Local Government Energy Audit Report

Nicholas Murray Butler School

July 31, 2019

Prepared for:
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Disclaimer

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

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

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

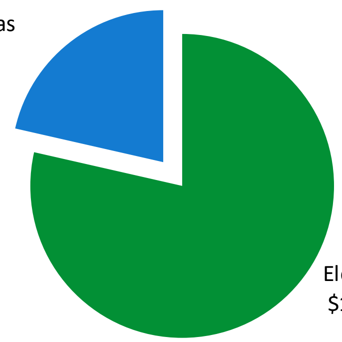
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state and federal requirements.

Table of Contents

1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Nicholas Murray Butler 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: $160,520 Electricity: 872,580 kWh Natural Gas: 42,640 Therms	
ENERGY STAR® Benchmarking Score	18 *(1-100 scale)*	This building performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

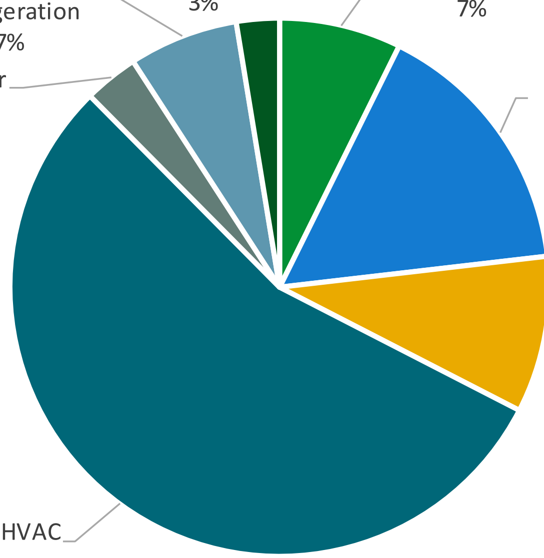


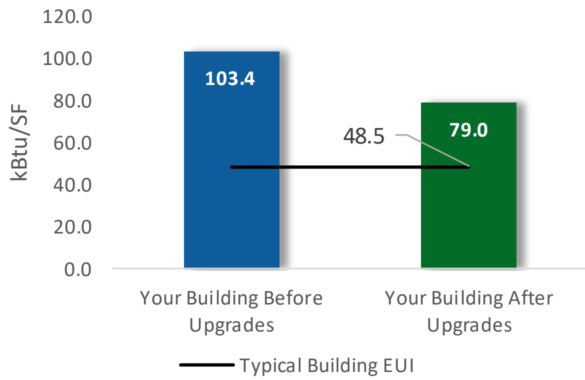
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

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

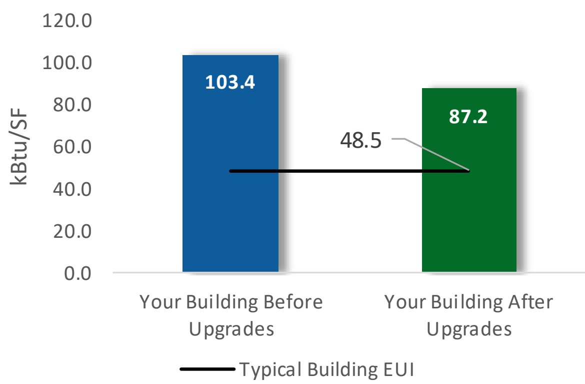
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$481,253
Potential Rebates & Incentives[1]	$43,398
Annual Cost Savings	$54,159
Annual Energy Savings	Electricity: 352,164 kWh Natural Gas: 5,127 Therms
Greenhouse Gas Emission Savings	207 Tons
Simple Payback	8.1 Years
Site Energy Savings (all utilities)	24%



Scenario 2: Cost Effective Package[2]

Installation Cost	$206,718
Potential Rebates & Incentives	$25,439
Annual Cost Savings	$41,050
Annual Energy Savings	Electricity: 279,874 kWh Natural Gas: 1,829 Therms
Greenhouse Gas Emission Savings	152 Tons
Simple Payback	4.4 Years
Site Energy Savings (all utilities)	16%



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	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**93,804**	**25.3**	**-16**	**$13,426**	**$201,397**	**$77,058**	**$14,784**	**$62,274**	**4.6**	**92,577**
ECM 1	Install LED Fixtures	16,730	2.8	-2	$2,406	$36,083	$39,938	$5,600	$34,338	14.3	16,670
ECM 2	Retrofit Fixtures with LED Lamps	77,074	22.5	-15	$11,021	$165,314	$37,120	$9,184	$27,936	2.5	75,907
Lighting Control Measures		**10,573**	**2.8**	**-2**	**$1,510**	**$12,082**	**$12,825**	**$1,050**	**$11,775**	**7.8**	**10,389**
ECM 3	Install Occupancy Sensor Lighting Controls	8,109	2.1	-2	$1,158	$9,266	$8,100	$1,050	$7,050	6.1	7,967
ECM 4	Install High/Low Lighting Controls	2,464	0.7	-1	$352	$2,816	$4,725	$0	$4,725	13.4	2,421
Variable Frequency Drive (VFD) Measures		**136,250**	**30.6**	**0**	**$19,691**	**$295,358**	**$89,111**	**$9,355**	**$79,756**	**4.1**	**137,203**
ECM 5	Install VFD on Variable Air Volume (VAV) Fans	13,596	4.5	0	$1,965	$29,472	$9,228	$1,975	$7,253	3.7	13,691
ECM 6	Install VFDs on Constant Volume (CV) Fans	54,610	15.3	0	$7,892	$118,382	$35,901	$4,080	$31,821	4.0	54,992
ECM 7	Install VFDs on Chilled Water Pumps	44,427	8.4	0	$6,420	$96,306	$20,174	$2,400	$17,774	2.8	44,737
ECM 8	Install VFDs on Heating Water Pumps	15,279	1.5	0	$2,208	$33,122	$9,476	$0	$9,476	4.3	15,386
ECM 9	Install VFDs on Cooling Tower Fans	4,748	-0.3	0	$686	$10,293	$7,086	$900	$6,186	9.0	4,781
ECM 10	Install Boiler Draft Fan VFDs	3,591	1.2	0	$519	$7,783	$7,246	$0	$7,246	14.0	3,616
Electric Chiller Replacement		**68,700**	**38.4**	**0**	**$9,928**	**$198,566**	**$181,495**	**$10,750**	**$170,745**	**17.2**	**69,180**
ECM 11	Install High Efficiency Chillers	68,700	38.4	0	$9,928	$198,566	$181,495	$10,750	$170,745	17.2	69,180
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**330**	**$2,662**	**$53,244**	**$85,794**	**$7,209**	**$78,585**	**29.5**	**38,618**
ECM 12	Install High Efficiency Hot Water Boilers	0	0.0	330	$2,662	$53,244	$85,794	$7,209	$78,585	29.5	38,618
HVAC System Improvements		**2,757**	**0.0**	**38**	**$708**	**$10,615**	**$8,157**	**$0**	**$8,157**	**11.5**	**7,261**
ECM 13	Implement Demand Control Ventilation (DCV)	2,757	0.0	38	$708	$10,615	$8,157	$0	$8,157	11.5	7,261
Domestic Water Heating Upgrade		**0**	**0.0**	**43**	**$345**	**$3,447**	**$215**	**$0**	**$215**	**0.6**	**5,000**
ECM 14	Install Low-Flow DHW Devices	0	0.0	43	$345	$3,447	$215	$0	$215	0.6	5,000
Food Service & Refrigeration Measures		**10,475**	**0.8**	**0**	**$1,514**	**$23,520**	**$5,598**	**$250**	**$5,348**	**3.5**	**10,548**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	4,849	0.6	0	$701	$10,512	$1,213	$0	$1,213	1.7	4,883
ECM 16	Refrigeration Controls	5,626	0.2	0	$813	$13,008	$4,385	$250	$4,135	5.1	5,665
Custom Measures		**29,605**	**0.0**	**120**	**$4,375**	**$21,877**	**$21,000**	**$0**	**$21,000**	**4.8**	**43,880**
ECM 17	Retro-Commissioning Study & HVAC Improvements	29,605	0.0	120	$4,375	$21,876.74	$21,000	$0	$21,000	4.8	43,880
TOTALS (COST EFFECTIVE MEASURES)		**279,874**	**58.3**	**183**	**$41,050**	**$560,511**	**$206,718**	**$25,439**	**$181,279**	**4.4**	**303,242**
TOTALS (ALL MEASURES)		**352,164**	**97.9**	**513**	**$54,159**	**$820,104**	**$481,253**	**$43,398**	**$437,855**	**8.1**	**414,656**

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

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

Figure 2 – Evaluated Energy Improvements

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

1.1 Planning Your Project

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

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

Pick Your Installation Approach

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

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

Energy Conservation Measure		SmartStart	Direct Install	Pay For Performance
ECM 1	Install LED Fixtures	x		x
ECM 2	Retrofit Fixtures with LED Lamps	x		x
ECM 3	Install Occupancy Sensor Lighting Controls	x		x
ECM 4	Install High/Low Lighting Controls			x
ECM 5	Install VFD on Variable Air Volume (VAV) HVAC	x		x
ECM 6	Install VFDs on Constant Volume (CV) HVAC	x		x
ECM 7	Install VFDs on Chilled Water Pumps	x		x
ECM 8	Install VFDs on Hot Water Pumps			x
ECM 9	Install VFDs on Cooling Tower Fans	x		x
ECM 10	Install Boiler Draft Fan VFDs			x
ECM 11	Install High Efficiency Chillers	x		x
ECM 12	Install High Efficiency Hot Water Boilers	x		x
ECM 13	Implement Demand Control Ventilation			x
ECM 14	Install Low-Flow Domestic Hot Water Devices			x
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors			x
ECM 16	Refrigeration Controls	x		x
ECM 17	Retro-Commissioning Study & HVAC Improvements			

Figure 3 – Funding Options

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

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

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

Individual Measures with SmartStart

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

Turnkey Installation with Direct Install

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

Whole Building Approach with Pay for Performance

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

More Options from Around the State

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

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

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

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

Ongoing Electric Savings with Demand Response

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

2 Existing Conditions

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

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

2.1 Site Overview

On February 6, 2019, TRC performed an energy audit at Nicholas Murray Butler School located in Elizabeth, New Jersey. TRC met with Orlando Carnet to review the school operations and help focus our investigation on specific energy-using systems.

Nicholas Murray Butler School is a three-story, 70,000 square foot building built in 1998. Spaces include: classrooms, a gymnasium/auditorium, offices, a cafeteria, corridors, stairwells, restrooms, a music room, a library, electrical rooms, and mechanical spaces.

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

2.2 Building Occupancy

The school is occupied 10 months out of the year. Typical weekday occupancy is 119 staff and 799 students.

Building Name	Weekday/Weekend	Operating Schedule
Nicholas Murray Butler School	Weekday	8:30 AM - 3:00 PM
	Weekend	Closed

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

The building is constructed of concrete block and structural steel with a brick facade. The roof is mainly flat and covered with a rubber membrane and is in fair condition. Some sections of the building, such as the cafeteria, have a pitched corrugated steel roof.

Most of the windows are double-glazed and have aluminum frames. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition. Exterior doors are all solid wood with aluminum frames and are in fair condition. Degraded window and door seals increase drafts and outside air infiltration.

Building Envelope

Building Roof

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several fixtures with compact fluorescent (CFL) lamps. Additionally, there are some fixtures with 32-Watt U-bend T8 lamps. Typically, T8 fluorescent lamps use electronic ballasts.

Fluorescent fixture types include 4- foot long troffers, recessed or surface-mounted fixtures, and 2-foot fixtures with U-bend tube lamps. Fluorescent fixtures include 2, 3, or 4 lamps. Similarly, CFL lamps are situated in a mix of suspended, recessed, and surface-mounted fixtures. Gymnasium fixtures have high bay high-intensity discharge (HID) lamps and are manually controlled. Most exit signs use LED sources.

Most fixtures are in fair condition. Interior lighting levels were generally sufficient.

Hanging Linear Fixtures

Gym High Bay Fixtures

Troffer Fixtures

Exit Sign

Most lighting fixtures are controlled manually and the remainder by occupancy sensors.

Exterior fixtures include wall-mounted and pole-mounted area lighting fixtures with halogen lamps. There are additional area lighting fixtures, spot light fixtures and parking lot pole light fixtures with metal halide (MH) lamps.

Exterior light fixtures are controlled by a time clock.

Parking Lot Pole Light

Wall-mounted Area Light

2.5 Air Handling Systems

Air Handling Units

The air handling system includes five air handling units (AHU-1 through 5) that have cooling and heating coils that serve the area's heating and cooling loads. Four of the air handling units are single zone constant volume units serving the gym, music room, corridors/toilets, and cafeteria. Air handling unit (AHU-3) is a multizone VAV unit that serves the admin area and the library.

All AHUs have supply fans and return fans except AHU-1, which is a 100% OA unit equipped with supply and exhaust fans. All fans are constant speed units and are manually controlled. Motor size range between 3 hp to 15 hp.

Unit Ventilators

Unit ventilators have supply fan motors, outside air dampers, and heating hot water and chilled water coils They are controlled with a direct digital control (DDC) system. This system is original to the building and appears to be in fair operating condition.

Air Conditioning Unit

One of the building's server rooms is served by a 2.5-ton split system air conditioning unit to serve its cooling load.

2.6 Heating Hot Water Systems

Two Smith cast iron 2,403 MBh hot water boilers serve the building heating load. The burners are modulating with an estimated nominal efficiency of 78%. Both boilers are required under high load conditions. Installed in 1998, the boilers are nearing their end of useful life.

The hydronic distribution system is a 4-pipe heating and cooling system.

The boilers serve a primary/secondary distribution system with two constant speed 7.5 hp pumps circulating the primary loop and two VFD controlled 7.5 hp heating hot water pumps operating in lead/lag fashion on the secondary loop. All air handling units are served by secondary in-line circulating pumps for moving heating hot water through the HHW coils.

Boilers

HHW Pump

2.7 Chilled Water Systems

The chiller plant consists of a 250-ton Trane R-22 water-cooled screw chiller. The chiller is configured in a primary-secondary distribution loop with two constant flow primary pumps (P5 & P6) that provide chilled water to all AHUs and to classroom unit ventilators. All AHUs have in-line circulating pumps that circulate water through their chilled water coils.

The condenser water system consists of a one-cell cooling tower that is equipped with a constant speed 15 hp fan.

Chiller

Cooling Tower

2.8 Building Energy Management Systems (EMS)

The school has a digital energy management system that controls the operations of the HVAC system including chiller plant, boilers, and pumps.

2.9 Domestic Hot Water

Hot water is produced with two AO Smith 100 gallon 199.90 MBh gas-fired storage water heaters with a 97% efficiency. One heater serves the restrooms, and the other serves the kitchen.

At the time of the site visit, the domestic water heaters were set at 130°F.

Two 1/25 hp circulation pumps distribute water to end uses. The circulation pumps operate continuously.

DHW Heaters

2.10 Food Service Equipment

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

The dishwasher in the kitchen was broken/not in-use at the time of the site audit.

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

Rack Oven

Gas Fired Griddle

Steamer

Food Holding Cabinet

2.11 Refrigeration

The kitchen has one stand-up refrigerator with solid doors. There is a refrigerator chest that is used for storing milk. All equipment is high-efficiency and in fair condition.

The walk-in cooler has an estimated 0.5-ton compressor located on the roof and a two-fan evaporator. The walk-in medium temperature freezer has an estimated 0.5-ton compressor located on the roof and a two-fan evaporator. There are also three cold box tables used to store yogurt and milk.

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

Stand-Up Refrigerator

Walk-In Freezer

Cold Box Table

2.12 Plug Load & Vending Machines

The utility bill analysis indicates that plug loads consume approximately 3% percent of total building energy use. This is lower than a typical building.

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

There are approximately 150 computer work stations throughout the school. Plug loads throughout the building include general café and office equipment. There are classroom typical loads such as projectors and computers.

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

Photocopiers

Microwave Oven

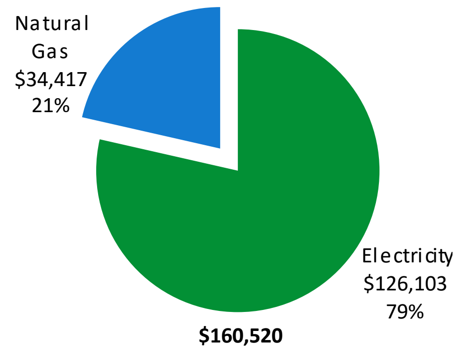
2.13 Water-Using Systems

There are 17 restrooms with toilets, urinals, and sinks. Faucet flow rates are at 2.20 gallons per minute (gpm) or higher.

3 Energy Use and Costs

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

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	872,580 kWh	$126,103
Natural Gas	42,640 Therms	$34,417
Total		**$160,520**



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

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

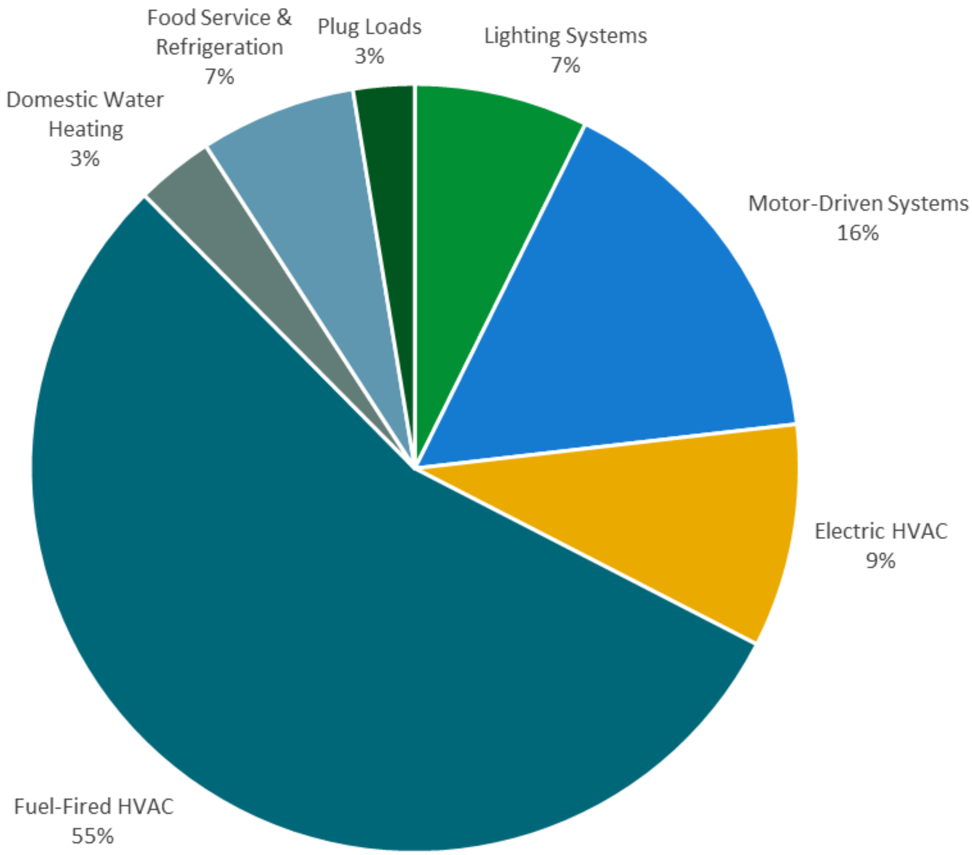
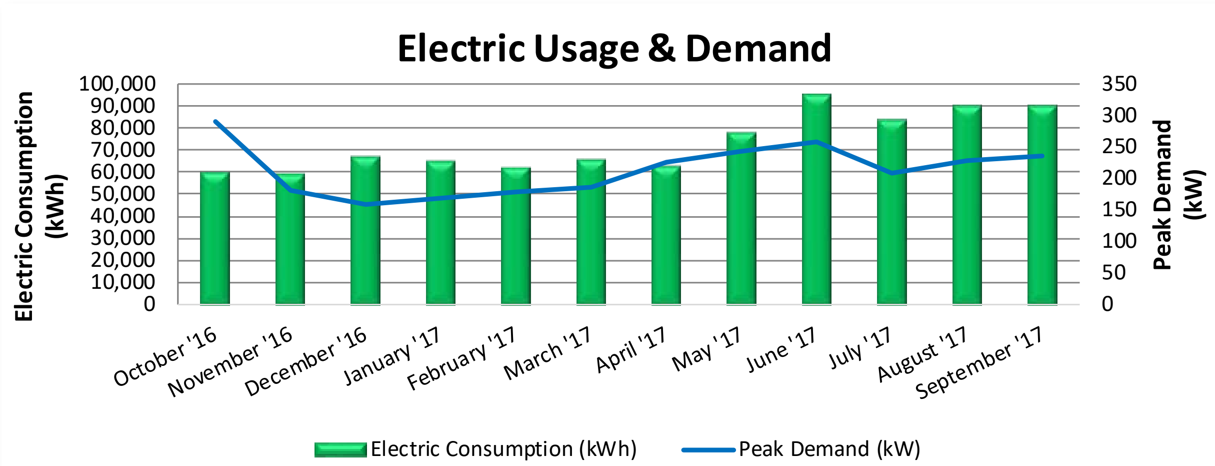


Figure 5 - Energy Balance

3.1 Electricity

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



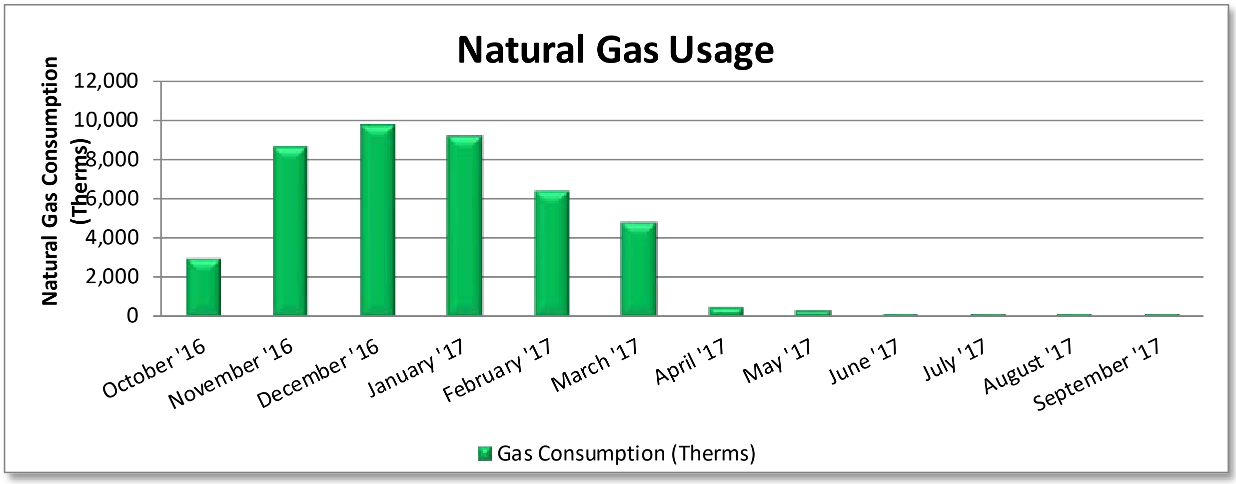
Electric Billing Data						
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**	**TRC Estimated Usage?**
11/7/16	31	59,742	291	$1,082	$8,465	No
12/8/16	31	59,466	181	$673	$8,050	No
1/10/17	33	67,024	160	$595	$8,943	No
2/8/17	29	64,693	169	$629	$8,773	Yes
3/10/17	30	62,361	178	$664	$8,457	No
4/10/17	31	65,957	186	$702	$8,923	No
5/10/17	30	63,059	226	$853	$8,725	No
6/9/17	30	77,548	243	$916	$12,681	No
7/11/17	32	94,999	259	$976	$14,960	No
8/9/17	29	83,647	208	$784	$12,940	No
9/8/17	30	89,423	230	$868	$13,933	No
10/9/17	31	89,442	237	$936	$11,945	No
Totals	**367**	**877,361**	**291**	**$9,678**	**$126,794**	
Annual	**365**	**872,580**	**291**	**$9,625**	**$126,103**	

Notes:

- Peak demand of 291 kW occurred in October/November 2016.
- The average electric cost over the past 12 months was $0.145/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

Elizabethtown Gas delivers natural gas under rate class general delivery services, with natural gas supply provided by UGI Energy Services, a third-party supplier.



Gas Billing Data				
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**	**TRC Estimated Usage?**
11/11/16	30	2,938	$2,403	No
12/13/16	32	8,590	$6,408	No
1/13/17	31	9,736	$7,232	No
2/13/17	31	9,158	$6,837	No
3/13/17	28	6,335	$4,852	No
4/12/17	30	4,749	$3,676	No
5/12/17	30	477	$697	No
6/12/17	31	299	$579	Yes
7/13/17	31	121	$456	No
8/11/17	29	119	$459	No
9/13/17	33	118	$455	No
10/13/17	30	117	$458	No
Totals	**366**	**42,757**	**$34,511**	
Annual	**365**	**42,640**	**$34,417**	

Notes:

- The average gas cost for the past 12 months is $0.807/therm, which is the blended rate used throughout the analysis.

3.3 Benchmarking

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

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

Benchmarking Score	18

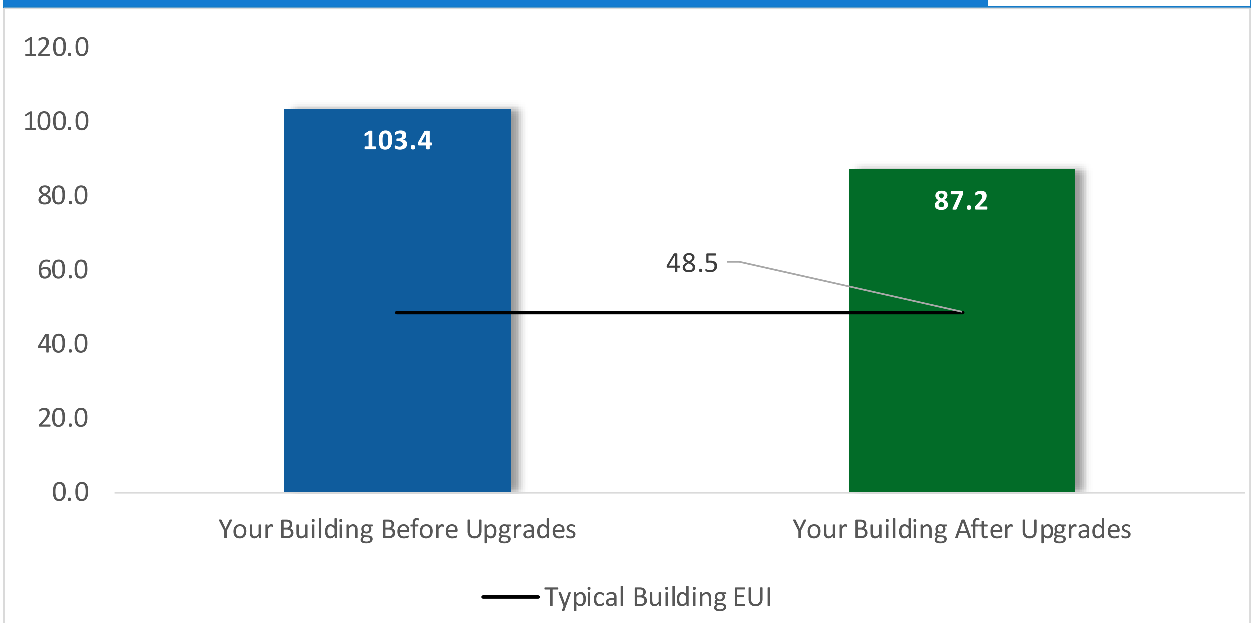


Figure 6 - Energy Use Intensity Comparison

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

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

Tracking Your Energy Performance

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

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

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

For more information on ENERGY STAR® and Portfolio Manager®, visit their website[3].

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

4 Energy Conservation Measures

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

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

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

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

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**93,804**	**25.3**	**-16**	**$13,426**	**$77,058**	**$14,784**	**$62,274**	**4.6**	**92,577**
ECM 1	Install LED Fixtures	16,730	2.8	-2	$2,406	$39,938	$5,600	$34,338	14.3	16,670
ECM 2	Retrofit Fixtures with LED Lamps	77,074	22.5	-15	$11,021	$37,120	$9,184	$27,936	2.5	75,907
Lighting Control Measures		**10,573**	**2.8**	**-2**	**$1,510**	**$12,825**	**$1,050**	**$11,775**	**7.8**	**10,389**
ECM 3	Install Occupancy Sensor Lighting Controls	8,109	2.1	-2	$1,158	$8,100	$1,050	$7,050	6.1	7,967
ECM 4	Install High/Low Lighting Controls	2,464	0.7	-1	$352	$4,725	$0	$4,725	13.4	2,421
Variable Frequency Drive (VFD) Measures		**136,250**	**30.6**	**0**	**$19,691**	**$89,111**	**$9,355**	**$79,756**	**4.1**	**137,203**
ECM 5	Install VFD on Variable Air Volume (VAV) Fans	13,596	4.5	0	$1,965	$9,228	$1,975	$7,253	3.7	13,691
ECM 6	Install VFDs on Constant Volume (CV) Fans	54,610	15.3	0	$7,892	$35,901	$4,080	$31,821	4.0	54,992
ECM 7	Install VFDs on Chilled Water Pumps	44,427	8.4	0	$6,420	$20,174	$2,400	$17,774	2.8	44,737
ECM 8	Install VFDs on Heating Water Pumps	15,279	1.5	0	$2,208	$9,476	$0	$9,476	4.3	15,386
ECM 9	Install VFDs on Cooling Tower Fans	4,748	-0.3	0	$686	$7,086	$900	$6,186	9.0	4,781
ECM 10	Install Boiler Draft Fan VFDs	3,591	1.2	0	$519	$7,246	$0	$7,246	14.0	3,616
Electric Chiller Replacement		**68,700**	**38.4**	**0**	**$9,928**	**$181,495**	**$10,750**	**$170,745**	**17.2**	**69,180**
ECM 11	Install High Efficiency Chillers	68,700	38.4	0	$9,928	$181,495	$10,750	$170,745	17.2	69,180
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**330**	**$2,662**	**$85,794**	**$7,209**	**$78,585**	**29.5**	**38,618**
ECM 12	Install High Efficiency Hot Water Boilers	0	0.0	330	$2,662	$85,794	$7,209	$78,585	29.5	38,618
HVAC System Improvements		**2,757**	**0.0**	**38**	**$708**	**$8,157**	**$0**	**$8,157**	**11.5**	**7,261**
ECM 13	Implement Demand Control Ventilation (DCV)	2,757	0.0	38	$708	$8,157	$0	$8,157	11.5	7,261
Domestic Water Heating Upgrade		**0**	**0.0**	**43**	**$345**	**$215**	**$0**	**$215**	**0.6**	**5,000**
ECM 14	Install Low-Flow DHW Devices	0	0.0	43	$345	$215	$0	$215	0.6	5,000
Food Service & Refrigeration Measures		**10,475**	**0.8**	**0**	**$1,514**	**$5,598**	**$250**	**$5,348**	**3.5**	**10,548**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	4,849	0.6	0	$701	$1,213	$0	$1,213	1.7	4,883
ECM 16	Refrigeration Controls	5,626	0.2	0	$813	$4,385	$250	$4,135	5.1	5,665
Custom Measures		**29,605**	**0.0**	**120**	**$4,375**	**$21,000**	**$0**	**$21,000**	**4.8**	**43,880**
ECM 17	Retro-Commissioning Study & HVAC Improvements	29,605	0.0	120	$4,375	$21,000	$0	$21,000	4.8	43,880
TOTALS		**352,164**	**97.9**	**513**	**$54,159**	**$481,253**	**$43,398**	**$437,855**	**8.1**	**414,656**

* - 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		**93,804**	**25.3**	**-16**	**$13,426**	**$77,058**	**$14,784**	**$62,274**	**4.6**	**92,577**
ECM 1	Install LED Fixtures	16,730	2.8	-2	$2,406	$39,938	$5,600	$34,338	14.3	16,670
ECM 2	Retrofit Fixtures with LED Lamps	77,074	22.5	-15	$11,021	$37,120	$9,184	$27,936	2.5	75,907
Lighting Control Measures		**10,573**	**2.8**	**-2**	**$1,510**	**$12,825**	**$1,050**	**$11,775**	**7.8**	**10,389**
ECM 3	Install Occupancy Sensor Lighting Controls	8,109	2.1	-2	$1,158	$8,100	$1,050	$7,050	6.1	7,967
ECM 4	Install High/Low Lighting Controls	2,464	0.7	-1	$352	$4,725	$0	$4,725	13.4	2,421
Variable Frequency Drive (VFD) Measures		**132,660**	**29.3**	**0**	**$19,172**	**$81,865**	**$9,355**	**$72,510**	**3.8**	**133,588**
ECM 5	Install VFD on Variable Air Volume (VAV) Fans	13,596	4.5	0	$1,965	$9,228	$1,975	$7,253	3.7	13,691
ECM 6	Install VFDs on Constant Volume (CV) Fans	54,610	15.3	0	$7,892	$35,901	$4,080	$31,821	4.0	54,992
ECM 7	Install VFDs on Chilled Water Pumps	44,427	8.4	0	$6,420	$20,174	$2,400	$17,774	2.8	44,737
ECM 8	Install VFDs on Heating Water Pumps	15,279	1.5	0	$2,208	$9,476	$0	$9,476	4.3	15,386
ECM 9	Install VFDs on Cooling Tower Fans	4,748	-0.3	0	$686	$7,086	$900	$6,186	9.0	4,781
HVAC System Improvements		**2,757**	**0.0**	**38**	**$708**	**$8,157**	**$0**	**$8,157**	**11.5**	**7,261**
ECM 13	Implement Demand Control Ventilation (DCV)	2,757	0.0	38	$708	$8,157	$0	$8,157	11.5	7,261
Domestic Water Heating Upgrade		**0**	**0.0**	**43**	**$345**	**$215**	**$0**	**$215**	**0.6**	**5,000**
ECM 14	Install Low-Flow DHW Devices	0	0.0	43	$345	$215	$0	$215	0.6	5,000
Food Service & Refrigeration Measures		**10,475**	**0.8**	**0**	**$1,514**	**$5,598**	**$250**	**$5,348**	**3.5**	**10,548**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	4,849	0.6	0	$701	$1,213	$0	$1,213	1.7	4,883
ECM 16	Refrigeration Controls	5,626	0.2	0	$813	$4,385	$250	$4,135	5.1	5,665
Custom Measures		**29,605**	**0.0**	**120**	**$4,375**	**$21,000**	**$0**	**$21,000**	**4.8**	**43,880**
ECM 17	Retro-Commissioning Study & HVAC Improvements	29,605	0.0	120	$4,375	$21,000	$0	$21,000	4.8	43,880
TOTALS		**279,874**	**58.3**	**183**	**$41,050**	**$206,718**	**$25,439**	**$181,279**	**4.4**	**303,242**

* - 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		**93,804**	**25.3**	**-16**	**$13,426**	**$77,058**	**$14,784**	**$62,274**	**4.6**	**92,577**
ECM 1	Install LED Fixtures	16,730	2.8	-2	$2,406	$39,938	$5,600	$34,338	14.3	16,670
ECM 2	Retrofit Fixtures with LED Lamps	77,074	22.5	-15	$11,021	$37,120	$9,184	$27,936	2.5	75,907

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

ECM 1: Install LED Fixtures

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

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

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

Affected building areas: gymnasium and exterior fixtures.

ECM 2: Retrofit Fixtures with LED Lamps

Replace linear fluorescent, U-bend fluorescent, compact fluorescent (CFL), and halogen incandescent lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as direct replacements for most other lighting technologies.

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

Affected building areas: all areas with fluorescent fixtures with T8 tubes, U-bend T8 tubes, CFL lamps, and halogen incandescent lamps.

4.2 Lighting Controls

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

ECM 3: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected building areas: offices, kitchen, music room, gymnasium, restrooms, and library.

ECM 4: Install High/Low Lighting Controls

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

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety requirements. Sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Fixtures automatically switch back to low level after a predefined period of vacancy. In parking lots and parking garages with significant ambient lighting, this control can sometimes be combined with photocell controls to turn the lights off when there is sufficient daylight.

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

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

Affected building areas: hallways.

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		**136,250**	**30.6**	**0**	**$19,691**	**$89,111**	**$9,355**	**$79,756**	**4.1**	**137,203**
ECM 5	Install VFD on Variable Air Volume (VAV) Fans	13,596	4.5	0	$1,965	$9,228	$1,975	$7,253	3.7	13,691
ECM 6	Install VFDs on Constant Volume (CV) Fans	54,610	15.3	0	$7,892	$35,901	$4,080	$31,821	4.0	54,992
ECM 7	Install VFDs on Chilled Water Pumps	44,427	8.4	0	$6,420	$20,174	$2,400	$17,774	2.8	44,737
ECM 8	Install VFDs on Heating Water Pumps	15,279	1.5	0	$2,208	$9,476	$0	$9,476	4.3	15,386
ECM 9	Install VFDs on Cooling Tower Fans	4,748	-0.3	0	$686	$7,086	$900	$6,186	9.0	4,781
ECM 10	Install Boiler Draft Fan VFDs	3,591	1.2	0	$519	$7,246	$0	$7,246	14.0	3,616

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

Premium efficiency motors have been proposed to be installed only in conjunction with proposed VFD motor measures. Non-inverter duty rated motors will need to be replaced when the VFD measure is implemented. If the proposed VFD measure is not selected for implementation the motor replacement should be reevaluated.

ECM 5: Install VFD on Variable Air Volume (VAV) Fans

Replace existing air volume control devices on variable volume fans, such as inlet vanes and variable pitch fan blades, with VFDs. Inlet guide vanes and variable pitch fan blades are an inefficient means of controlling the air volume compared to VFDs. The existing volume control device will be removed or permanently disabled, and the control signal will be redirected to the VFD to determine proper fan motor speed.

Energy savings result from using a more efficient control device to regulate the air flow provided by the fan. Additional maintenance savings may result from this measure. VFDs are solid state electronic devices, which generally requires less maintenance than mechanical air volume control devices.

Affected air handlers: AHU-3 – Supply and Return Fans.

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

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

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

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.

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

Affected air handlers: AHU-1, -2, -4 and -5, supply, return and exhaust fans.

ECM 7: Install VFDs on Chilled Water Pumps

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

For systems with variable chilled water flow through the chiller, the minimum flow to prevent the chiller from tripping off will need to be determined during the final project design. The control system should be programmed to maintain the minimum flow through the chiller and to prevent pump cavitation.

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

Affected pumps: Primary CHW pumps and AHU-1 CHW circulation pump.

ECM 8: Install VFDs on Heating Water Pumps

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

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

Affected pumps: Primary HHW pumps P1 & 2.

ECM 9: Install VFDs on Cooling Tower Fans

Install a VFD to control the cooling tower fan motor. The VFD will allow the cooling tower fan to operate at the minimum speed necessary to maintain the temperature of the condenser water returning to the chiller.

Energy savings result from reducing fan speed (and power) when there is a reduced load on the chiller and outside air wet bulb temperatures are depressed. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

ECM 10: Install Boiler Draft Fan VFDs

Replace existing volume control devices on boiler draft fans, such as inlet vanes or dampers, with VFDs. Inlet vanes or dampers are an inefficient means of controlling the air volume compared to VFDs. The existing volume control device will be removed or permanently disabled, and the control signal will be redirected to the VFD to determine proper fan motor speed.

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

Additional maintenance savings may result from this measure. VFDs are solid state electronic devices, which generally requires less maintenance than mechanical air volume control devices.

On the basis of the low-cost savings and long payback, this measure is not recommended.

4.4 Electric Chillers

#	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 Chiller Replacement		**68,700**	**38.4**	**0**	**$9,928**	**$181,495**	**$10,750**	**$170,745**	**17.2**	**69,180**
ECM 11	Install High Efficiency Chillers	68,700	38.4	0	$9,928	$181,495	$10,750	$170,745	17.2	69,180

ECM 11: Install High-Efficiency Chillers

Replace older inefficient electric chillers with new high-efficiency chillers. The type of chiller to be installed depends on the magnitude of the cooling load and variability of the cooling load profile, for example:

- Positive displacement chillers are usually under 600 tons of cooling capacity and centrifugal chillers generally start at 150 tons of cooling capacity.
- Constant speed chillers should be used to meet cooling loads with little or no variation while variable speed chillers are more efficient for variable cooling load profiles.
- Water-cooled chillers are more efficient than air cooled chillers but require cooling towers and additional pumps to circulate the cooling water.
- In any given size range, variable speed chillers tend to have better partial load efficiency, but worse full load efficiency, than constant speed chillers.

Energy savings result from the improvement in chiller efficiency and matching the right type of chiller to the cooling load. The energy savings are calculated based on the cooling capacity of the new chiller, the improvement in efficiency compared with the base case equipment, the cooling load profile, and the estimated annual operating hours of the chiller before and after the upgrade.

For the purposes of this analysis, we evaluated the replacement of chillers on a one-for-one basis with equipment of the same capacity. We recommend that you work with your design team to select chillers that are sized appropriately for the cooling load at the school. In some cases, the plant energy use can be reduced by selecting multiple chillers that match the facility load profile rather than one or two large chillers. This can also improve the chiller plant reliability through increased redundancy. Energy savings are maximized by proper selection of new equipment based on the cooling load profile.

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

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**	**330**	**$2,662**	**$85,794**	**$7,209**	**$78,585**	**29.5**	**38,618**
ECM 12	Install High Efficiency Hot Water Boilers	0	0.0	330	$2,662	$85,794	$7,209	$78,585	29.5	38,618

ECM 12: Install High-Efficiency Hot Water Boilers

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

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 the school. In many cases installing multiple modular boilers rather than one or two large boilers will result in higher overall plant efficiency while providing additional system redundancy.

Replacing the boilers has a long payback and may not be justifiable based simply on energy considerations. However, the boilers are nearing the end of their normal useful life. Typically, the marginal cost of purchasing high-efficiency boilers can be justified by the marginal savings from the improved efficiency. When the boilers are 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

#	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		**2,757**	**0.0**	**38**	**$708**	**$8,157**	**$0**	**$8,157**	**11.5**	**7,261**
ECM 13	Implement Demand Control Ventilation (DCV)	2,757	0.0	38	$708	$8,157	$0	$8,157	11.5	7,261

ECM 13: Implement Demand Control Ventilation (DCV)

Demand control ventilation (DCV) monitors 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/auditorium, music room, and cafeteria.

4.7 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**43**	**$345**	**$215**	**$0**	**$215**	**0.6**	**5,000**
ECM 14	Install Low-Flow DHW Devices	0	0.0	43	$345	$215	$0	$215	0.6	5,000

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.

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		**10,475**	**0.8**	**0**	**$1,514**	**$5,598**	**$250**	**$5,348**	**3.5**	**10,548**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	4,849	0.6	0	$701	$1,213	$0	$1,213	1.7	4,883
ECM 16	Refrigeration Controls	5,626	0.2	0	$813	$4,385	$250	$4,135	5.1	5,665

ECM 15: Refrigerator/Freezer Case Electrically Commutated Motors

Replace shaded pole or permanent split capacitor (PSC) motors with electronically commutated (EC) motors in walk-in coolers and freezers. 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, this measure eliminates losses due to friction and phase shifting.

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

Install additional controls to optimize the operation of walk-in freezer and cooler.

Defrost controllers can be used to override defrost of evaporator fans when the defrost operation is not necessary, which reduces annual energy consumption. This measure is applicable to existing evaporator fans with a traditional electric defrost mechanism.

Many walk-in coolers and freezers have evaporator fans that run continuously. The measure adds a control system feature to automatically shut off evaporator fans when not needed.

Energy savings for each of the control measures account for reduction in compressor and 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		**29,605**	**0.0**	**120**	**$4,375**	**$21,000**	**$0**	**$21,000**	**4.8**	**43,880**
ECM 17	Retro-Commissioning Study & HVAC Improvements	29,605	0.0	120	$4,375	$21,000	$0	$21,000	4.8	43,880

ECM 17: Retro-Commissioning Study & HVAC Improvements

Due to the complexity of today's HVAC systems and controls, it is likely for systems to be operating incorrectly or not as efficiently as they could be. Retro-commissioning studies reveal hidden deficiencies and highlights operational & maintenance (O&M) issues that could have been avoided as well as exposes hidden control system problems. There are valuable benefits to retro-commissioning in existing buildings. It is a detailed and specialized process that reviews how an HVAC system is controlled and designed to operate. Applying retro-commissioning to existing facilities includes planning, discovering root causes of inefficiencies, developing a cost-effective project delivery, and focusing on optimizing value to the building owner. The study includes functional system testing under various modes, such as heating or cooling loads, occupied and unoccupied modes, varying outside air temperature, and space temperatures. This is a systematic process to ensure that the building energy systems perform interactively according to the original design intent and the current operational needs of the school.

Retro-commissioning is a common practice recommended by the American Society of Heating Refrigeration and Energy (ASHRAE) to be revisited every couple of years. We recommend that an engineering firm who specializes in energy control systems and retro-commissioning be contacted for a detailed evaluation and implementation costs. Facility operations personnel would work with the engineers to develop goals and objectives. During on-site testing, the qualified personnel conducting the study would immediately make any no/low-cost improvements as identified. Furthermore, for any suggested corrective actions which require the purchase of material, a contractor who specializes in that scope of work would be contacted to implement the remaining improvements.

This measure is an effort to increase the optimization of the EMS and operation of HVAC systems and equipment. We have identified this potential measure in response to the relatively low benchmarking scope and the relative complexity of the building systems.

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. The results are based on industry standards.

5 Energy Efficient Best Practices

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

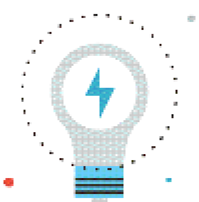
Energy Tracking with ENERGY STAR® Portfolio Manager®

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

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.

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.

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

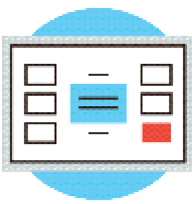
Motor Maintenance

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

Fans to Reduce Cooling Load

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

Thermostat Schedules and Temperature Resets



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

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.

Chiller Maintenance

Service chillers regularly to keep them operating properly. Chillers are responsible for a substantial portion of a commercial building's overall energy usage and when they do not work well, there is usually a noticeable increase in energy bills and increased occupant complaints. Regular diagnostics and service can save five to ten percent of the cost of operating your chiller. If you already have a maintenance contract in place, your existing service company should be able to provide these services.

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 effective as particulate buildup increases. Dirty filters also restrict air flow through the air conditioning or heat pump system, which increases the load on the distribution fans.

Duct Sealing

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

Boiler Maintenance

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

Water Heater Maintenance

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

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

Plug Load Controls

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

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

Water Conservation

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

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

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

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

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

Procurement Strategies

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

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

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

6 On-site Generation

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

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

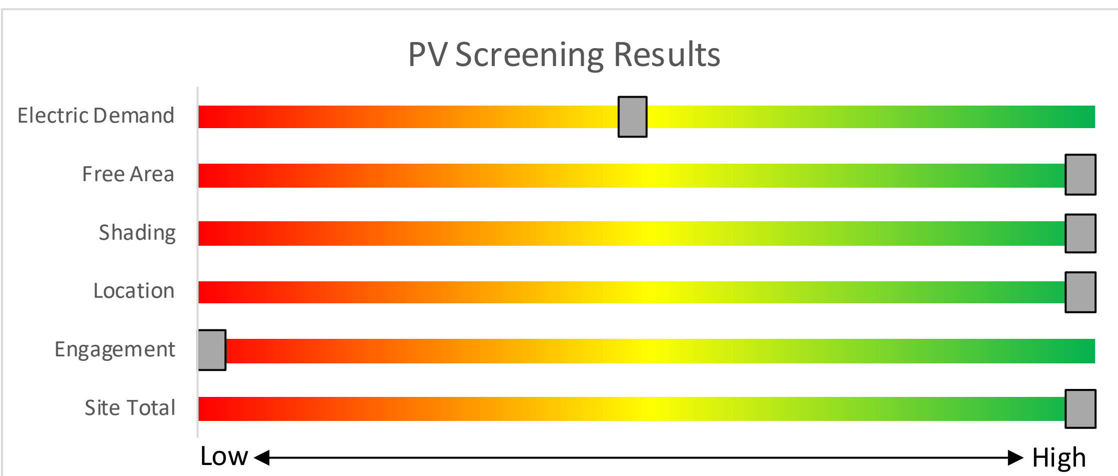
6.1 Solar Photovoltaic

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

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

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

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



Potential	High	
System Potential	202	kW DC STC
Electric Generation	240,657	kWh/yr
Displaced Cost	$34,780	/yr
Installed Cost	$525,200	

Figure 9 - Photovoltaic Screening

Solar Renewable Energy Credit (SREC) Registration Program

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

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

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

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

6.2 Combined Heat and Power

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

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

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

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

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

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

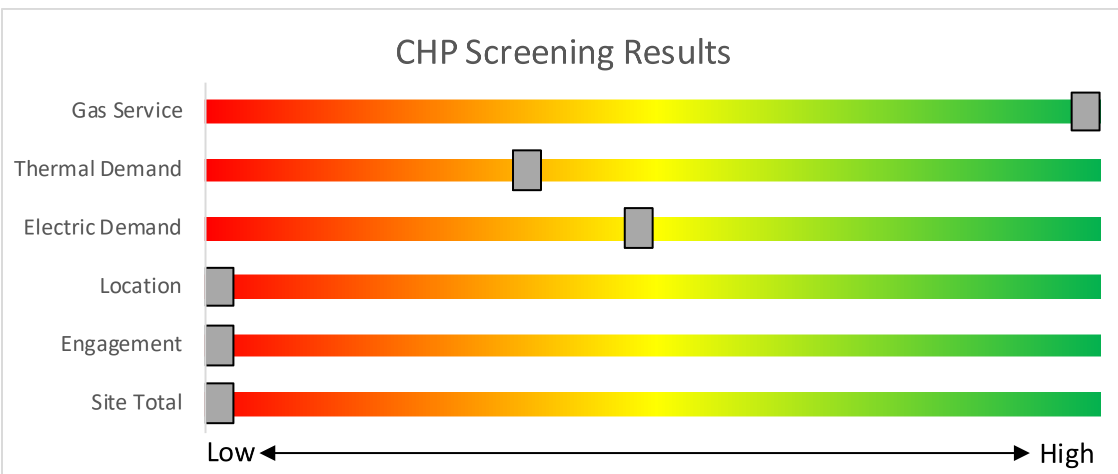


Figure 10 - Combined Heat and Power Screening

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

7 Project Funding and Incentives

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

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

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

7.1 SmartStart

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

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

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 Pay for Performance - Existing Buildings

Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures that results in at least 15% source energy savings, and lighting cannot make up the majority of the savings. P4P is a generally a good option for medium-to-large sized facilities looking to implement as many measures as possible under a single project to achieve deep energy savings. This program has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program.

The scope of work presented in this audit report does not quite meet the requirements of the current P4P program. However, due to the size of the facility and existing conditions, should additional measures be identified at a later point in time, for example through further evaluation or the Energy Savings Improvement Program process, the school could potentially meet the requirements necessary to participate in the 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.

7.3 Energy Savings Improvement Program

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

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

How to Participate

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

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

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

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

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

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

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

7.4 SREC Registration Program

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

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

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

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

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

8 Energy Purchasing and Procurement Strategies

8.1 Retail Electric Supply Options

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

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

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

8.2 Retail Natural Gas Supply Options

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

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

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

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

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Head Custodian	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	179	0	$26	$73	$20	2.1
Kitchen	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2, 3	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	2,054	0	$293	$927	$215	2.4
Kitchen	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2, 3	Relamp	Yes	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	1,882	0	$269	$872	$200	2.5
Kitchen	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2, 3	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.2	685	0	$98	$489	$95	4.0
Kitchen Janitor	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,470	0.0	134	0	$19	$55	$15	2.1
Kitchen Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,470	0.0	134	0	$19	$55	$15	2.1
Kitchen Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,470	0.0	134	0	$19	$55	$15	2.1
Kitchen Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,470	0.0	134	0	$19	$55	$15	2.1
Chiller Room	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.3	986	0	$141	$402	$110	2.1
Chiller Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	90	0	$13	$37	$10	2.1
Boiler Room	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.3	986	0	$141	$402	$110	2.1
Boiler Room	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Cafeteria	38	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2, 3	Relamp	Yes	38	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	1.7	6,503	-1	$929	$2,621	$640	2.1
Cafeteria	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Room K107	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.4	1,021	0	$146	$602	$165	3.0
107 Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	62	0	$9	$37	$10	3.0
Room K106	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	1,299	0	$186	$767	$210	3.0
K106 Restroom	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
K106 Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	62	0	$9	$37	$10	3.0
Room K105	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	1,299	0	$186	$767	$210	3.0
Room K104	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	1,299	0	$186	$767	$210	3.0
Room K103	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	1,299	0	$186	$767	$210	3.0
Room K102	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	1,299	0	$186	$767	$210	3.0
Room 101	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.4	1,114	0	$159	$657	$180	3.0
101 Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	124	0	$18	$73	$20	3.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Storage 2	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	62	0	$9	$37	$10	3.0
118 Music Room	10	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2, 3	Relamp	Yes	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	1,711	0	$244	$818	$185	2.6
Music Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.1	186	0	$27	$110	$30	3.0
Music Storage 2	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	179	0	$26	$73	$20	2.1
118 Music Room	16	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	2,470	2, 3	Relamp	Yes	16	LED Lamps: 2L LED Plug-In Lamps	Occupancy Sensor	18	1,704	0.2	584	0	$83	$1,078	$67	12.1
118 Music Room	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
118A Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.1	186	0	$27	$110	$30	3.0
Vestibule	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	90	0	$13	$37	$10	2.1
Stage	23	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	23	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.7	2,624	-1	$375	$1,380	$300	2.9
Boys	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.1	456	0	$65	$416	$75	5.2
Boys/Janitor	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	90	0	$13	$37	$10	2.1
Girls	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.1	456	0	$65	$416	$75	5.2
Gym/Auditorium	20	Metal Halide: (1) 150W Lamp	Wall Switch	S	190	2,470	1, 3	Fixture Replacement	Yes	20	LED - Fixtures: High-Bay	Occupancy Sensor	57	1,704	2.2	8,187	-2	$1,169	$16,038	$3,070	11.1
Gym/Auditorium	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
Office/Storage	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.3	1,141	0	$163	$635	$135	3.1
Front Vestibule	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.1	342	0	$49	$380	$65	6.4
Main Office	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.3	1,027	0	$147	$599	$125	3.2
Main Office	10	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.4	928	0	$133	$548	$150	3.0
126 Nurse Office	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.1	309	0	$44	$183	$50	3.0
126 Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	62	0	$9	$37	$10	3.0
Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	62	0	$9	$37	$10	3.0
CST Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,470	0.0	134	0	$19	$55	$15	2.1
Office 122	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	124	0	$18	$73	$20	3.0
Guidance Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.1	186	0	$27	$110	$30	3.0
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,470	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,704	0.1	402	0	$57	$416	$75	5.9

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	62	0	$9	$37	$10	3.0
Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	179	0	$26	$73	$20	2.1
120B Principal Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.1	513	0	$73	$434	$80	4.8
120A Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.1	186	0	$27	$110	$30	3.0
Conference Room	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.1	278	0	$40	$164	$45	3.0
1st Floor Hallway	50	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	2,470	2, 4	Relamp	Yes	50	LED Lamps: 2L LED Plug-In Lamps	High/Low Control	18	1,704	0.5	1,826	0	$261	$4,324	$100	16.2
1st Floor Hallway	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
1st Floor Hallway	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 4	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,704	0.5	1,825	0	$261	$1,259	$160	4.2
1st Floor Hallway	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
Vestibule	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	90	0	$13	$37	$10	2.1
1st Floor Hallway	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 4	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,704	0.2	570	0	$81	$408	$50	4.4
1st Floor Hallway	4	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	2,470	2, 4	Relamp	Yes	4	LED Lamps: 2L LED Plug-In Lamps	High/Low Control	18	1,704	0.0	146	0	$21	$427	$8	20.1
1st Floor Hallway	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
Boys	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.2	570	0	$81	$453	$85	4.5
Girls	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.2	570	0	$81	$453	$85	4.5
Girls Janitor	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	62	0	$9	$37	$10	3.0
1st Floor Hallway	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 4	Relamp	Yes	11	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,704	0.3	1,255	0	$179	$852	$110	4.1
1st Floor Hallway	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
Stairwell 1	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.2	897	0	$128	$365	$100	2.1
Room 208	13	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	13	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	1,206	0	$172	$712	$195	3.0
Room 207	10	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2, 3	Relamp	Yes	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.5	1,711	0	$244	$818	$185	2.6
Boys 2nd Floor	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.1	456	0	$65	$416	$75	5.2
Custodial	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	62	0	$9	$37	$10	3.0
Girls 2nd Floor	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.1	456	0	$65	$416	$75	5.2
Room 206	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Teachers' Room	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.2	464	0	$66	$274	$75	3.0
Room 205	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0
Staff Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.0	62	0	$9	$37	$10	3.0
Electrical Closet	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.1	269	0	$38	$110	$30	2.1
Room 213	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.2	557	0	$80	$329	$90	3.0
Room 204	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0
Room 203	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0
Room 201	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.4	1,021	0	$146	$602	$165	3.0
Room 201	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,704	0.0	109	0	$16	$145	$20	8.0
Room 202	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0
Mechanical Room	25	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	25	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.6	2,242	0	$320	$913	$250	2.1
Mechanical Room	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Elevator Machine Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	90	0	$13	$37	$10	2.1
Library	20	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2, 3	Relamp	Yes	20	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.9	3,423	-1	$489	$1,365	$335	2.1
Library	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,470	2, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.1	513	0	$73	$434	$80	4.8
Library	30	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	30	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.9	3,423	-1	$489	$1,635	$370	2.6
Office	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,704	2	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.1	371	0	$53	$219	$60	3.0
Library Stairwell	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.1	538	0	$77	$219	$60	2.1
Room 214A	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.1	371	0	$53	$219	$60	3.0
Library	5	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	2,470	2, 3	Relamp	Yes	5	LED Lamps: 2L LED Plug-In Lamps	Occupancy Sensor	18	1,704	0.0	183	0	$26	$522	$45	18.3
Stairwell2	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.2	628	0	$90	$256	$70	2.1
Stairwell2	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Room 301	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0
Room 302	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0
Room 303	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Room 304	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0
Electrical Room	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.1	269	0	$38	$110	$30	2.1
Room 305	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.4	1,021	0	$146	$602	$165	3.0
Room 306	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.3	835	0	$119	$493	$135	3.0
Room 307	10	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.4	928	0	$133	$548	$150	3.0
Room 308	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.4	1,114	0	$159	$657	$180	3.0
Boys	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.1	456	0	$65	$416	$75	5.2
Custodian Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	90	0	$13	$37	$10	2.1
Girls	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.1	456	0	$65	$416	$75	5.2
Room 312	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,704	2	Relamp	No	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,704	0.4	1,114	0	$159	$657	$180	3.0
3rd Floor Hallway	17	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 4	Relamp	Yes	17	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,704	0.5	1,939	0	$277	$1,296	$170	4.1
3rd Floor Hallway	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
2nd Floor Hallway	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2, 4	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,704	0.5	2,054	0	$293	$1,332	$180	3.9
2nd Floor Hallway	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
Elevator	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,470	0.0	179	0	$26	$73	$20	2.1
Exterior	12	Halogen Incandescent: 150W Area Fixture - 1L	Timeclock		150	5,293	2	Relamp	No	12	LED Lamps: 1L LED Screw-In	Timeclock	45	5,293	0.6	6,669	0	$964	$279	$12	0.3
Exterior	2	Metal Halide: (1) 70W Lamp	Timeclock		95	5,293	1	Fixture Replacement	No	2	LED - Fixtures: Architectural Flood/Spot Luminaire	Timeclock	29	5,293	0.1	704	0	$102	$1,035	$100	9.2
Exterior	2	Halogen Incandescent: 100W Pole Light Fixtures - 1L	Timeclock		100	5,293	2	Relamp	No	2	LED Lamps: 1L LED Screw-In	Timeclock	30	5,293	0.1	741	0	$107	$46	$2	0.4
Exterior	4	Metal Halide: (1) 70W Lamp	Timeclock		95	5,293	1	Fixture Replacement	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	29	5,293	0.1	1,408	0	$203	$3,864	$400	17.0
Exterior	21	Metal Halide: (1) 70W Lamp	Timeclock		95	5,293	1	Fixture Replacement	No	21	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Timeclock	29	5,293	0.7	7,391	0	$1,068	$19,542	$2,100	16.3

Motor Inventory & Recommendations

		Existing Conditions							Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Primary HHW Loop	2	Heating Hot Water Pump	7.5	89.5%	No	W	3,391	8	No	91.0%	Yes	2	1.5	15,279	0	$2,208	$9,476	$0	4.3
Boiler Room	Secondary HHW Loop	2	Heating Hot Water Pump	7.5	89.5%	Yes	B	3,391		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	DHW Recirculation	2	Process Pump	0.0	66.6%	No	W	8,760		No	66.6%	No		0.0	0	0	$0	$0	$0	0.0
Chiller Room	CHW Loop	2	Chilled Water Pump	20.0	88.5%	No	B	3,391	7	No	93.0%	Yes	2	8.2	43,503	0	$6,287	$17,164	$2,400	2.3
Mechanical Room	Gym/Auditorium	1	Supply Fan	10.0	90.2%	No	B	3,000	6	No	91.7%	Yes	1	2.9	8,940	0	$1,292	$5,152	$800	3.4
Mechanical Room	Gym/Auditorium	1	Exhaust Fan	5.0	87.5%	No	B	3,391	6	No	89.5%	Yes	1	1.5	5,263	0	$761	$4,076	$400	4.8
Mechanical Room	AHU-1 CHW Coil Loop	1	Chilled Water Pump	1.0	82.5%	No	W	2,745	7	No	85.5%	Yes	1	0.2	924	0	$133	$3,010	$0	22.6
Mechanical Room	AHU-1 HHW Coil Loop	1	Heating Hot Water Pump	0.3	72.4%	No	W	2,745		No	72.4%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Music Room	1	Supply Fan	2.0	85.5%	No	B	3,000	6	No	86.5%	Yes	1	0.6	1,870	0	$270	$3,261	$160	11.5
Mechanical Room	Music Room	1	Return Fan	1.0	80.0%	No	B	3,000	6	No	85.5%	Yes	1	0.3	1,092	0	$158	$3,010	$80	18.6
Mechanical Room	AHU-2 CHW Coil Loop	1	Chilled Water Pump	0.3	72.4%	No	W	2,745		No	72.4%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	AHU-2 HHW Coil Loop	1	Heating Hot Water Pump	0.3	72.4%	No	W	2,745		No	72.4%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Library/Admin	1	Supply Fan	10.0	90.2%	No	B	3,000	5	No	91.7%	Yes	1	2.9	8,940	0	$1,292	$5,152	$1,200	3.1
Mechanical Room	Library/Admin	1	Return Fan	5.0	87.5%	No	B	3,000	5	No	89.5%	Yes	1	1.5	4,656	0	$673	$4,076	$775	4.9
Mechanical Room	AHU-3 CHW Coil Loop	1	Chilled Water Pump	0.5	76.2%	No	W	2,745		No	76.2%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	AHU-3 HHW Coil Loop	1	Heating Hot Water Pump	0.3	72.4%	No	W	2,745		No	72.4%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Corridor/Toilets	1	Supply Fan	15.0	90.2%	No	B	4,000	6	No	93.0%	Yes	1	4.5	18,309	0	$2,646	$7,041	$1,200	2.2
Mechanical Room	Corridor/Toilets	1	Return Fan	7.5	88.5%	No	B	4,000	6	No	91.0%	Yes	1	2.3	9,289	0	$1,342	$4,738	$600	3.1
Mechanical Room	AHU-4 CHW Coil Loop	1	Chilled Water Pump	0.8	82.5%	No	W	2,745		No	82.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	AHU-4 HHW Coil Loop	1	Heating Hot Water Pump	0.3	72.4%	No	W	2,745		No	72.4%	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
Mechanical Room	Cafeteria	1	Supply Fan	7.5	88.5%	No	B	3,000	6	No	91.0%	Yes	1	2.2	6,966	0	$1,007	$4,738	$600	4.1
Mechanical Room	Cafeteria	1	Return Fan	3.0	86.5%	No	B	3,000	6	No	89.5%	Yes	1	0.9	2,881	0	$416	$3,884	$240	8.8
Mechanical Room	AHU-5 CHW Coil Loop	1	Chilled Water Pump	0.5	76.2%	No	W	2,745		No	76.2%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	AHU-5 HHW Coil Loop	1	Heating Hot Water Pump	0.3	72.4%	No	W	2,745		No	72.4%	No		0.0	0	0	$0	$0	$0	0.0
Classrooms	Classrooms	3	Supply Fan	0.1	68.5%	No	W	3,000		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Classrooms	Classrooms	23	Supply Fan	0.3	68.5%	No	W	3,000		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Rooms 111A, 215	Rooms 111A, 215	3	Supply Fan	0.1	68.5%	No	W	3,000		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Rooms 110 & 132	Rooms 110 & 132	2	Supply Fan	0.1	68.5%	No	W	3,000		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Room 109	Room 109	1	Supply Fan	0.3	68.5%	No	W	3,000		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Corridors and Stairs	Corridors and Stairs	4	Supply Fan	0.1	68.5%	No	W	4,000		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Corridors and Stairs	Corridors and Stairs	7	Supply Fan	0.0	68.5%	No	W	4,000		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Multple Zones	3	Exhaust Fan	0.3	68.5%	No	W	2,745		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Multple Zones	4	Exhaust Fan	0.3	68.5%	No	W	2,745		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Multple Zones	8	Exhaust Fan	0.5	68.5%	No	W	2,745		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Multple Zones	2	Exhaust Fan	0.1	68.5%	No	W	2,745		No	68.5%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Boilers	2	Combustion Air Fan	2.0	84.0%	No	B	2,745	10	No	86.5%	Yes	2	1.2	3,591	0	$519	$7,246	$0	14.0
Roof	Cooling Tower	1	Cooling Tower Fan	15.0	91.0%	No	B	3,391	9	No	92.4%	Yes	1	-0.3	4,748	0	$686	$7,086	$900	9.0

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	Interior	1	Split-System AC	2.46		W		No							0.0	0	0	$0	$0	$0	0.0

Electric Chiller Inventory & Recommendations

		Existing Conditions				Proposed Conditions									Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Chiller Quantity	System Type	Cooling Capacity per Unit (Tons)	Remaining Useful Life	ECM #	Install High Efficiency Chillers?	Chiller Quantity	System Type	Constant/ Variable Speed	Cooling Capacity (Tons)	Full Load Efficiency (kW/Ton)	IPLV Efficiency (kW/Ton)		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
Chiller Room	CHW Loop for Entire Building	1	Water-Cooled Screw Chiller	250.00	B	11	Yes	1	Water-Cooled Screw Chiller	Variable	250.00	0.68	0.43		38.4	68,700	0	$9,928	$181,495	$10,750	17.2

Fuel Heating Inventory & Recommendations

		Existing Conditions				Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	HHW Loop	2	Non-Condensing Hot Water Boiler	2,403.00	B	12	Yes	2	Non-Condensing Hot Water Boiler	2,403.00	85.00%	Et	0.0	0	330	$2,662	$85,794	$7,209	29.5

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
Mechanical Room	Gym/Auditorium	13	2.00	38.63	0.00	511.50	0.0	1,530	21	$393	$2,719	$0	6.9
Mechanical Room	Music Room	13	2.00	8.70	0.00	121.40	0.0	345	5	$91	$2,719	$0	30.0
Mechanical Room	Cafeteria	13	2.00	22.31	0.00	286.30	0.0	883	12	$224	$2,719	$0	12.1

DHW Inventory & Recommendations

		Existing Conditions			Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Kitchen	1	Storage Tank Water Heater (> 50 Gal)	W		No						0.0	0	0	$0	$0	$0	0.0
Boiler Room	Restrooms	1	Storage Tank Water Heater (> 50 Gal)	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	14	30	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	43	$345	$215	$0	0.6

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	Yes	Yes	0.4	5,237	0	$757	$2,799	$125	3.5
Kitchen	1	Medium Temp Freezer (0F to 30F)	15, 16	Yes	Yes	Yes	0.4	5,237	0	$757	$2,799	$125	3.5

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, Solid Door (31 - 50 cu. ft.)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Refrigerator Chest	Yes		No	0.0	0	0	$0	$0	$0	0.0

Novelty Cooler Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Cooler Description	ECM #	Install Automatic Shutoff 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	3	Cold Box Tables		No	0.00	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	Electric Griddle (4 Feet Width)	Yes		No	0.0	0	0	FALSE	$0	$0	#DIV/0!
Kitchen	1	Gas Steamer	Yes		No	0.0	0	0	FALSE	$0	$0	#DIV/0!
Kitchen	1	Gas Griddle (3 Feet Width)	Yes		No	0.0	0	0	FALSE	$0	$0	#DIV/0!
Kitchen	1	Gas Rack Oven (Double)	Yes		No	0.0	0	0	FALSE	$0	$0	#DIV/0!
Kitchen	2	Insulated Food Holding Cabinet (Full Size)	Yes		No	0.0	0	0	FALSE	$0	$0	#DIV/0!
Kitchen	3	Electric Steamer	No		No	0.0	0	0	FALSE	$0	$0	#DIV/0!

Dishwasher Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Dishwasher Type	Water Heater Fuel Type	Booster Heater Fuel 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	Payback w/ Incentives in Years
Kitchen	1	Single Tank Conveyor (High Temp)	None	N/A	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?
Throughout Building	150	Desktop Computers	150.0	Yes
Throughout Building	1	Laptops	45.0	Yes
Throughout Building	13	Printers (Small)	20.0	Yes
Throughout Building	1	Printers (Medium)	60.0	Yes
Throughout Building	5	Photocopier	600.0	Yes
Throughout Building	8	Projector	200.0	Yes
Throughout Building	4	Microwave	1,000.0	Yes
Throughout Building	2	Mini Fridge	153.0	Yes
Throughout Building	3	Refrigerator	172.0	Yes
Throughout Building	2	Coffee Machine	900.0	Yes
Throughout Building	8	LCD TV	100.0	Yes

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

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

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ENERGY STAR® Statement of Energy Performance

18

ENERGY STAR® Score[1]

Nicholas Murray Butler Elementary School (23)

Primary Property Type: K-12 School
Gross Floor Area (ft²): 70,000
Built: 1998

For Year Ending: September 30, 2017
Date Generated: February 25, 2019

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Nicholas Murray Butler Elementary School (23) 631-657 Westminister Avenue Elizabeth, New Jersey 07208	Elizabeth Board of Education 500 North Broad Street Elizabeth, NJ 07208 908-436-5180	Luis Couto 500 North Broad Street Elizabeth, NJ 07208 908-436-5180 coutolu@epsnj.org

Property ID: 6688950

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
104.5 kBtu/ft²

Source EUI
184 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	2,973,867 (41%)	
Natural Gas (kBtu)	4,338,946 (59%)	

National Median Comparison

National Median Site EUI (kBtu/ft²)	74.8
National Median Source EUI (kBtu/ft²)	131.8
% Diff from National Median Source EUI	40%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	532

Signature & Stamp of Verifying Professional

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

Signature: ______________________Date: ___________

Licensed Professional

____ ________
,
(____)____-______
____

Professional Engineer Stamp (if applicable)

APPENDIX C: GLOSSARY

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

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

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