Local Government Energy Audit Report

Dr. E. Alma Flagg Elementary School

August 26, 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 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 is encouraged to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on individual measures and conditions. TRC and NJBPU do not guarantee installed cost estimates and shall in no event be held liable should actual installed costs vary from estimates.

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

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

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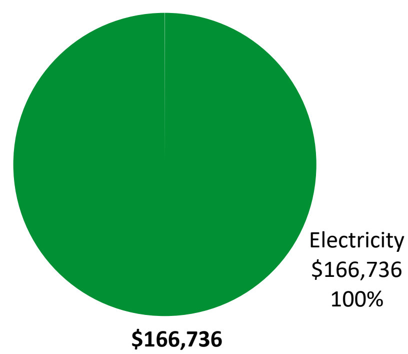
1 Executive Summary

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

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $166,736 Electricity: 1,548,946 kWh	
ENERGY STAR® Benchmarking Score	10 *(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.

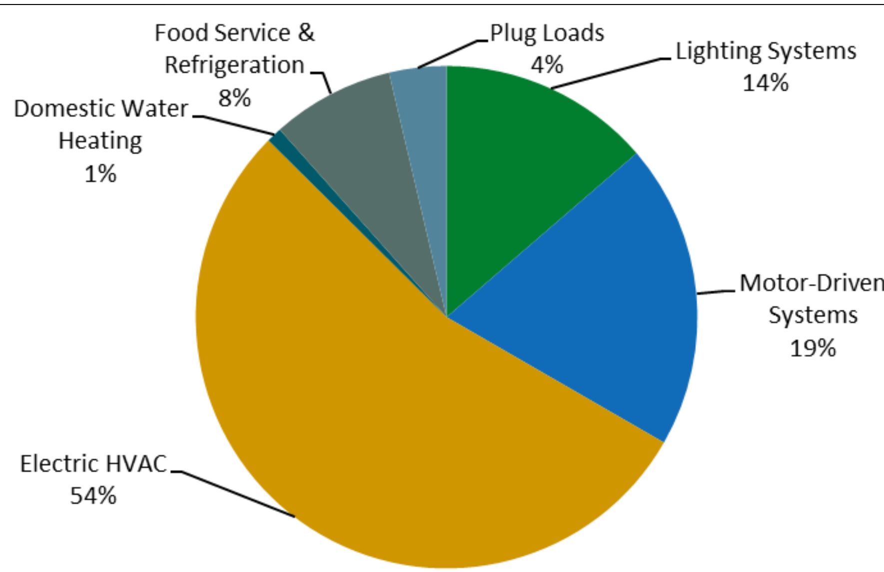


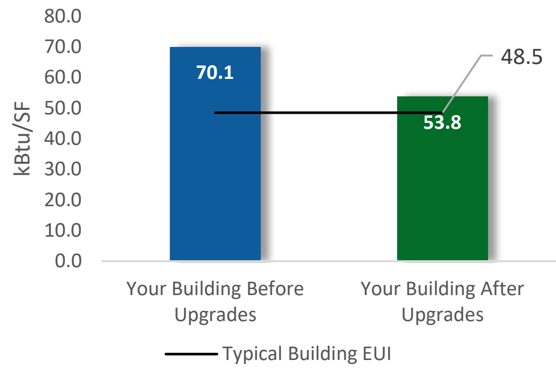
Figure 1 - Energy Use by System

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.

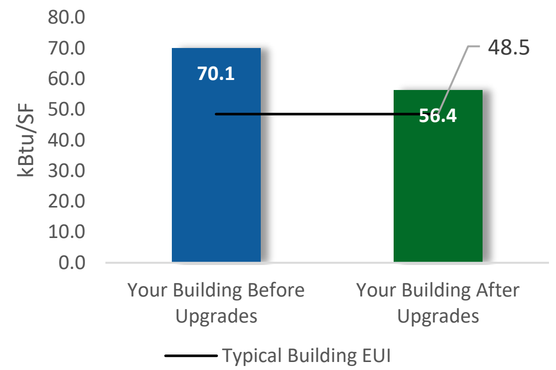
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$671,567
Potential Rebates & Incentives[1]	$42,761
Annual Cost Savings	$76,962
Annual Energy Savings	Electricity: 867,999 kWh
Greenhouse Gas Emission Savings	336 Tons
Simple Payback	8.2 Years
Site Energy Savings (all utilities)	23%



Scenario 2: Cost Effective Package[2]

Installation Cost	$451,520
Potential Rebates & Incentives	$23,051
Annual Cost Savings	$69,624
Annual Energy Savings	Electricity: 795,164 kWh
Greenhouse Gas Emission Savings	302 Tons
Simple Payback	6.2 Years
Site Energy Savings (all utilities)	20%



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 ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**88,417**	**27.2**	**0**	**$9,518**	**$51,593**	**$12,879**	**$38,714**	**4.1**	**89,035**
ECM 1	Install LED Fixtures	1,796	0.2	0	$193	$3,938	$1,500	$2,438	12.6	1,808
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	10,728	3.9	0	$1,155	$5,894	$150	$5,744	5.0	10,803
ECM 3	Retrofit Fixtures with LED Lamps	75,893	23.1	0	$8,170	$41,761	$11,229	$30,532	3.7	76,424
Lighting Control Measures		**22,340**	**7.1**	**0**	**$2,405**	**$23,110**	**$2,715**	**$20,395**	**8.5**	**22,496**
ECM 4	Install Occupancy Sensor Lighting Controls	18,545	6.7	0	$1,996	$21,110	$2,715	$18,395	9.2	18,674
ECM 5	Install High/Low Lighting Controls	3,795	0.4	0	$409	$2,000	$0	$2,000	4.9	3,822
Motor Upgrades		**7,865**	**1.6**	**0**	**$847**	**$18,834**	**$0**	**$18,834**	**22.2**	**7,920**
ECM 6	Premium Efficiency Motors	7,865	1.6	0	$847	$18,834	$0	$18,834	22.2	7,920
Variable Frequency Drive (VFD) Measures		**84,543**	**14.9**	**0**	**$9,101**	**$54,915**	**$4,440**	**$50,475**	**5.5**	**85,134**
ECM 7	Install VFDs on Constant Volume (CV) Fans	52,488	11.7	0	$5,650	$30,920	$3,240	$27,680	4.9	52,855
ECM 8	Install VFDs on Chilled Water Pumps	15,221	2.8	0	$1,638	$9,828	$0	$9,828	6.0	15,327
ECM 9	Install VFDs on Heating Water Pumps	11,035	1.0	0	$1,188	$6,552	$0	$6,552	5.5	11,112
ECM 10	Install VFDs on Cooling Tower Fans	5,800	-0.5	0	$624	$7,616	$1,200	$6,416	10.3	5,841
Electric Chiller Replacement		**57,364**	**15.6**	**0**	**$6,175**	**$170,637**	**$18,000**	**$152,637**	**24.7**	**57,765**
ECM 11	Install High Efficiency Chillers	57,364	15.6	0	$6,175	$170,637	$18,000	$152,637	24.7	57,765
HVAC System Improvements		**7,293**	**0.0**	**16**	**$939**	**$10,875**	**$0**	**$10,875**	**11.6**	**9,236**
ECM 12	Implement Demand Control Ventilation (DCV)	7,293	0.0	16	$939	$10,875	$0	$10,875	11.6	9,236
Domestic Water Heating Upgrade		**16,108**	**24.3**	**-53**	**$1,232**	**$49,468**	**$1,710**	**$47,758**	**38.7**	**10,040**
ECM 13	Install High Efficiency Gas-Fired Water Heater	15,470	24.3	-53	$1,164	$49,410	$1,710	$47,700	41.0	9,398
ECM 14	Install Low-Flow DHW Devices	638	0.0	0	$69	$57	$0	$57	0.8	642
Food Service & Refrigeration Measures		**6,801**	**0.8**	**0**	**$732**	**$1,600**	**$150**	**$1,450**	**2.0**	**6,849**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	1,966	0.2	0	$212	$910	$0	$910	4.3	1,980
ECM 16	Vending Machine Control	4,836	0.6	0	$521	$690	$150	$540	1.0	4,869
Custom Measures		**577,267**	**170.5**	**-1,697**	**$46,015**	**$290,535**	**$2,867**	**$287,668**	**6.3**	**382,560**
ECM 17	Computer Power Management Software	3,982	0.0	0	$429	$3,535	$0	$3,535	8.2	4,010
ECM 18	Installation of an Energy Management System	125,556	0.0	0	$13,515	$113,000	$0	$113,000	8.4	126,434
ECM 19	Heating System Upgrades	447,729	170.5	-1,697	$32,071	$174,000	$2,867	$171,133	5.3	252,117
TOTALS (COST EFFECTIVE MEASURES)		**795,164**	**222.1**	**-1,681**	**$69,624**	**$451,520**	**$23,051**	**$428,469**	**6.2**	**603,873**
TOTALS (ALL MEASURES)		**867,999**	**262.0**	**-1,734**	**$76,962**	**$671,567**	**$42,761**	**$628,806**	**8.2**	**671,036**

* - 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

1.1 Planning Your Project

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

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

Pick Your Installation Approach

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

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

Energy Conservation Measure		SmartStart	Direct Install	Pay For Performance
ECM 1	Install LED Fixtures	x		x
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	x		x
ECM 3	Retrofit Fixtures with LED Lamps	x		x
ECM 4	Install Occupancy Sensor Lighting Controls	x		x
ECM 5	Install High/Low Lighting Controls			x
ECM 6	Premium Efficiency Motors			x
ECM 7	Install VFDs on Constant Volume (CV) HVAC	x		x
ECM 8	Install VFDs on Chilled Water Pumps			x
ECM 9	Install VFDs on Hot Water Pumps			x
ECM 10	Install VFDs on Cooling Tower Fans	x		x
ECM 11	Implement Demand Control Ventilation			x
ECM 12	Install Low-Flow Domestic Hot Water Devices			x
ECM 13	Refrigerator/Freezer Case Electrically Commutated Motors	x		x
ECM 14	Vending Machine Control	x		x
ECM 15	Computer Power Management Software			x
ECM 16	Installation of an Energy Management System			x
ECM 17	Heating System Upgrades	x		

Figure 3 – Funding Options

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

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

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

Individual Measures with SmartStart

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

Turnkey Installation with Direct Install

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

Whole Building Approach with Pay for Performance

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

More Options from Around the State

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

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

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

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

Ongoing Electric Savings with Demand Response

The Demand Response Energy Aggregator program reduces electric loads at commercial facilities when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak power demand. By enabling commercial facilities to reduce their 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 Dr. E. Alma Flagg Elementary School. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs. 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.

An Important Note about Utilities: The Dr. E. Alma Flagg building is an all-electric building. Staff reported through conversations with the utility that there is potential that gas supply service may be provided at no cost to Newark Public Schools. The expectation is that this would include getting a gas line to the property boundary, installation of a gas meter, the engineering design support required for selecting gas supply details, hooking up boiler gas service, and all performing associated work required for implementation. The energy and economic analysis provided within this report does not include any of these aforementioned costs. The project economics involving fuel switching assume that natural gas service is provided to the location of the proposed replacement equipment.

Appendix A: Equipment Inventory & Recommendations provides a detailed list of the locations and recommended upgrades for each energy conservation measure.

2.1 Site Overview

On November 29, 2018, TRC performed an energy audit at Dr. E. Alma Flagg Elementary School located in Newark, New Jersey. TRC met with Christopher Smith to review the facility operations and help focus our investigation on specific energy-using systems.

Dr. E. Alma Flagg Elementary School is a two-story, 75,405 square foot building built in 1984. Spaces include: classrooms, gymnasium, library, auditorium, offices, cafeteria, kitchen, corridors, stairwells, and mechanical space. The building is an all-electric building and 100 percent heated and 100 percent cooled. Two electric boilers serve the hydronic heating system. Two chillers and cooling towers serve the chilled water system. HVAC equipment include air-handling units (AHUs) for larger areas, and a packaged heat recovery unit (HRU) supplies heated outside air for each of those five AHUs, which in turn deliver this outside air to the spaces indicated. Individual fan coil units, located above the ceiling in each classroom, perform the bulk of the heating by providing hot recirculated air for each space. The gymnasium is equipped with two ceiling hung air handling units, as well as electric wall mounted cabinet heaters installed above each set of exterior doors. Miscellaneous heating equipment includes both electric and hydronic unit heaters, as well as electric duct heaters.

Recent improvements include: Over the last five years the facility has replaced some exterior light fixtures with LED light fixtures, installed new high bay fixtures in the gymnasium, and installed an outdoor packaged AAON energy recovery unit.

Lack of control over the HVAC systems and equipment is the facility's main concern. The boilers are past the end of their useful life, are in poor condition, and are in need of replacement. Facility personnel reported that there is a concern with inconsistent space temperatures and lack of controllability. Facility staff reported that the chillers often operate nights and weekends due to high cooling loads on the second floor of the building and that there currently is no zone-level control. The fresh air intake system for the ASUs is also in poor condition. Based on conversations with facility personnel, an energy management system (EMS) is of great interest. The current level of control is limited and manual. The functionality of the rudimentary control system is unknown. Facility staff has reported that the gymnasium is inadequately heated, and it remains cold during the winter months. In addition, most of the lamps within the linear fluorescent high bay fixtures have gone out within a few months of being installed. Without replacing these lamps, the gymnasium is currently under lit.

2.2 Building Occupancy

The facility is occupied year-round, from September through June. Typical weekday occupancy is 50 staff and 500 students. Summer occupancy includes continuing custodial and maintenance activities.

Occupancy	Weekday/Weekend	Operating Schedule
Normal School Day	Weekday	6:30AM - 3:30PM
	Weekend (Saturday)	7:00AM - 6:00PM
After Hours Cleaning	Weekday	3:30PM - 11:00PM
	Weekend (Saturday)	6:00PM - 11:00PM
Summer School	Weekday	No Use
	Weekend	No Use

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are prefabricated concrete panels with structural steel framing. While there may be insulation within the panels, it is unknown if walls are insulated. The roof is flat, and it is covered with a gray rubber membrane over insulated steel decking. The roof appears to be in good condition. The building has minimal windows, most of which are double pane and fixed with metal frames, and they are in good condition. The glass-to-frame seals are in fair condition and are beginning to show evidence of excessive wear. Exterior doors are metal with metal frames and are in fair condition. However, the door seals are worn or missing. Degraded window and door seals increase drafts and outside air infiltration.

Photo caption

Building Facade

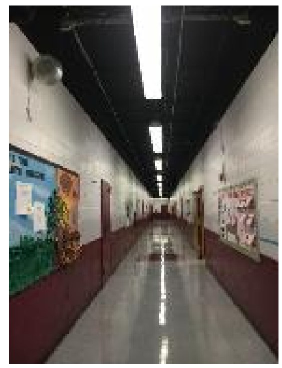
Building Facade

Building Facade

2.4 Lighting Systems

The primary interior lighting system uses 2', 17-Watt and 4', 32-Watt linear fluorescent T8 lamps. Fixture types include recessed troffer fixtures and wrap fixtures. Vestibules have U-lamp T8 fixtures. The gymnasium is lit by high bay fixtures with linear fluorescent T5 high output lamps. All fluorescent fixtures have electronic ballasts. There are also general purpose compact fluorescent lamps. Most fixtures are in good condition. Interior light fixtures are manually controlled via wall switches. The hallway and larger restroom light fixtures are controlled by key switches. All building exit signs are LED. Interior lighting levels were generally sufficient; however, a few offices were identified for a reduction in light levels. The gymnasium is under lit due to a significant number of lamps being burnt out.

Recessed Troffer T8 Fixtures in Cafeteria



Linear Fluorescent T8 Wrap Fixtures

Recessed Troffer T8 Fixtures

Recessed Troffer T8 Fixtures in Library

U-lamp T8 and 2' T8 Fixtures *Linear Fluorescent T5HO High Bay Fixtures in Gym*

Key Switches

Wall Switches

Exterior lighting is provided by wall pack fixtures including compact fluorescent, high pressure sodium, and LED sources. Exterior light fixtures are controlled by a photocell controls.

LED Wall Pack

HID Wall Pack

2.5 Air Handling Systems

Fan Coil Units (FCUs)

Unit ventilators and fan coil units include manually-controlled supply fan motors. There are no existing controls for outside air dampers or fan coil valves. The unit ventilators are in fair condition. The fan coil units are in poor condition.

Electric Unit Heater

Electric Cabinet Unit Heater

Air Handling Units

The building is conditioned by AHUs, which are located in the second floor mechanical room and at the ceiling of the gymnasium. These forced air systems are equipped with electric re-heat duct heaters, hot water/chilled water coils, and constant speed supply fans and motors. The duct heaters vary between 37 and 140 kW in heating capacity. These systems are constant volume, were installed in 1983, and are in poor condition. Intake dampers have mechanical linkage controls that are in poor condition and assumed not to be functionally operating. An AAON heat recovery unit (HRU) located outside provides ventilation, and it is in good condition. All HVAC equipment is controlled manually.

AHU with Chilled Water and Hot Water Coils

AHU with Chilled Water and Hot Water Coils

Heat Recovery Unit

AHU in Gym

2.6 Heating Hot Water Systems

Two electric heating boilers serve the building heating load. Boiler #1 is located in the first floor mechanical room, and Boiler #2 is located in a second floor book storage room. Boiler #1 is a Brasch Electroduct 240kW hot water boiler, and Boiler #2 is an AO Smith 360kW hot water boiler. Both boilers were installed in 1983 and are in poor condition. These boilers were not accessible during the site inspection, and information is assumed to be the same from a previous energy audit report provided to TRC . Both boilers are required under high-load conditions. The hydronic distribution system is a two-pipe heating only system. Hot water is supplied at 130°F and circulated to HVAC equipment by three 5 hp pumps with constant speed motors. The hot water is delivered to the coils of the five air handling units, the heat recovery make-up air unit, and to numerous ceiling mounted fan coils throughout the building. Pipe insulation is beginning to show signs of wear and should be repaired/replaced in the future.

Hot Water Pumps and Motors

2.7 Chilled Water Systems

The chiller plant consists of a two 100-ton, Trane centrifugal chillers. The chillers are configured in a distribution loop with three primary pumps driven by 5 hp motors. The chilled water and condenser water is pumped at constant flow. The chillers were installed in 1983 and are in poor condition. The pipe insulation is also in poor condition. The condenser water system consists of two Baltimore Air Coil (BAC) cooling towers. Water is circulated to both towers, and there are manual valves that allow only a single tower to operate. Each tower has a 10 hp constant speed fan motor. The pipe insulation is in fair condition.

Chillers

Cooling Towers

Chilled Water Pumps

Condenser Water Pumps and Motors

2.8 HVAC Controls

The HVAC equipment and systems are manually controlled at a panel located in the main mechanical room. There are switches to turn on and off supply air fans, zone occupancy, return fans, exhaust fans, and pumps. The building HVAC controls are in poor condition. The existing level of control is limited, and equipment is turned on and off by custodial staff when there is a call for it from personnel in the building. The site staff expressed an interest in installing an EMS.

Manual HVAC Controls

Manual HVAC Controls

Manual Dial Thermostats for FCUs

HVAC Zones

Manual Dial Thermostats

Thermostat in Poor Condition

2.9 Domestic Hot Water

Hot water is produced with a Bradford White 45 kW storage tank water heater with a 119 gallon storage capacity. This water heater was installed in 2018 and is in good condition. Hot water is also produced by a Bradford White 18 kW storage tank water heater with a 119 gallon storage capacity. This water heater was installed in 2001 and is in fair condition. There is also an AO Smith 18 kW storage tank water heater with a 120 gallon storage capacity that was leaking, turned off, in poor condition, and is no longer operational. Two fractional horsepower circulation pumps distribute water to end uses. The domestic hot water pipes are not insulated.

Domestic Hot Water Heaters and Storage Tanks

High Flow vs. Low Flow Sink Aerator

2.10 Food Service Equipment

The kitchen has all-electric equipment that is used to prepare meals for students. Most cooking is done using ovens, a steamer, and a griddle. Bulk prepared foods are held in a several electric holding cabinet. Equipment is not high efficiency and is in fair condition. The dishwasher is an ENERGY STAR® high-temperature unit. The dishwasher is not currently used.

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

Cooking Equipment

Cooking Equipment

Dishwasher

2.11 Refrigeration

The kitchen has two stand-up refrigerators with solid doors that are in good condition. There is also an energy efficient refrigeration chest in the cafeteria. The walk-in refrigerator has an estimated two ton compressor and a single fan evaporator. The walk-in low temperature freezer an estimated three ton compressor and a two fan evaporator. This walk-in equipment has evaporator fan and defrost controls.

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

Walk-in Freezer

Evaporator

Evaporator

Refrigerator Chest

2.12 Plug Load & Vending Machines

The utility bill analysis indicates that plug loads consume approximately 4 percent of total building energy use. This is lower than a typical building. You seem to already be doing a great job managing your electrical plug loads. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

There are approximately 69 computer work stations throughout the facility as well as a laptop cart of about 32 laptops. Plug loads throughout the building include general cafe and office equipment. There are classroom typical loads such as smart boards, small printers, projectors, and fans. There are several residential style refrigerators throughout the building. These vary in condition and efficiency.

There are three refrigerated beverage vending machines. Vending machines are/not equipped with occupancy-based controls.

Typical Plug Loads

Computers

Drink Vending Machine

Drink Vending Machine

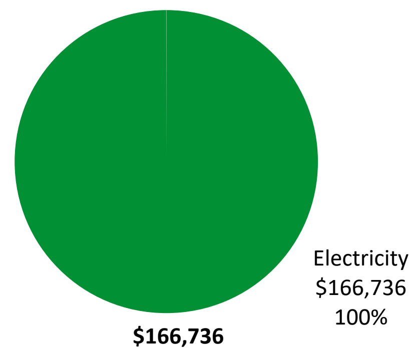
2.13 Water-Using Systems

There are restrooms with toilets, urinals, and sinks throughout the building. Most faucet flow rates are high and rated for 2.0 gallons per minute (gpm) or higher. There are some low flow faucets rated for 0.5 gpm. Showers in the locker rooms are not used. Toilets and urinals vary in rated gallons per flush (gpf).

3 ENERGY USE AND COSTS

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

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	1,548,946 kWh	$166,736
Total		**$166,736**



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.

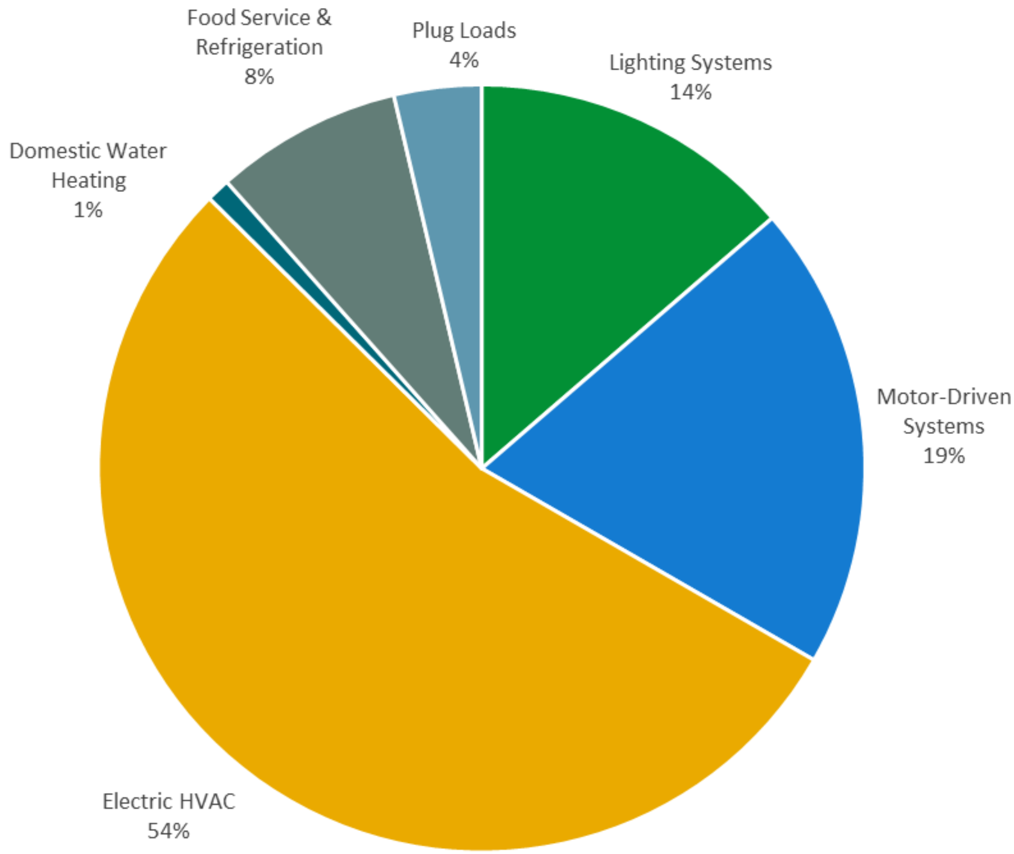
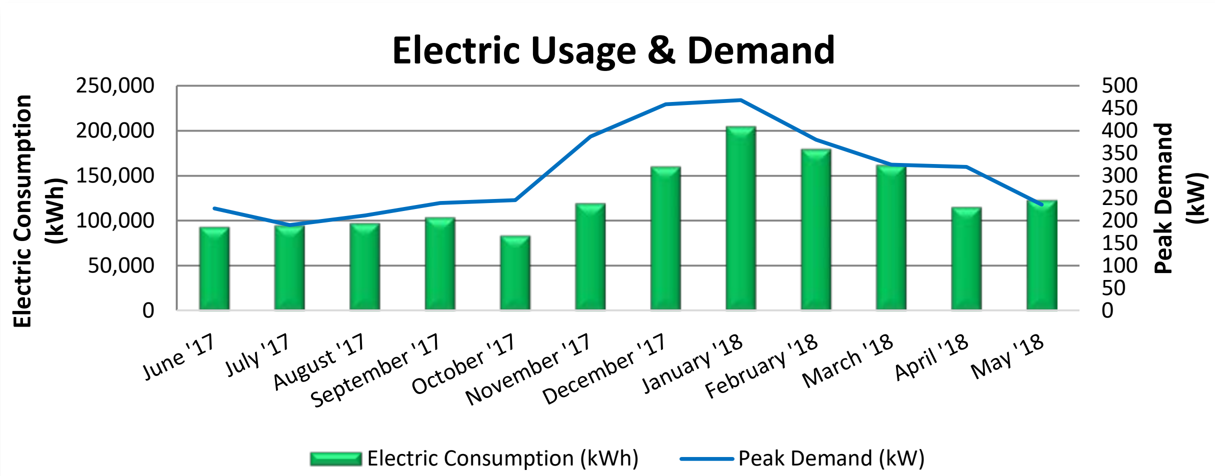


Figure 5 - Energy Balance

3.1 Electricity

PSE&G supplies and delivers electricity under rate class LPLS.



Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**
7/5/17	29	93,533	227	$856	$13,088
8/3/17	29	95,618	190	$716	$9,601
9/4/17	32	97,878	211	$796	$12,389
10/3/17	29	104,396	239	$900	$10,724
11/1/17	29	84,051	246	$925	$9,044
12/3/17	32	119,955	387	$1,458	$13,077
1/4/18	32	160,967	459	$1,731	$17,392
2/2/18	29	205,854	468	$1,763	$19,661
3/6/18	32	180,324	380	$1,432	$17,668
4/5/18	30	162,684	325	$1,223	$15,591
5/4/18	29	115,872	320	$1,204	$12,645
6/5/18	32	123,570	236	$843	$15,399
Totals	**364**	**1,544,702**	**468**	**$13,847**	**$166,279**
Annual	**365**	**1,548,946**	**468**	**$13,885**	**$166,736**

Notes:

- Peak demand of 468 kW occurred in January '18.
- The average electric cost over the past 12 months was $0.108/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.
- The average demand across these twelve months of data is 307 kW.
- Based on the data from the previous energy audit- electrical consumption has increased by 27% since 2014.

3.2 Benchmarking

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

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

Benchmarking Score	**10**

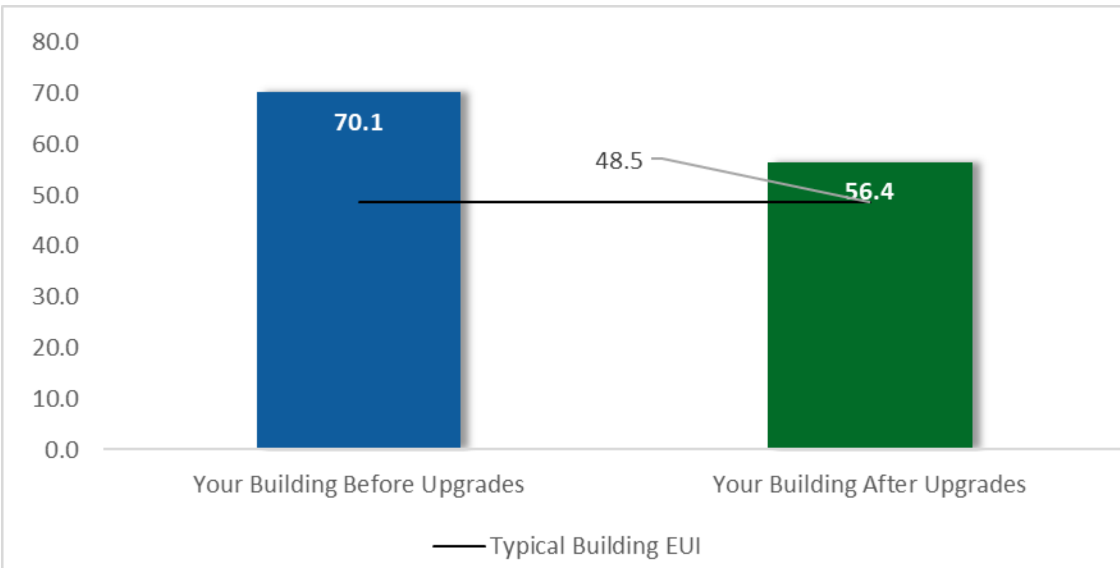


Figure 6 - Energy Use Intensity Comparison

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 the *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		**88,417**	**27.2**	**0**	**$9,518**	**$51,593**	**$12,879**	**$38,714**	**4.1**	**89,035**
ECM 1	Install LED Fixtures	1,796	0.2	0	$193	$3,938	$1,500	$2,438	12.6	1,808
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	10,728	3.9	0	$1,155	$5,894	$150	$5,744	5.0	10,803
ECM 3	Retrofit Fixtures with LED Lamps	75,893	23.1	0	$8,170	$41,761	$11,229	$30,532	3.7	76,424
Lighting Control Measures		**22,340**	**7.1**	**0**	**$2,405**	**$23,110**	**$2,715**	**$20,395**	**8.5**	**22,496**
ECM 4	Install Occupancy Sensor Lighting Controls	18,545	6.7	0	$1,996	$21,110	$2,715	$18,395	9.2	18,674
ECM 5	Install High/Low Lighting Controls	3,795	0.4	0	$409	$2,000	$0	$2,000	4.9	3,822
Motor Upgrades		**7,865**	**1.6**	**0**	**$847**	**$18,834**	**$0**	**$18,834**	**22.2**	**7,920**
ECM 6	Premium Efficiency Motors	7,865	1.6	0	$847	$18,834	$0	$18,834	22.2	7,920
Variable Frequency Drive (VFD) Measures		**84,543**	**14.9**	**0**	**$9,101**	**$54,915**	**$4,440**	**$50,475**	**5.5**	**85,134**
ECM 7	Install VFDs on Constant Volume (CV) Fans	52,488	11.7	0	$5,650	$30,920	$3,240	$27,680	4.9	52,855
ECM 8	Install VFDs on Chilled Water Pumps	15,221	2.8	0	$1,638	$9,828	$0	$9,828	6.0	15,327
ECM 9	Install VFDs on Heating Water Pumps	11,035	1.0	0	$1,188	$6,552	$0	$6,552	5.5	11,112
ECM 10	Install VFDs on Cooling Tower Fans	5,800	-0.5	0	$624	$7,616	$1,200	$6,416	10.3	5,841
Electric Chiller Replacement		**57,364**	**15.6**	**0**	**$6,175**	**$170,637**	**$18,000**	**$152,637**	**24.7**	**57,765**
ECM 11	Install High Efficiency Chillers	57,364	15.6	0	$6,175	$170,637	$18,000	$152,637	24.7	57,765
HVAC System Improvements		**7,293**	**0.0**	**16**	**$939**	**$10,875**	**$0**	**$10,875**	**11.6**	**9,236**
ECM 12	Implement Demand Control Ventilation (DCV)	7,293	0.0	16	$939	$10,875	$0	$10,875	11.6	9,236
Domestic Water Heating Upgrade		**16,108**	**24.3**	**-53**	**$1,232**	**$49,468**	**$1,710**	**$47,758**	**38.7**	**10,040**
ECM 13	Install High Efficiency Gas-Fired Water Heater	15,470	24.3	-53	$1,164	$49,410	$1,710	$47,700	41.0	9,398
ECM 14	Install Low-Flow DHW Devices	638	0.0	0	$69	$57	$0	$57	0.8	642
Food Service & Refrigeration Measures		**6,801**	**0.8**	**0**	**$732**	**$1,600**	**$150**	**$1,450**	**2.0**	**6,849**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	1,966	0.2	0	$212	$910	$0	$910	4.3	1,980
ECM 16	Vending Machine Control	4,836	0.6	0	$521	$690	$150	$540	1.0	4,869
Custom Measures		**577,267**	**170.5**	**-1,697**	**$46,015**	**$290,535**	**$2,867**	**$287,668**	**6.3**	**382,560**
ECM 17	Computer Power Management Software	3,982	0.0	0	$429	$3,535	$0	$3,535	8.2	4,010
ECM 18	Installation of an Energy Management System	125,556	0.0	0	$13,515	$113,000	$0	$113,000	8.4	126,434
ECM 19	Heating System Upgrades	447,729	170.5	-1,697	$32,071	$174,000	$2,867	$171,133	5.3	252,117
TOTALS		**867,999**	**262.0**	**-1,734**	**$76,962**	**$671,567**	**$42,761**	**$628,806**	**8.2**	**671,036**

* - 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		**88,417**	**27.2**	**0**	**$9,518**	**$51,593**	**$12,879**	**$38,714**	**4.1**	**89,035**
ECM 1	Install LED Fixtures	1,796	0.2	0	$193	$3,938	$1,500	$2,438	12.6	1,808
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	10,728	3.9	0	$1,155	$5,894	$150	$5,744	5.0	10,803
ECM 3	Retrofit Fixtures with LED Lamps	75,893	23.1	0	$8,170	$41,761	$11,229	$30,532	3.7	76,424
Lighting Control Measures		**22,340**	**7.1**	**0**	**$2,405**	**$23,110**	**$2,715**	**$20,395**	**8.5**	**22,496**
ECM 4	Install Occupancy Sensor Lighting Controls	18,545	6.7	0	$1,996	$21,110	$2,715	$18,395	9.2	18,674
ECM 5	Install High/Low Lighting Controls	3,795	0.4	0	$409	$2,000	$0	$2,000	4.9	3,822
Motor Upgrades		**7,865**	**1.6**	**0**	**$847**	**$18,834**	**$0**	**$18,834**	**22.2**	**7,920**
ECM 6	Premium Efficiency Motors	7,865	1.6	0	$847	$18,834	$0	$18,834	22.2	7,920
Variable Frequency Drive (VFD) Measures		**84,543**	**14.9**	**0**	**$9,101**	**$54,915**	**$4,440**	**$50,475**	**5.5**	**85,134**
ECM 7	Install VFDs on Constant Volume (CV) Fans	52,488	11.7	0	$5,650	$30,920	$3,240	$27,680	4.9	52,855
ECM 8	Install VFDs on Chilled Water Pumps	15,221	2.8	0	$1,638	$9,828	$0	$9,828	6.0	15,327
ECM 9	Install VFDs on Heating Water Pumps	11,035	1.0	0	$1,188	$6,552	$0	$6,552	5.5	11,112
ECM 10	Install VFDs on Cooling Tower Fans	5,800	-0.5	0	$624	$7,616	$1,200	$6,416	10.3	5,841
HVAC System Improvements		**7,293**	**0.0**	**16**	**$939**	**$10,875**	**$0**	**$10,875**	**11.6**	**9,236**
ECM 12	Implement Demand Control Ventilation (DCV)	7,293	0.0	16	$939	$10,875	$0	$10,875	11.6	9,236
Domestic Water Heating Upgrade		**638**	**0.0**	**0**	**$69**	**$57**	**$0**	**$57**	**0.8**	**642**
ECM 14	Install Low-Flow DHW Devices	638	0.0	0	$69	$57	$0	$57	0.8	642
Food Service & Refrigeration Measures		**6,801**	**0.8**	**0**	**$732**	**$1,600**	**$150**	**$1,450**	**2.0**	**6,849**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	1,966	0.2	0	$212	$910	$0	$910	4.3	1,980
ECM 16	Vending Machine Control	4,836	0.6	0	$521	$690	$150	$540	1.0	4,869
Custom Measures		**577,267**	**170.5**	**-1,697**	**$46,015**	**$290,535**	**$2,867**	**$287,668**	**6.3**	**382,560**
ECM 17	Computer Power Management Software	3,982	0.0	0	$429	$3,535	$0	$3,535	8.2	4,010
ECM 18	Installation of an Energy Management System	125,556	0.0	0	$13,515	$113,000	$0	$113,000	8.4	126,434
ECM 19	Heating System Upgrades	447,729	170.5	-1,697	$32,071	$174,000	$2,867	$171,133	5.3	252,117
TOTALS		**795,164**	**222.1**	**-1,681**	**$69,624**	**$451,520**	**$23,051**	**$428,469**	**6.2**	**603,873**

* - 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		**88,417**	**27.2**	**0**	**$9,518**	**$51,593**	**$12,879**	**$38,714**	**4.1**	**89,035**
ECM 1	Install LED Fixtures	1,796	0.2	0	$193	$3,938	$1,500	$2,438	12.6	1,808
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	10,728	3.9	0	$1,155	$5,894	$150	$5,744	5.0	10,803
ECM 3	Retrofit Fixtures with LED Lamps	75,893	23.1	0	$8,170	$41,761	$11,229	$30,532	3.7	76,424

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

ECM 1: Install LED Fixtures

Replace existing fixtures containing high pressure sodium and compact fluorescent lamps with new LED light fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output.

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

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

Affected building areas: exterior fixtures.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Retrofit fluorescent fixtures in offices that are currently over lit and high bay fixtures in the gymnasium by removing the fluorescent tubes and ballasts and replacing them with LED tubes, LED drivers and retrofit kits (if necessary), which are designed to be used in retrofitted fluorescent fixtures.

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

Affected building areas: office rooms that are over lit with 4-lamp fluorescent fixtures and the gymnasium

ECM 3: Retrofit Fixtures with LED Lamps

Replace fluorescent T8 lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies.

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

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

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**22,340**	**7.1**	**0**	**$2,405**	**$23,110**	**$2,715**	**$20,395**	**8.5**	**22,496**
ECM 4	Install Occupancy Sensor Lighting Controls	18,545	6.7	0	$1,996	$21,110	$2,715	$18,395	9.2	18,674
ECM 5	Install High/Low Lighting Controls	3,795	0.4	0	$409	$2,000	$0	$2,000	4.9	3,822

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

ECM 4: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected building areas: classrooms, offices, conference rooms, gymnasium, library, cafeteria, restrooms, and storage rooms.

ECM 5: Install High/Low Lighting Controls

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

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

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 Motors

#	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)
Motor Upgrades		**7,865**	**1.6**	**0**	**$847**	**$18,834**	**$0**	**$18,834**	**22.2**	**7,920**
ECM 6	Premium Efficiency Motors	7,865	1.6	0	$847	$18,834	$0	$18,834	22.2	7,920

ECM 6: Premium Efficiency Motors

Replace standard efficiency motors with IHP 2014 efficiency motors. This evaluation assumes that existing motors will be replaced with motors of equivalent size and type. In some cases, additional savings may be possible by downsizing motors to better meet the motor's current load requirements.

Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours. The base case motor energy consumption is estimated using the efficiencies found on nameplates or estimated based on the age of the motor and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the current *New Jersey's Clean Energy Program Protocols to Measure Resource Savings*.

This measure is recommended as it is coupled with the variable frequency drive (VFD) measures that follow.

Affected motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Mechanical Room	Condenser Water Pumps	2	Condenser Water Pump	7.5	P-1, P-2
Mechanical Room	Condenser Water Pumps	1	Condenser Water Pump	7.5	P-3
Mechanical Room	Chilled Water Pumps	2	Chilled Water Pump	5.0	P-4, P-5
Mechanical Room	Chilled Water Pumps	1	Chilled Water Pump	5.0	P-6
Mechanical Room	Hot Water Pumps	1	Heating Hot Water Pump	5.0	P-7, P-8
Mechanical Room	Hot Water Pumps	1	Heating Hot Water Pump	5.0	
Cooling Tower	Fans	2	Cooling Tower Fan	10.0	Cooling Tower: BAC Model VTO-078-KC
2nd Floor MER	AHU-1	1	Supply Fan	7.5	Dayton
2nd Floor MER	AHU-2	1	Supply Fan	2.0	Marathon Electric
2nd Floor MER	AHU-3	1	Supply Fan	7.5	
2nd Floor MER	AHU-4	1	Supply Fan	7.5	Baldor
2nd Floor MER	AHU-5	1	Supply Fan	5.0	Marathon Electric
2nd Floor MER	AHU-1	1	Return Fan	3.0	Gould
2nd Floor MER	AHU-2	1	Return Fan	1.0	
2nd Floor MER	AHU-3	1	Return Fan	3.0	
2nd Floor MER	AHU-4	1	Return Fan	3.0	Marathon Electric
2nd Floor MER	AHU-5	1	Return Fan	1.0	

4.4 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		**84,543**	**14.9**	**0**	**$9,101**	**$54,915**	**$4,440**	**$50,475**	**5.5**	**85,134**
ECM 7	Install VFDs on Constant Volume (CV) Fans	52,488	11.7	0	$5,650	$30,920	$3,240	$27,680	4.9	52,855
ECM 8	Install VFDs on Chilled Water Pumps	15,221	2.8	0	$1,638	$9,828	$0	$9,828	6.0	15,327
ECM 9	Install VFDs on Heating Water Pumps	11,035	1.0	0	$1,188	$6,552	$0	$6,552	5.5	11,112
ECM 10	Install VFDs on Cooling Tower Fans	5,800	-0.5	0	$624	$7,616	$1,200	$6,416	10.3	5,841

Variable frequency drives control motors for fans, pumps, and process equipment based on the actual output required of the driven equipment. Energy savings result from more efficient control of motor energy usage when equipment operates at partial load. The magnitude of energy savings depends on the estimated amount of time that the motor would operate at partial load. For equipment with proposed VFDs, we have included replacing the controlled motor with a new motor —unless the existing motor meets or exceeds IHP 2014 standards—to conservatively account for the cost of an inverter duty rated motor. The savings and cost associated with the new motor are presented with the Premium Efficiency Motor measures. If the proposed VFD measure is not selected for implementation the motor replacement should be reevaluated.

ECM 7: 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.

ECM 8: Install VFDs on Chilled Water Pumps

Install VFDs to control chilled water pumps. Two-way valves must serve the chilled water coils being served 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.

ECM 9: Install VFDs on Heating Water Pumps

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

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

ECM 10: Install VFDs on Cooling Tower Fans

Install a VFD to control the cooling tower fan motors. The VFD will allow the cooling tower fans 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.

4.5 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		**57,364**	**15.6**	**0**	**$6,175**	**$170,637**	**$18,000**	**$152,637**	**24.7**	**57,765**
ECM 11	Install High Efficiency Chillers	57,364	15.6	0	$6,175	$170,637	$18,000	$152,637	24.7	57,765

Replacing the chillers has a long payback based on energy savings and may not be justifiable based simply on energy considerations. However, the chiller has reached 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 chillers are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

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. 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.

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		**7,293**	**0.0**	**16**	**$939**	**$10,875**	**$0**	**$10,875**	**11.6**	**9,236**
ECM 12	Implement Demand Control Ventilation (DCV)	7,293	0.0	16	$939	$10,875	$0	$10,875	11.6	9,236

ECM 12: 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 excessive fan motor usage as well as 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, system air flow, outside air reduction, and other factors. Energy savings results from eliminating unnecessary ventilation and space conditioning.

Affected building areas: air handling units serving the classrooms, gymnasium, cafeteria, library, and art rooms.

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		**16,108**	**24.3**	**-53**	**$1,232**	**$49,468**	**$1,710**	**$47,758**	**38.7**	**10,040**
ECM 13	Install High Efficiency Gas-Fired Water Heater	15,470	24.3	-53	$1,164	$49,410	$1,710	$47,700	41.0	9,398
ECM 14	Install Low-Flow DHW Devices	638	0.0	0	$69	$57	$0	$57	0.8	642

Replacing the domestic hot water storage tanks in the main mechanical room and replacing the electric storage tank water heater in the remote mechanical room with high efficiency condensing gas fired storage tank heaters has a long payback and may not be justifiable based simply on energy considerations. However, the current systems are nearing the end of their normal useful life and not currently properly sized for the current office building needs.

ECM 13: Install High Efficiency Gas-Fired Water Heater

Replace the existing tank water heaters with high efficiency tank water heaters. Energy savings result from the increased efficiency of the unit, which uses less gas to heat water, and fewer operating hours to maintain the tank water temperature. Note that the installation costs assume that a properly sized gas line has been provided to the point of connections.

ECM 14: Install Low-Flow DHW Devices

Install low-flow devices to reduce overall hot water demand. The following are low flow rates for devices. We are recommended to reduce hot water usage by replacing faucet aerators in restrooms.

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		**6,801**	**0.8**	**0**	**$732**	**$1,600**	**$150**	**$1,450**	**2.0**	**6,849**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	1,966	0.2	0	$212	$910	$0	$910	4.3	1,980
ECM 16	Vending Machine Control	4,836	0.6	0	$521	$690	$150	$540	1.0	4,869

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 refrigeration equipment. Fractional horsepower EC motors are significantly more efficient than mechanically commutated, brushed motors, particularly at low speeds or partial load. By using variable-speed technology, EC motors can optimize fan usage. Because these motors are brushless and use DC power, losses due to friction and phase shifting are eliminated.

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

ECM 16: Vending Machine Control

Vending machines operate continuously, even during unoccupied hours. Install occupancy sensor controls to reduce energy use. These controls power down vending machines when the vending machine area has been vacant for some time, and, they power up the machines at necessary regular intervals or when the surrounding area is occupied. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines.

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		**577,267**	**170.5**	**-1,697**	**$46,015**	**$290,535**	**$2,867**	**$287,668**	**6.3**	**382,560**
ECM 17	Computer Power Management Software	3,982	0.0	0	$429	$3,535	$0	$3,535	8.2	4,010
ECM 18	Installation of an Energy Management System	125,556	0.0	0	$13,515	$113,000	$0	$113,000	8.4	126,434
ECM 19	Heating System Upgrades	447,729	170.5	-1,697	$32,071	$174,000	$2,867	$171,133	5.3	252,117

ECM 17: Computer Power Management Software

We evaluated the implementation of computer power management software at a high level. The computing environment in most school and office facilities includes desktops, which are typically left on over nights, weekends, and holidays. Screen savers are commonly confused as a power management strategy. This contributes to excessive electrical energy consumption, which may be avoided by proper management. There are innovative software packages available in the market today that are designed to deliver significant energy saving and provide ongoing tracking measurements.

Operational and maintenance benefits are captured through the use of a central power management platform where issues may be diagnosed, and problematic devices may be isolated. Energy savings policies may be enforced as well as identifying and eliminating underutilized devices. This measure investigates the potential benefits to implementing computer power management software to better match the energy use to user needs.

This measure in effort to increase the plug load management of the school district was of interest for facility personnel. Further analysis should be conducted for the feasibility of this measure. An entire baseline tracking of existing computing fleet energy use would need to be performed to optimize proposed software strategies. This would need to be implemented in conjunction with the IT department. This is not an investment grade analysis nor should be used as a basis for design and construction.

ECM 18: Installation of an Energy Management System

The installation of the existing Energy Management System (EMS) would increase the efficiency of the building HVAC system operation. This evaluation is provided at a high level as it is of great interest for facility personnel.

Upgrade of controls to optimize the start/stop of all key HVAC equipment and tying in all space temperature controls will minimize the amount of wasted energy. Schedules may be put in place to limit system operation when the building is closed. Temperature set back controls may be applied to operate systems only to the point necessary. Ventilation and economizer controls and programming would allow air handling units to operate according to room schedules, occupancy, and availability for “free cooling” or “free heating”.

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

ECM 19: Heating System Upgrades

Replacement of the older inefficient electric boilers with natural gas fired, high efficiency condensing hot water boilers was of interest to facility personnel. The heating system upgrade was evaluated at a high level. Energy savings results from improved combustion efficiency and reduced standby losses at low loads. Further analysis should be conducted for the feasibility of this measure. For the purposes of this analysis, we evaluated the heating system upgrade based on the existing capacity of the boiler plant. As noted, this does not include costs associated with gas supply to the building.

The most notable efficiency improvement is an upgrade to 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, project design should evaluate whether the system return water temperature can be held to 130°F or below in the new boiler configuration.

If the overall boiler plant capacity could be reduced, this measure may be even more cost effective. It is the recommended that reconfiguring the boiler plant be further evaluated. This is not an investment grade analysis, nor should be used as a basis for design and construction. Modular boilers with input ratings of 1,000 to 2,000 kBtu/hr are readily available. Configuring a boiler plant around several modular boilers provides several advantages. The first is that the overall system operates better at low load conditions since only one or two modular boilers are operating at full load rather than one large boiler operating inefficiently at low load. A typical modular boiler plant for a school of this size will generally use three to five boilers which provides better redundancy than a plant with two large boilers. Finally, three to five modular boilers will often take less space than two old large boilers.

Additional Considerations: If the school district moves forward toward implementation of a comprehensive project under the Energy Savings Improvement Program (ESIP), we would recommend including this measure. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load. In many cases installing multiple modular boilers rather than one or two large boilers will result in higher overall plant efficiency while providing additional system redundancy.

This is a fuel switching project. TRC recommends that the District review cost projections for natural gas and electricity, including an evaluation whether to pursue on-site generation as a means of controlling their cost of electricity.

This project does not address the electric resistance unit heaters and supplemental duct heaters. Additional cost and savings would be associated with converting these additional heat sources to natural gas. Other forms of electrically generated heat, such as heat pumps, are more efficient than resistance heating apparatus and could be considered as part of the overall upgrade.

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.

Weatherization

Caulk or weather strip leaky doors and windows to reduce drafts and loss of heated or cooled air. Sealing cracks and openings can reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

Doors and Windows

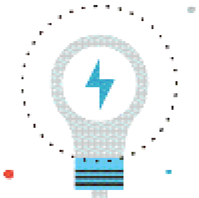
Close exterior doors and windows in heated and cooled areas. Leaving doors and windows open leads to a loss of heat during the winter and chilled air during the summer. Reducing air changes per hour (ACH) can lead to increased occupant comfort as well as heating and cooling savings, especially when combined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

Window Treatments/Coverings

Use high-reflectivity films or cover windows with shades or shutters to reduce solar heat gain and reduce the load on cooling and heating systems. Older, single pane windows and east or west-facing windows are especially prone to solar heat gain. In addition, use shades or shutters at night during cold weather to reduce heat loss.

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

Lighting Maintenance



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

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

Motor Controls

Electric motors often run unnecessarily, and this is an overlooked opportunity to save energy. These motors should be identified and turned off when appropriate. For example, exhaust fans often run unnecessarily when ventilation requirements are already met. Whenever possible, use automatic devices such as twist timers or occupancy sensors to turn off motors when they are not needed.

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.

Destratification Fans

For areas with high ceilings, destratification fans f air balance the air temperature from floor to ceiling. They help reduce the recovery time needed to warm the space after nightly temperature setbacks and will increase occupants’ the comfort level.

Areas with high ceilings require the heating system to heat a larger volume of space than that which is occupied. As the warm air rises, the warmest space is at the ceiling level, rather than floor level. Higher temperatures at the ceiling accelerate heat loss through the roof, which requires additional energy consumption by the heating equipment to compensate for this accelerated heat transfer.

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

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

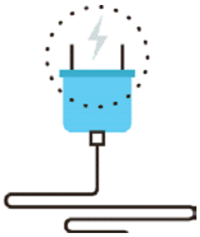
Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to keeping the heating system running efficiently and preventing expensive repairs. Annual tune-ups should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is 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.

Computer Power Management Software

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

Water Conservation

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

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

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

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

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

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

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

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

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 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 reduction, 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 a 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.

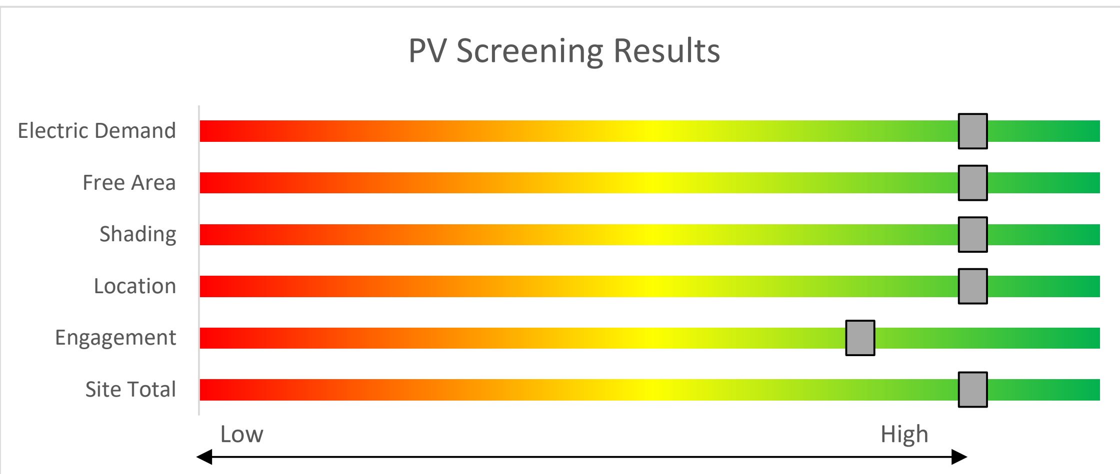

Figure 9 - Photovoltaic Screening

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

6.2 Combined Heat and Power

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

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

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

A preliminary screening based on heating and electrical demand, siting, and interconnection shows that the facility has no potential for installing a cost-effective CHP system. The building does not currently have gas service, and therefore, does not meet the minimum requirements for a cost-effective CHP installation.

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.

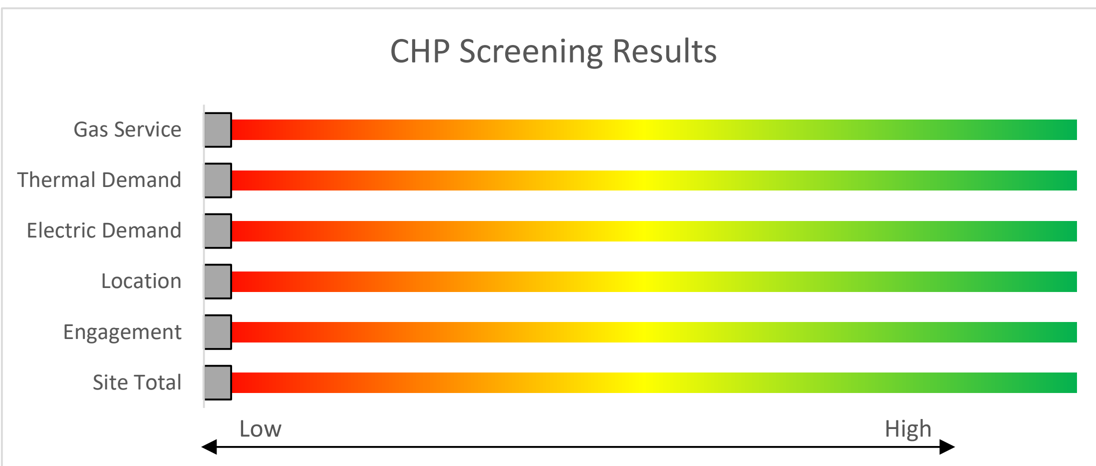

Figure 10 - Combined Heat and Power Screening

7 Project Funding and Incentives

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

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
Vestibule	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	3	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	8,760	0.0	412	0	$44	$145	$20	2.8
Main Office	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	O	114	2,464	2, 4	Relamp & Reballast	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,700	0.6	1,688	0	$182	$1,249	$125	6.2
Principal Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.2	591	0	$64	$408	$100	4.8
Conference Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.2	591	0	$64	$408	$100	4.8
Mechanical Room	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.2	593	0	$64	$329	$90	3.7
Locker Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.0	132	0	$14	$73	$20	3.7
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.0	132	0	$14	$73	$20	3.7
Locker Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.0	132	0	$14	$73	$20	3.7
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.0	132	0	$14	$73	$20	3.7
Kitchen	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3	Relamp	No	12	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,464	0.5	1,341	0	$144	$876	$240	4.4
Locker Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.0	66	0	$7	$37	$10	3.7
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,464	0.0	32	0	$3	$33	$6	7.7
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.0	66	0	$7	$37	$10	3.7
Pantry	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,464	0.0	112	0	$12	$73	$20	4.4
Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,232	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,232	0.0	66	0	$7	$73	$20	7.5
Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,232	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,232	0.0	33	0	$4	$37	$10	7.5
Cafeteria	42	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	42	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	2.2	6,201	0	$668	$4,147	$980	4.7
Stage	6	LED Screw-In Lamps: Screw in Lamp	Wall Switch	S	9	1,232		None	No	6	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	1,232	0.0	0	0	$0	$0	$0	0.0
Stage	6	Compact Fluorescent: Screw in Lamp	Wall Switch	S	13	1,232		None	No	6	Compact Fluorescent: Screw in Lamp	Wall Switch	13	1,232	0.0	0	0	$0	$0	$0	0.0
2nd Floor Mechanical	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3	Relamp	No	9	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,464	0.4	1,006	0	$108	$657	$180	4.4
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,464	0.0	32	0	$3	$33	$6	7.7
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,464	0.0	32	0	$3	$33	$6	7.7
Book Room 108	6	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,700	0.1	263	0	$28	$380	$65	11.1
Waiting Room 106	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	O	114	2,464	2	Relamp & Reballast	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.1	339	0	$37	$218	$20	5.4
Nurse's Office 105	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.3	886	0	$95	$708	$155	5.8

	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
Resting Room	3	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	616	3	Relamp	No	3	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	616	0.0	24	0	$3	$98	$18	30.9
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,464	0.0	32	0	$3	$33	$6	7.7
Stairs	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	234	0	$25	$37	$10	1.1
Dance Room 112	12	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,464	3, 4	Relamp	Yes	12	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,700	0.2	509	0	$55	$660	$107	10.1
Community Entrance	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	468	0	$50	$73	$20	1.1
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.0	132	0	$14	$73	$20	3.7
Hallway	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	468	0	$50	$73	$20	1.1
Elevator Machine Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,464	3	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,464	0.0	35	0	$4	$18	$5	3.5
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	None	29	2,464	0.0	132	0	$14	$73	$20	3.7
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	None	29	2,464	0.0	132	0	$14	$73	$20	3.7
Home Economics Classroom 124	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$1,287	$215	7.5
Lounge	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.3	886	0	$95	$708	$155	5.8
Classroom 125	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 125B	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.3	886	0	$95	$708	$155	5.8
Supply Rooms (3 Total)	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.1	198	0	$21	$110	$30	3.7
Classroom 130	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.3	886	0	$95	$708	$155	5.8
Classroom 131	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.3	886	0	$95	$708	$155	5.8
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	None	29	2,464	0.0	132	0	$14	$73	$20	3.7
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	None	29	2,464	0.0	132	0	$14	$73	$20	3.7
Custodial Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,464	3	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,464	0.0	35	0	$4	$18	$5	3.5
Gym Entrance	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	234	0	$25	$37	$10	1.1
Gymnasium	20	Linear Fluorescent - T5HO: 4' T5HO (54W) - 6L	Wall Switch	U	358	2,464	2, 4	Relamp & Reballast	Yes	20	LED - Linear Tubes: (6) 4' T5HO (25W) Lamps	Occupancy Sensor	153	1,700	3.6	10,076	0	$1,085	$8,663	$700	7.3
Storage Rooms (2 Total)	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,464	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,464	0.1	263	0	$28	$146	$40	3.7
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	O	114	2,464	2, 4	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,700	0.1	375	0	$40	$334	$40	7.3
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	O	114	2,464	2, 4	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,700	0.1	375	0	$40	$334	$40	7.3

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	None	29	2,464	0.0	66	0	$7	$37	$10	3.7
Locker Room / Storage	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,700	0.2	503	0	$54	$489	$60	7.9
Locker Room / Storage	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,700	0.2	503	0	$54	$489	$60	7.9
First Floor Hallway	43	Linear Fluorescent - T8: 4' T8 (32W) - 1L	None	S	32	8,760	3, 5	Relamp	Yes	43	LED - Linear Tubes: (1) 4' Lamp	High/Low Control	15	6,044	0.7	6,711	0	$722	$1,585	$215	1.9
Vestibule near Gym	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	3	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	8,760	0.0	412	0	$44	$145	$20	2.8
Classroom 143	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.6	1,772	0	$191	$1,146	$275	4.6
Classroom 144	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 145	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.6	1,772	0	$191	$1,146	$275	4.6
Classroom 146	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 147	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 148	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 149	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.6	1,772	0	$191	$1,146	$275	4.6
Classroom 150	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 151	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 152	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Second Floor Hallway	38	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	8,760	3, 5	Relamp	Yes	38	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	6,044	1.1	11,322	0	$1,219	$2,588	$380	1.8
Stairwells	7	Linear Fluorescent - T8: 4' T8 (32W) - 1L	None	S	32	8,760	3	Relamp	No	7	LED - Linear Tubes: (1) 4' Lamp	None	15	8,760	0.1	869	0	$94	$128	$35	1.0
Stairwells	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	8,760	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	None	29	8,760	0.0	234	0	$25	$37	$10	1.1
Classroom 223	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 224	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 225	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 226	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 227	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 234	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 235	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Classroom 236	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 237	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 238	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 239	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 240	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 242	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 243	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Classroom 234	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.5	1,329	0	$143	$927	$215	5.0
Storage Room - Locked	18	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,232	3	Relamp	No	18	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,232	0.7	1,006	0	$108	$1,315	$360	8.8
Library	34	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	34	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	1.8	5,020	0	$540	$3,563	$820	5.1
Workroom	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.2	591	0	$64	$408	$100	4.8
Workroom	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.2	591	0	$64	$408	$100	4.8
Workroom	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.2	591	0	$64	$408	$100	4.8
Computer Lab	14	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	14	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.7	2,067	0	$223	$1,292	$315	4.4
Art Room - Locked	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.3	886	0	$95	$708	$155	5.8
Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,464	0.0	112	0	$12	$73	$20	4.4
Teacher's Lounge	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.2	591	0	$64	$408	$100	4.8
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,464	0.0	32	0	$3	$33	$6	7.7
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,464	0.0	32	0	$3	$33	$6	7.7
Hallway	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	8,760	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	8,760	0.0	397	0	$43	$73	$20	1.2
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.1	295	0	$32	$446	$40	12.8
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.1	295	0	$32	$446	$40	12.8
Custodial Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,464	3	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,464	0.0	35	0	$4	$18	$5	3.5
Security Offices	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,464	3	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,464	0.0	64	0	$7	$65	$12	7.7
Security Offices	5	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	5	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.3	738	0	$79	$635	$135	6.3

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.1	295	0	$32	$416	$75	10.7
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.1	295	0	$32	$262	$60	6.4
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.1	295	0	$32	$262	$60	6.4
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.1	295	0	$32	$262	$60	6.4
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.1	295	0	$32	$262	$60	6.4
Workroom 213	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.2	591	0	$64	$408	$100	4.8
Workroom 214	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.2	591	0	$64	$408	$100	4.8
Workroom 228	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.3	886	0	$95	$554	$140	4.3
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.1	295	0	$32	$446	$40	12.8
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.1	295	0	$32	$446	$40	12.8
Storage Room - Locked	6	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,700	0.1	263	0	$28	$380	$65	11.1
Dance Room 223	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,464	3, 4	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,700	0.3	886	0	$95	$708	$155	5.8
Dance Room 223	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,464	3	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,464	0.0	32	0	$3	$33	$6	7.7
Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,464	3	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,464	0.0	70	0	$8	$37	$10	3.5
Exterior	10	Compact Fluorescent: Wall Pack Fixture	Timeclock	S	26	4,380	1	Fixture Replacement	No	10	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	18	4,380	0.0	350	0	$38	$2,063	$1,000	28.2
Exterior	5	High-Pressure Sodium: (1) 70W Lamp	Timeclock	S	95	4,380	1	Fixture Replacement	No	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	29	4,380	0.2	1,445	0	$156	$1,875	$500	8.8
Exterior	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	S	29	4,380		None	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	29	4,380	0.0	0	0	$0	$0	$0	0.0
Transition Spaces	24	Exit Signs: LED - 2 W Lamp	None	S	6	8,760		None	No	24	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0

Motor Inventory & Recommendations

		Existing Conditions							Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	Condenser Water Pumps	2	Condenser Water Pump	7.5	88.5%	No	W	3,391	6	Yes	91.0%	No		0.2	883	0	$95	$2,263	$0	23.8
Mechanical Room	Condenser Water Pumps	1	Condenser Water Pump	7.5	88.5%	No	W	4,000	6	Yes	91.0%	No		0.1	521	0	$56	$1,131	$0	20.2
Mechanical Room	Chilled Water Pumps	2	Chilled Water Pump	5.0	88.5%	No	W	2,745	6, 8	Yes	89.5%	Yes	2	1.9	8,852	0	$953	$8,152	$0	8.6
Mechanical Room	Chilled Water Pumps	1	Chilled Water Pump	5.0	85.5%	No	W	4,000	6, 8	Yes	89.5%	Yes	1	1.0	7,070	0	$761	$4,076	$0	5.4
Mechanical Room	Hot Water Pumps	1	Heating Hot Water Pump	5.0	85.5%	No	W	2,745	6, 9	Yes	89.5%	Yes	1	0.6	4,852	0	$522	$4,076	$0	7.8
Mechanical Room	Hot Water Pumps	1	Heating Hot Water Pump	5.0	85.5%	No	W	4,000	6, 9	Yes	89.5%	Yes	1	0.6	7,070	0	$761	$4,076	$0	5.4
Cooling Tower	Fans	2	Cooling Tower Fan	10.0	89.5%	No	W	3,391	6, 10	Yes	91.7%	Yes	2	-0.3	6,715	0	$723	$10,750	$1,200	13.2
Mechanical Room	DHW Circ Pumps	2	Water Supply Pump	0.1	74.0%	No	W	2,745		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
2nd Floor MER	AHU-1	1	Supply Fan	7.5	87.5%	No	W	4,000	6, 7	Yes	91.0%	Yes	1	2.3	10,255	0	$1,104	$4,738	$600	3.7
2nd Floor MER	AHU-2	1	Supply Fan	2.0	89.5%	No	W	4,000	6, 7	Yes	89.5%	Yes	1	0.6	2,501	0	$269	$3,261	$160	11.5
2nd Floor MER	AHU-3	1	Supply Fan	7.5	87.5%	No	W	4,000	6, 7	Yes	91.0%	Yes	1	2.3	10,255	0	$1,104	$4,738	$600	3.7
2nd Floor MER	AHU-4	1	Supply Fan	7.5	88.5%	No	W	4,000	6, 7	Yes	91.0%	Yes	1	2.2	9,952	0	$1,071	$4,738	$600	3.9
2nd Floor MER	AHU-5	1	Supply Fan	5.0	85.5%	No	W	4,000	6, 7	Yes	89.5%	Yes	1	1.5	7,070	0	$761	$4,076	$400	4.8
2nd Floor MER	AHU-1	1	Return Fan	3.0	76.9%	No	W	4,000	6, 7	Yes	89.5%	Yes	1	1.1	5,472	0	$589	$3,884	$240	6.2
2nd Floor MER	AHU-2	1	Return Fan	1.0	76.9%	No	W	4,000	6, 7	Yes	85.5%	Yes	1	0.3	1,719	0	$185	$3,010	$80	15.8
2nd Floor MER	AHU-3	1	Return Fan	3.0	89.5%	No	W	4,000	6, 7	Yes	89.5%	Yes	1	0.9	3,751	0	$404	$3,884	$240	9.0
2nd Floor MER	AHU-4	1	Return Fan	3.0	89.5%	No	W	4,000	6, 7	Yes	89.5%	Yes	1	0.9	3,751	0	$404	$3,884	$240	9.0
2nd Floor MER	AHU-5	1	Return Fan	1.0	76.9%	No	W	4,000	6, 7	Yes	85.5%	Yes	1	0.3	1,719	0	$185	$3,010	$80	15.8
Classrooms/Offices	Unit Ventilators	52	Supply Fan	0.2	74.0%	No	W	4,000		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Building	Exhaust	5	Exhaust Fan	0.3	74.0%	No	W	4,000		No	74.0%	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
Outdoors	AAON HRU	1	Supply Fan	10.0	91.7%	No	W	4,000		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0

Electric HVAC Inventory & Recommendations

		Existing Conditions					Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room - Locked	Space Heating Electric Boiler	1	Electric Resistance Heat		819.12	B		No							0.0	0	0	$0	$0	$0	0.0
Boiler Room - Locked	Space Heating Electric Boiler	1	Electric Resistance Heat		1,228.68	B		No							0.0	0	0	$0	$0	$0	0.0
2nd Floor MER	AHU-1	1	Electric Resistance Heat		238.91	B		No							0.0	0	0	$0	$0	$0	0.0
2nd Floor MER	AHU-2	1	Electric Resistance Heat		63.14	B		No							0.0	0	0	$0	$0	$0	0.0
2nd Floor MER	AHU-3	1	Electric Resistance Heat		238.91	B		No							0.0	0	0	$0	$0	$0	0.0
2nd Floor MER	AHU-4	1	Electric Resistance Heat		97.27	B		No							0.0	0	0	$0	$0	$0	0.0
2nd Floor MER	AHU-5	1	Electric Resistance Heat		63.14	B		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
Mechanical Room	Space Cooling System	1	Water-Cooled Reciprocating Chiller	100.00	B	NR	Yes	1	Air-Cooled Centrifugal Chiller	Variable	100.00	1.24	0.74	7.8	28,682	0	$3,087	$85,318	$9,000	24.7
Mechanical Room	Space Cooling System	1	Water-Cooled Reciprocating Chiller	100.00	B	NR	Yes	1	Air-Cooled Centrifugal Chiller	Variable	100.00	1.24	0.74	7.8	28,682	0	$3,087	$85,318	$9,000	24.7

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
2nd Floor MER	AHU-1	11	2.00	17.03	238.91	348.77	0.0	2,484	6	$320	$2,719	$0	8.5
2nd Floor MER	AHU-2	11	1.00	4.50	63.14	92.18	0.0	657	1	$84	$1,359	$0	16.1
2nd Floor MER	AHU-3	11	2.00	17.03	238.91	348.77	0.0	2,484	6	$320	$2,719	$0	8.5
2nd Floor MER	AHU-4	11	2.00	6.93	97.27	142.00	0.0	1,011	2	$130	$2,719	$0	20.9
2nd Floor MER	AHU-5	11	1.00	4.50	63.14	92.18	0.0	657	1	$84	$1,359	$0	16.1

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
Mechanical Room	Domestic Hot Water	1	Storage Tank Water Heater (> 50 Gal)	B	NR	Yes	1	Storage Tank Water Heater (> 50 Gal)	Natural Gas	92.00%	Et	5.4	0	0	$0	$16,470	$570	0.0
Mechanical Room	Domestic Hot Water - Kitchen	1	Storage Tank Water Heater (> 50 Gal)	N	NR	Yes	1	Storage Tank Water Heater (> 50 Gal)	Natural Gas	92.00%	Et	13.5	10,313	-35	$776	$16,470	$570	20.5
Mechanical Room	Domestic Hot Water	1	Storage Tank Water Heater (> 50 Gal)	W	NR	Yes	1	Storage Tank Water Heater (> 50 Gal)	Natural Gas	92.00%	Et	5.4	5,157	-18	$388	$16,470	$570	41.0

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	12	3	Faucet Aerator (Lavatory)	2.00	0.50	0.0	221	0	$24	$22	$0	0.9
Restrooms	12	5	Faucet Aerator (Lavatory)	2.20	0.50	0.0	417	0	$45	$36	$0	0.8

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	Low Temp Freezer (-35F to -5F)	13	Yes	No	No	0.1	983	0	$106	$607	$0	5.7
Kitchen	1	Cooler (35F to 55F)	13	Yes	No	No	0.1	983	0	$106	$303	$0	2.9

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	2	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	No		No	0.0	0	0	$0	$0	$0	0.0
Cafeteria	1	Refrigerator Chest	Yes		No	0.0	0	0	$0	$0	$0	0.0

Cooking Equipment Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	High Efficiency Equipement?	ECM #	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Electric Convection Oven (Full Size)	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Combination Oven/Steam Cooker (15 - 28 Pans)	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Griddle (4 Feet Width)	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Steamer	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (Full Size)	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?
School	69	Computers	120.0	
School	1	Laptop Cart	2,160.0	
School	26	Fan	100.0	
School	3	Mini Fridge	260.0	
School	29	Smart Board / Projector	300.0	
School	39	Small Office Printers	50.0	
School	3	Large Xerox- Type Printers	515.0	
School	2	Coffee Maker	400.0	
School	4	Microwave	1,100.0	
School	2	Residential Refrigerator	690.0	
School	1	Electric Stove	1,500.0	
School	3	Mini Fridge	260.0	
School	14	Water Dispenser	300.0	
School	2	Large Speakers	500.0	
School	1	Misc. Kitchen Equipment	2,500.0	
School	1	Misc. IT Equipment	4,500.0	

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Cafeteria	1	Refrigerated	14	Yes	0.2	1,612	0	$174	$230	$50	1.0
Lounge	1	Refrigerated	14	Yes	0.2	1,612	0	$174	$230	$50	1.0
Lounge	1	Refrigerated	14	Yes	0.2	1,612	0	$174	$230	$50	1.0

Custom Recommendations (High Level Screening)

Computer Power Management Software

# of Desktops	Normal Running Mode					Idle Running Mode					Suspended/Off Mode				
69	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	Weekends & Holidays	Energy Rate (W)*	Weekly Run Hours	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	Weekends & Holidays	Energy Rate (W)*	Weekly Run Hours	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	Weekends & Holidays	Energy Rate (W)*	Weekly Run Hours
Existing Conditions	25%	5%	5%	120	17	5%	5%	5%	80	47	70%	90%	90%	5	142
Proposed Conditions	25%	0%	0%	120	11	0%	0%	0%	80	38	75%	100%	100%	5	157

Usage per Device			Energy Impact & Financial Analysis					
Weeks of Use	Annual kWh Usage	Diversity Factor**	Total Annual kWh Savings	Total Annual Energy Cost Savings	Cost per Desktop	Add'l Hardware Cost	Total Installation Cost	Simple Payback Period (Years)
44	290	90%	3,982	$429	$15.00	$2,500	$3,535	8.2
44	232							

Installation of an Energy Management System

Existing Conditions				Proposed Conditions			Energy Impact & Financial Analysis					
Annual Electric HVAC Energy Use (kWh)	Annual Heating Gas Use (mmBtu)	Annual Heating Oil Use (mmBtu)	Annual Motor HVAC Energy Use (kWh)	Assumed % Heating/ Cooling Savings		Assumed % Motor Savings	Total Annual kWh Savings	Total Annual Gas mmBtu Savings	Total Annual Fuel mmBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Simple Payback Period (Years)
842,465	0.0	0.0	305,749	12%		8%	125,556	0	0	$13,515	$113,000	8.4

Equations: (Based on Industry Standards)
Average Cost for EMS installation is $1.50/sqft
Based on a comprehensive study by the Environmental Protection Agency, Energy savings range between 10% and 30%.
The HVAC systems should have proper temperature set backs and operate according to occupancy schedules.
Air-handling units should be equipped with outdoor air damper controls and CO2 sensors to provide demand control ventilation.
HVAC Improvements revealed through a RCx study should be included within this measure.
Examples are as follows: Check Valve and Damper Operation, Economizer Controls, Temperature and Humidity Sensors, CO2 Sensors, etc.
The building currently has little to no funcional control for HVAC equipment and systems. This is a critical maintenance confrn/facility concern.

Heating System Upgrades

Replace Electric Boilers with High Efficiency Gas Boilers

Existing Conditions					Proposed Conditions					Energy Impact & Financial Analysis					
Annual Electric HVAC Demand (kW)	*Heating Capacity Total (MBH)*	*Estimated Heating EFLH*	*Annual Electric HVAC Energy Use (kWh)*	*Annual Electric HVAC Energy Costs ($)*	Average Heating Efficiency	Heating Capacity Total (MBH)	Estimated Heating EFLH	Annual Gas HVAC Energy Use (mmBtu)	Annual Gas HVAC Energy Costs ($)	Total Annual kWh Savings	Total Annual Gas mmBtu Savings	Total Annual Energy Cost Savings	Estimated Installation Cost	Estimated Incentive	Simple Payback Period (Years)
171	2,047.8	749.7	447,729	$48,196	90%	2,047.8	749.7	1,697	$16,125	447,729	-1,697	$32,071	$174,000	$2,867	5.3

Equations: (Based on Industry Standards)

Estimated Costs based on RS Means and includes material and labor ($46.7/MBH) plus $4000 for extension of gas supply lines

Estimated Costs include an increase of 40% engineering services and 25% contingency above what is stated above

Estimated Costs DO NOT INCLUDE costs for asbestos abatement or natural gas supply service installations

Estimated Incentive is based on SS program and evaluated at $1.40/MBH

Further analysis should be conducted for the feasibility of this measure. This is not an invvestment grade analysis or should be used as a basis for design and construction.

Existing Electric Savings is equal to the estimated electric use for heating boilers as seen in the ElecHVAC section and based on the blended average rate for electric

Proposed Gas Consumption is based on the same estimated annual full load run hours in the existing case multipled by the estimated heating load of the building

Proposed boilers are natural gas fired, high efficiency condensing hot water boilers

Proposed gas costs are based on an average rate of $9.50/mmBtu

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

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

LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

10

ENERGY STAR® Score[1]

Dr. E. Alma Flagg Elementary School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 75,406
Built: 1984

For Year Ending: May 31, 2018
Date Generated: February 14, 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
Dr. E. Alma Flagg Elementary School 150 3rd St. Newark, New Jersey 07104	_______________ , (___)___-_____	____ ________ , (___)___-_____ _______________

Property ID: 3877121

Energy Consumption and Energy Use Intensity (EUI)

Site EUI	Annual Energy by Fuel		National Median Comparison	
69.6 kBtu/ft²	Electric - Grid (kBtu)	5,247,730 (100%)	National Median Site EUI (kBtu/ft²)	43.7
			National Median Source EUI (kBtu/ft²)	122.5
			% Diff from National Median Source EUI	59%
Source EUI			**Annual Emissions**	
194.9 kBtu/ft²			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.