	$64	$1,288	$2,601	$300	$2,301	35.7	874
Food Service & Refrigeration Measures		**527**	**0.1**	**0**	**$82**	**$1,227**	**$607**	**$0**	**$607**	**7.4**	**531**
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors	527	0.1	0	$82	$1,227	$607	$0	$607	7.4	531
TOTALS (COST EFFECTIVE MEASURES)		**100,114**	**24.3**	**-16**	**$15,402**	**$220,158**	**$64,172**	**$10,564**	**$53,608**	**3.5**	**98,940**
TOTALS (ALL MEASURES)		**111,577**	**30.1**	**33**	**$17,602**	**$255,263**	**$264,827**	**$20,860**	**$243,967**	**13.9**	**116,194**

* - 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	Install LED Fixtures	x	x	
ECM 2	Retrofit Fixtures with LED Lamps	x	x	
ECM 3	Install LED Exit Signs	x	x	
ECM 4	Install Occupancy Sensor Lighting Controls	x	x	
ECM 5	Install High/Low Lighting Controls		x	
ECM 6	Install VFDs on Constant Volume (CV) HVAC	x	x	
ECM 7	Install VFDs on Hot Water Pumps		x	
ECM 8	Install High Efficiency Electric AC	x	x	
ECM 9	Install High Efficiency Steam Boilers	x		
ECM 10	Install Tankless Water Heater	x	x	
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors		x	

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 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 Madison-Monroe School. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs. This report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing ECMs.

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

2.1 Site Overview

On February 22, 2019, TRC performed an energy audit at Madison-Monroe School located in Elizabeth, New Jersey. TRC met with Melanie Shyka to review the school operations and help focus our investigation on specific energy-using systems.

Madison Monroe is a three-story, 45,655 square foot building built in 1917. Spaces include: classrooms, a gymnasium, offices, a cafeteria, corridors, stairwells, offices, a commercial kitchen, mechanical space and 10 Temporary Classroom Units (TCUs).

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

2.2 Building Occupancy

The school is occupied from September through June from 8:00 AM to 6:00 PM. Typical weekday occupancy is 95 staff and 718 students.

Building Name	Weekday/Weekend	Operating Schedule
Madison Monroe School	Weekday	8:00 AM - 6:00 PM
	Weekend	No operation

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

The facility building walls are concrete block over structural steel with a brick façade and brick dividing walls. The roof is flat and covered with asphalt layering. There are ten TCUs on the property that also have flat roofs with EPDM membrane. They were observed to be in good condition.

All of the windows are double pane with thermal break. The exterior doors have a metal frame with plexiglass. Windows and doors are in good condition and do not allow excessive air infiltration in the building.

Building Roof

Trailer Roof

Building Façade and Windows

Trailer Facade

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. Additionally, there are some compact fluorescent lamps (CFL) and incandescent lamps. Typically, T8 fluorescent lamps use electronic ballasts.

Fixture types include 2-, 3-, or 4-lamp, 2- or 4-foot long troffer fixtures and 2-foot fixtures with U-bend tube lamps. Most fixtures are in fair condition. Gymnasium fixtures have high bay 400-watt multi vapor lamps fixtures that are manually controlled.

Most exit signs are LED; however, there is a fixture in Room 9 that is an incandescent unit. Interior lighting levels were generally sufficient.

Most lighting fixtures are controlled via manual switches, with occupancy sensors in some areas. Most spaces have been evaluated for the installation of wall-mounted or remotely mounted occupancy sensors, including high-low controls for the hallways.

Exterior fixtures include a variety of HID fixtures including metal halide (70-watt), high pressure sodium (70-watt), and mercury vapor lamp fixtures (75-watt and 250 watt). There are also a few wall-mounted 60-watt LED fixtures. The exterior lights are also controlled manually.

Gym

Occupancy Sensors

Classroom Lighting

Hallway Lighting

2.5 Air Handling Systems

Unit Ventilators

There are 15 unit ventilators that have supply fan motors, pneumatically controlled outside air dampers, and fan coil valves. This system is original to the building and appears to be in fair operating condition.

Packaged Units

The gym is cooled using a 15-ton AAON packaged unit with an EER of 11.3. The unit includes a direct gas-fired unit with a capacity of 234 MBh and an efficiency of 80%.

Nurse's office and the kitchen are cooled using 2-ton packaged units with EER values averaging approximately 9.2.

TCUs 1, 2 8 and 9 have electric cooling provided by Goodman AC units with a capacity of 2-tons and an EER of 10.3. The other 6 TCUs have Bard packaged units that cool the spaces with a 3-ton cooling capacity that provides 34.1 MBh capacity of electric heating in the respective spaces.

A few offices are cooled using window AC units

All units, except the gym unit, are beyond their useful life and have been evaluated for replacement. The gym unit was installed in the year 2012, is in good condition and well maintained.

Split AC Unit

Split AC Unit

Split AC Unit

Packaged AC Unit

2.6 Steam Heating Systems

Two non-condensing Weil McLain steam boilers with heating capacities of 3,480 MBh and efficiencies of 82% serve the majority of the building heating load. Steam is circulated to the radiators to heat a few spaces (such as corridors and stairwells) and some parts of the building. This is converted to hot water using heat exchangers and circulated to unit ventilators with two 5 hp constant speed pumps, heating up spaces such as the classrooms. The temperature is controlled in the respective space's thermostats.

The summer setback in the school is 70°F and the winter setback is 68°F. The boilers are old and have been evaluated for replacement.

Boilers

Hot Water Pumps

Radiators

TCU Packaged Unit

2.7 Domestic Hot Water

Hot water is produced with a 91-gallon 199 MBh gas-fired universal storage water heater with a 78% efficiency.

Domestic Hot Water (DHW) Heater

2.8 Food Service and Refrigeration Equipment

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

The kitchen has two refrigerator chests and a stand-up refrigerator that vary in efficiency and condition.

The walk-in refrigerator has an estimated 0.3-ton compressor and a two fan evaporator. Visit https://www.energystar.gov/products/commercial_food_service_equipment for the latest information on high-efficiency food service equipment.

Milk Cooler

Warming Cabinet

Conventional Oven

Stand-up Refrigerator

2.9 Plug Load & Vending Machines

The utility bill analysis indicates that plug loads consume about 5% of the total building energy use. This is lower than a typical building.

You seem to already be doing a great job managing your electrical plug loads. This report makes additional suggestions for ECMs in this area as well as Energy Efficient Best Practices.

There are approximately 55 computer work stations throughout the school. Plug loads throughout the building include general café and office equipment. There are classroom typical loads such as Smart Boards, projectors, and fans.

There are several residential-style refrigerators throughout the building used to store food. These vary in condition and efficiency.

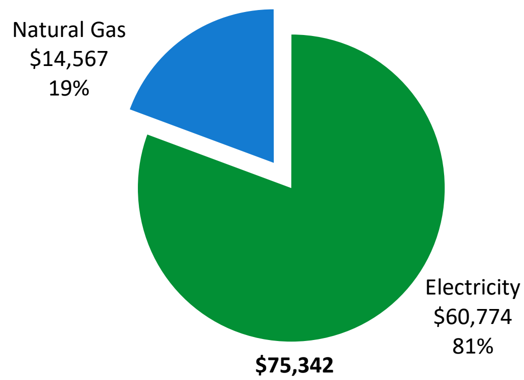
2.10 Water-Using Systems

Faucet flow rates are at 2.2 gallons per minute (gpm) or higher. Toilets are rated at 1.6 gallons per flush (gpf) and urinals are rated at 1.0 gpf.

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	391,533 kWh	$60,774
Natural Gas	12,541 Therms	$14,567
Total		**$75,342**



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.

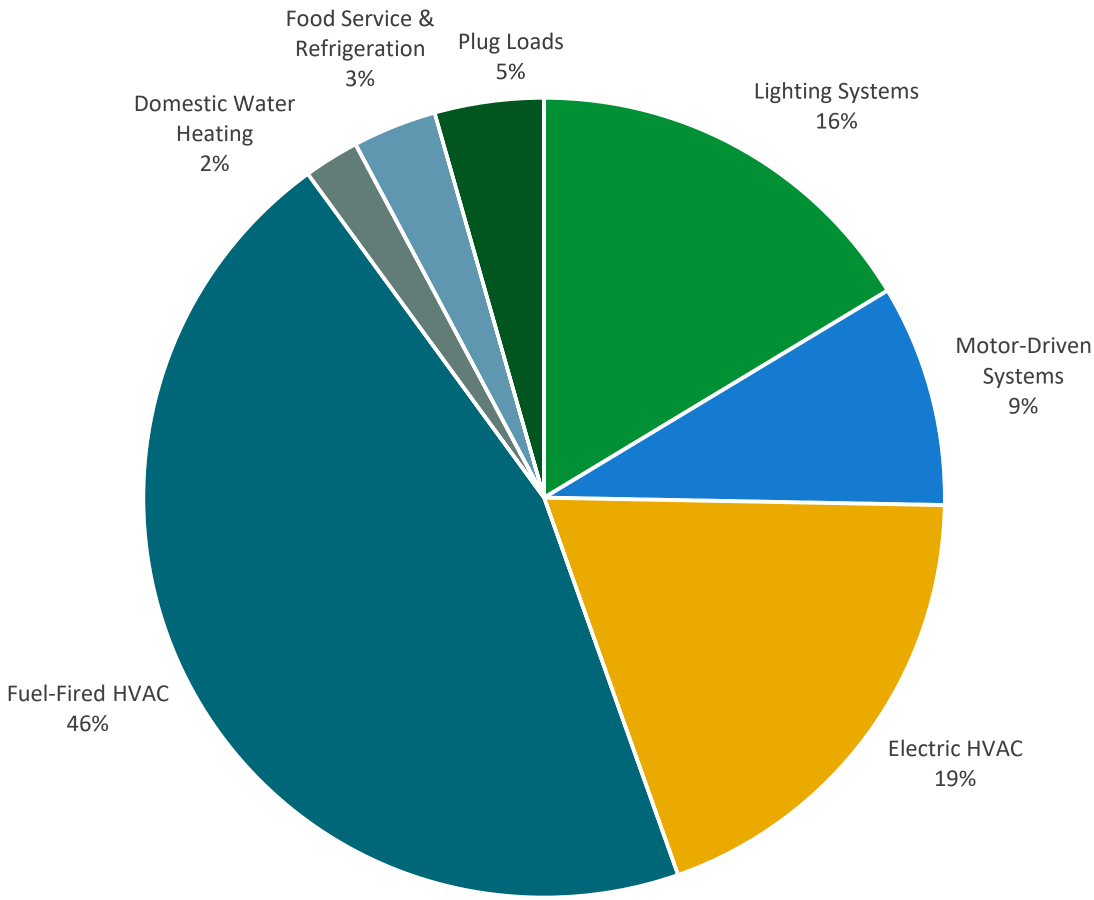
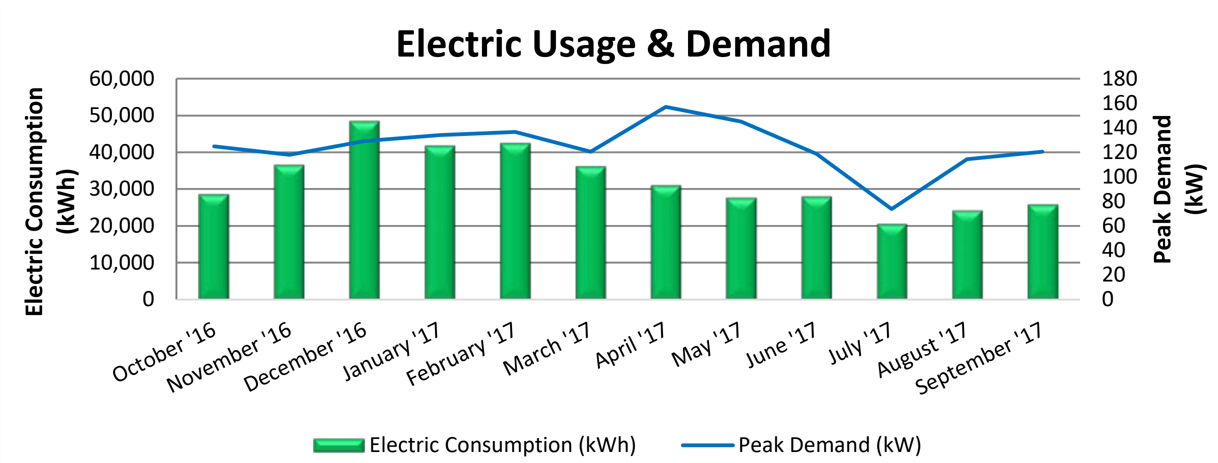


Figure 5 - Energy Balance

3.1 Electricity

PSE&G delivers electricity under rate class LPLS, with electric production provided by a third-party supplier.



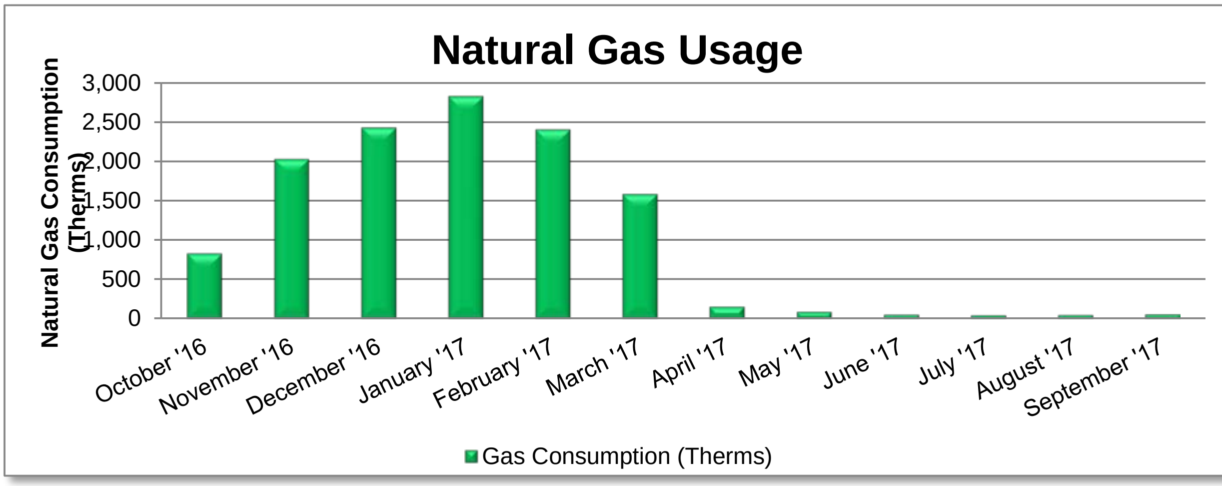
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
11/14/16	30	28,635	125	$561	$4,141
12/15/16	31	36,682	118	$527	$5,169
1/18/17	34	48,501	129	$577	$6,756
2/15/17	28	41,862	134	$598	$5,929
3/17/17	30	42,603	137	$608	$6,006
4/18/17	32	36,302	121	$543	$5,209
5/18/17	30	31,168	157	$709	$4,667
6/16/17	29	27,727	145	$655	$5,583
7/18/17	32	28,098	119	$536	$5,268
8/16/17	29	20,700	74	$333	$3,686
9/15/17	30	24,372	115	$520	$4,719
10/16/17	31	25,956	121	$570	$3,808
Totals	**366**	**392,606**	**157**	**$6,738**	**$60,941**
Annual	**365**	**391,533**	**157**	**$6,720**	**$60,774**

Notes:

- Peak demand of 157 kW occurred between April and May 2017.
- The average electric cost over the past 12 months was $0.155/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

Elizabethtown Gas delivers natural gas under rate class 203, with natural gas supply provided by a third-party supplier.



Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
11/15/16	30	832	$1,042
12/15/16	30	2,030	$1,775
1/17/17	33	2,430	$2,358
2/15/17	29	2,828	$2,270
3/16/17	29	2,407	$2,013
4/17/17	32	1,587	$1,574
5/16/17	29	155	$645
6/15/17	30	91	$501
7/17/17	32	55	$617
8/18/17	32	50	$601
9/17/17	30	54	$601
10/17/17	30	59	$611
Totals	**366**	**12,576**	**$14,607**
Annual	**365**	**12,541**	**$14,567**

Notes:

- The average gas cost for the past 12 months is $0.863/therm, which is the blended rate used throughout the analysis.

3.3 Benchmarking

Your building was benchmarked using the United States Environmental Protection Agency's (EPA) *Portfolio Manager®* software. Benchmarking compares your building's energy use to that of similar buildings across the county, 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	56

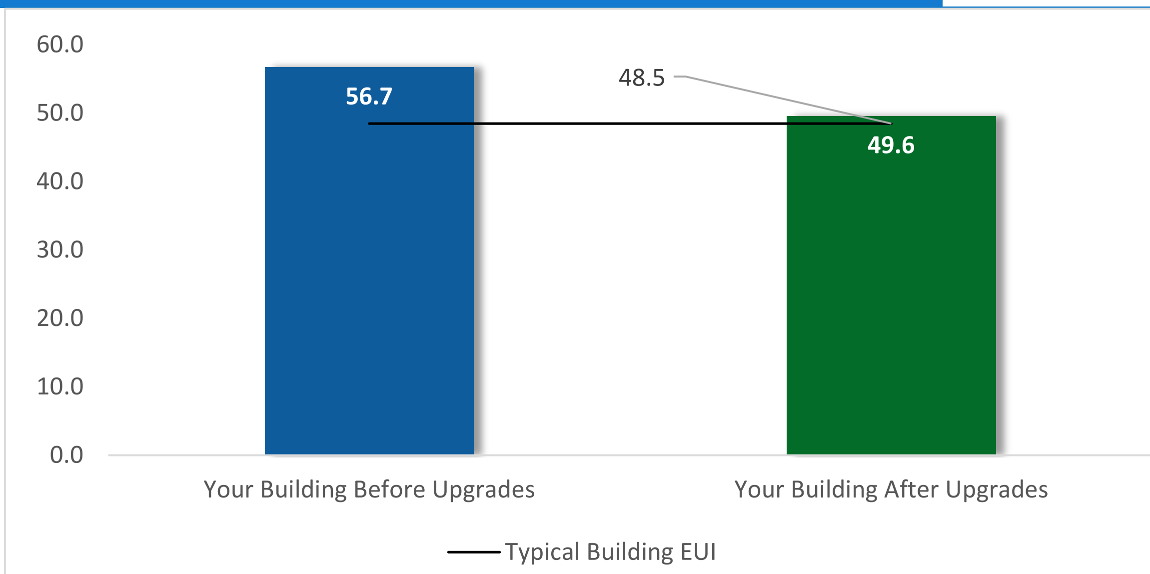


Figure 6 - Energy Use Intensity Comparison

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

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

Tracking Your Energy Performance

Keeping track of your energy use 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[3].

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

4 Energy Conservation Measures

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

Calculations of energy use and savings are based on the current version of *New Jersey's Clean Energy Program Protocols to Measure Resource Savings*, which is approved by the New Jersey Board of Public Utilities. 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.

#	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		**70,972**	**17.7**	**-14**	**$10,897**	**$40,041**	**$8,929**	**$31,112**	**2.9**	**69,842**
ECM 1	Install LED Fixtures	15,480	3.2	-2	$2,382	$15,919	$2,500	$13,419	5.6	15,303
ECM 2	Retrofit Fixtures with LED Lamps	55,222	14.5	-11	$8,473	$23,977	$6,429	$17,548	2.1	54,274
ECM 3	Install LED Exit Signs	270	0.0	0	$41	$145	$0	$145	3.5	265
Lighting Control Measures		**10,121**	**2.4**	**-2**	**$1,553**	**$6,750**	**$795**	**$5,955**	**3.8**	**9,944**
ECM 4	Install Occupancy Sensor Lighting Controls	9,244	2.2	-2	$1,418	$5,750	$795	$4,955	3.5	9,082
ECM 5	Install High/Low Lighting Controls	877	0.2	0	$135	$1,000	$0	$1,000	7.4	862
Variable Frequency Drive (VFD) Measures		**18,494**	**4.2**	**0**	**$2,871**	**$16,775**	**$840**	**$15,935**	**5.6**	**18,623**
ECM 6	Install VFDs on Constant Volume (CV) Fans	9,365	3.1	0	$1,454	$8,622	$840	$7,782	5.4	9,430
ECM 7	Install VFDs on Heating Water Pumps	9,129	1.1	0	$1,417	$8,152	$0	$8,152	5.8	9,193
Electric Unitary HVAC Measures		**11,463**	**5.7**	**0**	**$1,779**	**$68,694**	**$3,036**	**$65,658**	**36.9**	**11,544**
ECM 8	Install High Efficiency Air Conditioning Units	11,463	5.7	0	$1,779	$68,694	$3,036	$65,658	36.9	11,544
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**41**	**$356**	**$129,361**	**$6,960**	**$122,401**	**343.5**	**4,837**
ECM 9	Install High Efficiency Steam Boilers	0	0.0	41	$356	$129,361	$6,960	$122,401	343.5	4,837
Domestic Water Heating Upgrade		**0**	**0.0**	**7**	**$64**	**$2,601**	**$300**	**$2,301**	**35.7**	**874**
ECM 10	Install Tankless Water Heater	0	0.0	7	$64	$2,601	$300	$2,301	35.7	874
Food Service & Refrigeration Measures		**527**	**0.1**	**0**	**$82**	**$607**	**$0**	**$607**	**7.4**	**531**
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors	527	0.1	0	$82	$607	$0	$607	7.4	531
TOTALS		**111,577**	**30.1**	**33**	**$17,602**	**$264,827**	**$20,860**	**$243,967**	**13.9**	**116,194**

* - 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		**70,972**	**17.7**	**-14**	**$10,897**	**$40,041**	**$8,929**	**$31,112**	**2.9**	**69,842**
ECM 1	Install LED Fixtures	15,480	3.2	-2	$2,382	$15,919	$2,500	$13,419	5.6	15,303
ECM 2	Retrofit Fixtures with LED Lamps	55,222	14.5	-11	$8,473	$23,977	$6,429	$17,548	2.1	54,274
ECM 3	Install LED Exit Signs	270	0.0	0	$41	$145	$0	$145	3.5	265
Lighting Control Measures		**10,121**	**2.4**	**-2**	**$1,553**	**$6,750**	**$795**	**$5,955**	**3.8**	**9,944**
ECM 4	Install Occupancy Sensor Lighting Controls	9,244	2.2	-2	$1,418	$5,750	$795	$4,955	3.5	9,082
ECM 5	Install High/Low Lighting Controls	877	0.2	0	$135	$1,000	$0	$1,000	7.4	862
Variable Frequency Drive (VFD) Measures		**18,494**	**4.2**	**0**	**$2,871**	**$16,775**	**$840**	**$15,935**	**5.6**	**18,623**
ECM 6	Install VFDs on Constant Volume (CV) Fans	9,365	3.1	0	$1,454	$8,622	$840	$7,782	5.4	9,430
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Food Service & Refrigeration Measures		**527**	**0.1**	**0**	**$82**	**$607**	**$0**	**$607**	**7.4**	**531**
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors	527	0.1	0	$82	$607	$0	$607	7.4	531
TOTALS		**100,114**	**24.3**	**-16**	**$15,402**	**$64,172**	**$10,564**	**$53,608**	**3.5**	**98,940**

* - 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		**70,972**	**17.7**	**-14**	**$10,897**	**$40,041**	**$8,929**	**$31,112**	**2.9**	**69,842**
ECM 1	Install LED Fixtures	15,480	3.2	-2	$2,382	$15,919	$2,500	$13,419	5.6	15,303
ECM 2	Retrofit Fixtures with LED Lamps	55,222	14.5	-11	$8,473	$23,977	$6,429	$17,548	2.1	54,274
ECM 3	Install LED Exit Signs	270	0.0	0	$41	$145	$0	$145	3.5	265

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

ECM 1: Install LED Fixtures

Replace existing fixtures containing HID lamps with new LED light fixtures. This measure saves energy by installing LEDs, which use less power than other technologies with a comparable light output.

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

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

Affected building areas: gymnasium and exterior fixtures.

ECM 2: Retrofit Fixtures with LED Lamps

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

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, CFLs, or incandescent lamps.

ECM 3: Install LED Exit Signs

Replace incandescent exit signs with LED exit signs. LED exit signs require virtually no maintenance and have a life expectancy of at least 20 years. This measure saves energy by installing LED fixtures, which use less power than other technologies with an equivalent lighting output. Maintenance savings and improved reliability may also be achieved, as the longer-lasting LED lamps will not need to be replaced as often as the existing lamps.

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		**10,121**	**2.4**	**-2**	**$1,553**	**$6,750**	**$795**	**$5,955**	**3.8**	**9,944**
ECM 4	Install Occupancy Sensor Lighting Controls	9,244	2.2	-2	$1,418	$5,750	$795	$4,955	3.5	9,082
ECM 5	Install High/Low Lighting Controls	877	0.2	0	$135	$1,000	$0	$1,000	7.4	862

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 4: Install Occupancy Sensor Lighting Controls

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

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

Occupancy sensors can be mounted on the wall at existing switch locations, 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, conference rooms, classrooms, gymnasium, library, restrooms, and storage rooms.

ECM 5: Install High/Low Lighting Controls

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

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety requirements. Sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Fixtures automatically switch back to low level after a predefined period of vacancy. 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 taken into account 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: hallways

4.3 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**18,494**	**4.2**	**0**	**$2,871**	**$16,775**	**$840**	**$15,935**	**5.6**	**18,623**
ECM 6	Install VFDs on Constant Volume (CV) Fans	9,365	3.1	0	$1,454	$8,622	$840	$7,782	5.4	9,430
ECM 7	Install VFDs on Heating Water Pumps	9,129	1.1	0	$1,417	$8,152	$0	$8,152	5.8	9,193

Variable frequency drives (VFDs) control motors for fans, pumps, and process equipment based on the actual output required of the driven equipment. Energy savings result from more efficient control of motor energy usage when equipment operates at partial load. The magnitude of energy savings depends on the estimated amount of time that the motor would operate at partial load. For equipment with proposed VFDs, we have included replacing the controlled motor with a new motor—unless the existing motor meets or exceeds IHP 2014 standards—to conservatively account for the cost of an inverter duty rated motor.

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

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

Zone thermostats signal the VFD to adjust fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature.

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

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

Affected air handlers: Gym AAON unit.

ECM 7: Install VFDs on Heating Water Pumps

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

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

Affected pumps: 5 hp hot water pumps.

4.4 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		**11,463**	**5.7**	**0**	**$1,779**	**$68,694**	**$3,036**	**$65,658**	**36.9**	**11,544**
ECM 8	Install High Efficiency Air Conditioning Units	11,463	5.7	0	$1,779	$68,694	$3,036	$65,658	36.9	11,544

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

ECM 8: Install High-Efficiency Air Conditioning Units

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

4.5 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**41**	**$356**	**$129,361**	**$6,960**	**$122,401**	**343.5**	**4,837**
ECM 9	Install High Efficiency Steam Boilers	0	0.0	41	$356	$129,361	$6,960	$122,401	343.5	4,837

ECM 9: Install High-Efficiency Steam Boilers

Replace older inefficient steam boilers with high-efficiency steam boilers. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

For the purposes of this analysis, we evaluated the replacement of boilers on a one-for-one basis with equipment of the same capacity. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load at this facility. In many cases installing multiple modular boilers rather than one or two large boilers will result in higher overall plant efficiency while providing additional system redundancy.

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

4.6 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**7**	**$64**	**$2,601**	**$300**	**$2,301**	**35.7**	**874**
ECM 10	Install Tankless Water Heater	0	0.0	7	$64	$2,601	$300	$2,301	35.7	874

ECM 10: Install Tankless Water Heater

Replace the existing tank water heater with a tankless water heating system. Tankless water heaters (a.k.a. "on-demand water heaters") only heat water when hot water is needed. Water is heated as it flows through the pipe to the hot water tap. Energy savings from a tankless water heater are based on eliminating heat losses associated with maintaining unnecessary standby hot water capacity.

4.7 Food Service & Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**527**	**0.1**	**0**	**$82**	**$607**	**$0**	**$607**	**7.4**	**531**
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors	527	0.1	0	$82	$607	$0	$607	7.4	531

ECM 11: Refrigerator/Freezer Case Electrically Commutated Motors

Replace shaded pole or permanent split capacitor (PSC) motors with electronically commutated (EC) motors in the walk-in refrigerator. Fractional horsepower EC motors are significantly more efficient than mechanically commutated, brushed motors–particularly at low speeds or partial load. By using variable-speed technology, EC motors can optimize fan usage. Because these motors are brushless and use DC power, losses due to friction and phase shifting are eliminated.

Savings for this measure consider both the increased efficiency of the motor as well as the reduction in refrigeration load due to motor heat loss.

5 Energy Efficient Best Practices

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

Energy Tracking with ENERGY STAR® Portfolio Manager®

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

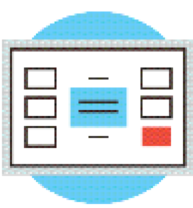
Lighting Controls

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

Motor Maintenance

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

Thermostat Schedules and Temperature Resets



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

AC System Evaporator/Condenser Coil Cleaning

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

[4] 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.

Steam Trap Repair and Replacement

Steam traps are a crucial part of delivering heat from the boiler to the space heating units. Repair of replace traps that are blocked or allowing steam to pass. Inspect steam traps as part of a regular steam system maintenance plan.

Boiler Maintenance

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

Furnace Maintenance

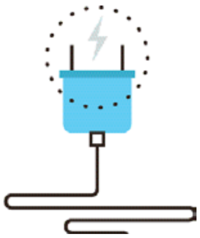
Preventative maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. Following the manufacturer’s instructions, a yearly tune-up should check for gas / carbon monoxide leaks; change the air and fuel filters; check components for cracks, corrosion, dirt, or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

Water Heater Maintenance

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

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

Plug Load Controls



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

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 gpf and for flush valve toilets is 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

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

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

If the facility has detached buildings with a master water meter for the entire campus, check for unnatural wet areas in the lawn or water seeping in the foundation at water pipe penetrations through the foundation. Periodically check overnight meter readings when the school 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.

[5] 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

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

[7] 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.

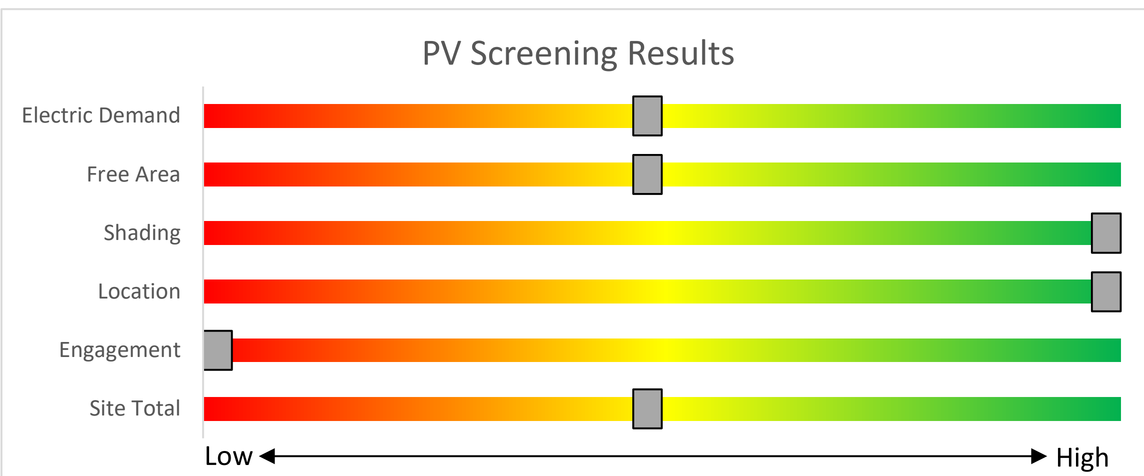
6.1 Solar Photovoltaic

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 school has medium potential for installing a PV array.

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

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



Potential	Medium	
System Potential	86	kW DC STC
Electric Generation	102,458	kWh/yr
Displaced Cost	$15,900	/yr
Installed Cost	$223,600	

Figure 9 - Photovoltaic Screening

Solar Renewable Energy Credit (SREC) Registration Program

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

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

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

- **Basic Info on Solar PV in New Jersey**: www.njcleanenergy.com/whysolar
- **New Jersey Solar Market FAQs**: www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs
- **Approved Solar Installers in the New Jersey 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 school 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 school has no potential for installing a cost-effective CHP system.

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

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

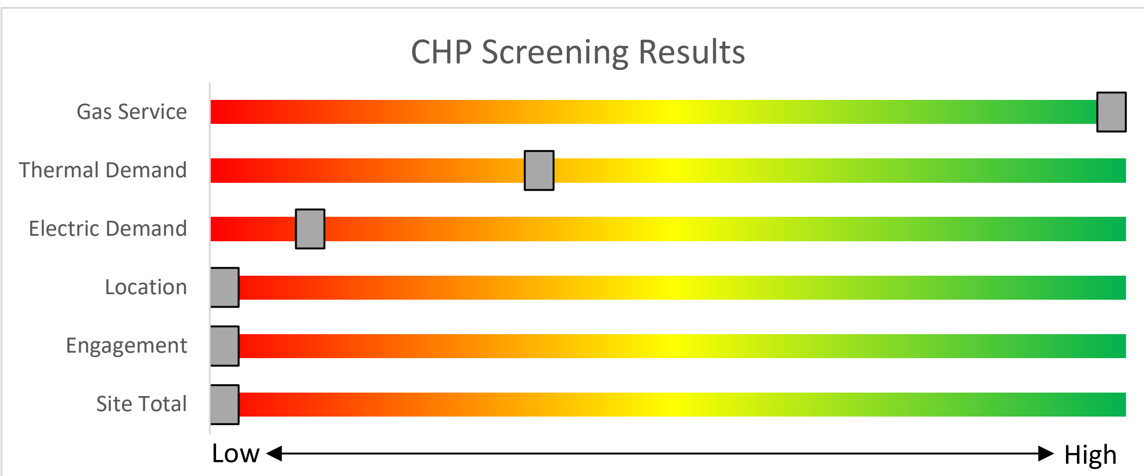


Figure 10 - Combined Heat and Power Screening

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?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's Clean Energy Programs.

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

7.1 SmartStart

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

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

<u>Equipment with Prescriptive Incentives Currently Available</u>:

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

Incentives

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

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

How to Participate

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

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

7.2 Direct Install

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

Incentives

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

How to Participate

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

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

7.3 Energy Savings Improvement Program

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

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

How to Participate

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

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

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

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

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

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

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

7.4 SREC Registration Program

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

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

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

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

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

8 Energy Purchasing and Procurement Strategies

8.1 Retail Electric Supply Options

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

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

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

8.2 Retail Natural Gas Supply Options

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

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

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

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

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boys basement	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.2	768	0	$118	$489	$95	3.3
Basement hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	201	0	$31	$73	$20	1.7
Fireroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	101	0	$15	$37	$10	1.7
Room B3	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,805	0	$277	$854	$195	2.4
Boiler room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	101	0	$15	$37	$10	1.7
Boiler room	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	8	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.3	1,366	0	$210	$584	$160	2.0
Boiler storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Boiler closet	2	Incandescent: Screw-in 1 lamp	Wall Switch	S	60	2,772	2	Relamp	No	2	LED Lamps: Screw-in 1 lamp	Wall Switch	9	2,772	0.1	311	0	$48	$34	$2	0.7
Boiler room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	201	0	$31	$73	$20	1.7
Boiler room	1	Compact Fluorescent: Screw-in 1 lamp	Wall Switch	S	26	2,772	2	Relamp	No	1	LED Lamps: Screw-in 1 lamp	Wall Switch	18	2,772	0.0	24	0	$4	$17	$1	4.4
Boiler hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	201	0	$31	$73	$20	1.7
Boiler closet 2	1	Incandescent: Screw-in 1 lamp	Wall Switch	S	60	2,772	2	Relamp	No	1	LED Lamps: Screw-in 1 lamp	Wall Switch	9	2,772	0.0	156	0	$24	$17	$1	0.7
Boiler closet 2	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	101	0	$15	$37	$10	1.7
Room B1	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,913	2	Relamp	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.3	833	0	$128	$438	$120	2.5
Room B1	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
Girls Basement	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.2	1,024	0	$157	$562	$115	2.8
Girls closet	1	Incandescent: Screw-in 1 lamp	Wall Switch	S	60	2,772	2	Relamp	No	1	LED Lamps: Screw-in 1 lamp	Wall Switch	9	2,772	0.0	156	0	$24	$17	$1	0.7
ESL office	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Basement hall	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Basement hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	201	0	$31	$73	$20	1.7
Basement hall	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Basement hall	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
Room B4	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.5	1,414	0	$217	$876	$240	2.9
Room B5	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.2	902	0	$138	$408	$100	2.2
B5 teachers	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.1	451	0	$69	$262	$60	2.9

	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
Room B2	10	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,178	0	$181	$730	$200	2.9
Kitchen	5	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	5	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.2	854	0	$131	$365	$100	2.0
Kitchen	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,772	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,772	0.0	151	0	$23	$55	$15	1.7
Kitchen supply	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Kitchen hall	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Ladies room	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Boys room	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Kitchen	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
Basement hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 5	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	1,913	0.1	451	0	$69	$346	$40	4.4
Stairs - gym	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.1	342	0	$52	$146	$40	2.0
Stairs - gym	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
Gym Closet	1	Compact Fluorescent: Screw-in 1 lamp	Wall Switch	S	26	2,772	2	Relamp	No	1	LED Lamps: Screw-in 1 lamp	Wall Switch	18	2,772	0.0	24	0	$4	$17	$1	4.4
Gym	12	Mercury Vapor: (1) 400W Lamp	Wall Switch	S	455	2,772	1, 4	Fixture Replacement	Yes	12	LED - Fixtures: High-Bay	Occupancy Sensor	137	1,913	3.1	13,202	-3	$2,025	$9,839	$1,870	3.9
Stage	6	Incandescent: Screw-in 2 lamp	Wall Switch	S	120	2,772	2, 4	Relamp	Yes	6	LED Lamps: Screw-in 2 lamps	Occupancy Sensor	18	1,913	0.5	1,968	0	$302	$477	$47	1.4
Kitchen stairs	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Kitchen stairs	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	101	0	$15	$37	$10	1.7
Kitchen stairs	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
Gym	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
Gym hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 5	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	1,913	0.1	451	0	$69	$346	$40	4.4
Room 1	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
Room 3	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
Nurse room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	201	0	$31	$73	$20	1.7
Nurse room	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,772	0.0	88	0	$14	$72	$10	4.6
Nurse restroom	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,772	0.0	88	0	$14	$72	$10	4.6
Main office	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.2	902	0	$138	$408	$100	2.2

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Principal office	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.2	902	0	$138	$408	$100	2.2
Main vestibule	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.1	342	0	$52	$146	$40	2.0
Copy room	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.1	342	0	$52	$146	$40	2.0
Room 6	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
Room 5	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
Room 4	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
Main floor hall	5	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 5	Relamp	Yes	5	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	1,913	0.3	1,128	0	$173	$565	$100	2.7
Main floor hall	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
Madison stairwell	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,772		None	No	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	0	0	$0	$0	$0	0.0
Madison stairwell	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
Social worker room	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Class 11	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.5	2,030	0	$311	$927	$215	2.3
Room 12	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
Room10	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
Teachers room	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.2	902	0	$138	$408	$100	2.2
Teachers closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,772	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,772	0.0	53	0	$8	$18	$5	1.6
Teachers restroom	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,772	0.0	88	0	$14	$72	$10	4.6
Room 8	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
Room 9	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
Room 7	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	1,913	2	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.4	1,060	0	$163	$657	$180	2.9
IT closet	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.2	677	0	$104	$335	$80	2.5
2nd floor hall	5	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 5	Relamp	Yes	5	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	1,913	0.3	1,128	0	$173	$565	$100	2.7
2nd floor hall	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Monroe Stairs	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.2	683	0	$105	$292	$80	2.0
Monroe Stairs	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

	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
Guidance room	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
TCU	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
Room 3	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.6	2,707	-1	$415	$1,146	$275	2.1
Room 3	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
3/4 closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,772	0.0	171	0	$26	$73	$20	2.0
3 restroom	1	Incandescent: Screw-in 1 lamp	Wall Switch	S	60	2,772	2	Relamp	No	1	LED Lamps: Screw-in 1 lamp	Wall Switch	9	2,772	0.0	156	0	$24	$17	$1	0.7
4 restroom	1	Incandescent: Screw-in 1 lamp	Wall Switch	S	60	2,772	2	Relamp	No	1	LED Lamps: Screw-in 1 lamp	Wall Switch	9	2,772	0.0	156	0	$24	$17	$1	0.7
5/4 restroom hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 5	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	1,913	0.1	451	0	$69	$346	$40	4.4
Room 4	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,772	2, 4	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,913	0.6	2,707	-1	$415	$1,146	$275	2.1
Room 10	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.5	2,049	0	$314	$854	$195	2.1
Room 10	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	201	0	$31	$73	$20	1.7
10 restroom	1	Incandescent: Screw-in 1 lamp	Wall Switch	S	60	2,772	2	Relamp	No	1	LED Lamps: Screw-in 1 lamp	Wall Switch	9	2,772	0.0	156	0	$24	$17	$1	0.7
10 restroom	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Room 9	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.5	2,305	0	$354	$927	$215	2.0
9 Restroom	1	Incandescent: Screw-in 1 lamp	Wall Switch	S	60	2,772	2	Relamp	No	1	LED Lamps: Screw-in 1 lamp	Wall Switch	9	2,772	0.0	156	0	$24	$17	$1	0.7
Room 9	2	Exit Signs: Incandescent	None		20	8,760	3	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	270	0	$41	$145	$0	3.5
Speech office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.1	512	0	$79	$262	$60	2.6
Speech office	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
Room 8	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.4	1,793	0	$275	$781	$175	2.2
Room 8	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
8 Restroom	1	LED - Fixtures: Ambient - 2' - Direct Fixture	Wall Switch	S	17	2,772		None	No	1	LED - Fixtures: Ambient - 2' - Direct Fixture	Wall Switch	17	2,772	0.0	0	0	$0	$0	$0	0.0
Room 7	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.4	1,793	0	$275	$781	$175	2.2
Child study office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.1	512	0	$79	$262	$60	2.6
Child study office	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
Room SGI	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.1	384	0	$59	$226	$50	3.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Room SGI	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
Room 5	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.5	2,049	0	$314	$854	$195	2.1
Room 5	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
5 restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	101	0	$15	$37	$10	1.7
Room 6	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.5	2,049	0	$314	$854	$195	2.1
Room 6	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
6 restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	101	0	$15	$37	$10	1.7
6 storage	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.1	512	0	$79	$262	$60	2.6
Room A1	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,772	2, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,913	0.5	2,305	0	$354	$927	$215	2.0
Room A1	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
A1/A2 Hall	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	101	0	$15	$37	$10	1.7
A1 restroom	1	LED - Fixtures: Ambient - 2' - Direct Fixture	Wall Switch	S	17	2,772		None	No	1	LED - Fixtures: Ambient - 2' - Direct Fixture	Wall Switch	17	2,772	0.0	0	0	$0	$0	$0	0.0
A1 restroom	1	Incandescent: Screw-in 1 lamp	Wall Switch	S	60	2,772	2	Relamp	No	1	LED Lamps: Screw-in 1 lamp	Wall Switch	9	2,772	0.0	156	0	$24	$17	$1	0.7
Room A2	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2, 4	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,913	0.4	1,536	0	$236	$708	$155	2.3
Room A2	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
A2 closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,772	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,772	0.0	101	0	$15	$37	$10	1.7
TCU	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch		18	2,310		None	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	18	2,310	0.0	0	0	$0	$0	$0	0.0
TCU	6	Incandescent: Screw-in 1 lamp	Wall Switch		60	2,310	2	Relamp	No	6	LED Lamps: Screw-in 1 lamp	Wall Switch	9	2,310	0.2	707	0	$110	$103	$6	0.9
Exterior	2	High-Pressure Sodium: (1) 70W Lamp	Photocell		95	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	29	4,380	0.1	583	0	$90	$1,932	$200	19.2
Exterior	1	Metal Halide: (1) 70W Lamp	Photocell		95	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	29	4,380	0.0	291	0	$45	$966	$100	19.2
Parking lot - Pole lights	3	Mercury Vapor: (1) 250W Lamp	Timeclock		290	4,380	1	Fixture Replacement	No	3	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Timeclock	87	4,380	0.3	2,667	0	$414	$2,792	$300	6.0
Exterior - Pole lights	1	Mercury Vapor: (1) 75W Lamp	Photocell		93	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell	28	4,380	0.0	285	0	$44	$931	$100	18.8

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**
Boiler room	Boiler	1	Heating Hot Water Pump	5.0	87.5%	No		2,745	7	No	89.5%	Yes	1	0.5	4,565	0	$709	$4,076	$0	5.8
Boiler room	Boiler	1	Heating Hot Water Pump	5.0	87.5%	No		2,745	7	No	89.5%	Yes	1	0.5	4,565	0	$709	$4,076	$0	5.8
Boiler room	Boiler feed	1	Boiler Feed Water Pump	0.5	60.0%	No		2,745		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler room	Boiler feed	1	Boiler Feed Water Pump	0.5	60.0%	No		2,745		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler room	Boiler	2	Process Blower	2.0	84.0%	No		2,745		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Various rooms	Unit ventilators	15	Supply Fan	0.3	60.0%	No	B	2,745		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Gym	1	Supply Fan	7.5	89.5%	No	W	2,745	6	No	91.0%	Yes	1	2.2	6,626	0	$1,028	$4,738	$600	4.0
Roof	Gym	1	Exhaust Fan	3.0	87.5%	No	W	2,745	6	No	89.5%	Yes	1	0.9	2,739	0	$425	$3,884	$240	8.6
Roof	School	7	Exhaust Fan	0.3	60.0%	No		2,745		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Trailers	TCU	6	Supply Fan	0.3	60.0%	No		2,745		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
Roof	Gym	1	Packaged AC	15.00		W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Nurse	1	Packaged AC	2.00		B	8	Yes	1	Packaged AC	2.00		14.00		0.5	900	0	$140	$4,538	$184	31.2
Roof	kitchen	1	Packaged AC	2.00		B	8	Yes	1	Packaged AC	2.00		14.00		0.5	900	0	$140	$4,538	$184	31.2
Trailer roof	TCU 8	1	Split-System AC	2.00		B	8	Yes	1	Split-System AC	2.00		14.00		0.3	616	0	$96	$2,992	$184	29.4
Trailer roof	TCU 9	1	Split-System AC	2.00		B	8	Yes	1	Split-System AC	2.00		14.00		0.3	616	0	$96	$2,992	$184	29.4
Trailer roof	TCU 1	1	Split-System AC	2.00		B	8	Yes	1	Split-System AC	2.00		14.00		0.3	616	0	$96	$2,992	$184	29.4
Trailer roof	TCU 2	1	Split-System AC	2.00		B	8	Yes	1	Split-System AC	2.00		14.00		0.3	616	0	$96	$2,992	$184	29.4
Trailer roof	TCUs	6	Packaged AC	3.50		B	8	Yes	6	Packaged AC	3.50		14.00		3.6	7,200	0	$1,118	$47,648	$1,932	40.9
Offices	Offices	6	Window AC	1.00		B		No							0.0	0	0	$0	$0	$0	0.0
Trailer roof	TCUs	6	Electric Resistance Heat		34.12	B		No							0.0	0	0	$0	$0	$0	0.0
Roof	TCU	1	Split-System AC	3.50		B		No							0.0	0	0	$0	$0	$0	0.0

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	B1	1	Forced Draft Steam Boiler	3,480.00	B	9	Yes	1	Forced Draft Steam Boiler	3,480.00	81.00%	Et	0.0	0	21	$178	$64,680	$3,480	343.5
Boiler room	B2	1	Forced Draft Steam Boiler	3,480.00	B	9	Yes	1	Forced Draft Steam Boiler	3,480.00	81.00%	Et	0.0	0	21	$178	$64,680	$3,480	343.5
Roof	Gym	1	Furnace	234.00	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
Boiler room	Kitchen and restrooms	1	Storage Tank Water Heater (> 50 Gal)	W	10	Yes	1	Tankless Water Heater	Natural Gas	90.00%	EF	0.0	0	7	$64	$2,601	$300	35.7

Walk-In Cooler/Freezer Inventory & Recommendations

	Existing Conditions		Proposed Conditions				Energy Impact & Financial Analysis						
Location	Cooler/ Freezer Quantity	Case Type/Temperature	ECM #	Install EC Evaporator Fan Motors?	Install Electric Defrost Control?	Install Evaporator Fan Control?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Cooler (35F to 55F)	11	Yes	No	No	0.1	527	0	$82	$607	$0	7.4

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	2	Refrigerator Chest	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	No		No	0.0	0	0	$0	$0	$0	0.0

Cooking Equipment Inventory & Recommendations

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

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Madison Monroe	55	Desktop computer	145.0	Yes
Madison Monroe	29	Printer - Small	60.0	Yes
Madison Monroe	9	Printer - Medium	90.0	Yes
Madison Monroe	3	Printer - Large	200.0	Yes
Madison Monroe	2	Paper shredder	120.0	Yes
Madison Monroe	25	Projector	200.0	Yes
Madison Monroe	7	Microwave	900.0	Yes
Madison Monroe	2	Small - refrigerator	60.0	Yes
Madison Monroe	4	Medium refrigerator	80.0	Yes
Madison Monroe	3	Large refrigerator	220.0	Yes
Madison Monroe	1	Coffee Machine	400.0	Yes
Madison Monroe	1	Television	120.0	Yes

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]

Madison-Monroe Elementary School (16)

Primary Property Type: K-12 School
Gross Floor Area (ft²): 45,655
Built: 1917

For Year Ending: September 30, 2017
Date Generated: March 28, 2019

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
Madison-Monroe Elementary School (16) 1091 North Avenue Elizabeth, New Jersey 07201	Elizabeth Board of Education 500 North Broad Street Elizabeth, NJ 07208 908-436-5180	Luis Couto 500 North Broad Street Elizabeth, NJ 07208 908-436-5180 coutolu@epsnj.org

Property ID: 6688945

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
56.8 kBtu/ft²

Source EUI
110.8 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	1,334,980 (52%)
Natural Gas (kBtu)	1,257,472 (48%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	60.7
National Median Source EUI (kBtu/ft²)	118.4
% Diff from National Median Source EUI	-6%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	202

Signature & Stamp of Verifying Professional

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

Signature: ______________________Date: ___________

Licensed Professional

____ ________
,
(___)____-______
____

Professional Engineer Stamp
(if applicable)

APPENDIX C: GLOSSARY

TERM	DEFINITION
Blended Rate	Used to calculate 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.
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.