Local Government Energy Audit Report

Union Beach Memorial School

December 11, 2020

Prepared for:
Union Beach Board of Education
221 Morningside Avenue
Union Beach, NJ 07735

Prepared by:
TRC
900 Route 9 North
Woodbridge, NJ 07095

Disclaimer

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

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

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

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

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

Table of Contents

1 Executive Summary 1

1.1 Planning Your Project 4

Pick Your Installation Approach 4
More Options from Around the State 6

2 Existing Conditions 7

2.1 Site Overview 7
2.2 Building Occupancy 7
2.3 Building Envelope 8
2.4 Lighting Systems 9
2.5 Air Handling Systems 11

Unit Ventilators 11
Packaged Units 11
Air Conditioners 12
Air Handling Units 12
Make-Up Air Units 12
Electric Heaters 12
Exhaust Fans 13

2.6 Heating Hot Water Systems 14
2.7 Building Energy Management Systems (EMS) 15
2.8 Domestic Hot Water 16
2.9 Food Service Equipment 17
2.10 Refrigeration 17
2.11 Plug Load & Vending Machines 18
2.12 Water-Using Systems 18
2.13 Process Equipment 18
2.14 On-Site Generation 19

3 Energy Use and Costs 20

3.1 Electricity 22
3.2 Natural Gas 24
3.3 Benchmarking 25

Tracking Your Energy Performance 26

4 Energy Conservation Measures 27

4.1 Lighting 30

ECM 1: Install LED Fixtures 30
ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers 30
ECM 3: Retrofit Fixtures with LED Lamps 31

4.2 Lighting Controls 31

ECM 4: Install Occupancy Sensor Lighting Controls 31
ECM 5: Install High/Low Lighting Controls 32

4.3 Variable Frequency Drives (VFD) 33

ECM 6: Install VFDs on Constant Volume (CV) Fans ... 33
ECM 7: Install VFDs on Heating Water Pumps ... 34
ECM 8: Install VFDs on Kitchen Hood Fan Motors ... 34

4.4 Electric Unitary HVAC ... 35

ECM 9: Install High Efficiency Air Conditioning Units ... 35

4.5 Gas-Fired Heating ... 36

ECM 10: Install High Efficiency Hot Water Boilers ... 36

4.6 HVAC Improvements ... 37

ECM 11: Install Occupancy-Controlled Thermostats ... 37
ECM 12: Implement Demand Control Ventilation (DCV) ... 37

4.7 Domestic Water Heating ... 38

ECM 13: Install High Efficiency Gas-Fired Water Heater ... 38
ECM 14: Install Low-Flow DHW Devices ... 38

4.8 Food Service & Refrigeration Measures ... 39

ECM 15: Refrigerator/Freezer Case Electrically Commutated Motors ... 39
ECM 16: Refrigeration Controls ... 39

4.9 Custom Measures ... 40

ECM 17: Expansion of the Energy Management System ... 40
ECM 18: Timer Controls for Window ACs ... 41

5 Energy Efficient Best Practices ... 42

Energy Tracking with ENERGY STAR® Portfolio Manager® ... 42
Doors and Windows ... 42
Lighting Maintenance ... 42
Lighting Controls ... 43
Motor Maintenance ... 43
Economizer Maintenance ... 43
AC System Evaporator/Condenser Coil Cleaning ... 43
HVAC Filter Cleaning and Replacement ... 43
Ductwork Maintenance ... 44
Boiler Maintenance ... 44
Label HVAC Equipment ... 44
Optimize HVAC Equipment Schedules ... 45
Water Heater Maintenance ... 45
Refrigeration Equipment Maintenance ... 46
Plug Load Controls ... 46
Computer Power Management Software ... 46
Water Conservation ... 47
Procurement Strategies ... 47

6 On-site Generation ... 48

6.1 Solar Photovoltaic ... 49
6.2 Combined Heat and Power ... 51

7 Project Funding and Incentives ... 52

7.1 SmartStart ... 53
7.2 Direct Install ... 54

7.3 Pay for Performance - Existing Buildings ... 55
7.4 Combined Heat and Power ... 56
7.5 Energy Savings Improvement Program ... 57
7.6 Transition Incentive (TI) Program ... 58

8 Energy Purchasing and Procurement Strategies ... 59

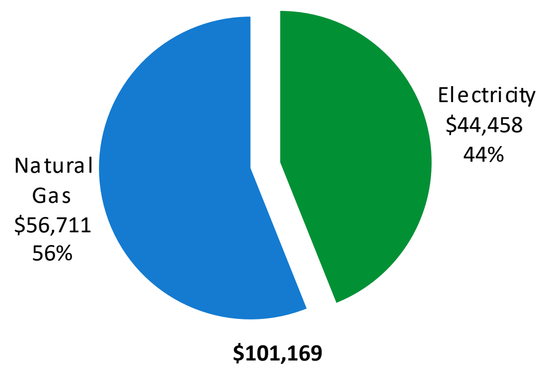
8.1 Retail Electric Supply Options ... 59
8.2 Retail Natural Gas Supply Options ... 59

Appendix A: Equipment Inventory & Recommendations ... A-1
Appendix B: ENERGY STAR® Statement of Energy Performance ... B-1
Appendix C: Glossary ... C-1

1 EXECUTIVE SUMMARY

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

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $101,169 Electricity: 701,653 kWh Natural Gas: 52,629 Therms	
ENERGY STAR® Benchmarking Score	77 *(1-100 scale)*	Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance and lower your energy bills even more.

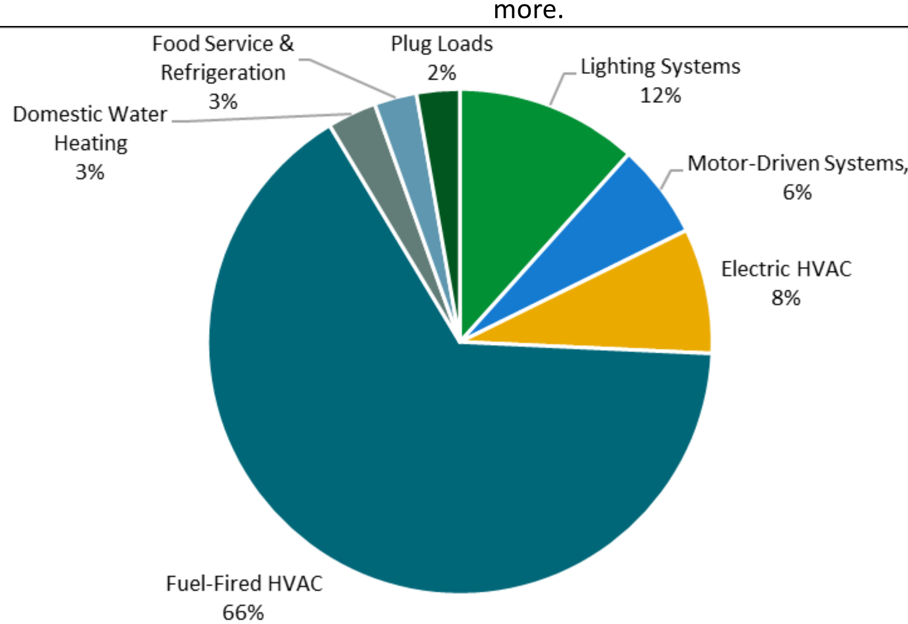


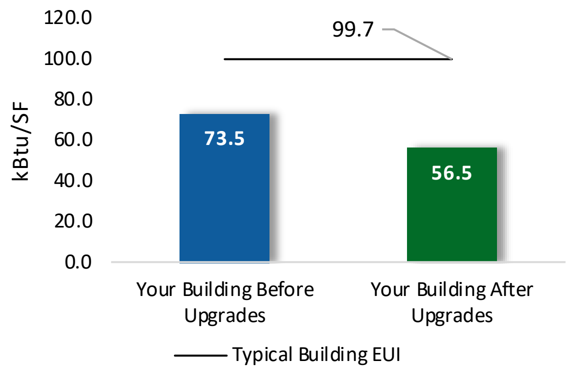
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

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

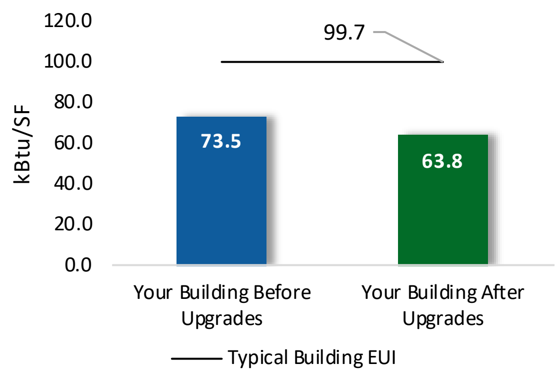
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$642,109
Potential Rebates & Incentives[1]	$89,865
Annual Cost Savings	$26,427
Annual Energy Savings	Electricity: 275,936 kWh Natural Gas: 8,300 Therms
Greenhouse Gas Emission Savings	188 Tons
Simple Payback	20.9 Years
Site Energy Savings (all utilities)	23%



Scenario 2: Cost Effective Package[2]

Installation Cost	$165,348
Potential Rebates & Incentives	$49,602
Annual Cost Savings	$16,783
Annual Energy Savings	Electricity: 221,760 kWh Natural Gas: 2,535 Therms
Greenhouse Gas Emission Savings	126 Tons
Simple Payback	6.9 Years
Site Energy Savings (all utilities)	13%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	None

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

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**167,357**	**50.5**	**-34**	**$10,234**	**$116,510**	**$28,928**	**$87,582**	**8.6**	**164,509**
ECM 1	Install LED Fixtures	Yes	10,619	2.4	-2	$656	$11,296	$2,200	$9,096	13.9	10,507
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	93,649	30.4	-20	$5,723	$77,921	$13,400	$64,521	11.3	92,011
ECM 3	Retrofit Fixtures with LED Lamps	Yes	63,089	17.7	-13	$3,856	$27,292	$13,328	$13,964	3.6	61,991
Lighting Control Measures			**34,304**	**9.3**	**-7**	**$2,096**	**$32,146**	**$12,310**	**$19,836**	**9.5**	**33,704**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	29,893	8.3	-6	$1,827	$26,296	$6,630	$19,666	10.8	29,370
ECM 5	Install High/Low Lighting Controls	Yes	4,411	0.9	-1	$270	$5,850	$5,680	$170	0.6	4,334
Variable Frequency Drive (VFD) Measures			**31,854**	**5.7**	**23**	**$2,271**	**$127,072**	**$9,500**	**$117,572**	**51.8**	**34,824**
ECM 6	Install VFDs on Constant Volume (CV) Fans	No	6,301	2.9	0	$399	$8,152	$3,600	$4,552	11.4	6,345
ECM 7	Install VFDs on Heating Water Pumps	No	24,271	2.8	0	$1,538	$115,910	$5,750	$110,160	71.6	24,441
ECM 8	Install VFDs on Kitchen Hood Fan Motors	Yes	1,282	0.0	23	$334	$3,010	$150	$2,860	8.6	4,038
Electric Unitary HVAC Measures			**6,915**	**8.4**	**0**	**$438**	**$177,754**	**$17,696**	**$160,058**	**365.3**	**6,964**
ECM 9	Install High Efficiency Air Conditioning Units	No	6,915	8.4	0	$438	$177,754	$17,696	$160,058	365.3	6,964
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**245**	**$2,641**	**$57,111**	**$10,469**	**$46,642**	**17.7**	**28,692**
ECM 10	Install High Efficiency Hot Water Boilers	No	0	0.0	245	$2,641	$57,111	$10,469	$46,642	17.7	28,692
HVAC System Improvements			**1,536**	**0.0**	**297**	**$3,300**	**$20,322**	**$7,650**	**$12,672**	**3.8**	**36,341**
ECM 11	Install Occupancy-Controlled Thermostats	Yes	0	0.0	237	$2,556	$12,166	$7,650	$4,516	1.8	27,773
ECM 12	Implement Demand Control Ventilation (DCV)	No	1,536	0.0	60	$744	$8,157	$0	$8,157	11.0	8,568
Domestic Water Heating Upgrade			**491**	**0.0**	**55**	**$622**	**$18,170**	**$2,692**	**$15,478**	**24.9**	**6,912**
ECM 13	Install High Efficiency Gas-Fired Water Heater	No	0	0.0	20	$221	$17,568	$2,128	$15,440	70.0	2,398
ECM 14	Install Low-Flow DHW Devices	Yes	491	0.0	34	$401	$602	$564	$38	0.1	4,514
Food Service & Refrigeration Measures			**2,543**	**0.1**	**0**	**$161**	**$4,561**	**$620**	**$3,941**	**24.5**	**2,561**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	No	885	0.1	0	$56	$1,213	$320	$893	15.9	891
ECM 16	Refrigeration Controls	No	1,658	0.0	0	$105	$3,348	$300	$3,048	29.0	1,670
Custom Measures			**30,936**	**0.0**	**251**	**$4,664**	**$88,462**	**$0**	**$88,462**	**19.0**	**60,536**
ECM 17	Installation of an Energy Management System	No	12,610	0.0	251	$3,503	$87,547	$0	$87,547	25.0	42,082
ECM 18	Timer Controls for Window ACs	Yes	18,326	0.0	0	$1,161	$915	$0	$915	0.8	18,454
TOTALS (COST EFFECTIVE MEASURES)			**221,760**	**59.8**	**254**	**$16,783**	**$165,348**	**$49,602**	**$115,746**	**6.9**	**252,992**
TOTALS (ALL MEASURES)			**275,936**	**74.0**	**830**	**$26,427**	**$642,109**	**$89,865**	**$552,243**	**20.9**	**375,043**

* - 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 Fluorescent Fixtures with LED Lamps and Drivers	X	X	
ECM 3	Retrofit Fixtures with LED Lamps	X	X	
ECM 4	Install Occupancy Sensor Lighting Controls	X	X	
ECM 5	Install High/Low Lighting Controls	X	X	
ECM 6	Install VFDs on Constant Volume (CV) Fans	X		
ECM 7	Install VFDs on Heating Water Pumps	X	X	
ECM 8	Install VFDs on Kitchen Hood Fan Motors	X	X	
ECM 9	Install High Efficiency Air Conditioning Units	X	X	
ECM 10	Install High Efficiency Hot Water Boilers	X	X	
ECM 11	Install Occupancy-Controlled Thermostats	X	X	
ECM 12	Implement Demand Control Ventilation (DCV)			
ECM 13	Install High Efficiency Gas-Fired Water Heater	X	X	
ECM 14	Install Low-Flow DHW Devices	X	X	
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	X	X	
ECM 16	Refrigeration Controls	X	X	
ECM 17	Installation of an Energy Management System			
ECM 18	Timer Controls for Window ACs			

Figure 3 – Funding Options

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

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

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

Individual Measures with SmartStart

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

Turnkey Installation with Direct Install

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

Whole Building Approach with Pay for Performance

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

More Options from Around the State

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

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

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

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

Ongoing Electric Savings with Demand Response

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

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Memorial 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 September 10, 2020, TRC performed an energy audit at Memorial School located in Union Beach, New Jersey. TRC met with Jamison Lauer to review the facility operations and help focus our investigation on specific energy-using systems.

Memorial School is a one-story, 104,223 square foot building built in 1955 with subsequent construction in 1960, 1965, 1970, 1999, and 2005. Spaces include classrooms, gymnasium, locker rooms, offices, cafeteria, corridors, kitchen, two boiler rooms, and electrical equipment spaces.

Facility concerns include the hot water boiler system (in poor condition), varying lighting levels in classrooms, and the poor condition of windows and building envelope.

2.2 Building Occupancy

The facility is occupied regular hours from September through June (school season - 10 months). The school is open on Saturdays for recreation activities until 9:00 pm and closed on Sundays. Typical weekday occupancy is approximately 90 staff and 630 students.

During summer (late June, July and August), there are summer programs and classes. Staff members occupy the offices space throughout the year.

Building Name	Weekday/Weekend	Operating Schedule
Memorial School (Student & Office Hours)	Weekday	8:00 AM - 4:00 PM
	Weekend	9:00 AM - 9:00 PM
	Summer	Varies
Memorial School (Custodial Hours)	Weekday	5:30 AM - 10:30 PM
	Weekend	8:00 AM - 9:00 PM
	Summer	5:30 AM - 3:30 PM

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

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

Most of the windows are double glazed and have aluminum frames. The glass-to-frame seals are in fair condition. The operable part of many windows does not hold position when lifted. Also, window film is flaking off from a significant number of windows. The metal panels below some windows are in poor condition; several metal panels on classroom exterior walls are rusted and in poor condition.

Exterior doors have aluminum frames and are in good condition with functional door seals.

			
Roof	*Exterior walls and windows*	*Panel below windows in poor condition*	*Exterior door*

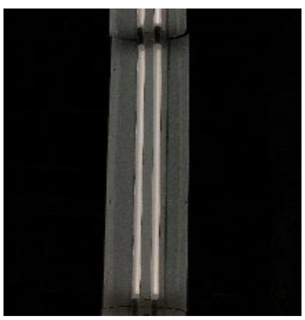
2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several 40-watt T12 linear fluorescent tube lamps and compact fluorescent lamps (CFL). In addition, there are some 4-foot LED tubes, a few LED fixtures and a few 32-Watt U-shaped T8 fluorescent lamps. The multi-purpose room/cafeteria has 250-Watt metal halide lamps.

Fixture types include 1-lamp, 2-lamp, 3-lamp, and 4-lamp, 4-foot long troffer, recessed and surface mounted fixtures. Most fixtures are in good condition. All exit signs are LED type.

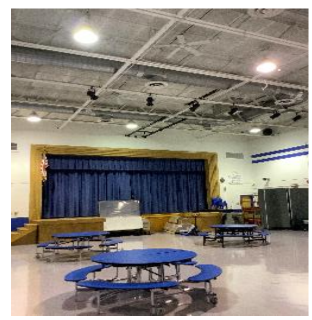
Interior lighting levels in 34 classrooms with 3-lamp and 4-lamp T8 and T12 fixtures were found to be higher than the recommended lighting level of 30-foot to 50 foot-candles and were judged over lit. Besides being visually uncomfortable, over lit spaces lead to excess energy consumption. When the school upgrades additional lighting to LED, it is recommended that the school facility staff work with the contactor to ensure that lighting levels are not excessive.

In our analysis, we have recommended eliminating one 4-foot tube from most of the 4-lamp and 3-lamp fixtures and adding optical reflectors to these fixtures (ECM 2).

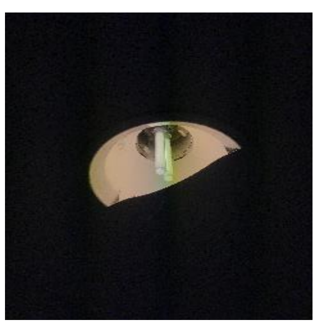

4' LED T8 tube lamps

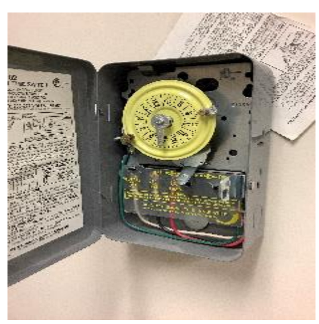

2' x 4' T8 3-lamp fixture


6-lamp fixture in Gym with CFLs


Metal halide lamps in multipurpose room

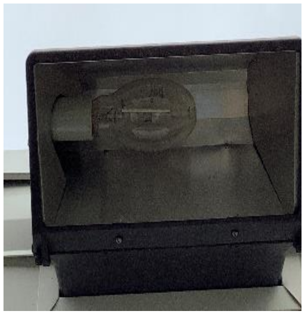
Lighting fixtures in five classrooms, three restrooms, an electrical closet and janitor closet were noted to be controlled by wall-mounted or ceiling-mounted occupancy sensors. All the remaining interior lighting is manually controlled by wall switches.


CFL in can fixture


Timer control for exterior fixtures

Exterior fixtures include several wall-mounted fixtures containing metal halide lamps, some LED wall-mounted fixtures, a few wall-mounted fixtures with compact fluorescent lamps and several linear fluorescent tube lamps mounted under the solar PV canopy. All exterior fixtures are timer controlled.

Very few of the exterior lighting lamps are functional. Most of the metal halide lamps, compact fluorescent lamps and linear fluorescent tubes under the solar PV canopy have burned out.



Wall-mounted fixture with metal halide lamp

Wall-mounted fixture with CFL

Wall-mounted fixture with metal halide lamp

LED fixture

2.5 Air Handling Systems

Unit Ventilators

Unit ventilators (UV) are installed in 50 classrooms, the child study team office, and in the facility manager's office. They all have supply fan motors and provide only space heating and ventilation. Except for eight UVs which were installed about ten years ago, all unit ventilators are original to the building.

The newer units are controlled by the Energy Management System (EMS), while the older units are controlled by a pneumatic system. Facilities staff reported that the pneumatic control system leaks air and is not used anymore. Reportedly the older unit ventilators are left running during the entire heating season. We recommend assessing the pneumatic system for temporary repair and installing new unit ventilators when a capital improvement project is undertaken.

Packaged Units

There are seven packaged rooftop units (RTUs) which serve the gymnasium, multipurpose room, a few classrooms, media center, and main office. All RTUs have direct expansion (DX) coils for cooling. Out of the seven RTUs, the two RTUs for the gymnasium are equipped with gas-fired furnaces for heating, the two RTUs serving the multipurpose room provide only cooling, and the rest are equipped with hot water coils for heating. Heating capacity of the gas-fired furnaces are 320 MBh and their efficiency is 80.0%. All RTUs are between 12 years to 15 years old and are reaching the end of their useful life.

The RTUs for the media center and Classrooms 1 through 6 leak conditioned, cool air from gaps in their metal body frame. This condition leads to excess energy consumption and longer compressor run hours, which can lead to premature failure. It is recommended that operational and maintenance issues be checked by your HVAC contractor and fixed as soon as possible. Refer to Section 5.0 for details regarding ductwork maintenance and other energy efficient best practices.

The table below lists the RTU tag names, areas served by these units, their cooling EER, and the manufacturer:

	Tag Name	Area Served	Cooling Capacity (Tons)	Cooling EER	Gas Heating Output Capacity (MBh)	Gas Heating Efficiency	Manufacturer
1	RTU 4	Gymnasium	15	11.24	320	80.0%	York
2	RTU 5	Gymnasium	15	11.24	320	80.0%	York
3	-	Classroom 1 to 6	26	10.34	N/A	N/A	Aaon
4	-	Media Center	20	9.77	N/A	N/A	Aaon
5	-	Main Office	16	10.77	N/A	N/A	Aaon
6	RTU 6	Multipurpose Room/Cafeteria	20	10.23	Cooling Only	Cooling Only	Aaon
7	RTU 7	Multipurpose Room/Cafeteria	20	10.23	Cooling Only	Cooling Only	Aaon

Note- Packaged units for Classrooms 1 to 6, Media center and Main office have hot water coils for heating.

Refer to Appendix A for detailed information about each unit.

Air Conditioners

During the audit, we found approximately 60 window air conditioners (ACs) installed in classrooms, the faculty lounge/break room, child study team office, custodial staff break room, IT staff room. and facility manager's office. Most ACs have cooling capacity between 0.5-tons to 2-tons. The SEER values for the ACs are between 9 and 10.3.

Several ACs were found to be missing window insulation covers or window insulation that was not properly in place, which leads to outside air infiltration. This creates an excessive cooling load on the AC units and results in excess electricity consumption.

Additionally, it was noted that several ACs were installed in rooms much larger than their capacity to cool. This also leads to longer run hours, results in undercooling, and can shorten the useful life of the units.

Air Handling Units

There is a single air handling unit (AHU) behind the stage in the multipurpose room. It is equipped with a 3.0 hp constant speed motor for the supply fan and hot water coils for heating the multipurpose room.

Make-Up Air Units

There are a total of five make-up air units installed on the roof. Two Reznor units serve the locker rooms, a Reznor unit serves the hallway area near the gymnasium, a Reznor unit serves the multipurpose room/cafeteria and a Greenheck unit serves the kitchen. All make-up air units are equipped with gas-fired furnaces and they heat the outside air before forcing it into the spaces through ducts.

Electric Heaters

Three classrooms and the child study team room are equipped with wall-mounted electric heaters. The heaters use blowers to force warm air into the rooms. The maximum heating capacity of these heaters is 4.8 kW. They are used in the heating season.

Exhaust Fans

There are approximately 30 exhaust fans installed on the roof. The exhaust fans serve hallways, the kitchen cooking area, restrooms, gymnasium, and boiler rooms. Exhaust fan motors range from 0.16 hp to 0.5 hp. The exhaust fans are in fair condition.

Packaged Rooftop Unit

Make-up air unit

Unit ventilator

Window AC

Exhaust fan

Classroom electric heater

Window AC with poor insulation

Window AC with wooden plank as insulation

2.6 Heating Hot Water Systems

The hot water heating system has two HB Smith hot water non-condensing type boilers and three RBI hot water condensing-type boilers.

The HB Smith boilers both have nameplate input capacities of 1,491 MBh, however, they have estimated maximum outputs of 1,050 MBh and 1,330 MBh, respectively. Although the boilers have the same input capacity, due to poor condition of one of the boilers and burner upgrades done to the other, the thermal efficiencies of the boilers are different. The boiler with 1,050 MBh output capacity is rusted in many sections and its efficiency is between 70% - 72%, owing to its condition and age. The boiler with a 1,330 MBh output capacity had recent upgrades to its burner system which increased its efficiency. A recent boiler combustion test confirmed its efficiency to be 89%. The boilers were installed in 1991 and are located in Boiler Room 1.

The three RBI condensing type boilers have an output capacity of 1,716 MBh and a nominal efficiency rating of 88.0%, according to the manufacturer's specifications. One boiler has been out of service for a few years due to leakage. The other two functional boilers are configured in an automated lead-lag control scheme. The boilers were installed in 2014 and the functional units are in good condition. These boilers are located in Boiler Room 2.

The boilers are shut down between mid-April and mid-October every year.

Heating hot water is supplied to the unit ventilators and three RTUs with the help of two 7.5 hp, four 3.0 hp, one 1 hp, two three-fourth hp and three one-sixth hp hot water pumps. All pumps are driven by constant speed motors.

The hot water supply temperature remains between 170 °F and 180 °F during peak winter conditions. The boilers are locked out at outside air temperatures above 60°F.


HB Smith cast iron boiler


Boiler internal parts rusted

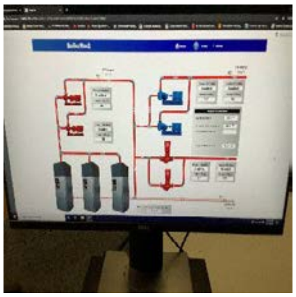

RBI condensing type boilers


Heating hot water pumps

2.7 Building Energy Management Systems (EMS)

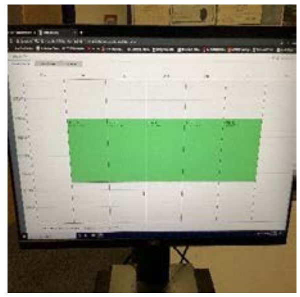
An EMS controls the RTUs and the eight newer unit ventilators. The system allows equipment scheduling, space temperatures, supply air temperatures, outside air for ventilation, and heating hot water loop temperature monitoring and control.

The site staff expressed an interest in expanding the level of control provided by the EMS.



Boiler system graphics

Building layout graphic



Equipment scheduling screen

RTU graphic screen

2.8 Domestic Hot Water

Domestic hot water (DHW) for use in kitchen, restrooms, and other areas of the building is produced by a total of five storage tank-type water heaters. The capacities and other relevant details are provided in the table below:

	Heater Location	Fuel	Input Heating Capacity	Tank Capacity (Gal)	Manufacturer
1	Boiler Room 1	Natural Gas	75.1 MBh	74	A.O. Smith
2	Boiler Room 2	Natural Gas	75 MBh	75	Rheem
3	Janitor closet	Electric	4 kW	40	Rheem
4	Janitorial Room	Natural Gas	150 MBh	100	A.O. Smith
5	Kitchen	Natural Gas	154 MBh	81	A.O. Smith

The 154 MBh and 150 MBh A.O. Smith water heaters are in fair condition but are beyond their useful life. The domestic hot water pipes are insulated, and the insulation is good condition.

Electric water heater

Gas-fired water heater

2.9 Food Service Equipment

The kitchen has a mix of gas and electric equipment that is used to prepare and store meals for students. Most of the cooking is done using the electric convection ovens and a gas steamer. Also, there are two electric insulated food holding cabinets.

There is no dishwasher in this school.

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

Electric oven

Gas-fired steamer

2.10 Refrigeration

The kitchen has one walk-in cooler and one walk-in medium temperature freezer. In addition, there is one stand-up, glass door refrigerator, refrigerator chest, and freezer chest. All equipment is in good condition. The freezer chest is ENERGY STAR® rated.

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

Solid door refrigerator

Refrigerator chest

2.11 Plug Load & Vending Machines

The location is doing a great job managing their electrical plug loads. This report makes additional suggestions for ECMs in this area as well as Energy Efficient Best Practices.

There are 650 desktop and laptop computers throughout the facility. Other plug loads throughout the building include general cafe, office equipment. Café equipment includes heated/chilled serving tables in the kitchen, microwave ovens, and toaster ovens, residential-style refrigerators, and coffee makers.

Office and other equipment include printers, copiers, paper shredders, and air purifier machines. There is also typical classroom plug load equipment such as smart boards, projectors, televisions, and portable fans.

There are no vending machines in this school.

Large copier/printer

Refrigerator

Microwave

Water cooler

2.12 Water-Using Systems

Faucet flow rate in most restrooms is at 2.5 gallons per minute (gpm), while a few restrooms have faucets with a 0.5 gpm flow rate. Faucet flow rates in the kitchen and classrooms are 2.0 gpm.

0.5 gpm faucet

2.0 gpm faucet

2.13 Process Equipment

Unit ventilators controls operate based on a pneumatic system with compressed air provided by an air compressor, powered by two 3.0 hp motors. The compressed air system is not currently used because of air leaks within the system.

2.14 On-Site Generation

Union Beach Memorial School has a solar photovoltaic (solar PV) power generating system with a rated capacity of 496.56 kW DC. The system is comprised of a carport canopy solar PV system with capacity of 362.01 kW DC and a rooftop solar PV system with capacity of 134.55 kW DC. The entire system provided approximately 63.5% of the electricity used at this facility between February 2019 and January 2020. According to the information provided by the school staff, the school purchases power generated by the solar PV system under a Power Purchase Agreement (PPA) with Terraform Power, LLC.

According to our estimates, the solar PV system has also reduced the school's peak electric demand purchases by approximately 200 kW AC. In other words, without the solar PV system, the peak demand billed by your electric utility would have been 200 kW higher than it currently is. This reduction is saving you significant electric utility expense. The maximum billed electric demand in the historical use period covered in this report was 136 kW.

When the energy conservation measures (ECMs) recommended in this report are implemented, you should expect to see a further reduction in the peak demand billed by your utility company. The magnitude of the reduction will vary depending on whether you choose to implement a few ECMs or all the ECMs evaluated in this report. In the event you plan to implement most of the ECMs recommended in this report, we recommend having a discussion with your electric utility company about how your billed peak demand and rate class will be affected.

Carport solar panels

Carport solar panels

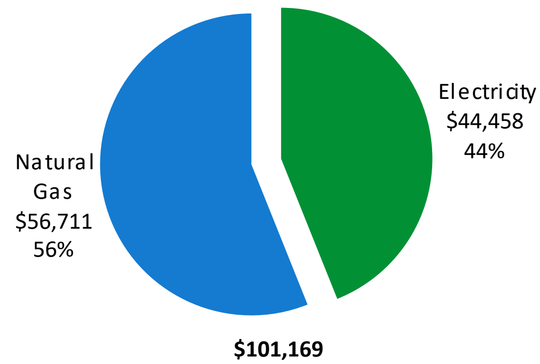
Rooftop solar panels

Rooftop solar panels

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	701,653 kWh	$44,458
Natural Gas	52,629 Therms	$56,711
Total		**$101,169**



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

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

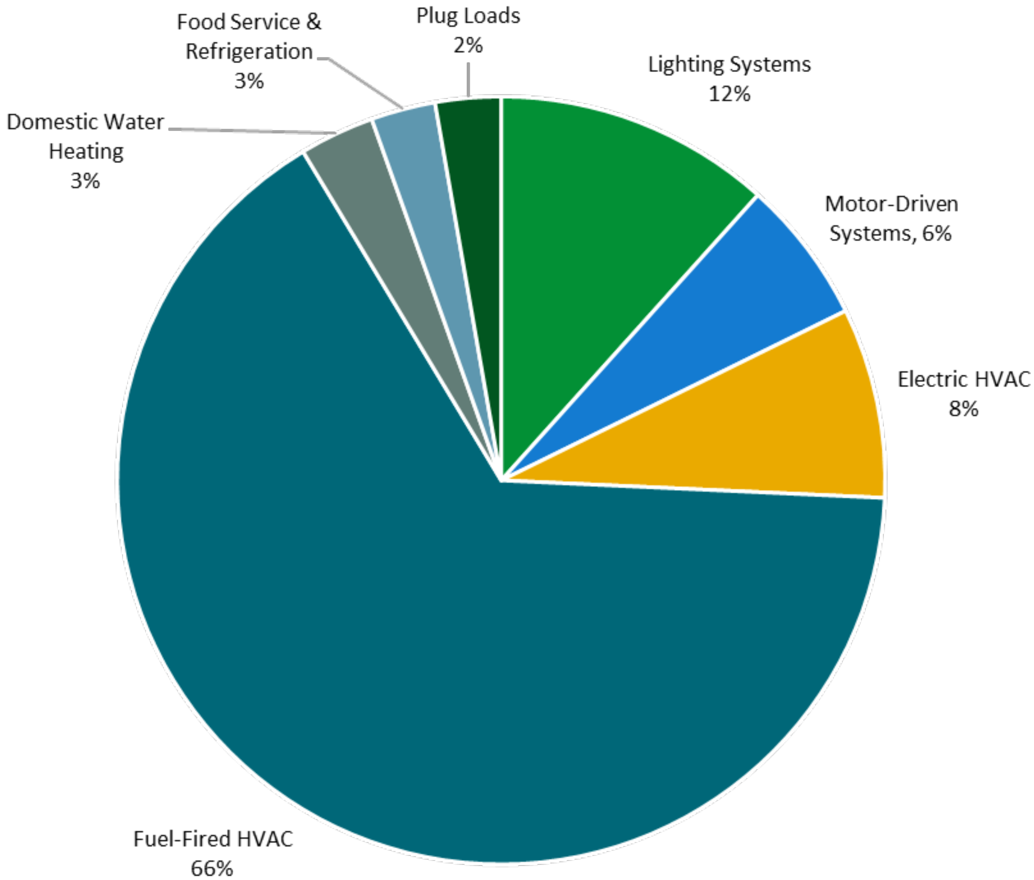
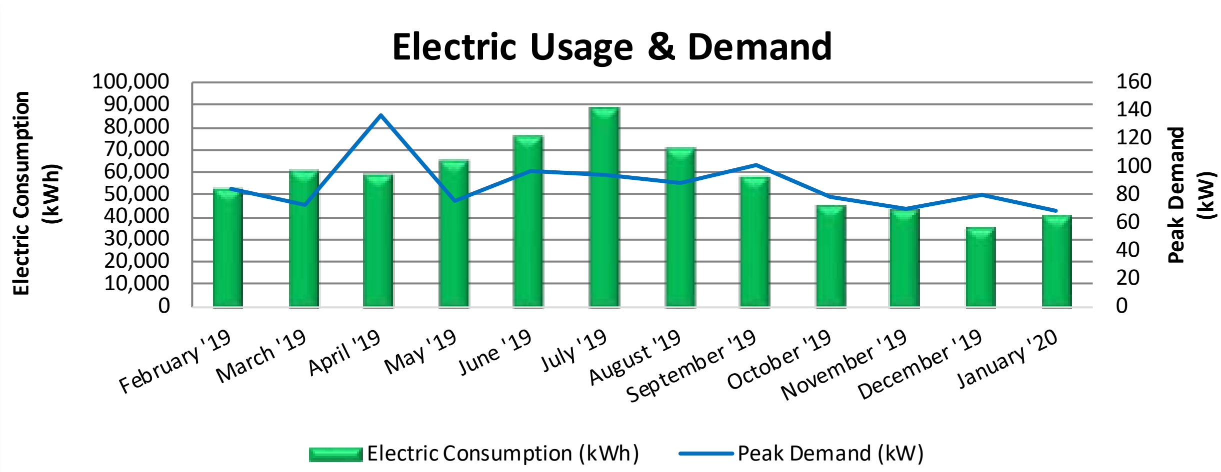
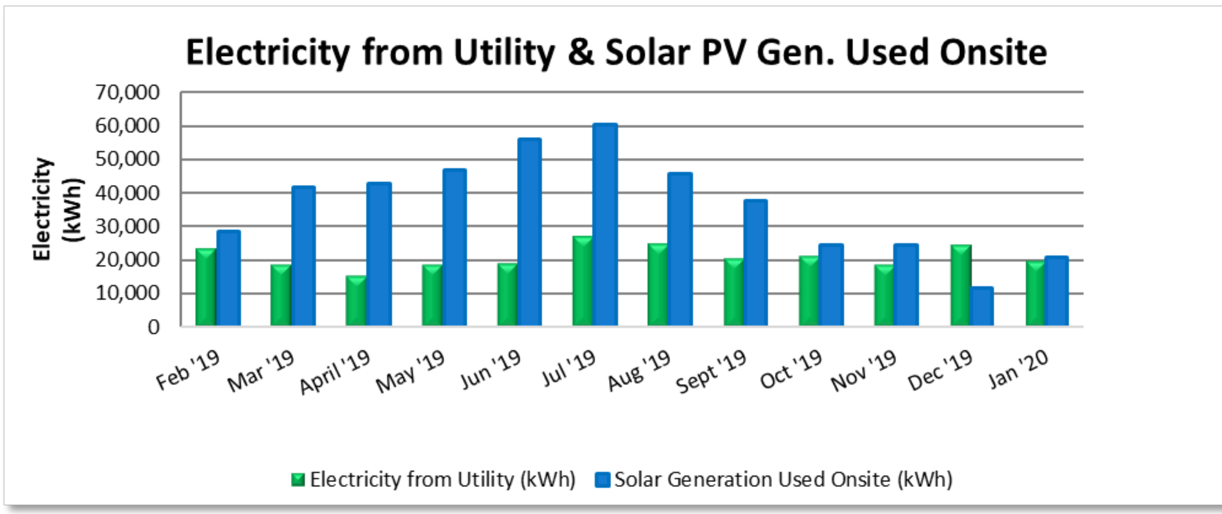


Figure 5 - Energy Balance

3.1 Electricity

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





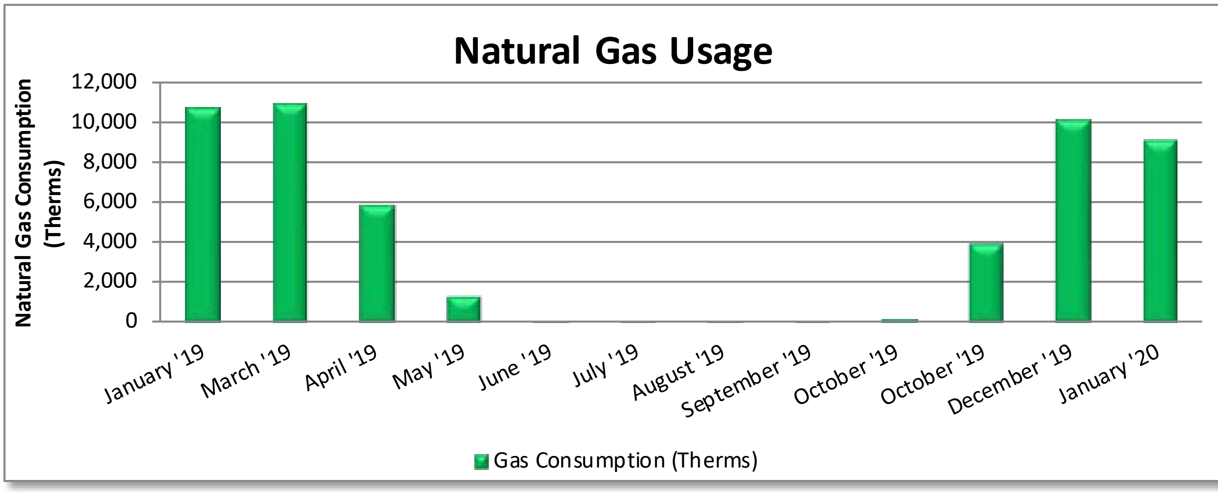
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
2/27/19	30	52,249	84	$527	$2,803
3/27/19	28	60,396	73	$456	$4,174
4/25/19	29	58,371	136	$415	$4,456
5/29/19	34	65,360	75	$469	$4,827
6/27/19	29	75,318	96	$638	$5,401
7/26/19	29	87,930	94	$625	$5,598
8/27/19	32	70,611	89	$587	$4,734
9/26/19	30	58,149	101	$670	$3,799
10/28/19	32	45,588	79	$485	$2,582
11/25/19	28	43,387	70	$429	$2,386
12/27/19	32	36,045	80	$491	$1,304
1/24/20	28	40,560	68	$421	$1,906
Totals	**361**	**693,964**	**136**	**$6,213**	**$43,971**
Annual	**365**	**701,653**	**136**	**$6,282**	**$44,458**

Notes:

- Peak demand of 136 kW occurred in April 2019.
- Average demand over the past 12 months was 87 kW.
- The average electric cost over the past 12 months was $0.063/kWh, which is the blended rate that includes energy supply, distribution, demand, other charges and cost of power generated by the solar PV system which is purchased under the PPA. This report uses this blended rate to estimate energy cost savings.
- On-site power generation by the solar PV system is through a PPA and the site purchases the generated electricity from Terraform Power, LLC.

3.2 Natural Gas

NJ Natural Gas delivers natural gas under rate class Monthly 057CNN2G, with natural gas supply provided by UGI, a third-party supplier.



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
2/14/19	28	10,647	$10,690
3/19/19	33	10,871	$10,657
4/17/19	29	5,857	$5,533
5/16/19	29	1,363	$2,014
6/19/19	34	186	$1,078
7/22/19	33	104	$1,008
8/19/19	28	76	$986
9/17/19	29	124	$1,023
10/17/19	30	224	$1,087
11/14/19	28	3,985	$4,245
12/17/19	33	10,092	$9,579
1/17/20	31	9,100	$8,811
Totals	**365**	**52,629**	**$56,711**
Annual	**365**	**52,629**	**$56,711**

Notes:

- The average gas cost for the past 12 months is $1.078/therm, which is the blended rate used throughout the analysis.

3.3 Benchmarking

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

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

Benchmarking Score	**77**

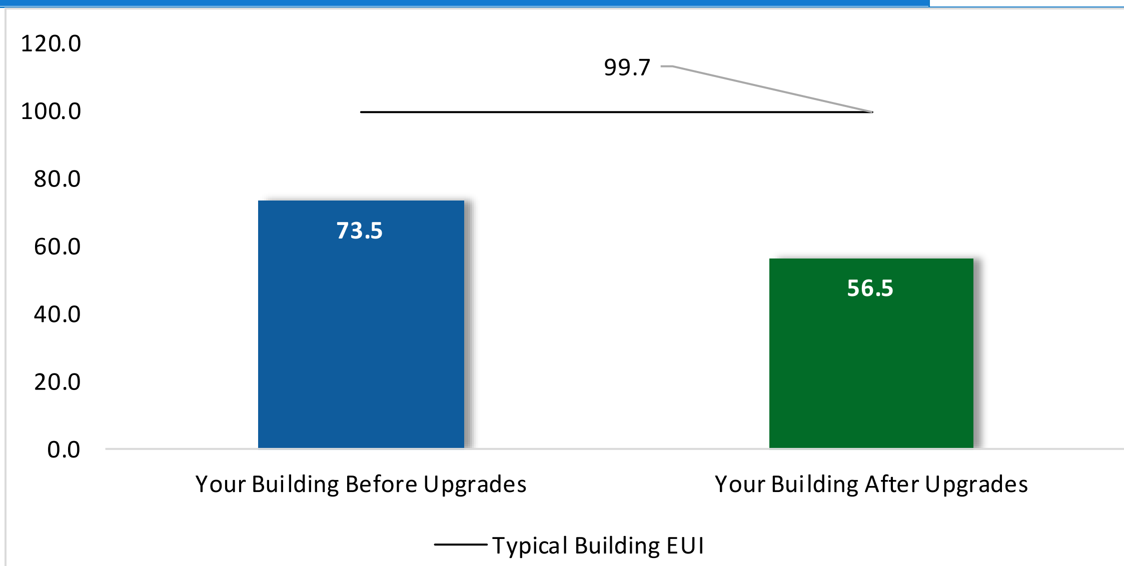


Figure 6 - Energy Use Intensity Comparison[3]

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

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

[3] Based on all evaluated ECMs

Tracking Your Energy Performance

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

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

Free online training is available to help you use ENERGY STAR® Portfolio Manager® to track your building's performance at: https://www.energystar.gov/buildings/training.

For more information on ENERGY STAR® and Portfolio Manager®, visit their website[4].

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

4 Energy Conservation Measures

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

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

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

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

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**167,357**	**50.5**	**-34**	**$10,234**	**$116,510**	**$28,928**	**$87,582**	**8.6**	**164,509**
ECM 1	Install LED Fixtures	Yes	10,619	2.4	-2	$656	$11,296	$2,200	$9,096	13.9	10,507
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	93,649	30.4	-20	$5,723	$77,921	$13,400	$64,521	11.3	92,011
ECM 3	Retrofit Fixtures with LED Lamps	Yes	63,089	17.7	-13	$3,856	$27,292	$13,328	$13,964	3.6	61,991
Lighting Control Measures			**34,304**	**9.3**	**-7**	**$2,096**	**$32,146**	**$12,310**	**$19,836**	**9.5**	**33,704**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	29,893	8.3	-6	$1,827	$26,296	$6,630	$19,666	10.8	29,370
ECM 5	Install High/Low Lighting Controls	Yes	4,411	0.9	-1	$270	$5,850	$5,680	$170	0.6	4,334
Variable Frequency Drive (VFD) Measures			**31,854**	**5.7**	**23**	**$2,271**	**$127,072**	**$9,500**	**$117,572**	**51.8**	**34,824**
ECM 6	Install VFDs on Constant Volume (CV) Fans	No	6,301	2.9	0	$399	$8,152	$3,600	$4,552	11.4	6,345
ECM 7	Install VFDs on Heating Water Pumps	No	24,271	2.8	0	$1,538	$115,910	$5,750	$110,160	71.6	24,441
ECM 8	Install VFDs on Kitchen Hood Fan Motors	Yes	1,282	0.0	23	$334	$3,010	$150	$2,860	8.6	4,038
Electric Unitary HVAC Measures			**6,915**	**8.4**	**0**	**$438**	**$177,754**	**$17,696**	**$160,058**	**365.3**	**6,964**
ECM 9	Install High Efficiency Air Conditioning Units	No	6,915	8.4	0	$438	$177,754	$17,696	$160,058	365.3	6,964
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**245**	**$2,641**	**$57,111**	**$10,469**	**$46,642**	**17.7**	**28,692**
ECM 10	Install High Efficiency Hot Water Boilers	No	0	0.0	245	$2,641	$57,111	$10,469	$46,642	17.7	28,692
HVAC System Improvements			**1,536**	**0.0**	**297**	**$3,300**	**$20,322**	**$7,650**	**$12,672**	**3.8**	**36,341**
ECM 11	Install Occupancy-Controlled Thermostats	Yes	0	0.0	237	$2,556	$12,166	$7,650	$4,516	1.8	27,773
ECM 12	Implement Demand Control Ventilation (DCV)	No	1,536	0.0	60	$744	$8,157	$0	$8,157	11.0	8,568
Domestic Water Heating Upgrade			**491**	**0.0**	**55**	**$622**	**$18,170**	**$2,692**	**$15,478**	**24.9**	**6,912**
ECM 13	Install High Efficiency Gas-Fired Water Heater	No	0	0.0	20	$221	$17,568	$2,128	$15,440	70.0	2,398
ECM 14	Install Low-Flow DHW Devices	Yes	491	0.0	34	$401	$602	$564	$38	0.1	4,514
Food Service & Refrigeration Measures			**2,543**	**0.1**	**0**	**$161**	**$4,561**	**$620**	**$3,941**	**24.5**	**2,561**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	No	885	0.1	0	$56	$1,213	$320	$893	15.9	891
ECM 16	Refrigeration Controls	No	1,658	0.0	0	$105	$3,348	$300	$3,048	29.0	1,670
Custom Measures			**30,936**	**0.0**	**251**	**$4,664**	**$88,462**	**$0**	**$88,462**	**19.0**	**60,536**
ECM 17	Installation of an Energy Management System	No	12,610	0.0	251	$3,503	$87,547	$0	$87,547	25.0	42,082
ECM 18	Timer Controls for Window ACs	Yes	18,326	0.0	0	$1,161	$915	$0	$915	0.8	18,454
TOTALS			**275,936**	**74.0**	**830**	**$26,427**	**$642,109**	**$89,865**	**$552,243**	**20.9**	**375,043**

* - 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		**167,357**	**50.5**	**-34**	**$10,234**	**$116,510**	**$28,928**	**$87,582**	**8.6**	**164,509**
ECM 1	Install LED Fixtures	10,619	2.4	-2	$656	$11,296	$2,200	$9,096	13.9	10,507
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	93,649	30.4	-20	$5,723	$77,921	$13,400	$64,521	11.3	92,011
ECM 3	Retrofit Fixtures with LED Lamps	63,089	17.7	-13	$3,856	$27,292	$13,328	$13,964	3.6	61,991
Lighting Control Measures		**34,304**	**9.3**	**-7**	**$2,096**	**$32,146**	**$12,310**	**$19,836**	**9.5**	**33,704**
ECM 4	Install Occupancy Sensor Lighting Controls	29,893	8.3	-6	$1,827	$26,296	$6,630	$19,666	10.8	29,370
ECM 5	Install High/Low Lighting Controls	4,411	0.9	-1	$270	$5,850	$5,680	$170	0.6	4,334
Variable Frequency Drive (VFD) Measures		**1,282**	**0.0**	**23**	**$334**	**$3,010**	**$150**	**$2,860**	**8.6**	**4,038**
ECM 8	Install VFDs on Kitchen Hood Fan Motors	1,282	0.0	23	$334	$3,010	$150	$2,860	8.6	4,038
HVAC System Improvements		**0**	**0.0**	**237**	**$2,556**	**$12,166**	**$7,650**	**$4,516**	**1.8**	**27,773**
ECM 11	Install Occupancy-Controlled Thermostats	0	0.0	237	$2,556	$12,166	$7,650	$4,516	1.8	27,773
Domestic Water Heating Upgrade		**491**	**0.0**	**34**	**$401**	**$602**	**$564**	**$38**	**0.1**	**4,514**
ECM 14	Install Low-Flow DHW Devices	491	0.0	34	$401	$602	$564	$38	0.1	4,514
Custom Measures		**18,326**	**0.0**	**0**	**$1,161**	**$915**	**$0**	**$915**	**0.8**	**18,454**
ECM 18	Timer Controls for Window ACs	18,326	0.0	0	$1,161	$915	$0	$915	0.8	18,454
TOTALS		**221,760**	**59.8**	**254**	**$16,783**	**$165,348**	**$49,602**	**$115,746**	**6.9**	**252,992**

* - 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		**167,357**	**50.5**	**-34**	**$10,234**	**$116,510**	**$28,928**	**$87,582**	**8.6**	**164,509**
ECM 1	Install LED Fixtures	10,619	2.4	-2	$656	$11,296	$2,200	$9,096	13.9	10,507
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	93,649	30.4	-20	$5,723	$77,921	$13,400	$64,521	11.3	92,011
ECM 3	Retrofit Fixtures with LED Lamps	63,089	17.7	-13	$3,856	$27,292	$13,328	$13,964	3.6	61,991

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

ECM 1: Install LED Fixtures

Replace existing 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 since LED lamps last longer than other light sources and therefore do not need to be replaced as often.

Affected building areas: metal halide fixtures in cafeteria, exterior fixtures with metal halide and high-pressure sodium lamps.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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

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

We judged light levels to be above recommended guidelines in several classroom areas. We recommend one less lamp than the existing case in most of the 3-lamp and 4-lamp fixtures (de-lamping) and installing optical reflectors to fixtures in these areas.

Affected building areas: all areas with fluorescent fixtures with T12 tubes, all 4-lamp and 3-lamp T8 fixtures where de-lamping is recommended.

ECM 3: Retrofit Fixtures with LED Lamps

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

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

Affected building areas: all areas with fluorescent 1-lamp or 2-lamp fixtures with T8 tubes, all compact fluorescent 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		**34,304**	**9.3**	**-7**	**$2,096**	**$32,146**	**$12,310**	**$19,836**	**9.5**	**33,704**
ECM 4	Install Occupancy Sensor Lighting Controls	29,893	8.3	-6	$1,827	$26,296	$6,630	$19,666	10.8	29,370
ECM 5	Install High/Low Lighting Controls	4,411	0.9	-1	$270	$5,850	$5,680	$170	0.6	4,334

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 that lighting controls use dual technology sensors, which reduce the possibility of lights turning off unexpectedly.

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

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

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

Affected building areas: all interior spaces except hallways, multipurpose room stage, and boiler 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 code requirements for egress. Sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Fixtures automatically switch back to low level after a predefined period of vacancy. In parking lots and parking garages with significant ambient lighting, this control can sometimes be combined with photocell controls to turn the lights off when there is sufficient daylight.

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

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

Affected building areas: Hallways.

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

4.3 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		**31,854**	**5.7**	**23**	**$2,271**	**$127,072**	**$9,500**	**$117,572**	**51.8**	**34,824**
ECM 6	Install VFDs on Constant Volume (CV) Fans	6,301	2.9	0	$399	$8,152	$3,600	$4,552	11.4	6,345
ECM 7	Install VFDs on Heating Water Pumps	24,271	2.8	0	$1,538	$115,910	$5,750	$110,160	71.6	24,441
ECM 8	Install VFDs on Kitchen Hood Fan Motors	1,282	0.0	23	$334	$3,010	$150	$2,860	8.6	4,038

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

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

We evaluated installing 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.

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

For air handlers with direct expansion (DX) cooling systems, the minimum air flow across the cooling coil required to prevent the coil from freezing must be determined during the final project design. The control system programming should maintain the minimum air flow whenever the compressor is operating. Prior to implementation, verify minimum fan speed in cooling mode with the manufacturer. Note that savings will vary depending on the operating characteristics of each AHU.

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

Affected air handlers: gym RTU 4 and RTU 5.

ECM 7: Install VFDs on Heating Water Pumps

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

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

Affected pumps: the 1.5 hp, 3.0 hp, and 7.5 hp motors for the hot water pumps.

ECM 8: Install VFDs on Kitchen Hood Fan Motors

Install VFDs and sensors to control the kitchen hood fan motors. The air flow of the hood is varied based on two key inputs: temperature and smoke/cooking fumes. The VFD controls the amount of exhaust (and kitchen make-up air) based on temperature—the lower the temperature the lower the flow. If the optic sensor is triggered by smoke or cooking fumes, the speed of the fan ramps up to 100%.

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

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		**6,915**	**8.4**	**0**	**$438**	**$177,754**	**$17,696**	**$160,058**	**365.3**	**6,964**
ECM 9	Install High Efficiency Air Conditioning Units	6,915	8.4	0	$438	$177,754	$17,696	$160,058	365.3	6,964

Replacing the unitary HVAC units has a long payback period and may not be justifiable based simply on energy considerations. However, most of the units at this facility are nearing the end of their normal useful life. Although the simple payback period based on energy savings alone is extremely long, the marginal cost of purchasing a high efficiency unit can typically be justified by the marginal savings from the improved efficiency. Thus, the payback period will be much shorter when you consider replacing the existing units at the end of their useful life. When the seven packaged rooftop units are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 9: Install High Efficiency Air Conditioning Units

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

Affected units: all seven packaged rooftop units.

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**	**245**	**$2,641**	**$57,111**	**$10,469**	**$46,642**	**17.7**	**28,692**
ECM 10	Install High Efficiency Hot Water Boilers	0	0.0	245	$2,641	$57,111	$10,469	$46,642	17.7	28,692

ECM 10: Install High Efficiency Hot Water Boilers

We evaluated replacing the older, inefficient cast iron HB Smith hot water boilers with high efficiency hot water boilers. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

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

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 and may not be justifiable based simply on energy considerations. However, the boilers are beyond their normal useful life and in poor condition. Typically, the marginal cost of purchasing high efficiency boilers can be justified by the marginal savings from the improved efficiency. When the boiler is eventually replaced, consider purchasing boilers that exceed the minimum efficiency required by building codes. We also recommend working with your mechanical design team to determine whether the heating system can operate with return water temperatures below 130°F, which would allow the use of condensing boilers.

4.6 HVAC Improvements

#	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)
HVAC System Improvements		**1,536**	**0.0**	**297**	**$3,300**	**$20,322**	**$7,650**	**$12,672**	**3.8**	**36,341**
ECM 11	Install Occupancy-Controlled Thermostats	0	0.0	237	$2,556	$12,166	$7,650	$4,516	1.8	27,773
ECM 12	Implement Demand Control Ventilation (DCV)	1,536	0.0	60	$744	$8,157	$0	$8,157	11.0	8,568

ECM 11: Install Occupancy-Controlled Thermostats

Replace manual thermostats with occupancy-controlled thermostats. An occupancy-controlled thermostat is paired with a door detector and/or sensor to identify movement and determine if a room is occupied or unoccupied. When occupancy is detected, the thermostat enables the programmed temperature setpoint. If no occupancy is sensed, the thermostat switches to unoccupied mode after a set period of time and reduces the temperature setpoint.

By reducing heating temperature setpoints and increasing cooling temperature setpoints when the space is unoccupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures for building usage. Occupancy controlled thermostats provide energy savings by reducing heating and cooling energy usage when rooms are unoccupied.

ECM 12: Implement Demand Control Ventilation (DCV)

We evaluated a measure to implement demand control ventilation (DCV) that would monitor the indoor air's carbon dioxide (CO_2) content to measure room occupancy. This data is used to regulate the amount of outdoor air provided to the space for ventilation.

Standard ventilation systems often provide outside air based on a space's estimated maximum occupancy but not actual occupancy. During low occupancy periods, the space may then be over ventilated. This wastes energy through heating and cooling the excess outside air flow. DCV reduces unnecessary outdoor air intake by regulating ventilation based on actual occupancy levels. DCV is most suited for facilities where occupancy levels vary significantly from hour to hour and day to day.

Energy savings associated with DCV are based on hours of operation, space occupancy, outside air reduction, and other factors. Energy savings results from eliminating unnecessary ventilation and space conditioning.

Affected building areas: gymnasium, multipurpose room, and media center.

4.7 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**491**	**0.0**	**55**	**$622**	**$18,170**	**$2,692**	**$15,478**	**24.9**	**6,912**
ECM 13	Install High Efficiency Gas-Fired Water Heater	0	0.0	20	$221	$17,568	$2,128	$15,440	70.0	2,398
ECM 14	Install Low-Flow DHW Devices	491	0.0	34	$401	$602	$564	$38	0.1	4,514

ECM 13: Install High Efficiency Gas-Fired Water Heater

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

ECM 14: Install Low-Flow DHW Devices

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

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

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing. Pre-rinse spray valves (PRSVs) — often used in commercial and institutional kitchens — remove food waste from dishes prior to dishwashing.

Additional cost savings may result from reduced water usage.

4.8 Food Service & Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**2,543**	**0.1**	**0**	**$161**	**$4,561**	**$620**	**$3,941**	**24.5**	**2,561**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	885	0.1	0	$56	$1,213	$320	$893	15.9	891
ECM 16	Refrigeration Controls	1,658	0.0	0	$105	$3,348	$300	$3,048	29.0	1,670

ECM 15: Refrigerator/Freezer Case Electrically Commutated Motors

We evaluated replacing shaded pole or permanent split capacitor (PSC) motors with electronically commutated (EC) motors in the walk-in cooler and walk-in freezer. 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.

ECM 16: Refrigeration Controls

Many walk-in coolers and freezers have evaporator fans that run continuously. We evaluated a measure that adds a control system feature to automatically shut off evaporator fans when not needed. The energy savings account for reduction in fan operating hours as well as reduction in the refrigeration heat load as appropriate.

4.9 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**30,936**	**0.0**	**251**	**$4,664**	**$88,462**	**$0**	**$88,462**	**19.0**	**60,536**
ECM 17	Installation of an Energy Management System	12,610	0.0	251	$3,503	$87,547	$0	$87,547	25.0	42,082
ECM 18	Timer Controls for Window ACs	18,326	0.0	0	$1,161	$915	$0	$915	0.8	18,454

ECM 17: Expansion of the Energy Management System

Most larger facilities have some type of energy management system (EMS) which provides for centralized, remote control and monitoring of HVAC equipment and sometimes lighting or other building systems. An EMS utilizes a system of temperature and pressure sensors that obtain feedback about field conditions and provide signals to control systems that adjust HVAC system operation for optimal functioning. Thirty years ago, most control systems were pneumatic systems driven by compressed air, with pneumatic thermostats and air driven actuators for valves and dampers. Pneumatic controls have largely been replaced by direct digital control (DDC) systems, but many pneumatic systems remain. Contemporary DDC systems afford tighter controls and enhanced monitoring and trending capabilities as compared to the older systems.

Based on our survey, it appears that the expanding the control of your existing EMS system to HVAC equipment not currently controlled by it could increase the efficiency of your building HVAC system operation.

A controls upgrade would enable automated equipment “start” and “stop” times, temperature setpoints, lockouts and deadbands to be programmed remotely using a graphic interface. Controls can be configured to optimize ventilation and outside air intake by adjusting economizer position, damper function and fan speed. Existing hot water distribution system controls are typically “tied in”, including associated pumps and valves. Coordinated control of HVAC systems is dependent on a network of sensors and status points. A comprehensive building control system provides monitoring and control for all HVAC systems so operators can adjust system programming for optimal comfort and energy savings. As noted in Section 2.5, the existing pneumatic control system is in disrepair. Additional savings, not calculated in this review, may result from repair or replacement of the pneumatic distribution system.

It is recommended that an HVAC engineer or contractor who specializes in energy management systems be contacted for a detailed evaluation and implementation costs. For the purposes of this report, the potential energy savings and measure costs were estimated based on industry standards and previous project experience. Further analysis should be conducted for the feasibility of this measure. This is not an investment grade analysis nor should be used as a basis for design and construction.

A high-level evaluation of potential savings and costs is provided for demonstration purposes only. It is a screening evaluation for the potential in installing an EMS. Based on industry standards and previous project experience, the potential energy savings may be up to 20% of existing HVAC energy use. The average cost for expanding the existing EMS control to all HVAC equipment may be between $1.5 and $3 per square foot. Actual savings and costs will need to be outlined by the specific contractor engaged to implement the system. For the purposes of this report, we have conservatively estimated savings to be 4% of the HVAC energy consumption baseline.

ECM 18: Timer Controls for Window ACs

During cooling season, approximately 50 window ACs installed in the classrooms and other spaces are manually controlled and therefore may be left to operate outside of occupied hours. Unnecessary operation not only leads to excess electricity consumption but also shortens the useful life of the ACs.

We recommend installing wall socket timer control plugs and connecting the window ACs through them. Such timers are inexpensive, ranging from $10 on up. The more expensive models are digitally programmable and incorporated battery backup capability. They are typically rated to control up to 15 amps, which is adequate to control a single window AC. Such timers can be programmed to allow the ACs to run only for the hours cooling is required in the spaces. For example, ACs in the classrooms could be programmed to operate from 1 hour before the classrooms are occupied up to the time the classrooms are generally vacated by teachers or students. Note that while the units are enabled by the timer, the AC unit's temperature settings would continue to be configurable by the occupant as they are currently.

This ECM is a low-cost measure which can save significant energy and prolong the useful life of the window ACs.

5 Energy Efficient Best Practices

A whole building maintenance plan will extend equipment life; improve occupant comfort, health, and safety; and reduce energy and maintenance costs.

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

You may already be doing some of these things— see our list below for potential additions to your maintenance plan. Be sure to consult with qualified equipment specialists for details on proper maintenance and system operation.

Energy Tracking with ENERGY STAR® Portfolio Manager®

You've heard it before - you can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[5]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Doors and Windows

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

Lighting Maintenance

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

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

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

Lighting Controls

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

Motor Maintenance

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

Economizer Maintenance

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

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

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

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

Ductwork Maintenance

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

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

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

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

Boiler Maintenance

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

Label HVAC Equipment

For improved coordination in maintenance practices, we recommend labeling or re-labeling the site HVAC equipment. Maintain continuity in labeling by following labeling conventions as indicated in the facility drawings or EMS building equipment list. Use weatherproof or heatproof labeling or stickers for permanence, but do not cover over original equipment nameplates, which should be kept clean and readable whenever possible. Besides equipment, label piping for service and direction of flow when possible. Ideally, maintain a log of HVAC equipment, including nameplate information, asset tag designation, areas served, installation year, service dates, and other pertinent information.

This investment in your equipment will enhance collaboration and communication between your staff and your contracted service providers and may help you with regulatory compliance.

Optimize HVAC Equipment Schedules

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

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

Water Heater Maintenance

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

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

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

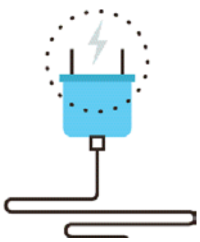
Refrigeration Equipment Maintenance

Preventative maintenance keeps commercial refrigeration equipment running reliably and efficiently. Commercial refrigerators and freezers are mission-critical equipment that can cost a fortune when they go down. Even when they appear to be working properly, refrigeration units can be consuming too much energy. Have walk-in refrigeration and freezer and other commercial systems serviced at least annually. This practice will allow systems to perform to their highest capabilities and will help identify system issues if they exist.

Maintaining your commercial refrigeration equipment can save between 5 and 10 percent on energy costs. When condenser coils are dirty, your commercial refrigerators and freezers work harder to maintain the temperature inside. Worn gaskets, hinges, door handles or faulty seals cause cold air to leak from the unit, forcing the unit to run longer and use more electricity.

Regular cleaning and maintenance also help your commercial refrigeration equipment to last longer.

Plug Load Controls



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

Computer Power Management Software

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

---

[6] For additional information refer to "Assessing and Reducing Plug and Process Loads in Office Buildings" http://www.nrel.gov/docs/fy13osti/54175.pdf, or "Plug Load Best Practices Guide" http://www.advancedbuildings.net/plug-load-best-practices-guide-offices.

Water Conservation

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

For more information regarding water conservation go to the EPA's WaterSense® website[7] or download a copy of EPA's "WaterSense® at Work: Best Management Practices for Commercial and Institutional Facilities"[8] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

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

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

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

Procurement Strategies

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

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

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

6 On-site Generation

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

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

6.1 Solar Photovoltaic

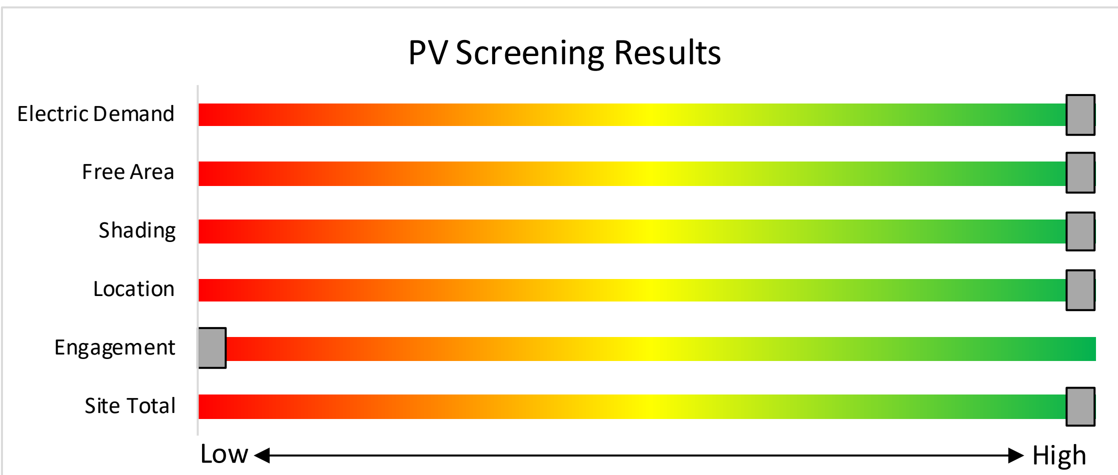
Photovoltaic (PV) panels convert sunlight into electricity. Individual panels are combined into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is then connected to the building's electrical distribution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

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

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

Since the existing solar PV system contributes to over 60% of the total electricity consumed at this school, we recommend discussing with your utility company about how installing more solar PV capacity will affect the peak electric load (kW), the electric rate class and net kWh consumption over a year.

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



Potential	High	
System Potential	75	kW DC STC
Electric Generation	89,353	kWh/yr
Displaced Cost	$5,660	/yr
Installed Cost	$195,000	

Figure 9 - Photovoltaic Screening

Transition Incentive (TI) Program

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

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

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

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

6.2 Combined Heat and Power

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

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

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

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

Based on a preliminary analysis, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation. Low and infrequent thermal load is the most significant factor contributing to the lack of CHP potential.

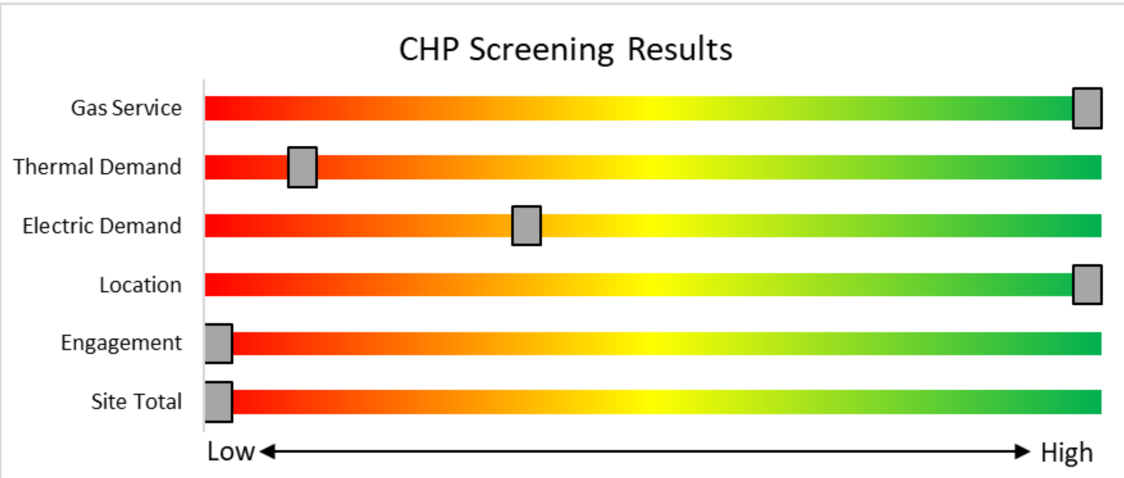


Figure 10 – Combined Heat & Power Screening

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

7 Project Funding and Incentives

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

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

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

7.1 SmartStart

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

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

Equipment with Prescriptive Incentives Currently Available:

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

Incentives

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

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

How to Participate

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

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

7.2 Direct Install

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

Incentives

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

How to Participate

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

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

7.3 Pay for Performance - Existing Buildings

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

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

Based on the site building and utility data provided, the facility does not meet the requirements of the current P4P program.

Incentives

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

How to Participate

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

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

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

7.4 Combined Heat and Power

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

Incentives

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

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

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

How to Participate

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

7.5 Energy Savings Improvement Program

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

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

How to Participate

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

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

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

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

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

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

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

7.6 Transition Incentive (TI) Program

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

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

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

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

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

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

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

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

8 Energy Purchasing and Procurement Strategies

8.1 Retail Electric Supply Options

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

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

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

8.2 Retail Natural Gas Supply Options

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

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

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

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

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Cafeteria	15	Metal Halide: (1) 250W Lamp	Wall Switch	S	295	2,090	1, 4	Fixture Replacement	Yes	15	LED - Fixtures: 75W LED High Bay fixture	Occupancy Sensor	75	1,442	2.6	8,388	-2	$513	$10,590	$1,050	18.6
Office - Copy room	13	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	13	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.6	1,882	0	$115	$982	$460	4.5
Boiler Room 1	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	660	0.1	96	0	$6	$146	$80	11.3
Gymnasium	24	Compact Fluorescent: (8) 32W Biaxial Plug-In Lamps	Wall Switch	S	256	4,224	3, 4	Relamp	Yes	24	LED Lamps: (8) 23W Plug-In LED Lamps	Occupancy Sensor	184	2,915	2.2	14,390	-3	$879	$2,940	$524	2.7
Gymnasium	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Gymnasium	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	660	0.0	48	0	$3	$73	$40	11.3
Gymnasium	2	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	660	3, 4	Relamp	Yes	2	LED Lamps: (2) 23W Plug-In LED Lamps	Occupancy Sensor	23	455	0.1	70	0	$4	$166	$8	37.0
Gymnasium	7	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	3,150	3, 4	Relamp	Yes	7	LED Lamps: (2) 23W Plug-In LED Lamps	Occupancy Sensor	23	2,174	0.2	1,167	0	$71	$445	$98	4.9
Gymnasium	2	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	660	3, 4	Relamp	Yes	2	LED Lamps: (2) 23W Plug-In LED Lamps	Occupancy Sensor	23	455	0.1	70	0	$4	$166	$8	37.0
Gymnasium	2	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	3,150	3, 4	Relamp	Yes	2	LED Lamps: (2) 23W Plug-In LED Lamps	Occupancy Sensor	23	2,174	0.1	334	0	$20	$166	$8	7.8
Gymnasium	1	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	2,090	3	Relamp	No	1	LED Lamps: (2) 23W Plug-In LED Lamps	Wall Switch	23	2,090	0.0	94	0	$6	$25	$4	3.6
Gymnasium	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	455	0.1	91	0	$6	$226	$100	22.5
Girls Locker Room	9	LED - Fixtures: Wrapped Lens	Wall Switch	S	17	3,150	4	None	Yes	9	LED - Fixtures: Wrapped Lens	Occupancy Sensor	17	2,174	0.0	164	0	$10	$270	$70	19.9
Girls Locker Room	2	LED - Fixtures: Wrapped Lens	Wall Switch	S	17	3,150		None	No	2	LED - Fixtures: Wrapped Lens	Wall Switch	17	3,150	0.0	0	0	$0	$0	$0	0.0
Girls Locker Room	2	LED - Fixtures: Wrapped Lens	Wall Switch	S	17	3,150		None	No	2	LED - Fixtures: Wrapped Lens	Wall Switch	17	3,150	0.0	0	0	$0	$0	$0	0.0
Restroom 1	4	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	660	2	Relamp & Reballast	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	660	0.2	171	0	$10	$275	$80	18.6
Restroom 2	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	660	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	660	0.0	43	0	$3	$69	$20	18.6
Restroom 3	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	660	2	Relamp & Reballast	No	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	660	0.2	214	0	$13	$344	$100	18.6
Restroom 3	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	660	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	660	0.0	43	0	$3	$69	$20	18.6
Restroom 3	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	660	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	660	0.0	43	0	$3	$69	$20	18.6
Janitorial Room	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	455	0.1	91	0	$6	$226	$60	29.6
Electrical Room 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	455	0.1	61	0	$4	$189	$40	40.0
Library	9	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	2,090	3, 4	Relamp	Yes	9	LED Lamps: (2) 23W Plug-In LED Lamps	Occupancy Sensor	23	1,442	0.3	996	0	$61	$495	$106	6.4
Library	13	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	2,090	3, 4	Relamp	Yes	13	LED Lamps: (2) 23W Plug-In LED Lamps	Occupancy Sensor	23	1,442	0.5	1,438	0	$88	$595	$122	5.4
Library	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	193	0	$12	$189	$40	12.6

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Library	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	193	0	$12	$189	$40	12.6
Library	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
Isolation room	6	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	2,090	3, 4	Relamp	Yes	6	LED Lamps: (2) 23W Plug-In LED Lamps	Occupancy Sensor	23	1,442	0.2	664	0	$41	$420	$94	8.0
Main office	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.4	1,158	0	$71	$708	$310	5.6
Main office-Corridor	6	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	2,090	3, 5	Relamp	Yes	6	LED Lamps: (2) 23W Plug-In LED Lamps	High/Low Control	23	1,442	0.2	664	0	$41	$375	$249	3.1
Main office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	193	0	$12	$189	$40	12.6
Main office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	386	0	$24	$262	$120	6.0
Main office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	386	0	$24	$416	$150	11.3
Main office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	660	0.0	24	0	$1	$37	$20	11.3
Main office	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.2	483	0	$29	$453	$170	9.6
Nurse's Office	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.2	676	0	$41	$526	$210	7.6
Nurse's Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	193	0	$12	$189	$40	12.6
Nurse's Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.0	97	0	$6	$153	$20	22.5
Main office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	660	0.0	24	0	$1	$37	$20	11.3
Main office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	660	0.0	24	0	$1	$37	$20	11.3
Main office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	455	0.1	91	0	$6	$226	$100	22.5
Main office	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.2	579	0	$35	$489	$190	8.5
Main office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	290	0	$18	$226	$100	7.1
Main office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	290	0	$18	$226	$100	7.1
Main office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	290	0	$18	$226	$100	7.1
Main office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	290	0	$18	$226	$100	7.1
Restroom 5	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,090	2, 4	Relamp & Reballast	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.0	156	0	$10	$185	$20	17.3
Restroom 6	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	660	2, 4	Relamp & Reballast	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	455	0.0	49	0	$3	$185	$20	54.6
Restroom 7	3	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,090	2, 4	Relamp & Reballast	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.1	469	0	$29	$322	$60	9.2
Electric closet	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	660	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	660	0.0	43	0	$3	$69	$20	18.6

	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
Restroom 8	3	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	660	2	Relamp & Reballast	No	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	660	0.1	129	0	$8	$206	$60	18.6
Restroom 9	3	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	660	2	Relamp & Reballast	No	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	660	0.1	129	0	$8	$206	$60	18.6
Restroom 10	3	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	660	2	Relamp & Reballast	No	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	660	0.1	129	0	$8	$206	$60	18.6
Boiler room 2	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	3,150		None	No	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,150	0.0	0	0	$0	$0	$0	0.0
Boiler room 2	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,090	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,090	0.0	136	0	$8	$69	$20	5.9
Kitchen	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.2	579	0	$35	$489	$190	8.5
Kitchen	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.4	1,158	0	$71	$708	$310	5.6
Cafeteria- Stage	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3	Relamp	No	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	660	0.2	192	0	$12	$292	$160	11.3
Restroom 11	6	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	660	2	Relamp & Reballast	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	660	0.3	257	0	$16	$413	$120	18.6
Restroom 12	7	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	660	2	Relamp & Reballast	No	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	660	0.3	300	0	$18	$481	$140	18.6
Electric closet 2	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.1	290	0	$18	$226	$60	9.4
Classroom 34	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Exterior Lighting	5	High-Pressure Sodium: (1) 70W Lamp	Timeclock		95	3,285	1	Fixture Replacement	No	5	LED - Fixtures: 20W LED wall-mounted fixture	Timeclock	21	3,285	0.0	1,215	0	$77	$1,125	$0	14.6
Exterior Lighting	5	Metal Halide: (1) 70W Lamp	Timeclock		95	3,285	1	Fixture Replacement	No	1	LED - Fixtures: 20W LED wall-mounted fixture	Timeclock	21	3,285	0.0	1,491	0	$94	$225	$0	2.4
Exterior Lighting	11	Compact Fluorescent: (1) 32W Biaxial Plug-In Lamp	Timeclock		32	3,285	1	Fixture Replacement	No	11	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	23	3,285	0.0	325	0	$21	$2,656	$2,200	22.1
Exterior Lighting	3	LED - Fixtures: Wall Pack	Timeclock		20	3,285		None	No	3	LED - Fixtures: Wall Pack	Timeclock	20	3,285	0.0	0	0	$0	$0	$0	0.0
Classroom 1	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,463	3	Relamp	No	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,463	0.4	797	0	$49	$548	$300	5.1
Classroom 2	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,463	3	Relamp	No	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,463	0.4	797	0	$49	$548	$300	5.1
Classroom 3	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,463	3	Relamp	No	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,463	0.4	797	0	$49	$548	$300	5.1
Classroom 4	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,463	3	Relamp	No	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,463	0.4	797	0	$49	$548	$300	5.1
Classroom 5	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.7	2,317	0	$142	$1,416	$620	5.6
Classroom 6	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,463	3	Relamp	No	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,463	0.5	1,062	0	$65	$730	$400	5.1
Classroom 7	12	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,090	2, 4	Relamp & Reballast	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,442	1.2	3,751	-1	$229	$1,690	$550	5.0
Classroom 8	12	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,090	2, 4	Relamp & Reballast	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,442	1.2	3,751	-1	$229	$1,690	$550	5.0
Classroom 9	12	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,090	2, 4	Relamp & Reballast	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,442	1.2	3,751	-1	$229	$1,690	$550	5.0

	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
Classroom 10	12	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,090	2, 4	Relamp & Reballast	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,442	1.2	3,751	-1	$229	$1,690	$550	5.0
Classroom 11	12	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,090	2, 4	Relamp & Reballast	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,442	1.2	3,751	-1	$229	$1,690	$550	5.0
Classroom 12	16	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,090	4	None	Yes	16	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,442	0.2	661	0	$40	$540	$140	9.9
Corridor 1 to 6	3	Compact Fluorescent: (1) 9W Biaxial Plug-In Lamp	Wall Switch	S	9	2,090	3, 5	Relamp	Yes	3	LED Lamps: (1) 7W Plug-In Lamp	High/Low Control	7	1,442	0.0	29	0	$2	$38	$6	17.9
Corridor 1 to 6	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,150	3, 5	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,174	0.7	3,492	-1	$213	$1,776	$1,380	1.9
Corridor 1 to 6	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,150	3, 5	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,174	0.2	1,091	0	$67	$499	$375	1.9
Corridor 1 to 6	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	3,150	2, 5	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,174	0.1	471	0	$29	$138	$40	3.4
Corridor 1 to 6	1	Compact Fluorescent: (1) 9W Biaxial Plug-In Lamp	Wall Switch	S	9	3,150	3	Relamp	No	1	LED Lamps: (1) 7W Plug-In Lamp	Wall Switch	7	3,150	0.0	7	0	$0	$13	$2	24.8
Teachers Lounge	4	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,090	2, 4	Relamp & Reballast	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,442	0.4	1,250	0	$76	$589	$200	5.1
Child study team	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.6	1,931	0	$118	$1,270	$540	6.2
Child study team	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.2	579	0	$35	$335	$160	4.9
Corridor 13 to 45	5	Compact Fluorescent: (1) 18W Biaxial Plug-In Lamp	Wall Switch	S	18	3,150	3, 5	Relamp	Yes	5	LED Lamps: (1) 13W Plug-In LED Lamp	High/Low Control	13	2,174	0.0	161	0	$10	$63	$10	5.3
Corridor 13 to 45	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,150	3, 5	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,174	0.5	2,182	0	$133	$1,223	$975	1.9
Corridor 13 to 45	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,150	3, 5	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,174	0.1	436	0	$27	$335	$200	5.0
Classroom 14	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3, 4	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.3	965	0	$59	$635	$270	6.2
Corridor 1 to 6	6	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	6	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Classroom 15	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.5	1,738	0	$106	$927	$430	4.7
Classroom 15	2	U-Bend Fluorescent - T8: U T8 (32W) - 1L	Wall Switch	S	39	660	3	Relamp	No	2	LED - Linear Tubes: (1) U-Lamp	Wall Switch	17	660	0.0	33	0	$2	$72	$20	26.3
Classroom 16	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.7	2,172	0	$133	$1,092	$520	4.3
Classroom 17	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.7	2,172	0	$133	$1,092	$520	4.3
Classroom 18	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.6	2,014	0	$123	$1,914	$310	13.0
Classroom 18	4	Compact Fluorescent: (1) 18W Biaxial Plug-In Lamp	Wall Switch	O	18	2,090	3, 4	Relamp	Yes	4	LED Lamps: (1) 13W Plug-In LED Lamp	Occupancy Sensor	13	1,442	0.0	86	0	$5	$50	$8	8.0
Classroom 18	1	U-Bend Fluorescent - T8: U T8 (32W) - 1L	Wall Switch	O	39	660	3	Relamp	No	1	LED - Linear Tubes: (1) U-Lamp	Wall Switch	17	660	0.0	16	0	$1	$36	$10	26.3
Classroom 19	1	Compact Fluorescent: (1) 18W Biaxial Plug-In Lamp	Wall Switch	S	18	2,090	3	Relamp	No	1	LED Lamps: (1) 13W Plug-In LED Lamp	Wall Switch	13	2,090	0.0	12	0	$1	$13	$2	13.8
Classroom 19	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.7	2,172	0	$133	$1,092	$520	4.3

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Classroom 20	1	Compact Fluorescent: (1) 18W Biaxial Plug-In Lamp	Wall Switch	O	18	2,090	3	Relamp	No	1	LED Lamps: (1) 13W Plug-In LED Lamp	Wall Switch	13	2,090	0.0	12	0	$1	$13	$2	13.8
Classroom 20	13	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	13	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.7	2,181	0	$133	$2,051	$330	12.9
Classroom 20	1	U-Bend Fluorescent - T8: U T8 (32W) - 1L	Wall Switch	O	39	660	3	Relamp	No	1	LED - Linear Tubes: (1) U-Lamp	Wall Switch	17	660	0.0	16	0	$1	$36	$10	26.3
Janitor closet	7	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Occupancy Sensor	S	88	1,463	2	Relamp & Reballast	No	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,463	0.3	665	0	$41	$481	$140	8.4
Restroom 13	1	U-Bend Fluorescent - T8: U T8 (32W) - 1L	Wall Switch	S	39	660	3	Relamp	No	1	LED - Linear Tubes: (1) U-Lamp	Wall Switch	17	660	0.0	16	0	$1	$36	$10	26.3
Lounge (36)	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,150	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,150	0.0	114	0	$7	$37	$20	2.4
Corridor 21 to 37	3	Compact Fluorescent: (1) 18W Biaxial Plug-In Lamp	Wall Switch	S	18	3,150	3, 5	Relamp	Yes	3	LED Lamps: (1) 13W Plug-In LED Lamp	High/Low Control	13	2,174	0.0	97	0	$6	$38	$6	5.3
Corridor 21 to 37	32	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,150	3, 5	Relamp	Yes	32	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,174	1.0	4,656	-1	$285	$2,518	$1,990	1.9
Corridor 21 to 37	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,150	3, 5	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,174	0.1	436	0	$27	$335	$200	5.0
Classroom 21	4	Compact Fluorescent: (1) 18W Biaxial Plug-In Lamp	Wall Switch	O	18	2,090	3, 4	Relamp	Yes	4	LED Lamps: (1) 13W Plug-In LED Lamp	Occupancy Sensor	13	1,442	0.0	86	0	$5	$50	$8	8.0
Classroom 21	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.7	2,349	0	$144	$2,188	$350	12.8
Classroom 21	1	U-Bend Fluorescent - T8: U T8 (32W) - 1L	Wall Switch	O	39	660	3	Relamp	No	1	LED - Linear Tubes: (1) U-Lamp	Wall Switch	17	660	0.0	16	0	$1	$36	$10	26.3
Classroom 21	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	O	62	2,090	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,442	0.1	180	0	$11	$145	$40	9.5
Classroom 22	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.4	1,158	0	$71	$708	$310	5.6
Classroom 23	21	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	1.1	3,524	-1	$215	$3,417	$560	13.3
Classroom 23	2	Compact Fluorescent: (1) 18W Biaxial Plug-In Lamp	Wall Switch	O	18	2,090	3, 4	Relamp	Yes	2	LED Lamps: (1) 13W Plug-In LED Lamp	Occupancy Sensor	13	1,442	0.0	43	0	$3	$141	$4	52.4
Classroom 24	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 25	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 26	2	Compact Fluorescent: (1) 18W Biaxial Plug-In Lamp	Wall Switch	S	18	2,090	3, 4	Relamp	Yes	2	LED Lamps: (1) 13W Plug-In LED Lamp	Occupancy Sensor	13	1,442	0.0	43	0	$3	$141	$4	52.4
Classroom 26	21	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	21	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	1.0	3,041	-1	$186	$1,690	$770	5.0
Classroom 27	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.7	2,172	0	$133	$1,092	$520	4.3
Classroom 29	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 30	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 28	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 31	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.7	2,172	0	$133	$1,092	$520	4.3

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Classroom 32	18	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,090	3, 4	Relamp	Yes	18	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.8	2,606	-1	$159	$1,526	$680	5.3
Classroom 33	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 34	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
IT Admin office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,090	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,090	0.0	76	0	$5	$37	$20	3.6
Faculty Lounge	5	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,090	2, 4	Delamp & Add Reflectors	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.6	1,793	0	$110	$716	$140	5.3
Teachers Lounge	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	660	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	660	0.0	24	0	$1	$37	$20	11.3
Classroom 37	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 38	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 39	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 40	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 41	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 42	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 43	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 44	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 45	13	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	13	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.7	2,181	0	$133	$2,051	$330	12.9
Corridor 37 to 45	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,150	3, 5	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,174	0.5	2,328	0	$142	$1,259	$995	1.9
Corridor 37 to 45	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
Corridor 46 to 13	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
Corridor 46 to 13	32	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,150	3, 5	Relamp	Yes	32	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,174	1.0	4,656	-1	$285	$2,518	$1,990	1.9
Classroom 46	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 47	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 48	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7
Classroom 49	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,090	3, 4	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,442	0.3	1,020	0	$62	$708	$310	6.4
Classroom 50	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	O	114	2,090	2, 4	Delamp & Add Reflectors	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,442	0.4	1,158	0	$71	$1,092	$250	11.9
Classroom 51	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	O	93	2,090	2, 4	Delamp & Add Reflectors	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,442	0.8	2,517	-1	$154	$2,325	$370	12.7

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
Roof	Gym RTU 4	1	Supply Fan	5.0	89.5%	No	W	2,016	6	No	89.5%	Yes	1	1.4	3,151	0	$200	$4,076	$1,800	11.4
Roof	Gym RTU 5	1	Supply Fan	5.0	89.5%	No	W	2,016	6	No	89.5%	Yes	1	1.4	3,151	0	$200	$4,076	$1,800	11.4
Roof	Gym RTU 4	1	Combustion Air Fan	0.1	60.0%	No	W	536		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Gym RTU 5	1	Combustion Air Fan	0.1	60.0%	No	W	536		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Classrooms 1 to 6	1	Supply Fan	15.0	93.0%	Yes	W	1,155		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Classrooms 1 to 6	1	Exhaust Fan	2.0	86.5%	Yes	W	1,050		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Classrooms 1 to 6	1	Other	0.2	62.2%	No	W	2,745		No	62.2%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Media Center	1	Supply Fan	7.5	91.0%	Yes	W	1,155		No	91.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Media Center	1	Exhaust Fan	5.0	89.5%	Yes	W	1,050		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Media Center	1	Combustion Air Fan	0.2	62.2%	No	W	536		No	62.2%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Main office	1	Supply Fan	5.0	89.5%	Yes	W	1,313		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Main office	1	Exhaust Fan	2.0	86.5%	Yes	W	1,339		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Main office	1	Combustion Air Fan	0.2	62.2%	No	W	536		No	62.2%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Multipurpose room RTU 6 & RTU 7	1	Supply Fan	7.5	91.0%	No	W	525		No	91.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Multipurpose room RTU 6 & RTU 7	1	Exhaust Fan	5.0	89.5%	No	W	945		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Cafeteria RTU 6 & RTU 7	1	Combustion Air Fan	0.2	62.2%	No	W	536		No	62.2%	No		0.0	0	0	$0	$0	$0	0.0
Boiler room 2	Pneumatic System	1	Air Compressor	3.0	82.5%	No	W	50		No	82.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Large EF	1	Exhaust Fan	0.5	75.0%	No	W	2,745		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Medium EF	10	Exhaust Fan	0.3	65.0%	No	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Small EF	20	Exhaust Fan	0.2	60.0%	No	W	2,745		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0

TRC

New Jersey's cleanenergy program™

		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 1	HHW pump	1	Heating Hot Water Pump	1.5	86.5%	No	W	2,688	7	No	86.5%	Yes	1	0.1	1,304	0	$83	$13,920	$150	166.7
Boiler Room 1	HHW Circulation pumps	3	Heating Hot Water Pump	0.2	68.5%	No	W	2,688		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room 1	HHW pumps	2	Heating Hot Water Pump	0.8	78.0%	No	W	2,688		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler room 2	Boiler room II main pumps	2	Heating Hot Water Pump	7.5	91.0%	No	W	2,688	7	No	91.0%	Yes	2	1.4	12,395	0	$785	$38,331	$4,000	43.7
Boiler room 2	HHW pumps blr rm. II	2	Heating Hot Water Pump	3.0	89.5%	No	W	2,688	7	No	89.5%	Yes	2	0.6	5,041	0	$319	$31,829	$800	97.1
Boiler room 2	Secondary pumps Blr Rm. II	2	Heating Hot Water Pump	3.0	86.5%	No	W	2,688	7	No	89.5%	Yes	2	0.7	5,531	0	$350	$31,829	$800	88.5
Roof	Kitchen	1	Kitchen Hood Exhaust Fan	1.0	82.5%	No	W	1,470	8	No	85.5%	Yes	1	0.0	1,282	23	$334	$3,010	$150	8.6
Cafeteria	AHU Multipurpose room heating AHU	1	Supply Fan	3.0	86.5%	No	W	840		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Locker rooms	2	Supply Fan	2.0	84.0%	No	W	840		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Hallway and Bathroom near Gym	2	Supply Fan	2.0	84.0%	No	W	840		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Near Multipurpose room	1	Supply Fan	2.0	84.0%	No	W	840		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Kitchen MAU	1	Supply Fan	2.0	86.5%	No	W	840		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 34	Classroom 34	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 8	Classroom 8	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 7	Classroom 7	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 9	Classroom 9	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 10	Classroom 10	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 11	Classroom 11	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 12	Classroom 12	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Child study team	Child study team	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0

		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
Classroom 14	Classroom 14	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 15	Classroom 15	1	Supply Fan	0.3	62.5%	No	W	1,050		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 16	Classroom 16	1	Supply Fan	0.3	62.5%	No	W	1,050		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 17	Classroom 17	1	Supply Fan	0.3	62.5%	No	W	1,050		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 18	Classroom 18	1	Supply Fan	0.3	62.5%	No	W	1,050		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 19	Classroom 19	1	Supply Fan	0.3	62.5%	No	W	1,050		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 20	Classroom 20	1	Supply Fan	0.3	62.5%	No	W	1,050		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 21	Classroom 21	1	Supply Fan	0.3	62.5%	No	W	1,050		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 22	Classroom 22	1	Supply Fan	0.3	62.5%	No	W	1,050		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 23	Classroom 23	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 24	Classroom 24	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 25	Classroom 25	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 26	Classroom 26	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 27	Classroom 27	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 29	Classroom 29	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 30	Classroom 30	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 28	Classroom 28	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 31	Classroom 31	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 32	Classroom 32	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 33	Classroom 33	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0

		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
Classroom 34	Classroom 34	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 37	Classroom 37	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 38	Classroom 38	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 39	Classroom 39	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 40	Classroom 40	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 41	Classroom 41	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 42	Classroom 42	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 43	Classroom 43	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 44	Classroom 44	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 45	Classroom 45	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 46	Classroom 46	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 47	Classroom 47	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 48	Classroom 48	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 49	Classroom 49	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 50	Classroom 50	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 51	Classroom 51	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 52	Classroom 52	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 53	Classroom 53	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 54	Classroom 54	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 56	Classroom 56	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0

		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
Classroom 57	Classroom 57	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 58	Classroom 58	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Facility Manager office	Facility Manager office	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 60	Classroom 60	1	Supply Fan	0.3	62.5%	No	W	1,600		No	62.5%	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 RTU 4	1	Packaged AC	15.00		W	9	Yes	1	Packaged AC	15.00		12.00		0.5	404	0	$26	$20,908	$2,370	724.2
Roof	Gym RTU 5	1	Packaged AC	15.00		W	9	Yes	1	Packaged AC	15.00		12.00		0.5	404	0	$26	$20,908	$2,370	724.2
Roof	Classrooms 1 to 6	1	Packaged AC	26.00		W	9	Yes	1	Packaged AC	26.00		12.00		2.1	1,665	0	$105	$43,872	$4,108	377.0
Roof	Media Center	1	Packaged AC	20.00		W	9	Yes	1	Packaged AC	20.00		12.00		2.3	1,829	0	$116	$33,748	$3,160	264.0
Roof	Main office	1	Packaged AC	16.00		W	9	Yes	1	Packaged AC	16.00		12.00		0.9	729	0	$46	$22,302	$2,528	428.3
Roof	Multipurpose room RTU 6 and RTU 7	1	Packaged AC	20.00		W	9	Yes	1	Packaged AC	20.00		12.00		1.7	1,387	0	$88	$33,748	$3,160	348.0
Classroom 34	Classroom 34	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 7	Classroom 7	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 8	Classroom 8	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 9	Classroom 9	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 10	Classroom 10	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 11	Classroom 11	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 12	Classroom 12	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 12	Classroom 12	2	Electric Resistance Heat		13.65	W		No							0.0	0	0	$0	$0	$0	0.0
Teachers Lounge	Teachers Lounge	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Child study team	Child study team	2	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Child study team	Child study team	2	Electric Resistance Heat		13.65	W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 14	Classroom 14	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 15	Classroom 15	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 16	Classroom 16	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0

		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 (kBtu/hr)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	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
Classroom 17	Classroom 17	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 18	Classroom 18	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 19	Classroom 19	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 19	Classroom 19	1	Electric Resistance Heat		13.65	W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 20	Classroom 20	1	Electric Resistance Heat		13.65	W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 20	Classroom 20	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Lounge (36)	Lounge (36)	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 21	Classroom 21	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 22	Classroom 22	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 23	Classroom 23	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 24	Classroom 24	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 25	Classroom 25	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 26	Classroom 26	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 27	Classroom 27	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 29	Classroom 29	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 30	Classroom 30	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 28	Classroom 28	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 31	Classroom 31	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 32	Classroom 32	2	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 33	Classroom 33	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0

		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 (kBtu/hr)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	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
Classroom 34	Classroom 34	1	Window Air Conditioner	1.50		W		No							0.0	0	0	$0	$0	$0	0.0
IT Admin office	IT Admin office	2	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Faculty Lounge	Faculty Lounge	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 37	Classroom 37	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 38	Classroom 38	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 39	Classroom 39	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 40	Classroom 40	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 41	Classroom 41	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 42	Classroom 42	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 43	Classroom 43	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 44	Classroom 44	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 45	Classroom 45	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 46	Classroom 46	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 47	Classroom 47	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 48	Classroom 48	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 49	Classroom 49	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 50	Classroom 50	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 51	Classroom 51	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 52	Classroom 52	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 53	Classroom 53	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0

		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 (kBtu/hr)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	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
Classroom 54	Classroom 54	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 56	Classroom 56	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 57	Classroom 57	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 58	Classroom 58	1	Window Air Conditioner	2.08		W		No							0.0	0	0	$0	$0	$0	0.0
Facility Manager office	Facility Manager office	1	Window Air Conditioner	2.08		B	9	Yes	1	Window AC	2.08		12.10		0.4	498	0	$32	$2,268	$0	71.9
Classroom 60	Classroom 60	1	Window Air Conditioner	2.08		W		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
Roof	Gym RTU 4	1	Furnace	320	W		No						0.0	0	0	$0	$0	$0	0.0
Roof	Gym RTU 5	1	Furnace	320	W		No						0.0	0	0	$0	$0	$0	0.0
Boiler Room 1	HHW System	1	Non-Condensing Hot Water Boiler	1,052	B	10	Yes	1	Condensing Hot Water Boiler	1,052	91.00%	Et	0.0	0	223	$2,405	$25,259	$4,630	8.6
Boiler Room 1	HHW System	1	Non-Condensing Hot Water Boiler	1,327	B	10	Yes	1	Condensing Hot Water Boiler	1,327	91.00%	Et	0.0	0	22	$236	$31,852	$5,839	110.4
Boiler Room 1	HHW System	1	Condensing Hot Water Boiler	1,716	W		No						0.0	0	0	$0	$0	$0	0.0
Boiler Room 2	HHW System	1	Condensing Hot Water Boiler	1,716	W		No						0.0	0	0	$0	$0	$0	0.0
Boiler Room 2	HHW System	1	Condensing Hot Water Boiler	1,716	W		No						0.0	0	0	$0	$0	$0	0.0

Occupancy Controlled Thermostat Recommendations

		Recommendation Inputs							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Thermostat Quantity	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (MBh)	Output Heating Capacity of Controlled System (MBh)	Cooling Setpoint Temp (deg F)	Heating Setpoint Temp (deg F)	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
Classrooms	Classrooms	11	51.00	0.00	0.00	2,905.65	72	70	0.0	0	237	$2,556	$12,166	$7,650	1.8

Demand Control Ventilation Recommendations

		Recommendation Inputs					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Number of Zones	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	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	Multi-purpose Room	12	2.00	20.00	0.00	602.18	0.0	440	24	$283	$2,719	$0	9.6
Roof	Gymnasium	12	2.00	30.00	0.00	640.00	0.0	640	21	$272	$2,719	$0	10.0
Roof	Media Center	12	2.00	20.00	0.00	376.37	0.0	456	15	$189	$2,719	$0	14.4

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 1	Boiler Room 1	1	Storage Tank Water Heater (> 50 Gal)	W		No						0.0	0	0	$0	$0	$0	0.0
Boiler room 2	Boiler room 2	1	Storage Tank Water Heater (> 50 Gal)	W		No						0.0	0	0	$0	$0	$0	0.0
Janitor closet	Janitor closet	1	Storage Tank Water Heater (≤ 50 Gal)	W		No						0.0	0	0	$0	$0	$0	0.0
Janitorial Room	Janitorial Room	1	Storage Tank Water Heater (> 50 Gal)	B	13	Yes	1	Storage Tank Water Heater (> 50 Gal)	Natural Gas	93.00%	Et	0.0	0	10	$109	$8,669	$1,050	70.0
Kitchen	Kitchen	1	Storage Tank Water Heater (> 50 Gal)	B	13	Yes	1	Storage Tank Water Heater (> 50 Gal)	Natural Gas	93.00%	Et	0.0	0	10	$112	$8,900	$1,078	70.0

Low-Flow Device Recommendations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Classrooms	14	12	Faucet Aerator (Kitchen)	2.00	1.50	0.0	491	0	$31	$86	$48	1.2
Classrooms	14	42	Faucet Aerator (Lavatory)	2.00	0.50	0.0	0	18	$189	$301	$301	0.0
Restrooms	14	30	Faucet Aerator (Lavatory)	2.50	0.50	0.0	0	17	$180	$215	$215	0.0

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)	15, 16	Yes	No	Yes	0.1	1,276	0	$81	$2,281	$310	24.4
Kitchen	1	Medium Temp Freezer (0F to 30F)	15, 16	Yes	No	Yes	0.1	1,266	0	$80	$2,281	$310	24.6

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	1	Stand-Up Refrigerator, Glass Door (16 - 30 cu. ft.)	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Refrigerator Chest	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Freezer Chest	Yes		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	Insulated Food Holding Cabinet (1/2 Size)	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (Full Size)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Convection Oven (Half Size)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Convection Oven (Half Size)	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Convection Oven (Half Size)	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Steamer	No		No	0.0	0	0	$0	$0	$0	0.0

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Kitchen	2	Serving Table (Chilled)	936	No
Kitchen	2	Serving Table (Heated)	3,400	No
Isolation Room	3	Air Purifier	92	No
Classroom	2	Clothes Washer	900	No
Faculty Lounge	1	Coffee Machine	400	No
Classrooms/Offices	150	Desktop	28	No
Classroom 12	1	Dishwasher (Undercounter)	1,200	No
Classrooms	72	Fan (Wall-mounted)	50	No
Classroom 34	1	Fan (Portable)	50	No
Classrooms/Offices	300	Laptop	20	No
Faculty/Staff Lounge	8	Microwave	1,200	No
Offices/Classrooms	5	Printer (Medium/Small)	50	No
Offices/Classrooms	5	Printer/Copier (Large)	550	No
Classrooms	56	Projector	200	No
Classrooms/Offices	7	Refrigerator (Residential)	500	No
Classrooms	12	Television	120	No
Faculty Lounge	1	Toaster	1,500	No
Staff Lounge	3	Water Cooler	500	No

Custom (High Level) Measure Analysis

Installation of an Energy Management System

Building Square Footage	83,378
Percent of Conditioned Area Impacted	70%
Fuel Utility Rate	$10.776 MMBtu
Blended Electric Utility Rate	$0.063 kWh

Existing Conditions						Proposed Conditions					Energy Impact & Financial Analysis						
Description	Area(s)/System(s) Served	Remaining Useful Life	Total HVAC Motor Usage kWh	Total HVAC Electric Usage kWh	Total HVAC Fuel Usage MMBtu	Description	% Savings HVAC Motor Usage kWh	% Savings HVAC Electric Usage kWh	% Savings HVAC Fuel Usage MMBtu	Estimated Cost per Sqft	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Limited/No HVAC Controls	HVAC Equipment & Systems	W	135,799	179,448	5,019	Installation of an Energy Management System	4%	4%	5%	$1.50	0.00	12,610	251	$3,503	$87,547	$0	24.99

Timer control for Window AC

Existing Conditions			Proposed Conditions			Energy Impact & Financial Analysis						
Description	Area/System(s) Served	Total Existing kWh consumption	Description	% Reduction in run hours	Estimated Cost	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total NJCEP Incentives	Payback w/ Incentives in Years
Window AC run beyond occupied hours	Classrooms/Window ACs	91,631	Timer Controls for Window ACs	20%	$915.00	0.00	18,326	0	$1,161	$915	$0	0.79

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.

LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

77

ENERGY STAR® Score[1]

Union Beach Memorial School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 104,223
Built: 1955

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

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Union Beach Memorial School 221 Morningside Avenue Union Beach, New Jersey 07735	UnionBeachBOE 221 Morningside Ave Union Beach, NJ 07735 (732) 864-4992	Union Beach Public Schools Board of Education 221 Morningside Avenue Union Beach, NJ 07735 (732) 864-4992 jlauer@unionbeachschools.org

Property ID: 12420388

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
72.8 kBtu/ft²

Source EUI
90.7 kBtu/ft²

Annual Energy by Fuel

Electric - Solar (kBtu)	1,498,216 (20%)
Electric - Grid (kBtu)	891,164 (12%)
Natural Gas (kBtu)	5,198,777 (68%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	99.7
National Median Source EUI (kBtu/ft²)	124.1
% Diff from National Median Source EUI	-27%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	505

Signature & Stamp of Verifying Professional

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

LP Signature: ______________________ Date: ___________

Licensed Professional

____ ________

,

(____)____-______

____

Professional Engineer or Registered Architect Stamp (if applicable)

Appendix C: Glossary

TERM	DEFINITION
Blended Rate	Used to calculate fiscal savings associated with measures. The blended rate is calculated by dividing the amount of your bill by the total energy use. For example, if your bill is $22,217.22, and you used 266,400 kilowatt-hours, your blended rate is 8.3 cents per kilowatt-hour.
Btu	*British thermal unit*: a unit of energy equal to the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
CHP	*Combined heat and power*. Also referred to as cogeneration.
COP	*Coefficient of performance*: a measure of efficiency in terms of useful energy delivered divided by total energy input.
Demand Response	Demand response reduces or shifts electricity usage at or among participating buildings/sites during peak energy use periods in response to time-based rates or other forms of financial incentives.
DCV	*Demand control ventilation*: a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need.
US DOE	*United States Department of Energy*
EC Motor	*Electronically commutated motor*
ECM	*Energy conservation measure*
EER	*Energy efficiency ratio*: a measure of efficiency in terms of cooling energy provided divided by electric input.
EUI	*Energy Use Intensity:* measures energy consumption per square foot and is a standard metric for comparing buildings' energy performance.
Energy Efficiency	Reducing the amount of energy necessary to provide comfort and service to a building/area. Achieved through the installation of new equipment and/or optimizing the operation of energy use systems. Unlike conservation, which involves some reduction of service, energy efficiency provides energy reductions without sacrifice of service.
ENERGY STAR®	ENERGY STAR® is the government-backed symbol for energy efficiency. The ENERGY STAR® program is managed by the EPA.
EPA	*United States Environmental Protection Agency*
Generation	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
GHG	*Greenhouse gas* gases that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface.
gpf	*Gallons per flush*

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

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