Local Government Energy Audit Report

Verona High School

April 30, 2024

Prepared for:
Verona Board of Education
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Verona, New Jersey 07044

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Disclaimer

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

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

TRC bases estimated material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on selected products and installers. TRC and NJBPU do not guarantee cost estimates and shall in no event be held liable should actual installed costs vary from these material and labor estimates.

Incentive values provided in this report are estimated based on previously run state efficiency programs. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available utility program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

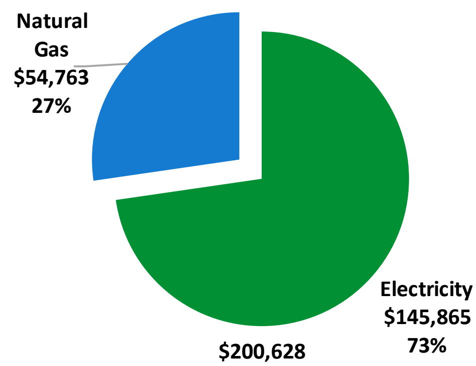
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

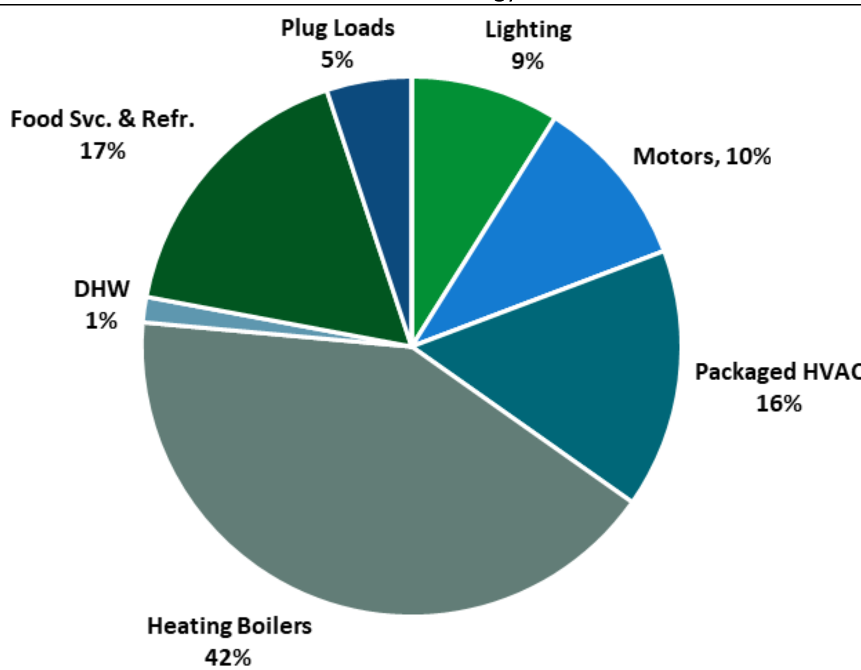
Table of Contents

1 Executive Summary

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

BUILDING PERFORMANCE REPORT

Annual Energy Utilities	Costs: $200,628 Electricity: 696,669 kWh Natural Gas: 44,717 Therms	
ENERGY STAR® Benchmarking Score	77 *(1-100 scale)*	Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance, and lower your energy bills even more.



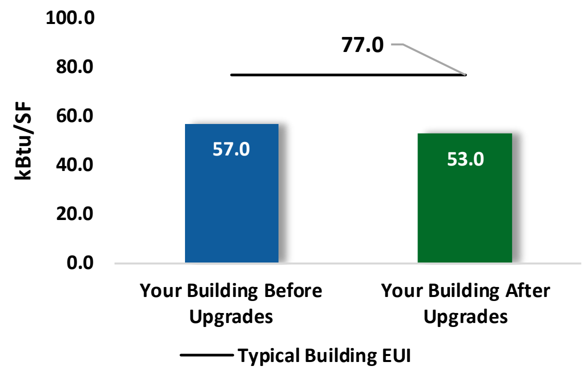
Energy Use by System

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.

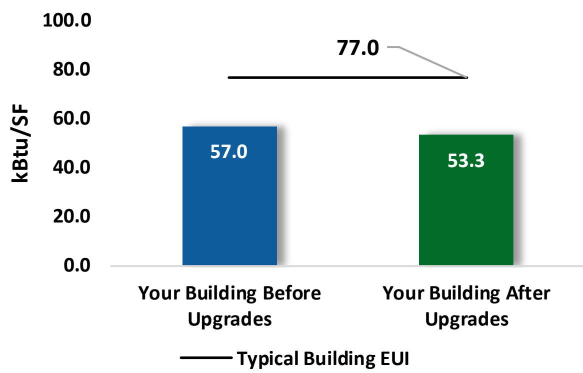
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$290,420
Potential Rebates & Incentives[1]	$21,390
Annual Cost Savings	$19,273
Annual Energy Savings	Electricity: 79,839 kWh Natural Gas: 2,088 Therms
Greenhouse Gas Emission Savings	52 Tons
Simple Payback	14.0 Years
Site Energy Savings (All Utilities)	7%



Scenario 2: Cost Effective Package[2]

Installation Cost	$96,520
Potential Rebates & Incentives	$14,090
Annual Cost Savings	$17,054
Annual Energy Savings	Electricity: 69,630 kWh Natural Gas: 2,022 Therms
Greenhouse Gas Emission Savings	47 Tons
Simple Payback	4.8 Years
Site Energy Savings (all utilities)	6%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	None

[1] Incentives are based on previously run state rebate programs. Contact your utility provider for current program incentives that may apply.

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**4,574**	**5.8**	**-1**	**$946**	**$3,630**	**$610**	**$3,020**	**3.2**	**4,496**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	4,574	5.8	-1	$946	$3,630	$610	$3,020	3.2	4,496
Lighting Control Measures			**32,083**	**7.5**	**-7**	**$6,635**	**$35,050**	**$7,840**	**$27,210**	**4.1**	**31,522**
ECM 2	Install Occupancy Sensor Lighting Controls	Yes	26,343	6.7	-6	$5,448	$27,460	$3,220	$24,240	4.4	25,882
ECM 3	Install High/Low Lighting Controls	Yes	5,740	0.8	-1	$1,187	$7,590	$4,620	$2,970	2.5	5,640
Motor Upgrades			**2,781**	**0.7**	**0**	**$582**	**$18,300**	**$0**	**$18,300**	**31.4**	**2,800**
ECM 4	Premium Efficiency Motors	No	2,781	0.7	0	$582	$18,300	$0	$18,300	31.4	2,800
Variable Frequency Drive (VFD) Measures			**24,741**	**4.2**	**52**	**$5,819**	**$40,200**	**$2,800**	**$37,400**	**6.4**	**31,019**
ECM 5	Install VFDs on Constant Volume (CV) Fans	Yes	23,843	4.1	52	$5,631	$35,900	$2,700	$33,200	5.9	30,114
ECM 6	Install VFDs on Heating Water Pumps	No	898	0.1	0	$188	$4,300	$100	$4,200	22.3	904
Unitary HVAC Measures			**6,530**	**9.6**	**7**	**$1,448**	**$171,300**	**$7,200**	**$164,100**	**113.3**	**7,351**
ECM 7	Install High Efficiency Air Conditioning Units	No	6,530	9.6	7	$1,448	$171,300	$7,200	$164,100	113.3	7,351
HVAC System Improvements			**0**	**0.0**	**55**	**$678**	**$660**	**$80**	**$580**	**0.9**	**6,479**
ECM 8	Install Pipe Insulation	Yes	0	0.0	55	$678	$660	$80	$580	0.9	6,479
Domestic Water Heating Upgrade			**0**	**0.0**	**16**	**$196**	**$240**	**$80**	**$160**	**0.8**	**1,876**
ECM 9	Install Low-Flow DHW Devices	Yes	0	0.0	16	$196	$240	$80	$160	0.8	1,876
Food Service & Refrigeration Measures			**9,130**	**1.7**	**86**	**$2,969**	**$21,040**	**$2,780**	**$18,260**	**6.2**	**19,300**
ECM 10	Food Service Equipment Replacement	Yes	1,550	0.9	86	$1,382	$12,900	$2,300	$10,600	7.7	11,667
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors	Yes	610	0.0	0	$128	$740	$80	$660	5.2	614
ECM 12	Replace Refrigeration Equipment	Yes	6,969	0.8	0	$1,459	$7,400	$400	$7,000	4.8	7,018
TOTALS (COST EFFECTIVE MEASURES)			**69,630**	**19.1**	**202**	**$17,054**	**$96,520**	**$14,090**	**$82,430**	**4.8**	**93,787**
TOTALS (ALL MEASURES)			**79,839**	**29.5**	**209**	**$19,273**	**$290,420**	**$21,390**	**$269,030**	**14.0**	**104,842**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

All Evaluated Energy Improvements[3]

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

[3] TRC bases estimated material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations.

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decision 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

Utility-run energy efficiency programs and 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.

Options from Your Utility Company

Prescriptive and Custom Rebates

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 Prescriptive and Custom Rebates 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 may be required for some incentives. Contact your utility company for more details prior to project installation.

Direct Install

The Direct Install program provides turnkey installation of multiple measures through an authorized contractor. This program can provide incentives up to 70% or 80% of the cost of selected measures. A Direct Install contractor will assess and verify individual measure eligibility and perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

Engineered Solutions

The Engineered Solutions program provides tailored energy-efficiency assistance and turnkey engineering services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. The program provides all professional services from audit, design, construction administration, to commissioning and measurement and verification for custom whole-building energy-efficiency projects. Engineered Solutions 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.

For more details on these programs please contact your utility provider.

Options from New Jersey's Clean Energy Program

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 and Power (CHP)

The CHP program provides incentives for combined heat and power (i.e., 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.

Successor Solar Incentive Program (SuSI)

New Jersey is committed to supporting solar energy. Solar projects help the state reach the renewable goals outlined in the state's Energy Master Plan. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available, but certified solar projects are able to earn one SREC II (Solar Renewable Energy Certificates II) for each megawatt-hour of solar electricity produced from a qualifying solar facility.

Ongoing Electric Savings with Demand Response

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

Large Energy User Program (LEUP)

LEUP is designed to promote self-investment in energy efficiency for the largest energy consumers in the state. Customers in this category spend about $5 million a year on energy bills. This program incentivizes owners/users of buildings to upgrade or install energy conserving measures in existing buildings to help offset the capital costs associated with the project. The efficiency upgrades are customized to meet the requirements of the customers' existing facilities, while advancing the State's energy efficiency, conservation, and greenhouse gas reduction goals.

For more details on these programs please visit New Jersey's Clean Energy Program website.

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Verona High 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.

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

2.1 Site Overview

On October 31, 2023, TRC performed an energy audit at Verona High School located in Verona, New Jersey. TRC met with Dennis James to review the facility operations and help focus our investigation on specific energy-using systems.

Verona High School is a 1-story, 120,245 square foot building built in 1956. Spaces include classrooms, gymnasiums, locker rooms, restrooms, auditorium, offices, cafeteria, corridors, stairwells, a commercial kitchen, storage rooms, a wood shop, and mechanical spaces.

Recent Improvements and Facility Concerns

Over the last five years the facility has replaced most lighting fixtures and bulbs with LED equivalents. Trane unit ventilators with variable speed fans and variable refrigerant flow (VRF) cooling, controlled by BAS, have also been installed across the district. District staff indicated interest in electric vehicle charging stations.

Facility concerns include the site's older rooftop mounted units (RTU's).

2.2 Building Occupancy

The facility is occupied Monday through Friday 6:00 AM through 6:30 PM for regular classes, after school programs, and janitorial and maintenance services.

The school is fully occupied from September through June. Typical weekday occupancy is 55 staff and 636 students. Summer occupancy includes a summer recreation program and continuing maintenance activities. There are no regular weekend activities.

The facility is occupied intermittently, as needed for maintenance and operations. Hours on select days often go later to 10:00 PM and other hours for weekends for after school and sporting activities.

Building Name	Weekday/Weekend	Operating Schedule
High School	Weekday	6:00 AM - 10:00 PM
	Weekend	Varied

Building Occupancy Schedule

2.3 Building Envelope

Building walls are concrete block over structural steel with a brick facade. The roof has multiple levels. Most sections are flat and covered with modified bitumen. The sheeting is in good to fair condition. Some areas, such as at transition points in the gym roof area, have drainage issues. Moss buildup was noted. A few decorative pitched sections of roof are comprised of painted metal sheeting.

Interior walls are a mix of painted concrete block, dry wall and brick depending on the room. Most spaces have a drop ceiling.

Windows are double glazed and have aluminum frames with a thermal break. The glass-to-frame seals are in good condition. The operable window weather seals are in good or fair condition, showing little evidence of excessive wear. Exterior doors are made of solid material and glass with aluminum frames and are in good condition with undamaged door seals. Degraded window and door seals increase drafts and outside air infiltration. There is also a roll up metal garage door with seals in fair condition.

Exterior Doors and Windows

Roll Up Garage Door

Roof

Water and Moss Buildup on Roof

2.4 Lighting Systems

The primary interior lighting system uses 4-foot 14.5-Watt and 2-foot 8.5-Watt linear LED T8 lamps. There are also several 32-Watt T8 fixtures in some of the mechanical and storage rooms and U-shaped T8 fixtures in the theater. Fixture types include 2- 3- or 4-lamp, 2- or 4-foot-long recessed troffers, surface mounted wrap, and pendant fixtures. The recessed troffers primarily have prismatic lenses, but some are parabolic.

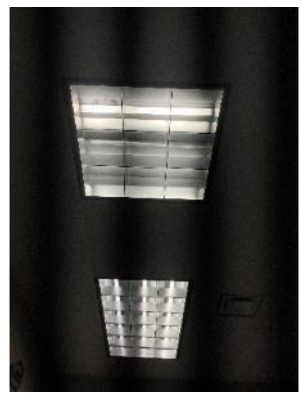
Additionally, there are some compact fluorescent lamps (CFL) in recessed can fixtures. Some of these have been converted to operate LED lamps. The Theater is primarily LED lighting but uses incandescent sources for the stage and lobby lighting. Gymnasium fixtures have high bay LED lamps. All exit signs are LED.

Most fixtures are in good or new condition. Interior lighting levels were generally sufficient. Many of the classrooms with 3-lamps per fixture have lighting controls that allow occupants to turn off 1 of the 3 lamps. Hi-low switching is used frequently by teachers to obtain lower lighting levels.

Lighting is controlled primarily by occupancy sensors, but some spaces still have traditional switches. Corridor lights are controlled by a key operated switch and left on throughout occupied hours.

Recessed Prismatic

Surface Mounted Wrap



Recessed Parabolic

Theater Lighting

Gym LED High Bays

Occupancy Sensor

Exterior lighting mainly consists of wall packs, canopy lights, wall sconces, and recessed can lights that use LED sources. The are a few fixtures with compact fluorescent lamps.

Exterior light fixtures are controlled by a time clock.

LED Wall Pack

Recessed Can LED hardwire fixture

Canopy Lighting

Time Clock

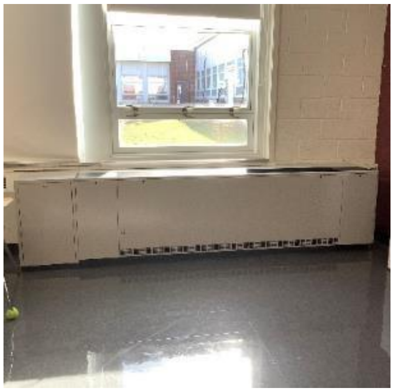
2.5 Air Handling Systems

Unit Ventilators

The high school uses several types of unit ventilators, mainly to provide heating, cooling, and ventilation to classrooms. Most unit ventilators are relatively new Trane units. These are equipped with variable speed supply fan motors, air dampers, and fan coil valves controlled by the BAS. They obtain heating and cooling through 12 roof mounted variable refrigerant flow (VRF) heat pump systems. The heat pumps range from 6 to 10 tons in cooling capacity and have efficiency ratings from 13.50 to 14.60 SEER. Heating outputs range from 80 to 135 MBh with heating efficiencies of about 4.05 to 4.34 COP. The units are controlled by the Trane Synchrony BAS. At the time of the audit, the zone temperature setpoints were programmed at 72 degrees in the BAS. Local thermostats allow small adjustments to space temperatures.

Several classrooms have older unit ventilators that provide heating only with hot water coils. Cooling for these areas is provided by mini split systems with separate fans as discussed in the following section.

There are also a few fan coil units (FCU) that provide heating only with hot water coils. Most are ceiling mounted in corridors and bathrooms. These are controlled by solely by local thermostats.



VRF Unit Ventilator

Old Unit Ventilator

Fan Coil Unit

Unitary Electric HVAC Equipment

Cooling to portions of the buildings is provided by three larger split system condensing units. ACC-1 is a 35-ton unit with an efficiency rating of 10.7 EER that was installed in 2007 to serve cooling needs of AHU-1. The unit has four 1 hp constant speed fan motors and is in poor condition.

ACC-1A and 2A are both 20-ton units with an efficiency rating of 11.10 EER. Each unit is equipped with four 3/4 hp supply motor. These units were installed in 2015 to serve the locker rooms and are in fair condition. DX line insulation is missing or on poor condition for these units. These units are BAS controlled.

ACC-1

ACC-1 Missing DX Insulation

ACC-2A and ACC-1

ACC-1A

There are four smaller split system condensing units that have 3- and 4- ton cooling capacities, each with efficiency ratings of 11.5 EER. These units are about four years old.

Three small spaces are cooled by through-wall or window air conditioning (AC) units. These are 0.75 tons with an efficiency rating of 9.5 EER. They are not ENERGY STAR labeled.

Classrooms without the older heating-only ventilators and a few other spaces such as offices including locker rooms, are cooled using either AC or heat pump ductless mini-split units. These vary in capacity between 0.75 and 3 tons. The units range from fair to new condition and range in efficiency between 11 to 28 SEER. Some are ENERGY STAR labeled.

Many DX lines have degraded or missing insulation. Some units well within their useful life were missing insulation, but most were missing on older units.

Mini-Split with Missing DX Insulation

Mini-Split with Missing DX Insulation

Split Condensing Units

VRF Split System Heat Pumps

Unitary Heating Equipment

A few spaces are heated by suspended hot water unit heaters. The supply pipes were partially uninsulated on the kitchen unit at the time of the audit. The units are controlled by a local thermostat.

Boiler Room unit heater

Kitchen unit heater

Packaged Units

Main areas of the building are served by packaged roof top units, as shown in the following table. Refer to Appendix A for detailed information about each unit.

The units are equipped with economizers. Most of the grates and dampers are in good condition. Supply fans range in size from 2 to 5 hp. Return fans range from none to 3 hp. Most motors are VFD controlled but RTU-1, -2, and -3 motors are constant speed.

The age of the units ranges from 2006 to 2020. The older units including RTU-1, -2, -3 and -6 are in fair condition. RTU-7 is not currently functional but serves the same area as RTU-6. The rest of the units are in good condition. All RTUs are BAS controlled.

Unit Tag	Area Served	Unit Description	Cooling Capacity (tons)	Cooling Efficiency (EER)	Heating Capacity (MBh)	VFD	BAS
RTU	Various	DX Cooling / Natural Gas Heating	12.5	11.20	115.20	Yes	Trane
RTU-1	SP Services	DX Cooling / Natural Gas Heating	15	15	147.6	No	Automated Logic
RTU-2	Board Office	DX Cooling / Natural Gas Heating	15	15	147.6	No	Automated Logic
RTU-3	Cafeteria	DX Cooling / Natural Gas Heating	18	11.50	210	No	Automated Logic
RTU-4	Library	DX Cooling	8.93	11.20	N/A	Yes	Automated Logic
RTU-5	Main Office	DX Cooling / Natural Gas Heating	10	11.20	196.8	Yes	Automated Logic
RTU-6	Band Room	DX Cooling / Natural Gas Heating	8	14.00	93	Yes	Automated Logic
RTU-7	Band Room (not functioning)	DX Cooling / Natural Gas Heating	8	14.00	93	Yes	Automated Logic
RTU-HS-1	Gym 1	DX Cooling / HHW	15	12.1	HW	Yes	Trane
RTU-HS-2	Gym 2	DX Cooling / HHW	15	12.1	HW	Yes	Trane

Refer to Appendix A for detailed information about each unit.

RTU-1 and -2

RTU and RTU-4

RTU-5

Supply Fan Motor with VFD

RTU-HS-1 and -2

RTU-6 and -7

Air Handling Units (AHUs)

The Auditorium is conditioned by an air handling unit (AHU) located in the roof penthouse mechanical space called Fan Room #2. This unit labeled AHU-1 is equipped with a supply fan motor, return fan motor, hot water heating coil, and a refrigerant coil for cooling. The supply and return fan motors are 10 and 3 hp respectively, and both are VFD controlled. Cooling refrigerant is provided to the unit by ACC-1. The supply fan motor is 89.5% efficient. The supply air capacity is 10,000 cubic feet per minute (cfm) and return is 8,000 cfm. The unit is controlled by the Automated Logic BAS.

Fan Room #1 and #2 each house a heating and ventilation unit, HV-2 and HV-3, which provide hot water heating and ventilation to the gym. Each unit contains two 2 hp supply fan motors equipped with VFDs. Ductwork appeared to be insulated.

The kitchen is served by a make-up air unit (MAU) with a constant speed 15 hp motor with a 92.4% efficiency rating.

The building has five energy recovery units (ERV) which are serve the various locker rooms and team rooms. ERV-3, -4, and -5 each have single 0.5 hp motor while ERV-1 and -2 each have two 0.5 hp motors. Motors are VFD controlled.

All AHUs are controlled by the Automated Logic BAS.

AHU-1

HV-3

AHU-1 VFDs

ERV-2

Kitchen MAU

The building has over 40 rooftop exhaust fans. These are controlled by BAS. Some are VFD controlled.

Exhaust Fan

VFD Exhaust Fan

Exhaust Fan VFDs

2.6 Heating Systems

The primary building heating load is served by three 1,880 MBh AERCO condensing hot water boilers, each with an efficiency rating of 94 percent.

The system includes 3 sets of two heating hot water (HHW) circulation pumps, each controlled by VFD. Pumps 1, 2, 5, and 6 are 7.5 hp NEMA premium motors with an efficiency rating of 91.7%. Pumps 3 and 4 are 5 hp NEMA premium motors with an efficiency rating of 89.5%. The boilers and three pumps operate in a lead-lag fashion with the remaining pumps in standby position. The HHW loop serves various radiators, fan coil units and air handling units throughout the building. Fan Room #2 where AHU-1 and HV-3 are housed, has a secondary loop with one hp pump. This pump does not have VFD control.

Pipes in the main boiler room were insulated and labeled. However, in Fan Room #2 about 40 feet of 3.5-inch diameter pipe is completely uninsulated.

Boilers were installed in 2015 and are in good condition. Boilers and pumps are controlled and monitored by the BAS. At the time of the audit when the outside air temperature was 63 degrees, supply temperature setpoints ranged from 97 to 99 degrees with return water temperature approximately 90 degrees.

Condensing Boilers

HHW Pumps and VFDs

HHW Pump Loop 1

Uninsulated HHW pipe – Fan Room #2

2.7 Building Automation System (BAS)

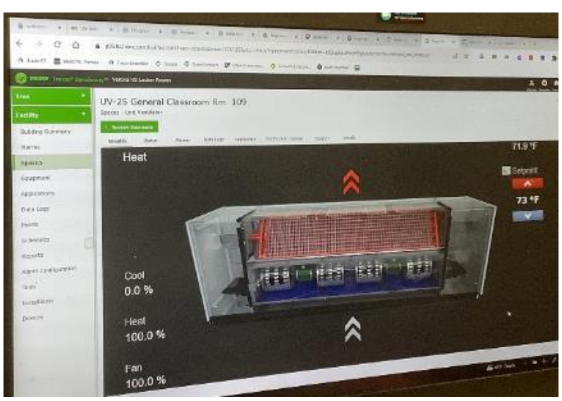
The Verona school district has three BAS control systems that control and monitor the HVAC equipment, the boilers, the air handlers, the package units, and unit ventilators, and exhaust fans across the schools.

Some High School mechanical equipment including the newer unit ventilators are operated from a new Trane Tracer Synchrony system while other equipment including the air handling units are operated by the older Automated Logic WebCTRL system.

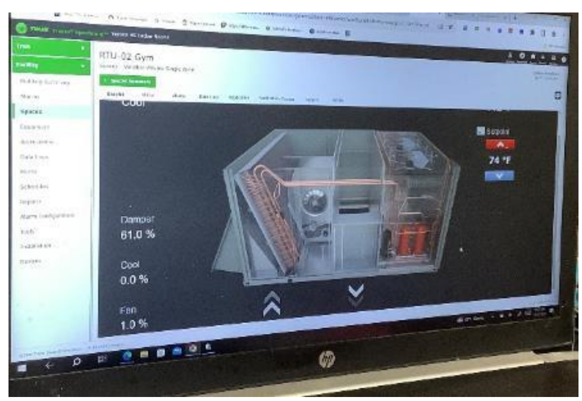
Exhaust fans, VAV boxes, and package units are split between the different BAS controls, mainly in accordance with equipment age.

The various BAS control systems provide equipment scheduling control and monitors and controls space temperatures, supply air temperatures, outside air dampers, humidity, heating water loop temperatures, and fan speeds.

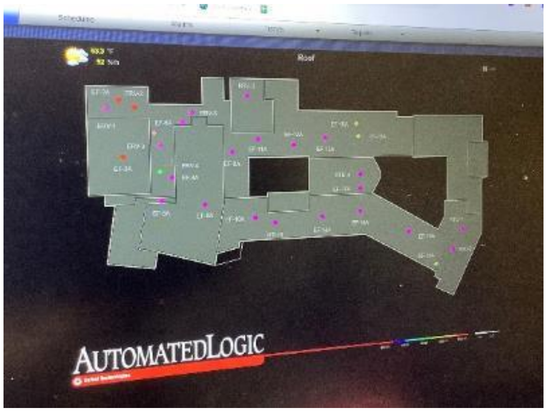
The site staff expressed an interest in transitioning all equipment to a single BAS.



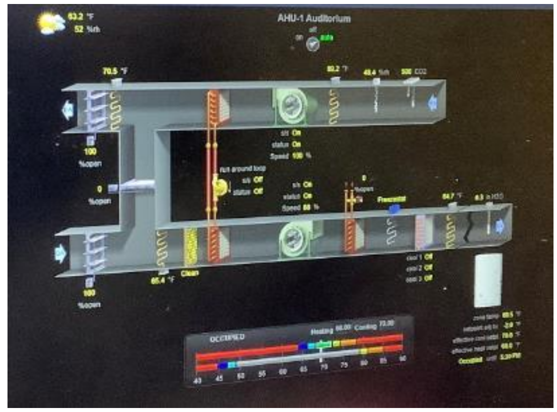
VRF Unit Ventilators – Trane



Gym RTU – Trane



Roof Unit Map – Automated Logic



Auditorium AHU-1 – Automated Logic

2.8 Domestic Hot Water

Hot water is produced by two 117 gallon 500 MBh gas-fired condensing storage water heaters, each with a rated efficiency of 96 percent.

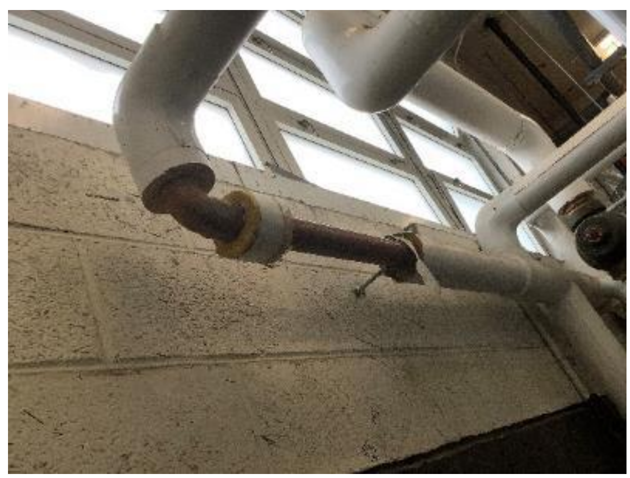
At the time of the site visit, the domestic water heaters were set at 146 and 149°F.

Two fractional circulation pumps distribute water to end uses. The circulation pumps operate continuously in lead-lag configuration.

Most domestic hot water pipes are insulated, and the insulation is in good condition. However, there was a 1-foot stretch of uninsulated 3.5 inch diameter pipe in the Boiler Room.

DHW Heaters

DHW Circulation Pumps



Uninsulated Pipe

2.9 Food Service Equipment

The High School kitchen has a mix of gas and electric equipment that is used to prepare lunches for students and staff. Food is prepared for all six District schools by the High School and Middle School commercial kitchens. Most cooking is done using gas-fired rack ovens, some of which are ENERGY STAR rated. Bulk prepared foods are held in several electric holding cabinets and served using food warming tables and display cases. Most equipment is not high efficiency but is in good condition.

Our analysis determined that this building's food service equipment accounts for a relatively high proportion of overall energy use. While cost effective opportunities to replace equipment are limited at this time, we recommend that you work with your food service equipment suppliers to maintain equipment in a way that minimizes energy use. This may include cleaning air intakes and exhausts or other methods of keeping your existing equipment operating in top shape. When food service equipment is eventually replaced, consider installing high efficiency or ENERGY STAR labeled equipment.

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

Gas Rack Oven

Oven and Fryer

Food Warming Tables

2.10 Refrigeration

The kitchen has several stand-up refrigerators and freezers with either solid or glass doors. There is a freezer chest and as well as many refrigerator chests. Most equipment is standard and in good condition.

The walk-in freezer set to -5 degrees and has an estimated 0.45-ton compressor located in the kitchen and is equipped a single fan evaporator. The walk-in cooler is set to maintain 35 degrees and has an estimated 0.38-ton compressor located in the kitchen and is equipped with a single fan evaporator. Evaporator fans do not have controls.

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

Walk-in Cooler *Glass Door Refrigerator* *Freezer Chest*

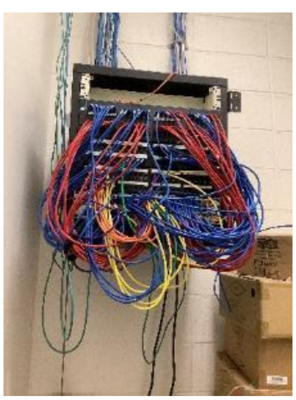
2.11 Plug Load and Vending Machines

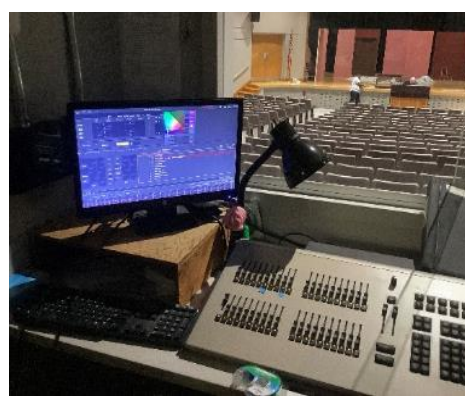
The location is doing a great job managing the electrical plug loads. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

There are approximately 185 computer workstations throughout the facility. There are several dedicated computer lab rooms, one with higher power gaming computers. The students and faculty have laptops available to them. The building has a number of portable charging carts for the devices. Plug loads include general cafe and office equipment. There are classroom typical loads such as smart boards, projectors, fans, and air purifiers. There is server equipment at various points throughout the building. The corridors have water fountains.

The building has some special workshop equipment including wood shop machines, hand tools, a laser cutter, training room physical therapy equipment, and three electric kilns ranging from 4,900 to 6,656 W each. The training room has an electric washer and dryer.

There is one refrigerated vending machine, and it is equipped with an occupancy sensor. There are several residential and mini style refrigerators throughout the building. These vary in condition and efficiency.





Server Equipment *Copier/Pinter* *Theater Sound Board Equipment*

Training Room Equipment *Woodshop Equipment* *Computer Lab*

2.12 Water-Using Systems

Water is provided by a municipal water supply company off-site. Potable water is used for drinking, cleaning, building conditioning, and gardening. Water leaks were not observed or reported.

EPA WaterSense® has set maximum flow rates for sanitary fixtures. They are: 1.28 gallons per flush (gpf) for toilets, 0.5 gpf for urinals, 1.5 gallons per minute (gpm) for lavatory faucets, and 2.0 gpm for showerheads.

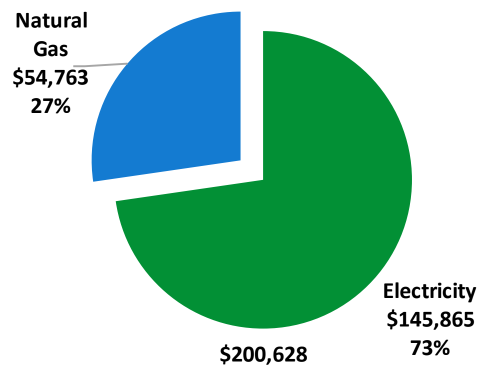
This facility has 20 restrooms and 2 locker rooms with toilets, urinals, and sinks. Locker rooms have low flow showers. Most restroom faucet flow rates are low flow 0.5 gallons per minute (gpm), but a few range higher, from 1 to 2 gpm. Kitchen and classroom faucets range from 1.2 to 2.2 gpm.

Restroom Sink *Low Flow Restroom Sink* *Kitchen Sink*

3 Energy Use and Costs

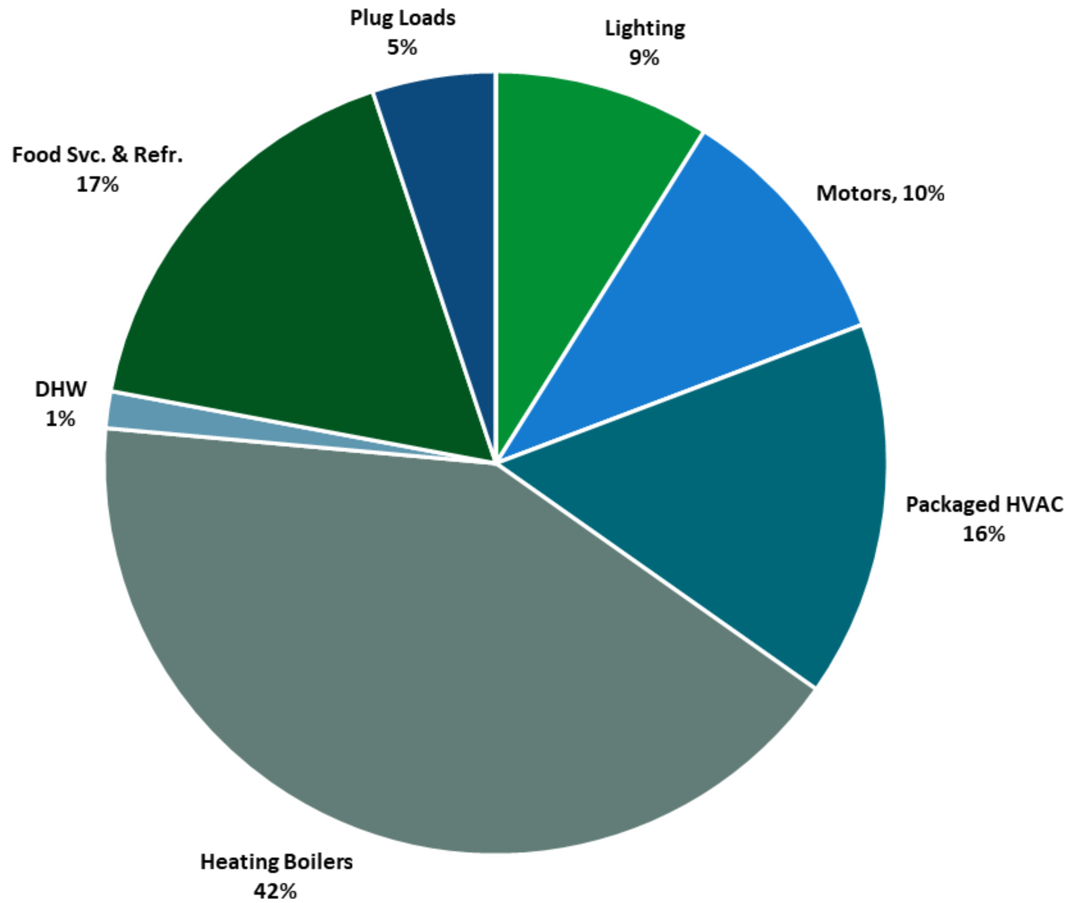
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	696,669 kWh	$145,865
Natural Gas	44,717 Therms	$54,763
Total		**$200,628**



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.

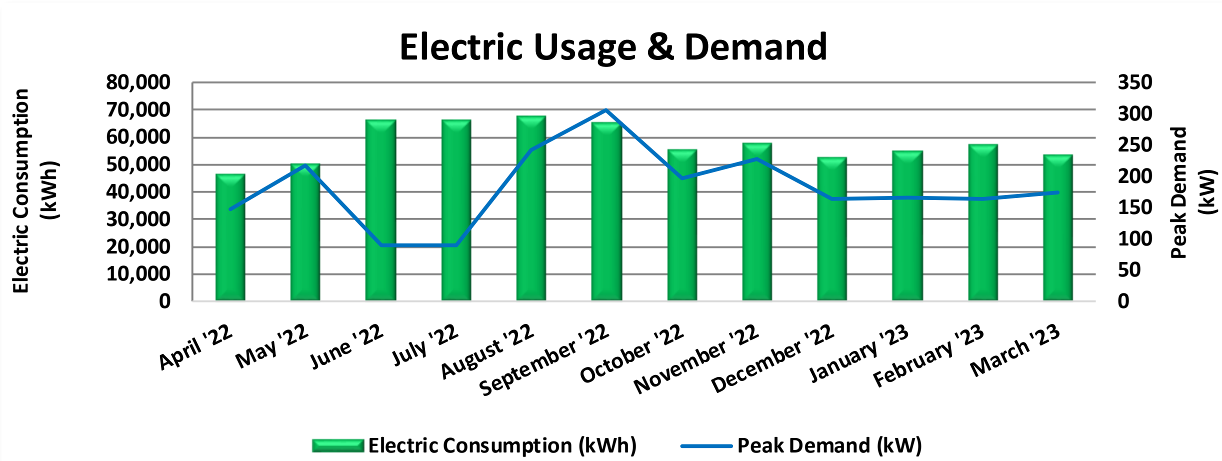
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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



Energy Balance by System

3.1 Electricity

PSE&G delivers electricity under rate class General Lighting & Power (GLP), with electric production provided by Constellation, a third-party supplier.



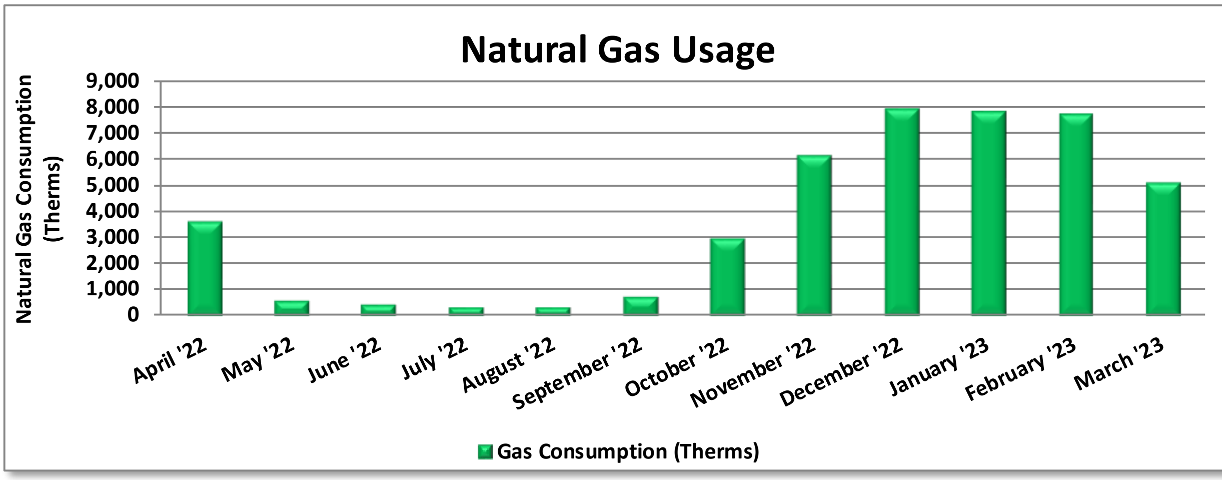
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
5/5/22	30	46,440	148	$559	$8,824
6/6/22	32	50,640	218	$2,798	$12,028
7/5/22	29	66,600	89	$1,693	$12,903
8/4/22	30	66,600	89	$1,693	$12,903
9/2/22	29	68,040	242	$2,870	$14,693
10/4/22	32	65,280	307	$1,373	$13,482
11/2/22	29	55,543	197	$825	$11,518
12/5/22	33	57,968	228	$1,020	$12,642
1/5/23	31	52,915	164	$733	$11,523
2/3/23	29	55,142	167	$745	$11,533
3/7/23	32	57,578	164	$731	$12,348
4/5/23	29	53,923	174	$777	$11,468
Totals	**365**	**696,669**	**307**	**$15,817**	**$145,865**
Annual	**365**	**696,669**	**307**	**$15,817**	**$145,865**

Notes:

- Peak demand of 307 kW occurred in September '22.
- Average demand over the past 12 months was 182 kW.
- The average electric cost over the past 12 months was $0.209/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.
- Because of the use of heat pumps, electricity is used relatively consistently through both the heating and the cooling seasons.
- Usage was estimated for the month of December.

3.2 Natural Gas

PSE&G delivers natural gas under rate class Large Volume Gas (LVG), with natural gas supply provided by Aggressive Energy LLC, a third-party supplier.



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
5/5/22	30	3,635	$6,757
6/6/22	32	602	$658
7/6/22	30	439	$530
8/4/22	29	343	$452
9/2/22	29	373	$477
10/4/22	32	764	$823
11/2/22	29	2,970	$4,269
12/5/22	33	6,194	$7,267
1/5/23	31	7,948	$9,379
2/3/23	29	7,865	$8,863
3/7/23	32	7,743	$8,581
3/30/23	23	5,105	$5,806
Totals	**359**	**43,982**	**$53,863**
Annual	**365**	**44,717**	**$54,763**

Notes:

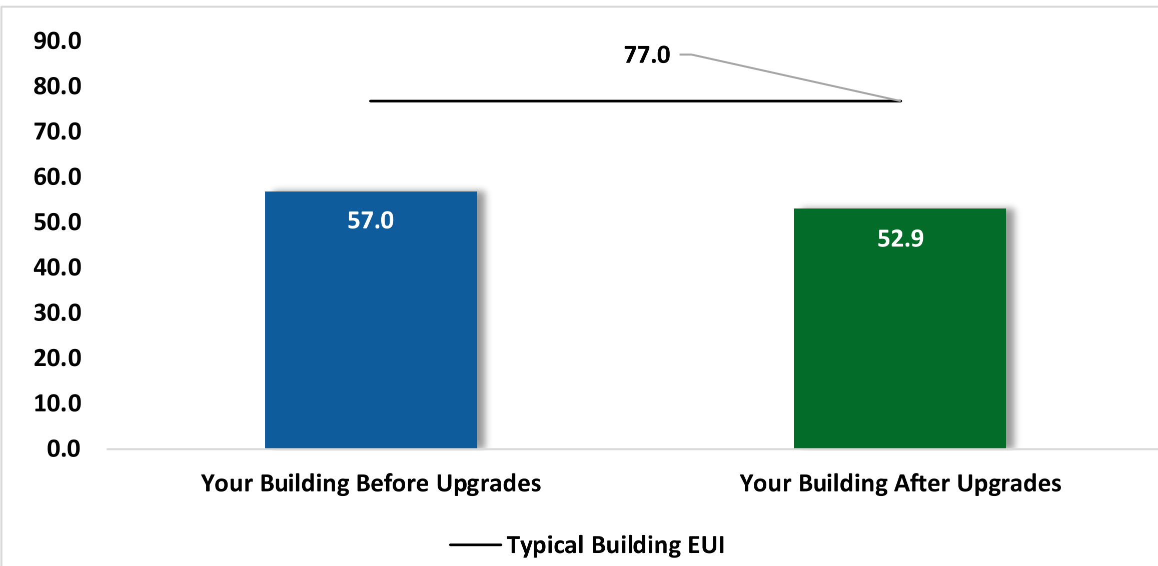
- The average gas cost for the past 12 months is $1.225/therm, which is the blended rate used throughout the analysis.
- The primary use of site natural gas is the heating season. In the summer months is drops down due to low kitchen equipment and DHW use as well while school is on summer break.

3.3 Benchmarking

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

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

Benchmarking Score	77



Energy Use Intensity Comparison[4]

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

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. Several factors can cause a building to vary from 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.

[4] Based on all evaluated ECMs

Tracking your Energy Performance

Keeping track of your energy and water use on a monthly basis is one of the best ways to keep utility costs in check and keep your facility operating efficiently. 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 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.

3.4 Understanding Your Utility Bills

The State of New Jersey Department of the Public Advocate provides detailed information on how to read natural gas and electric bills. Your bills contain important information including account numbers, meter numbers, rate schedules, meter readings, and the supply and delivery charges. Gas and electric bills both provide comparisons of current energy consumption with prior usage.

Sample bills, with annotation, may be viewed at:
https://www.nj.gov/rpa/docs/Understanding_Electric_Bill.pdf
https://www.nj.gov/rpa/docs/Understanding_Gas_Bill.pdf

Why Utility Bills Vary

Utility bills vary from one month to another for many reasons. For this reason, assessing the effects of your energy savings efforts can be difficult.

Billing periods vary, typically ranging between 28 and 33 days. Electric bills provide the kilowatt-hours (kWh) used per month while gas bills provide therms (or hundreds of cubic feet - CCF) per month consumption information. Monthly consumption information can be helpful as a tool to assess your efforts to reduce energy, particularly when compared to monthly usage from a similar calendar period in a prior year.

Bills typically vary seasonally, often with more gas consumed in the winter for heating, and more electricity used in the summer when air conditioning is used. Facilities with electric heating may experience higher electricity use in the winter. Seasonal variance will be impacted by the type of heating and cooling systems used. Normal seasonal fluctuations are further impacted by the weather. Extremely cold or hot weathers causes HVAC equipment to run longer, increasing usage. Other monthly fluctuations in usage can be caused by changes in building occupancy. Utility bills provide a comparison of usage between the current period and comparable billing month period of the prior year. Year-to-year monthly use comparisons can point to trends with energy savings for measures/projects that were implemented within the timeframe, but these comparisons do not account for changing weather of occupancy patterns.

The price of fuel and purchased power used to produce and delivery electricity and gas fluctuates. Any increase or decrease in these costs will be reflected in your monthly bill. Additionally, billing rates occasionally change after justification and approval of the NJBPU. For this reason, it is more useful to review energy use rather than cost when assessing energy use trends or the impact of energy conservation measures implemented.

4 Energy Conservation Measures

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

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

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

Financial incentives in this report are based on the previously run state rebate program SmartStart, which has been retired. Now, all investor-owned gas and electric utility companies are offering complementary energy efficiency programs directly to their customers. Some measures and proposed upgrades may be eligible for higher incentives than those shown below. The incentives in the summary tables should be used for high-level planning purposes. To verify incentives, reach out to your utility provider or visit the NJCEP website for more information.

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**4,574**	**5.8**	**-1**	**$946**	**$3,630**	**$610**	**$3,020**	**3.2**	**4,496**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	4,574	5.8	-1	$946	$3,630	$610	$3,020	3.2	4,496
Lighting Control Measures			**32,083**	**7.5**	**-7**	**$6,635**	**$35,050**	**$7,840**	**$27,210**	**4.1**	**31,522**
ECM 2	Install Occupancy Sensor Lighting Controls	Yes	26,343	6.7	-6	$5,448	$27,460	$3,220	$24,240	4.4	25,882
ECM 3	Install High/Low Lighting Controls	Yes	5,740	0.8	-1	$1,187	$7,590	$4,620	$2,970	2.5	5,640
Motor Upgrades			**2,781**	**0.7**	**0**	**$582**	**$18,300**	**$0**	**$18,300**	**31.4**	**2,800**
ECM 4	Premium Efficiency Motors	No	2,781	0.7	0	$582	$18,300	$0	$18,300	31.4	2,800
Variable Frequency Drive (VFD) Measures			**24,741**	**4.2**	**52**	**$5,819**	**$40,200**	**$2,800**	**$37,400**	**6.4**	**31,019**
ECM 5	Install VFDs on Constant Volume (CV) Fans	Yes	23,843	4.1	52	$5,631	$35,900	$2,700	$33,200	5.9	30,114
ECM 6	Install VFDs on Heating Water Pumps	No	898	0.1	0	$188	$4,300	$100	$4,200	22.3	904
Unitary HVAC Measures			**6,530**	**9.6**	**7**	**$1,448**	**$171,300**	**$7,200**	**$164,100**	**113.3**	**7,351**
ECM 7	Install High Efficiency Air Conditioning Units	No	6,530	9.6	7	$1,448	$171,300	$7,200	$164,100	113.3	7,351
HVAC System Improvements			**0**	**0.0**	**55**	**$678**	**$660**	**$80**	**$580**	**0.9**	**6,479**
ECM 8	Install Pipe Insulation	Yes	0	0.0	55	$678	$660	$80	$580	0.9	6,479
Domestic Water Heating Upgrade			**0**	**0.0**	**16**	**$196**	**$240**	**$80**	**$160**	**0.8**	**1,876**
ECM 9	Install Low-Flow DHW Devices	Yes	0	0.0	16	$196	$240	$80	$160	0.8	1,876
Food Service & Refrigeration Measures			**9,130**	**1.7**	**86**	**$2,969**	**$21,040**	**$2,780**	**$18,260**	**6.2**	**19,300**
ECM 10	Food Service Equipment Replacement	Yes	1,550	0.9	86	$1,382	$12,900	$2,300	$10,600	7.7	11,667
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors	Yes	610	0.0	0	$128	$740	$80	$660	5.2	614
ECM 12	Replace Refrigeration Equipment	Yes	6,969	0.8	0	$1,459	$7,400	$400	$7,000	4.8	7,018
TOTALS			**79,839**	**29.5**	**209**	**$19,273**	**$290,420**	**$21,390**	**$269,030**	**14.0**	**104,842**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**4,574**	**5.8**	**-1**	**$946**	**$3,630**	**$610**	**$3,020**	**3.2**	**4,496**
ECM 1	Retrofit Fixtures with LED Lamps	4,574	5.8	-1	$946	$3,630	$610	$3,020	3.2	4,496
Lighting Control Measures		**32,083**	**7.5**	**-7**	**$6,635**	**$35,050**	**$7,840**	**$27,210**	**4.1**	**31,522**
ECM 2	Install Occupancy Sensor Lighting Controls	26,343	6.7	-6	$5,448	$27,460	$3,220	$24,240	4.4	25,882
ECM 3	Install High/Low Lighting Controls	5,740	0.8	-1	$1,187	$7,590	$4,620	$2,970	2.5	5,640
Variable Frequency Drive (VFD) Measures		**23,843**	**4.1**	**52**	**$5,631**	**$35,900**	**$2,700**	**$33,200**	**5.9**	**30,114**
ECM 5	Install VFDs on Constant Volume (CV) Fans	23,843	4.1	52	$5,631	$35,900	$2,700	$33,200	5.9	30,114
HVAC System Improvements		**0**	**0.0**	**55**	**$678**	**$660**	**$80**	**$580**	**0.9**	**6,479**
ECM 8	Install Pipe Insulation	0	0.0	55	$678	$660	$80	$580	0.9	6,479
Domestic Water Heating Upgrade		**0**	**0.0**	**16**	**$196**	**$240**	**$80**	**$160**	**0.8**	**1,876**
ECM 9	Install Low-Flow DHW Devices	0	0.0	16	$196	$240	$80	$160	0.8	1,876
Food Service & Refrigeration Measures		**9,130**	**1.7**	**86**	**$2,969**	**$21,040**	**$2,780**	**$18,260**	**6.2**	**19,300**
ECM 10	Food Service Equipment Replacement	1,550	0.9	86	$1,382	$12,900	$2,300	$10,600	7.7	11,667
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors	610	0.0	0	$128	$740	$80	$660	5.2	614
ECM 12	Replace Refrigeration Equipment	6,969	0.8	0	$1,459	$7,400	$400	$7,000	4.8	7,018
TOTALS		**69,630**	**19.1**	**202**	**$17,054**	**$96,520**	**$14,090**	**$82,430**	**4.8**	**93,787**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

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 ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**4,574**	**5.8**	**-1**	**$946**	**$3,630**	**$610**	**$3,020**	**3.2**	**4,496**
ECM 1	Retrofit Fixtures with LED Lamps	4,574	5.8	-1	$946	$3,630	$610	$3,020	3.2	4,496

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

ECM 1: Retrofit Fixtures with LED Lamps

Replace fluorescent and incandescent lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies. Be sure to specify replacement lamps that are compatible with existing dimming controls, where applicable. In some circumstances, you may need to upgrade your dimming system for optimum performance.

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: band room, copy room two, corridor linear fluorescent T8s, theater, custodial closets, fan rooms one and two, all compact fluorescents (interior and exterior fixtures), office 115 corridor, kitchen restroom band storage, and various other storage rooms

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**32,083**	**7.5**	**-7**	**$6,635**	**$35,050**	**$7,840**	**$27,210**	**4.1**	**31,522**
ECM 2	Install Occupancy Sensor Lighting Controls	26,343	6.7	-6	$5,448	$27,460	$3,220	$24,240	4.4	25,882
ECM 3	Install High/Low Lighting Controls	5,740	0.8	-1	$1,187	$7,590	$4,620	$2,970	2.5	5,640

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 2: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected Building Areas: offices, conference rooms, classrooms, library, restrooms, and storage rooms

ECM 3: Install High/Low Lighting Controls

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

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

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

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 occupants approach the area.

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

Affected Building Areas: hallways, stairwells, and atrium

4.3 Motors

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Motor Upgrades		**2,781**	**0.7**	**0**	**$582**	**$18,300**	**$0**	**$18,300**	**31.4**	**2,800**
ECM 4	Premium Efficiency Motors	2,781	0.7	0	$582	$18,300	$0	$18,300	31.4	2,800

ECM 4: Premium Efficiency Motors

We evaluated replacing 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.

Affected Motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Kitchen	Kitchen	1	Kitchen Hood Exhaust Fan	15.0	MAU
Various Classrooms	Various Classrooms	24	Fan Coil Unit	0.1	Old Unit Ventilators
Various Classrooms	Various Classrooms	6	Fan Coil Unit	0.1	Veritcal Unit Ventilators
Corridors	Corridors	10	Fan Coil Unit	0.3	ceiling mounted FCU
Roof	Main Office	1	Supply Fan	3.0	RTU-5
Roof	gyms	2	Supply Fan	3.0	RTU-HS-1, 2 - gyms

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.*

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 ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**24,741**	**4.2**	**52**	**$5,819**	**$40,200**	**$2,800**	**$37,400**	**6.4**	**31,019**
ECM 5	Install VFDs on Constant Volume (CV) Fans	23,843	4.1	52	$5,631	$35,900	$2,700	$33,200	5.9	30,114
ECM 6	Install VFDs on Heating Water Pumps	898	0.1	0	$188	$4,300	$100	$4,200	22.3	904

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

ECM 5: Install VFDs on Constant Volume (CV) Fans

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

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

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

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

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

Affected Air Handlers: RTU-1, RTU-2, RTU-3, MAU, RV-1, and RV-8

ECM 6: Install VFDs on Heating Water Pumps

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

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

Affected Pumps: HHW loop one pump located in fan room two

4.5 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**6,530**	**9.6**	**7**	**$1,448**	**$171,300**	**$7,200**	**$164,100**	**113.3**	**7,351**
ECM 7	Install High Efficiency Air Conditioning Units	6,530	9.6	7	$1,448	$171,300	$7,200	$164,100	113.3	7,351

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

ECM 7: Install High Efficiency Air Conditioning Units

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

Affected Units: RTU, RTU-3, RTU-4, RTU-5, ACC-1, and various older ductless mini-split AC units

4.6 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**0**	**0.0**	**55**	**$678**	**$660**	**$80**	**$580**	**0.9**	**6,479**
ECM 8	Install Pipe Insulation	0	0.0	55	$678	$660	$80	$580	0.9	6,479

ECM 8: Install Pipe Insulation

Install insulation on heating water and domestic hot water system piping. Distribution system thermal losses are dependent on system fluid temperature, the size of the distribution system, and the extent and condition of piping insulation. When the insulation has been damaged due to exposure to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated, system thermal efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Affected Systems: DHW (boiler room) and HHW (fan room two and kitchen suspended heater).

4.7 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**16**	**$196**	**$240**	**$80**	**$160**	**0.8**	**1,876**
ECM 9	Install Low-Flow DHW Devices	0	0.0	16	$196	$240	$80	$160	0.8	1,876

ECM 9: Install Low-Flow DHW Devices

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

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

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing.

Additional cost savings may result from reduced water usage.

4.8 Food Service and Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**9,130**	**1.7**	**86**	**$2,969**	**$21,040**	**$2,780**	**$18,260**	**6.2**	**19,300**
ECM 10	Food Service Equipment Replacement	1,550	0.9	86	$1,382	$12,900	$2,300	$10,600	7.7	11,667
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors	610	0.0	0	$128	$740	$80	$660	5.2	614
ECM 12	Replace Refrigeration Equipment	6,969	0.8	0	$1,459	$7,400	$400	$7,000	4.8	7,018

ECM 10: Food Service Equipment Replacement

Buildings that use a lot of food service equipment are often among the most energy-intensive commercial buildings. Replace existing food service equipment with new, high-efficiency equipment. Consider replacing the following equipment with high efficiency or ENERGY STAR labeled versions:

Location	Quantity	Equipment Type	Manufacturer	Model
Kitchen	1	Electric Griddle (3 Feet Width)		
Kitchen	1	Gas Rack Oven (Double)	Vulcan	

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

ECM 11: Refrigerator/Freezer Case Electrically Commutated Motors

Replace shaded pole or permanent split capacitor (PSC) motors with electronically commutated (EC) motors in walk-in coolers and freezers. Fractional horsepower EC motors are significantly more efficient than mechanically commutated, brushed motors, particularly at low speeds or partial load. By using variable-speed technology, EC motors can optimize fan usage. Because these motors are brushless and use DC power, 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 12: Replace Refrigeration Equipment

Replace existing commercial refrigerators, freezers, and ice makers with new ENERGY STAR rated equipment. The energy savings associated with this measure come from reduced energy usage, due to more efficient technology, and reduced run times.

Affected Systems: Arctic Air freezer (boiler room), kitchen freezer chest, and QBD Cooling Systems refrigerator (training room)

4.9 Measures for Future Consideration

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

Verona Board of Education may wish to consider the Energy Savings Improvement Program (ESIP) or other whole building approach. With interest in implementing comprehensive, largescale and/or complex system wide projects, these measures may be pursued during development of a future energy savings plan. We recommend that you work with your energy service company (ESCO) and/or design team to:

- Evaluate these measures further.
- Develop firm costs.
- Determine measure savings.
- Prepare detailed implementation plans.

Other modernization or capital improvement funds may be leveraged for these types of refurbishments. As you plan for capital upgrades, be sure to consider the energy impact of the building systems and controls being specified.

Upgrade/Replace Building Automation System

Based on our site survey and on conversations with facility staff, it appears that the existing building automation system (BAS) is substantially limited in its capabilities, means of control, monitoring/ reporting function, or condition relative to new systems available in the marketplace. A substantial upgrade to your site's BAS could increase the efficiency of your building HVAC system operation.

The current generation BAS typically provides building systems with a network of temperature and pressure sensors that obtain feedback about field conditions and provide signals to control systems to adjust system operation for optimal functioning. Thirty years ago, most control systems were pneumatic systems driven by compressed air, with pneumatic thermostats and air driven actuators for valves and dampers. Pneumatics controls have largely been replaced by direct digital control (DDC) systems, but many pneumatic systems remain. Contemporary DDC systems afford tighter controls and enhanced monitoring and trending capabilities as compared to the older systems.

A controls upgrade would enable automated equipment start and stop times, temperature setpoints, and lockouts and deadbands to be programmed remotely using a graphic interface. Controls can be configured to optimize ventilation and outside air intake by adjusting economizer position, damper function, and fan speed. Existing chilled and hot water distribution system controls are typically tied in, including associated pumps and valves. Coordinated control of HVAC systems is dependent on a network of sensors and status points. A comprehensive building control system provides monitoring and control for all HVAC systems, so operators can adjust system programming for optimal comfort and energy savings.

It is recommended that an HVAC engineer or contractor who specializes in BAS be contacted for a detailed evaluation and implementation costs. A controls expert will be able to tell you to what extent an existing system can be refurbished or expanded, what sensors should be replaced, what additional HVAC systems could be controlled, and what monitoring and graphic capabilities can be added. 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.

VRF Systems

Consider variable refrigerant flow (VRF) systems as part of a comprehensive package unit upgrade project. (VRF systems use direct expansion (DX) heat pumps to transport heat between an outdoor condensing unit and a network of indoor evaporators, located near or within the conditioned space, through refrigerant piping installed in the building. Attributes that distinguish VRF from other DX system types are:

- Multiple indoor units connected to a common outdoor unit
- Scalability
- Variable capacity
- Distributed control
- Simultaneous heating and cooling capability

VRF provides flexibility by allowing for many different indoor units (with different capacities and configurations), individual zone control, the unique ability to offer simultaneous heating and cooling in separate zones on a common refrigerant circuit, and heat recovery from one zone to another. VRF systems are equipped with at least one variable-speed and/or variable-capacity compressor.

To match the building's load profiles, energy is transferred from one indoor space to another through the refrigerant line, and only one energy source is necessary to provide both heating and cooling. VRF systems also operate efficiently at part load because of the compressor's variable capacity control. VRF systems are ideal for applications with varying loads or where zoning is required. Some other advantages of VRF systems include consistent comfort, quiet operation, energy efficiency, installation flexibility, zoned heating and cooling, state-of-the-art controls, and reliability.

VRF systems are more expensive than conventional heat pump systems; however, the higher initial cost can be offset by improved cooling efficiency during part load operation—a SEER (cooling) rating of 18.0 is not uncommon for small packaged VRF-equipped heat pumps.

When you are replacing packaged HVAC equipment, we recommend a comprehensive approach. Work with your contractor or design engineer to make sure your systems are sized and zoned according to current space configurations and occupancy. Select high efficiency equipment and controls that match your heating and cooling needs. Commission the system and controls to ensure proper operation, comfort, ventilation, and energy use.

Replace Smooth V-Belts with Notched or Synchronous Belts

This measure is for the replacement of smooth V-belts in non-residential package and split HVAC systems with notched V-belts or for the installation of new equipment with synchronous belts instead of smooth V-belts. Typically, there is a V-belt between the motor and the supply air fan and/or return air fan in larger package and split HVAC systems.

In general, there are two styles of grooved V-belts: notched and synchronous. The U.S. Department of Energy (DOE) compares these two types as follows:[5]

[5] https://www.nrel.gov/docs/fy13osti/56012.pdf US DOE Motor Systems Tip Sheet #5

Characteristic	Notched V-Belts	Synchronous Belts
Description	A notched belt has grooves or notches that run perpendicular to the belt's length, which reduces the bending resistance of the belt.	They are also called cogged, timing, positive-drive, or high-torque drive belts, and are "toothed".
Pulleys/Sprockets	Can use the same pulleys as cross-section standard V-belts	Require the installation of mating grooved sprockets.
Typical Efficiency	Run cooler, last longer, and are about 2% more efficient than standard V-belts.	Operate with a consistent efficiency of 98% and maintain their efficiency over a wide load range.
Constraints	Have a sharp reduction in efficiency at high torque due to increased slippage.	Noisier than V-belts, less suited for use on shock-loaded applications, and transfer more vibration due to their stiffness.
Other Benefits	Lower cost than synchronous belts, overall.	Require minimal maintenance and re-tensioning. Operate in wet and oily environments, and run slip-free

The DOE offers the following suggested actions with respect to investigating the applicability of notched or synchronous V belts:

- Conducted a survey of belt-driven equipment. Gather application and operating-hour data. Then determine the cost effectiveness of replacing existing V-belts with notched belts or synchronous belts and sprockets.
- Consider synchronous belts for all new installations; the price premium is minimal due to the avoidance of conventional pulley costs.
- Consider having a power transmission specialist determine the energy and cost savings potential from retrofitting all V-belt drives with synchronous belts. Synchronous belts rely on tooth grip instead of friction to efficiently transfer power and provide a constant speed ratio.
- Install notched belts where the retrofit of a synchronous belt is not cost effective.

5 Energy Efficient Best Practices

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

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

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

Energy Tracking with ENERGY STAR Portfolio Manager

You've heard it before—you cannot manage what you do not 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[6] . 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. Materials used may include caulk, polyurethane foam, and other weather-stripping materials. There is an energy savings opportunity by reducing the uncontrolled air exchange between the outside and inside of the building. Blower door assisted comprehensive building air sealing will reduce the amount of air exchange, which will in turn reduce the load on the buildings heating and cooling equipment, providing energy savings and increased occupant comfort.

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 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

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

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.

Economizer Maintenance

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

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

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

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

Ductwork Maintenance

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

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

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

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

Label HVAC Equipment

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

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

Optimize HVAC Equipment Schedules

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

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

Water Heater Maintenance

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

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

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

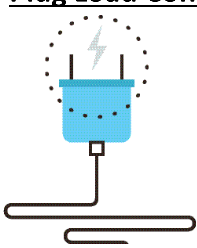
Refrigeration Equipment Maintenance

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

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

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

Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips[7]. Your local utility may offer incentives or rebates for this equipment.

Computer Monitor Replacement

ENERGY STAR labeled computer monitors can be up to 25% more efficient than standard monitors. ENERGY STAR rated monitors have power consumption requirements for different operating modes such as on, idle, and sleep.

Procurement Strategies

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

[7] 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 Water Best Practices

Getting Started

The commercial and institutional sector is the second largest consumer of publicly supplied water in the United States, accounting for 17% of the withdrawals from public water supplies[8]. In New Jersey, excluding water used for power generation, approximately 80% of total water use was attributed to potable supply during the period of 2009 to 2018. Water withdrawals for potable supply have not changed noticeably during the period from 1990 to 2018[9].

Water management planning serves as the foundation for any successful water reduction effort. It is the first step a commercial or institutional facility owner or manager should take to achieve and sustain long-term water savings. Understanding how water is used within a facility is critical for the water management planning process. A water assessment provides a comprehensive account of all known water uses at the facility. It allows the water management team to establish a baseline from which progress and program success can be measured. It also enables the water management team to set achievable goals and identify and prioritize specific projects based on the relative savings opportunities and project cost-effectiveness.

Water conservation devices may significantly reduce your water and sewer usage costs. Any reduction in water use reduces grid-level electricity use since a significant amount of electricity is used to treat and deliver water from reservoirs to end users.

For more information regarding water conservation or additional details regarding the practices shown below go to the EPA's WaterSense website[10] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[11] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Leak Detection and Repair

Identifying and repairing leaks and other water use anomalies within a facility's water distribution system or from processes or equipment can keep a facility from wasting significant quantities of water. Examples of common leaks include leaking toilets and faucets, drip irrigation malfunctions, stuck float valves, and broken distribution lines. Reading meters, installing failure abatement technologies, and conducting visual and auditory inspections are important best practices to detect leaks. Train building occupants, employees, and visitors to report any leaks that they detect. To reduce unnecessary water loss, detected leaks should be repaired quickly. Repairing leaks in water distribution that is pressurized by on-site pumps or in heated or chilled water piping will also reduce energy use.

Toilets and Urinals

Toilets and urinals are considered sanitary fixtures and are found in most facilities. High efficiency fixtures are at least 20% more efficient than available standard products. Leaking or damaged equipment is a substantial source of water waste. Train users to report continuously flushing, leaking, or otherwise improperly operating equipment to the appropriate personnel. Depending on the age of the equipment

[8] Estimated from analyzing data in: Solley, Wayne B,. et al, "Estimated Use of Water in the United States in 1995", U.S Geological Suvey Circular 1200, (1998)

[9] https://dep.nj.gov/wp-content/uploads/dsr/trends-water-supply.pdf

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

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

and the frequency of use, it may be cost effective to replace older inefficient fixtures with current generation WaterSense labeled equipment.

Commercial facilities typically use tank toilets or wall-mount flushometers. Educate and inform users with restroom signage and other means to avoid flushing inappropriate objects. For tank toilets, periodically check to ensure fill valves are working properly and that water level is set correctly. Annually test toilets to ensure the flappers are not worn or allowing water to seep from the tank into the bowl and down the sewer. Control stops and piston valves on flushometer toilets should be checked at least annually.

Most urinals use water to flush liquid. These standard single-user fixtures are present in most facilities. Non-water urinals use a specially designed trap that allows liquid waste to drain out of the fixture through a trap seal, and into the drainage system. Flushing urinals should be inspected at least annually for proper valve and sensor operation. For non-water urinals, follow maintenance practices as directed by the manufacturer to ensure products perform as expected. Non-water urinals can be considered during urinal replacement, however, review the condition and design of the existing plumbing system and the expected usage patterns to ensure that these products will provide the anticipated performance.

Faucets and Showerheads

Faucets and showerheads are sanitary fixtures that generally dispense heated water. Reducing water use by these fixtures translates into a reduction of site fuel or electric use depending on how water is heated. High efficiency fixtures are at least 20% more efficient than available standard products. Leaking or damaged equipment is a substantial source of water waste. Train users to report continuously dripping, leaking, or otherwise improperly operating equipment to the appropriate personnel. Depending on the age of the equipment and the frequency of use, it may be cost effective to replace older fixtures with current generation WaterSense labeled equipment.

Faucets are used for a variety of purposes, and standard flow rates are dictated by the intended use. Public use lavatory faucets and kitchen faucets are subject to maximum flow rates while service sinks are not. Periodically inspect faucet aerators for scale buildup to ensure flow is not being restricted. Clean or replace the aerator or other spout end device as needed. Check and adjust automatic sensors (where installed) to ensure they are operating properly to avoid faucets running longer than necessary. Post materials in restrooms and kitchens to ensure user awareness of the facility's water-efficiency goals. Remind users to turn off the tap when they are done and to consider turning the tap off during sanitation activities when it is not being used. Consider installing lavatory and kitchen faucet fixtures with reduced flow. Federal standards limit kitchen and restroom faucet flows to 2.2 gpm. To qualify for a WaterSense label a faucet cannot exceed 1.5 gpm.

Effective in 1992, the maximum allowable flow rate for all showerheads sold in the United States is 2.5 gpm. Since this standard was enacted, many showerheads have been designed to use even less water. WaterSense labeled equipment is designed to use 2.0 gpm, or less. For optimum showerhead efficiency, the system pressure should be tested to make sure that it is between 20 and 80 pounds per square inch (psi). Verify that plumbing lines are routed through a shower valve to prevent water pressure fluctuations. Periodically inspect showerheads for scale buildup to ensure flow is not being restricted. In general, replace showerheads with 2.5 gpm flow rates or higher with WaterSense labeled models. Note: Use of poor performing replacement reduced flow showerheads may result in increased use if the duration of use is increased to compensate for reduced performance. WaterSense labeled showerheads are independently certified to meet or exceed minimum performance requirements for spray coverage and force.

Commercial Kitchen Equipment

Commercial and institutional sectors, including hospitals, offices, and schools, have substantial kitchen water use. Water in food service is used for steam cooking, spray/flow cleaning, dish washing, and ice making. In most commercial kitchens, the commercial dishwasher and pre-rinse spray valve account for over two-thirds of the water use. Newer technologies and better practices are available that can significantly reduce commercial kitchen equipment water and energy use. For example, ENERGY STAR qualified dishwashers and steam cookers are at least 10% more water-efficient and 15% more energy-efficient than standard models. With some models saving significantly more.

Cooking equipment includes combination ovens, steam cookers, and steam kettles. For efficient steam cooking operation, fill vessels to capacity when possible, set temperatures optimally for the process, and keep doors and lids closed while cooking. Replace gaskets to ensure proper sealing and repair leaks. When replacing combination ovens, select connectionless equipment; replace steam cookers with ENERGY STAR rated steam cookers.

Spray/flow cleaning equipment includes dipper wells, pre-rinse spray valves, food disposals, and wash down sprayers. Turn off water when service periods are slow and keep flow rates to minimum level. Train users to scrape food rather than rely on water pressure. Inspect for leaks and scaling. Test system pressure to ensure it is between 20 and 80 pounds per square inch (psi) for optimum flow and performance of spray equipment. For dipper wells, consider installing in-line flow restrictors to reduce flow. Pre-rinse spray valves can be replaced with new assemblies which use 1.3 gpm or less. Washdown sprayers can be equipped with self-closing nozzles or consider mopping/sweeping as an alternative.

Dishwashers range in type and include undercounter, stationary/hood, conveyor, and flight-type models. Only run dishwashers when they are full, and fill racks to maximum capacity. Be sure to replace damaged dishwasher racks. Educate staff to scrape dishes prior to loading. Ensure that final rinse pressure and water temperature are within the manufacturer's recommendations. Operate the dishwasher close to or at the minimum flow rate and set rinse cycle time to the manufacturer's minimum recommended settings. Make sure that manual fill valves close completely after the wash tank is filled. Find and repair any leaks. Inspect valves and rinse nozzles for proper operation and repair worn nozzles. Look for ENERGY STAR qualified models when purchasing or leasing a new commercial dishwasher or replacing an existing unit. Consider your kitchen throughput to select an appropriately sized commercial dishwasher since an oversized dishwasher will waste water if the machine is not loaded to capacity.

7 On-Site Generation

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

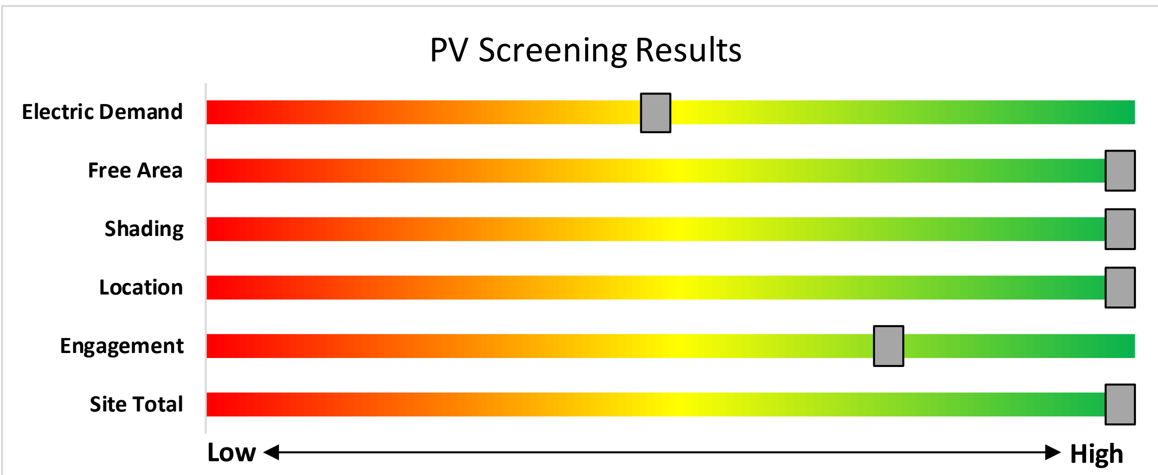
Preliminary screenings were performed to determine if an on-site generation measure could be a cost-effective solution for your facility. Before deciding to install an on-site generation system, we recommend conducting a feasibility study to analyze existing energy profiles, siting, interconnection,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

7.1 Solar Photovoltaic

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

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

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



Potential	High	
System Potential	182	kW DC STC
Electric Generation	216,829	kWh/yr
Displaced Cost	$45,400	/yr
Installed Cost	$473,200	

Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available for solar projects. Solar projects may qualify to earn SREC- IIs (Solar Renewable Energy Certificates-II), however, the project owners must register their solar projects prior to the start of construction to establish the project's eligibility.

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:

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

7.2 Combined Heat and Power

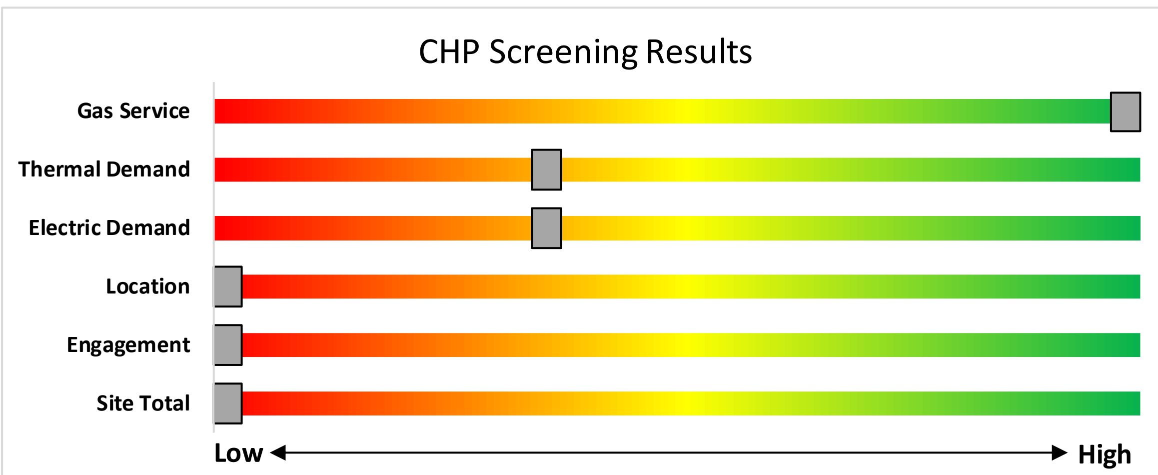
Combined heat and power (CHP) generates electricity at the facility and puts waste heat energy to good use. Common types of CHP systems are reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines.

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 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.



Combined Heat and Power Screening

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

8 Electric Vehicles

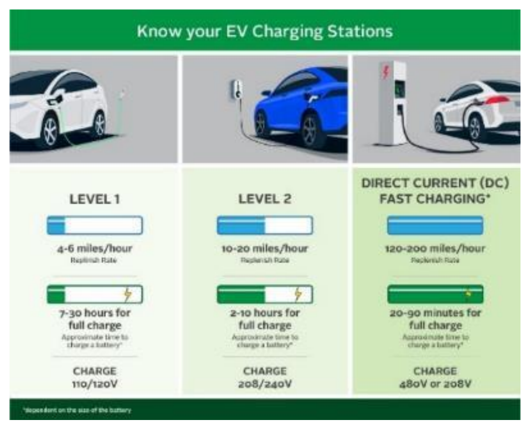
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes all-electric vehicles as zero-emission vehicles because they produce no direct exhaust or tailpipe emissions.

EVs are typically more expensive than similar conventional and hybrid vehicles, although some cost can be recovered through fuel savings, federal tax credit, or state incentives

8.1 EV Charging

EV charging stations provide a means for electric vehicle operators to recharge their batteries at a facility. While many EV drivers charge at home, others do not have access to regular home charging, and the ability to charge at work or in public locations is critical to making EVs practical for more drivers. Charging can also be used for electric fleet vehicles, which can reduce fuel and maintenance costs for fleets that replace gas or diesel vehicles with EVs.

EV charging comes in three main types. For this assessment, the screening considers addition of Level 2 charging, which is most common at workplaces and other public locations. Depending on the site type and usage, other levels of charging power may be more appropriate.



The preliminary assessment of EV charging at the facility shows that there is high potential for adding EV chargers to the facility's parking, based on potential costs of installation and other site factors.

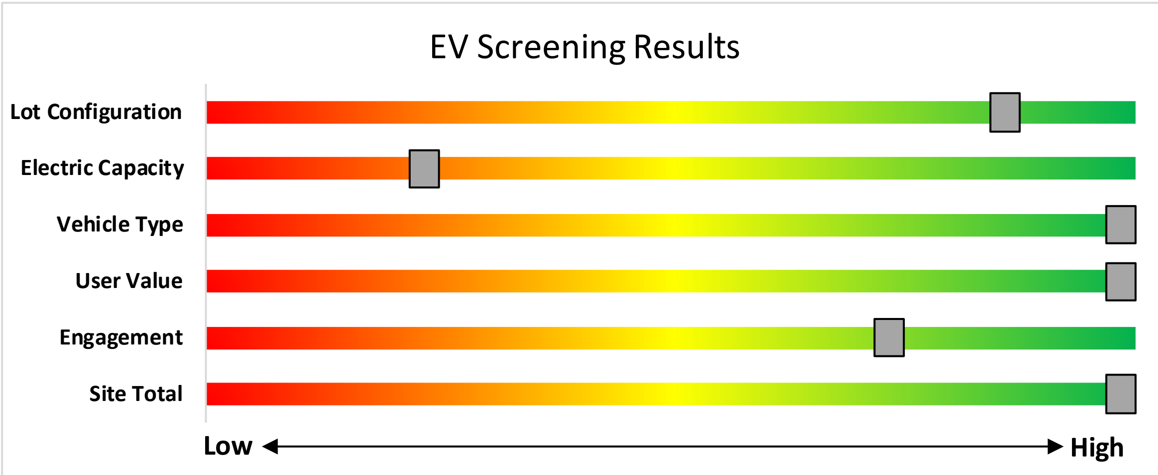
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

The type and size of the parking area impact the costs and feasibility of adding EV charging. Parking structure installations can be less costly than surface lot installations as power may be readily available, and equipment and wiring can be surface mounted. Parking lot installations often require trenching through concrete or asphalt surface. Large parking areas provide greater flexibility in charger siting than smaller lots.

The location and capacity of facility electric panels also impact charger installation costs. A Level 2 charger generally requires a dedicated 208-240V, 40 Amp circuit. The electric panel nearest the planned installation may not have available capacity and may need to be upgraded to serve new EV charging loads. Alternatively, chargers could be powered from a more distant panel. The distance from the panel to the location of charging stations ties directly to costs, as conduits, cables, and potential trenching costs all increase on a per-foot basis. The more charging stations planned, the more likely it is that additional electrical capacity will be needed.

Other factors to consider when planning for EV charging at a facility include who the intended users are, how long they park vehicles at the site, and whether they will need to pay for the electricity they use.

The graphic below displays the results of the EV charging assessment conducted as part of this audit. The position of each slider indicates the impact each factor has on the feasibility of installing EV charging at the site.



EV Charger Screening

Electric Vehicle Programs Available

New Jersey is leading the way on electric vehicle (EV) adoption on the East Coast. There are several programs designed to encourage EV adoption in New Jersey, which is crucial to reaching a 100% clean energy future.

NJCEP offers a variety of EV programs for vehicles, charging stations, and fleets. Certain EV charging stations that receive electric utility service from Atlantic City Electric Company (ACE), Public Service Electric and Gas Company (PSE&G) or Jersey Central Power and Light (JCP&L), may be eligible for additional electric vehicle charging incentives directly from the utility. Projects may be eligible for both the incentives offered by this BPU program and incentives offered by ACE, PSE&G or JCP&L, up to 90% of the combined charger purchase and installation costs. Please check ACE, PSE&G or JCP&L program eligibility requirements before purchasing EV charging equipment, as additional conditions on types of eligible chargers may apply for utility incentives.

EV Charging incentive information is available from Atlantic City Electric, PSE&G and JCP&L.For more information and to keep up to date on all EV programs please visit https://www.njcleanenergy.com/commercial-industrial/programs/electric-vehicle-programs

9 Project Funding and Incentives

Ready to improve your building's performance? New Jersey's Clean Energy Programs and Utility Energy Efficiency Programs can help. Pick the program that works best for you. This section provides an overview of currently available incentive programs in New Jersey.

NJBPU and NJCEP Administered Programs

New Jersey's cleanenergy program™

- New Construction (residential, commercial, industrial, government)
- Large Energy Users
- Energy Savings Improvement Program (financing)
- State Facilities Initiative*
- Local Government Energy Audits
- Combined Heat & Power & Fuel Cells

*State facilities are also eligible for utility programs

Utility Administered Programs

atlantic city electric – AN EXELON COMPANY; Jersey Central Power & Light – A FirstEnergy Company; PSEG; Rockland Electric Company; ELIZABETHTOWN GAS; SOUTH JERSEY GAS; New Jersey Natural Gas

- Existing buildings (residential, commercial, industrial, government)
- Efficient Products
    - Lighting & Marketplace
    - HVAC
    - Appliance Rebates
    - Appliance Recycling

9.1 New Jersey's Clean Energy Program

Save money while saving the planet! New Jersey's Clean Energy Program is a statewide program that offers incentives, programs, and services that benefit New Jersey residents, businesses, educational, non-profit, and government entities to help them save energy, money, and the environment.

Large Energy Users

The Large Energy Users Program (LEUP) is designed to foster self-directed investment in energy projects. This program is offered to New Jersey's largest energy customers. To qualify entities must have incurred at least $5 million in total energy costs in the prior fiscal year.

Incentives

Incentives are based on the specifications below. The maximum incentive per entity is the lesser of:

- $4 million
- 75% of the total project(s) cost
- 90% of total NJCEP fund contribution in previous year
- $0.33 per projected kWh saved; $3.75 per projected Therm saved annually

How to Participate

To participate in LEUP, you will first need submit an enrollment application. This program requires all qualified and approved applicants to submit an energy plan that outlines the proposed energy efficiency work for review and approval. Applicants may submit a Draft Energy Efficiency Plan (DEEP), or a Final Energy Efficiency Plan (FEEP). Once the FEEP is approved, the proposed work can begin.

Detailed program descriptions, instructions for applying, and applications can be found at http://www.njcleanenergy.com/LEUP.

Combined Heat and Power

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

Incentives[12]

<table>
<tr><th>Eligible Technology</th><th>Size (Installed Rated Capacity)</th><th>Incentive ($/Watt)[5]</th><th>% of Total Cost Cap per Project</th><th>$ Cap per Project</th></tr>
<tr><td rowspan="4">CHPs powered by non-renewable or renewable fuel source, or a combination:[4]
- Gas Internal Combustion Engine
- Gas Combustion Turbine
- Microturbine

Fuel Cells ≥60%</td><td>≤500 kW[1]</td><td>$2.00</td><td rowspan="2">30-40%[2]</td><td rowspan="2">$2 million</td></tr>
<tr><td>>500 kW - 1 MW[1]</td><td>$1.00</td></tr>
<tr><td>> 1 MW - 3 MW[1]</td><td>$0.55</td><td rowspan="2">30%</td><td rowspan="2">$3 million</td></tr>
<tr><td>>3 MW[1]</td><td>$0.35</td></tr>
<tr><td>Fuel Cells ≥40%</td><td>Same as above[1]</td><td>Applicable amount above</td><td>30%</td><td>$1 million</td></tr>
<tr><td rowspan="2">Waste Heat to Power (WHP)[3]
Powered by non-renewable fuel source.
Heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine)</td><td>≤1MW[1]</td><td>$1.00</td><td>30%</td><td>$2 million</td></tr>
<tr><td>> 1MW[1]</td><td>$.50</td><td>30%</td><td>$3 million</td></tr>
</table>

12

[1] Incentives are tiered, which means the incentive levels vary based upon the installed rated capacity, as listed in the chart above. For example, a 4 MW CHP system would receive $2.00/watt for the first 500 kW, $1.00/watt for the second 500 kW, $0.55/watt for the next 2 MW and $0.35/watt for the last 1 MW (up to the caps listed).

[2] The maximum incentive will be limited to 30% of total project. For CHP projects up to 1 MW, this cap will be increased to 40% where a cooling application is used or included with the CHP system (e.g. absorption chiller).

[3] Projects will be eligible for incentives shown above, not to exceed the lesser of % of total project cost per project cap or maximum $ per project cap. Projects installing CHP or FC with WHP will be eligible for incentive shown above, not to exceed the lesser caps of the CHP or FC incentive. Minimum efficiency will be calculated based on annual total electricity generated, utilized waste heat at the host site (i.e. not lost/rejected), and energy input.

[4] Systems fueled by a Class 1 Renewable Fuel Source, as defined by N.J.A.C. 14:8-2.5, are eligible for a 30% incentive bonus. If the fuel is mixed, the bonus will be prorated accordingly. For example, if the mix is 60/40 (60% being a Class 1 renewable), the bonus will be 18%. This bonus will be included in the final performance incentive payment, based on system performance and fuel mix consumption data. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

[5] CHP-FC systems located at Critical Facility and incorporating blackstart and islanding technology are eligible for a 25% incentive bonus. This bonus incentive will be paid with the second/Installation incentive payment. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

How to Participate

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

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The program is used to register and certify 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 SREC-IIs (Solar Renewable Energy Certificates-II). SuSI consists of two sub-programs. The Administratively Determined Incentive (ADI) Program and the Competitive Solar Incentive (CSI) Program.

Administratively Determined Incentive (ADI) Program

The ADI Program provides administratively set incentives for net metered residential projects, net metered non-residential projects 5 MW or less, and all community solar projects.

After the registration is accepted, construction is complete, and a complete final as-built packet has been submitted, the project is issued a New Jersey certification number, which enables it to generate New Jersey SREC- IIs.

Market Segments	Size MW dc	Incentive Value ($/SREC II)	Public Entities Incentive Value - $20 Adder ($/SRECII)
Net Metered Residential	All types and sizes	$90	N/A
Small Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects smaller than 1 MW	$100	$120
Large Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects 1 MW to 5 MW	$90	$110
Small Net Metered Non-Residential Ground Mount	Projects smaller than 1 MW	$85	$105
Large Net Metered Non-Residential Ground Mount	Projects 1 MW to 5 MW	$80	$100
LMI Community Solar	Up to 5 MW	$90	N/A
Non-LMI Community Solar	Up to 5 MW	$70	N/A
Interim Subsection (t)	All types and sizes	$100	N/A

Eligible projects may generate SREC-IIs for 15 years following the commencement of commercial operations which is defined as permission to operate (PTO) from the Electric Distribution Company. After 15 years, projects may be eligible for a NJ Class I REC.

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

The ADI Program online portal is now open to new registrations.

Competitive Solar Incentive (CSI) Program

The CSI Program opened on April 15, 2023, and will serve as the permanent program within the SuSI Program providing incentives to larger solar facilities. The CSI Program is open to qualifying grid supply solar facilities, non-residential net metered solar installations with a capacity greater than five (5) megawatts ("MW"), and to eligible grid supply solar facilities installed in combination with energy storage.

CSI eligible facilities will only be allowed to register in the CSI program upon award of a bid pursuant to N.J.A.C. 14:8-11.10.

The CSI program structure has separate categories, or tranches, to ensure that a range of solar project types, including those on preferred sites, are able to participate despite potentially different project cost profiles. The Board has approved four tranches for grid supply and large net metered solar and an additional fifth tranche for storage in combination with grid supply solar. The following table lists procurement targets for the first solicitation:

Tranche	Project Type	MW (dc) Targets
Tranche 1.	Basic Grid Supply	140
Tranche 2.	Grid Supply on the Built Environment	80
Tranche 3.	Grid Supply on Contaminated Sites and Landfills	40
Tranche 4.	Net Metered Non- Residential	40
Tranche 5.	*Storage Paired with Grid	160 MWh

*The storage tranche of 160 MWh corresponds to a 4-hour storage pairing of 40 MW of solar

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan.

If you are considering installing solar on your building, visit the following link for more information: https://njcleanenergy.com/renewable-energy/programs/susi-program

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 contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the energy conservation measures (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 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.

Demand Response (DR) Energy Aggregator

Demand Response Energy Aggregator is a program designed to reduce the electric load when electric wholesale prices are high or when the reliability of the electric grid is threatened due to peak demand. Grid operators call upon curtailment service providers and commercial facilities to reduce electric usage during times of peak demand, making the grid more reliable and reducing transmission costs for all ratepayers. Curtailment service providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary and participants receive payments whether or not their facility is called upon to curtail its electric usage.

Typically, an electric customer must be capable of reducing their electric demand, within minutes, by at least 100 kW or more in order to participate in a DR program. Customers with greater capability to quickly curtail their demand during peak hours receive higher payments. Customers with back-up generators on site may also receive additional DR payments for their generating capacity if they agree to run the generators for grid support when called upon. Eligible customers who have chosen to participate in DR programs often find it to be a valuable source of revenue for their facility, because the payments can significantly offset annual electric costs.

Participating customers can often quickly reduce their peak load through simple measures, such as temporarily raising temperature setpoints on thermostats (so that air conditioning units run less frequently) or agreeing to dim or shut off less critical lighting. This usually requires some level of building automation and controls capability to ensure rapid load reduction during a DR curtailment event. DR program participants may need to install smart meters or may need to also sub-meter larger energy-using equipment, such as chillers, to demonstrate compliance with DR program requirements.

DR does not include the reduction of electricity consumption based on normal operating practice or behavior. For example, if a company's normal schedule is to close for a holiday, the reduction of electricity due to this closure or scaled-back operation is not considered a DR activity in most situations.

The first step toward participation in a DR program is to contact a curtailment service provider. A list of these providers is available on the website of the independent system operator, PJM, and it includes contact information for each company, as well as the states where they have active business[13]. PJM also posts training materials for program members interested in specific rules and requirements regarding DR activity along with a variety of other DR program information[14].

Curtailment service providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding program rules and requirements for metering and controls, assess a facility's ability to temporarily reduce electric load, and provide details on payments to be expected for participation in the program. Providers usually offer multiple options for DR to larger facilities, and they may also install controls or remote monitoring equipment of their own to help ensure compliance with all terms and conditions of a DR contract.

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[13] http://www.pjm.com/markets-and-operations/demand-response.aspx.

[14] http://www.pjm.com/training/training-events.aspx.

9.2 Utility Energy Efficiency Programs

The Clean Energy Act, signed into law by Governor Murphy in 2018, requires New Jersey's investor-owned gas and electric utilities to reduce their customers' use by set percentages over time. To help reach these targets the New Jersey Board of Public Utilities approved a comprehensive suite of energy efficiency programs to be run by the utility companies.

Prescriptive and Custom

The Prescriptive and Custom rebate program through your utility provider 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.

Equipment Examples

Lighting
Lighting Controls
HVAC Equipment
Refrigeration
Gas Heating
Gas Cooling
Commercial Kitchen Equipment
Food Service Equipment
Variable Frequency Drives
Electronically Commutate Motors
Variable Frequency Drives
Plug Loads Controls
Washers and Dryers
Agricultural
Water Heating

The Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type. The Custom program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives.

Direct Install

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

Incentives

The program pays up to 70% of the total installed cost of eligible measures.

How to Participate

To participate in Direct Install, you will work with a participating contractor. The contractor will be paid the measure incentives directly by the program, which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the Direct Install program, subject to program rules and eligibility, while the remaining percent of the cost is paid to the contractor by the customer.

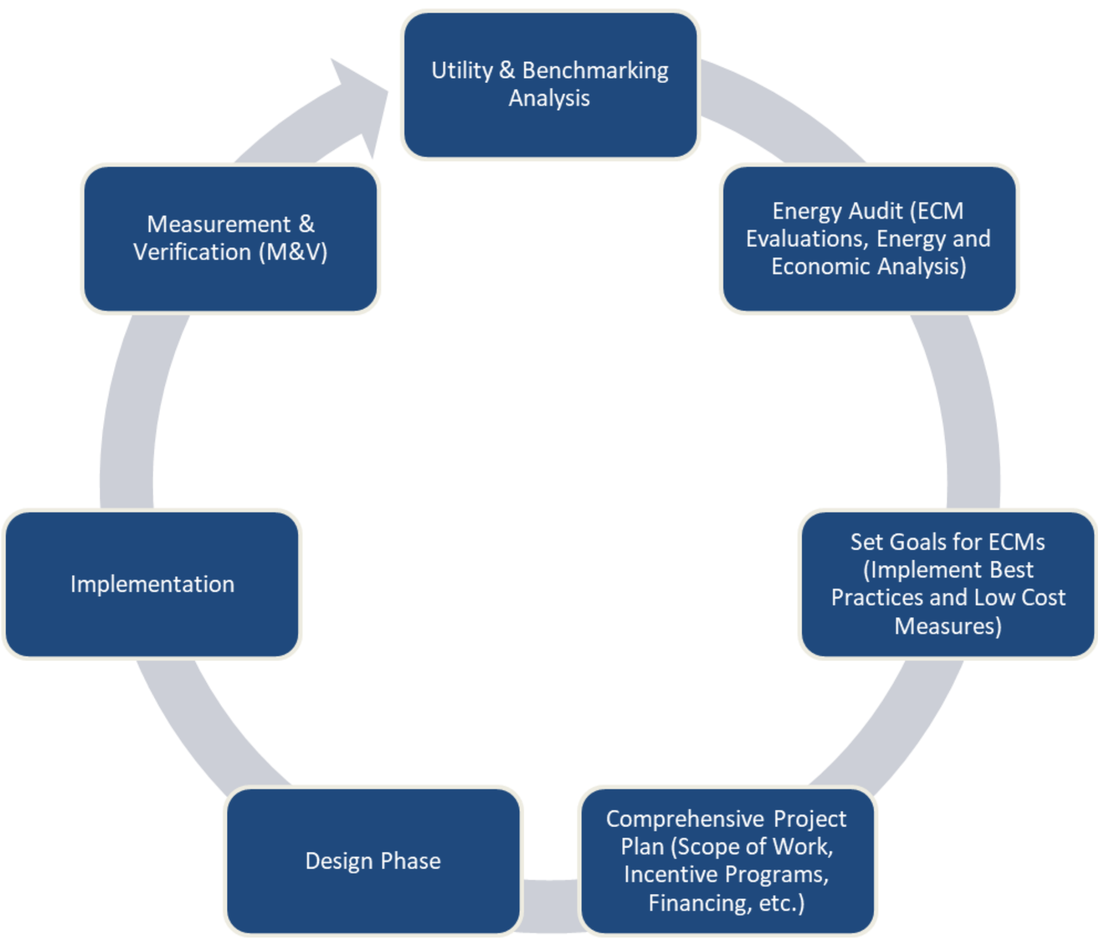
Engineered Solutions

The Engineered Solutions Program provides tailored energy-efficiency assistance and services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. Customers receive expert guided services, including investment-grade energy auditing, engineering design, installation assistance, construction administration, commissioning, and measurement and verification (M&V) services to support the implementation of cost-effective and comprehensive efficiency projects. Engineered Solutions is generally a good option for medium to large sized facilities with a peak demand over 200 kW looking to implement as many measures as possible under a single project to achieve deep energy savings. Engineered Solutions 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 for this program are based on project scope and energy savings achieved.

For more information on any of these programs, contact your local utility provider or visit https://www.njcleanenergy.com/transition.

10 Project Development

Energy conservation measures (ECMs) have been identified for your site, and their energy and economic analyses are provided within this LGEA report. Note that some of the identified projects may be mutually exclusive, such as replacing equipment versus upgrading motors or controls. The next steps with project development are to set goals and create a comprehensive project plan. The graphic below provides an overview of the process flow for a typical energy efficiency or renewable energy project. We recommend implementing as many ECMs as possible prior to undertaking a feasibility study for a renewable project. The cyclical nature of this process flow demonstrates the ongoing work required to continually improve building energy efficiency over time. If your building(s) scope of work is relatively simple to implement or small in scope, the measurement and verification (M&V) step may not be required. It should be noted through a typical project cycle, there will be changes in costs based on specific scopes of work, contractor selections, design considerations, construction, etc. The estimated costs provided throughout this LGEA report demonstrate the unburdened turn-key material and labor cost only. There will be contingencies and additional costs at the time of implementation. We recommend comprehensive project planning that includes the review of multiple bids for project work, incorporates potential operations and maintenance (O&M) cost savings, and maximizes your incentive potential.



Project Development Cycle

11 Energy Purchasing and Procurement Strategies

11.1 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. 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[15].

11.2 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 fluctuate monthly. The utility provides basic gas supply service 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[16].

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

[16] 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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
8 Band Room	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
8 Band Room	40	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000	2	None	Yes	40	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,380	0.3	791	0	$164	$990	$110	5.4
8 Band Room	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,000	0.0	0	0	$0	$0	$0	0.0
8 Band Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,000	1	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,000	0.0	73	0	$15	$50	$10	2.7
Board Break Room	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Board office entrance	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Board office entrance	1	LED Lamps: (1) 28W A19 Screw-In Lamp	Wall Switch	S	28	4,800		None	No	1	LED Lamps: (1) 28W A19 Screw-In Lamp	Wall Switch	28	4,800	0.0	0	0	$0	$0	$0	0.0
Boiler Room	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Boiler Room	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,800	2	None	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,312	0.0	332	0	$69	$330	$40	4.2
Boiler Room	10	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	4,800	2	None	Yes	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,312	0.1	712	0	$147	$330	$40	2.0
Break room 115F	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,000		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,000	0.0	0	0	$0	$0	$0	0.0
Break room 115F	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	2,000		None	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,000	0.0	0	0	$0	$0	$0	0.0
Cafeteria	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Cafeteria	133	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	3,500	2	None	Yes	133	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,415	0.9	4,603	-1	$952	$2,980	$320	2.8
Cafeteria	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	3,500	2	None	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,415	0.1	277	0	$57	$330	$40	5.1
Child Study	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 10 computer lab	18	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000	2	None	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,380	0.1	356	0	$74	$660	$70	8.0
Classroom 11	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 12	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 13	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 14	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 14 storage	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500	2	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.0	10	0	$2	$150	$20	63.6
Classroom 15	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000	2	None	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,380	0.1	158	0	$33	$330	$40	8.9
Classroom 16	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 18	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Classroom 19	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 19b	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,000	2	None	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,380	0.0	89	0	$18	$330	$40	15.8
Classroom 20	12	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,000	2	None	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,380	0.1	356	0	$74	$330	$40	3.9
Classroom 21	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 22	12	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	2,000		None	No	12	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 23	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 24	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 25	12	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	2,000		None	No	12	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 26	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Classroom 26	16	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	16	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 27	12	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	2,000		None	No	12	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 28	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 30	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 31	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 32	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 33	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 34	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 35	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 36 - art room	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000	2	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,380	0.0	79	0	$16	$330	$40	17.7
Classroom 36 - art room	25	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	25	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 37	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 38	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 39	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 41	7	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	7	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 42 WOOD SHOP	22	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	800		None	No	22	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	800	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Classroom 43	7	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	7	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 45	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 47	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 49	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 51	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 53	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,000		None	No	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom 55	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,000		None	No	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,000	0.0	0	0	$0	$0	$0	0.0
Classroom woodshop computer lab	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800	2	None	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	552	0.0	47	0	$10	$330	$40	29.5
Classroom woodshop computer lab	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	800		None	No	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	800	0.0	0	0	$0	$0	$0	0.0
Copy Room	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,500		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,500	0.0	0	0	$0	$0	$0	0.0
Copy Room 2	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,500	1, 2	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,035	0.2	366	0	$76	$600	$100	6.6
Corridor	4	Compact Fluorescent: (1) 26W Triple Biaxial Plug-In Lamp	Wall Switch	S	26	4,800	1, 4	Relamp	Yes	4	LED Lamps: GX23 (Plug-In) Lamps	High/Low Control	19	3,312	0.0	272	0	$56	$330	$140	3.4
Corridor	22	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	22	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor	6	LED - Fixtures: Ambient - 2' - Direct/Indirect Fixture	Wall Switch	S	30	4,800	4	None	Yes	6	LED - Fixtures: Ambient - 2' - Direct/Indirect Fixture	High/Low Control	30	3,312	0.0	295	0	$61	$280	$210	1.1
Corridor	1	LED - Fixtures: Ambient - 4' - Direct Fixture	Wall Switch	S	40	4,800		None	No	1	LED - Fixtures: Ambient - 4' - Direct Fixture	Wall Switch	40	4,800	0.0	0	0	$0	$0	$0	0.0
Corridor	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	4,800	4	None	Yes	3	LED - Linear Tubes: (1) 4' Lamp	High/Low Control	15	3,312	0.0	71	0	$15	$280	$110	11.5
Corridor	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,800	4	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,312	0.0	142	0	$29	$280	$110	5.8
Corridor	89	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,800	4	None	Yes	89	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,312	0.6	4,225	-1	$874	$4,230	$3,120	1.3
Corridor	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,800	4	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,312	0.0	142	0	$29	$280	$110	5.8
Corridor	5	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	4,800	4	None	Yes	5	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	3,312	0.0	356	0	$74	$280	$180	1.4
Corridor	2	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	S	22	4,800	1, 4	Relamp	Yes	2	LED - Linear Tubes: (1) 2' Lamp	High/Low Control	9	3,312	0.0	170	0	$35	$330	$80	7.1
Corridor	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	4,800	1, 4	Relamp	Yes	2	LED - Linear Tubes: (1) 4' Lamp	High/Low Control	15	3,312	0.0	232	0	$48	$330	$80	5.2
Corridor boys locker	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor boys locker	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000	4	None	Yes	8	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,380	0.1	158	0	$33	$560	$280	8.6
Corridor boys locker	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	2,000		None	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,000	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Corridor FACP	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor FACP	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,800	4	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,312	0.0	142	0	$29	$280	$110	5.8
Corridor gym	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Corridor to courtyard	3	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	500	4	None	Yes	3	LED - Linear Tubes: (2) 2' Lamps	High/Low Control	17	345	0.0	9	0	$2	$280	$110	94.5
Custodial Closet	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.0	0	0	$0	$0	$0	0.0
Custodial closet c	1	Compact Fluorescent: (1) 26W Spiral Plug-In Lamp	Wall Switch	S	26	500	1	Relamp	No	1	LED Lamps: (2) 23W Biax Lamps	Wall Switch	19	500	0.0	4	0	$1	$30	$0	37.7
Electrical 114N	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	500		None	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	500	0.0	0	0	$0	$0	$0	0.0
Exterior 3	1	Compact Fluorescent: (2) 13W Double Biaxial Plug-In Lamps	Timeclock		26	4,380	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Timeclock	19	4,380	0.0	31	0	$6	$40	$0	6.2
Exterior 3	2	Compact Fluorescent: (2) 13W Double Biaxial Plug-In Lamps	Timeclock		26	4,380	1	Relamp	No	2	LED Lamps: GX23 (Plug-In) Lamps	Timeclock	19	4,380	0.0	61	0	$13	$80	$0	6.2
Exterior 3	3	LED Lamps: (1) 10W A19 Screw-In Lamp	Timeclock		10	4,380		None	No	3	LED Lamps: (1) 10W A19 Screw-In Lamp	Timeclock	10	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 3	7	LED - Fixtures: Cove Mount	Timeclock		30	4,380		None	No	7	LED - Fixtures: Cove Mount	Timeclock	30	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 3	11	LED - Fixtures: Low-Bay	Timeclock		28	4,380		None	No	11	LED - Fixtures: Low-Bay	Timeclock	28	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 3	9	LED - Fixtures: Wall Pack	Timeclock		20	4,380		None	No	9	LED - Fixtures: Wall Pack	Timeclock	20	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 3	6	LED - Fixtures: Wall Pack	Timeclock		30	4,380	3	None	Yes	6	LED - Fixtures: Wall Pack	Photocell	30	4,380	0.0	0	0	$0	$490	$0	0.0
Exterior 3	4	LED - Fixtures: Wall Pack	Timeclock		40	4,380		None	No	4	LED - Fixtures: Wall Pack	Timeclock	40	4,380	0.0	0	0	$0	$0	$0	0.0
Faculty Room	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	1,500		None	No	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,500	0.0	0	0	$0	$0	$0	0.0
File room 114H	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	500	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	345	0.0	15	0	$3	$150	$20	42.4
Gymnasium auxiliary	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Gymnasium auxiliary	18	LED - Fixtures: High-Bay	Wall Switch	S	200	3,000	2	None	Yes	18	LED - Fixtures: High-Bay	Occupancy Sensor	200	2,070	0.8	3,683	-1	$762	$660	$70	0.8
Gymnasium main	30	LED - Fixtures: High-Bay	Wall Switch	S	200	3,000	2	None	Yes	30	LED - Fixtures: High-Bay	Occupancy Sensor	200	2,070	1.3	6,138	-1	$1,269	$660	$70	0.5
Janitorial 2	1	LED Lamps: (1) 20W PAR38 Screw-In Lamp	Wall Switch	S	20	500		None	No	1	LED Lamps: (1) 20W PAR38 Screw-In Lamp	Wall Switch	20	500	0.0	0	0	$0	$0	$0	0.0
Janitorial 2 (1)	1	LED Lamps: (1) 20W PAR38 Screw-In Lamp	Wall Switch	S	20	500		None	No	1	LED Lamps: (1) 20W PAR38 Screw-In Lamp	Wall Switch	20	500	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	7	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	7	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	1	LED Lamps: (9) 9W A19 Screw-In Lamps	Wall Switch	S	81	2,000		None	No	1	LED Lamps: (9) 9W A19 Screw-In Lamps	Wall Switch	81	2,000	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	26	LED - Fixtures: Ambient - 4' - Direct Fixture	Wall Switch	S	40	2,000	2	None	Yes	26	LED - Fixtures: Ambient - 4' - Direct Fixture	Occupancy Sensor	40	1,380	0.2	709	0	$147	$660	$70	4.0

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen 1	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000	2	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,380	0.0	40	0	$8	$150	$20	15.9
Kitchen custodial	1	LED Lamps: (1) 17W A19 Screw-In Lamp	Wall Switch	S	17	500		None	No	1	LED Lamps: (1) 17W A19 Screw-In Lamp	Wall Switch	17	500	0.0	0	0	$0	$0	$0	0.0
Library	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	3,000	2	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,070	0.0	59	0	$12	$150	$20	10.6
Library	48	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	3,000	2	None	Yes	48	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.6	2,848	-1	$589	$1,320	$140	2.0
Library	19	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	3,000	2	None	Yes	19	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,070	0.1	330	0	$68	$660	$70	8.6
Library gaming lab	8	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	1,500	2	None	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,035	0.1	237	0	$49	$330	$40	5.9
Locker Room mens	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Locker Room mens	10	LED - Fixtures: Cove Mount	Wall Switch	S	15	2,000	2	None	Yes	10	LED - Fixtures: Cove Mount	Occupancy Sensor	15	1,380	0.0	102	0	$21	$330	$40	13.7
Locker Room mens	2	LED - Fixtures: Linear Strip	Wall Switch	S	40	2,000	2	None	Yes	2	LED - Fixtures: Linear Strip	Occupancy Sensor	40	1,380	0.0	55	0	$11	$330	$40	25.7
Locker Room mens	31	LED - Fixtures: Linear Strip	Occupancy Sensor	S	40	2,000		None	No	31	LED - Fixtures: Linear Strip	Occupancy Sensor	40	2,000	0.0	0	0	$0	$0	$0	0.0
Locker Room womens	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Locker Room womens	10	LED - Fixtures: Cove Mount	Wall Switch	S	15	2,000	2	None	Yes	10	LED - Fixtures: Cove Mount	Occupancy Sensor	15	1,380	0.0	102	0	$21	$330	$40	13.7
Locker Room womens	2	LED - Fixtures: Linear Strip	Wall Switch	S	40	2,000	2	None	Yes	2	LED - Fixtures: Linear Strip	Occupancy Sensor	40	1,380	0.0	55	0	$11	$330	$40	25.7
Locker Room womens	31	LED - Fixtures: Linear Strip	Occupancy Sensor	S	40	2,000		None	No	31	LED - Fixtures: Linear Strip	Occupancy Sensor	40	2,000	0.0	0	0	$0	$0	$0	0.0
Main entrance	6	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	4,800	2	None	Yes	6	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,312	0.0	167	0	$35	$330	$40	8.4
Office - 114A	6	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.1	134	0	$28	$330	$40	10.5
Office - 114A (1)	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.0	45	0	$9	$150	$20	14.1
Office - 114B	6	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.1	134	0	$28	$330	$40	10.5
Office - 114C	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.0	45	0	$9	$150	$20	14.1
Office - 114D	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.0	45	0	$9	$150	$20	14.1
Office - 114K	24	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,500	2	None	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.2	356	0	$74	$660	$70	8.0
Office - 115A	4	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.0	89	0	$18	$330	$40	15.8
Office - 115B	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.0	45	0	$9	$150	$20	14.1
Office - 115C	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.0	45	0	$9	$150	$20	14.1
Office - 115E	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.0	45	0	$9	$150	$20	14.1

	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**	**Estimated M&L Cost ($)**	**Total Incentives**	**Simple Payback w/ Incentives in Years**
Office - 115F	4	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	1,500	2	None	Yes	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,035	0.0	35	0	$7	$330	$40	40.3
Office - 115G	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.0	45	0	$9	$150	$20	14.1
Office - 115H	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,500	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,035	0.0	45	0	$9	$150	$20	14.1
Office - 17	5	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	1,500		None	No	5	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,500	0.0	0	0	$0	$0	$0	0.0
Office - Band	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,500	2	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.0	45	0	$9	$330	$40	31.5
Office - Band (1)	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,500	2	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.0	59	0	$12	$330	$40	23.6
Office - Board 114	5	Compact Fluorescent: (1) 26W Triple Biaxial Plug-In Lamp	Wall Switch	S	26	2,800	1, 2	Relamp	Yes	5	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	19	1,932	0.0	199	0	$41	$390	$50	8.3
Office - Board 114	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,800		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,800	0.0	0	0	$0	$0	$0	0.0
Office - Board 114	13	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,800	2	None	Yes	13	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,932	0.1	540	0	$112	$330	$40	2.6
Office - Board 114	6	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	2,800	2	None	Yes	6	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,932	0.0	97	0	$20	$330	$40	14.4
Office - Boiler room	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,800	2	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,312	0.0	95	0	$20	$150	$20	6.6
Office - Director of Facilities	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,800		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,800	0.0	0	0	$0	$0	$0	0.0
Office - Director of Facilities	3	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	2,800	2	None	Yes	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,932	0.0	49	0	$10	$330	$40	28.8
Office - IT Manager	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,800	2	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,932	0.0	83	0	$17	$150	$20	7.6
Office - Library	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,000	2	None	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,380	0.1	158	0	$33	$330	$40	8.9
Office - Mail Room	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,000		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,000	0.0	0	0	$0	$0	$0	0.0
Office - Main	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Office - Main	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,880		None	No	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,880	0.0	0	0	$0	$0	$0	0.0
Office - Main (1)	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,016		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,016	0.0	0	0	$0	$0	$0	0.0
Office - Main (2)	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,016		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,016	0.0	0	0	$0	$0	$0	0.0
Office - Main (3)	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,016		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,016	0.0	0	0	$0	$0	$0	0.0
Office - Main (4)	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,016		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,016	0.0	0	0	$0	$0	$0	0.0
Office - Main (5)	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,016		None	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,016	0.0	0	0	$0	$0	$0	0.0
Office - Main (6)	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,016		None	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,016	0.0	0	0	$0	$0	$0	0.0
Office - Main (7)	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,016		None	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,016	0.0	0	0	$0	$0	$0	0.0

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Office - Main (8)	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	2,016		None	No	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,016	0.0	0	0	$0	$0	$0	0.0
Office - Nurse	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,880	2	None	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,987	0.0	128	0	$27	$330	$40	10.9
Office - Nurse back	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,880	2	None	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,987	0.0	128	0	$27	$330	$40	10.9
Office - Principal	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,016		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,016	0.0	0	0	$0	$0	$0	0.0
Office 115 corridor	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,880		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,880	0.0	0	0	$0	$0	$0	0.0
Office 115 corridor	6	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	2,880	2	None	Yes	6	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,987	0.0	100	0	$21	$330	$40	14.0
Office 115 corridor	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,880	1	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,880	0.0	157	0	$32	$60	$20	1.2
Restroom - 17	1	LED Lamps: (2) 10W A19 Screw-In Lamps	Wall Switch	S	20	1,000		None	No	1	LED Lamps: (2) 10W A19 Screw-In Lamps	Wall Switch	20	1,000	0.0	0	0	$0	$0	$0	0.0
Restroom - 301	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,000		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,000	0.0	0	0	$0	$0	$0	0.0
Restroom - 302	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,000		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,000	0.0	0	0	$0	$0	$0	0.0
Restroom - Band	1	LED - Fixtures: Ambient - 2' - Direct Fixture	Wall Switch	S	20	1,000		None	No	1	LED - Fixtures: Ambient - 2' - Direct Fixture	Wall Switch	20	1,000	0.0	0	0	$0	$0	$0	0.0
Restroom - Boiler room	1	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	S	9	1,000		None	No	1	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	9	1,000	0.0	0	0	$0	$0	$0	0.0
Restroom - Faculty room	2	LED - Fixtures: Ambient - 2' - Direct Fixture	Occupancy Sensor	S	20	1,000		None	No	2	LED - Fixtures: Ambient - 2' - Direct Fixture	Occupancy Sensor	20	1,000	0.0	0	0	$0	$0	$0	0.0
Restroom - Female - WT	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,000	2	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	30	0	$6	$330	$40	47.3
Restroom - Female 2	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,000	2	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	30	0	$6	$330	$40	47.3
Restroom - Girl's	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,000		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,000	0.0	0	0	$0	$0	$0	0.0
Restroom - Kitchen	1	Compact Fluorescent: (1) 13W Spiral Plug-In Lamp	Wall Switch	S	13	400	1	Relamp	No	1	LED Lamps: (1) 10.5W Plug-In Lamp	Wall Switch	10	400	0.0	1	0	$0	$30	$0	109.9
Restroom - Kitchen	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	400		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	400	0.0	0	0	$0	$0	$0	0.0
Restroom - locker room	1	LED - Fixtures: Cove Mount	Occupancy Sensor	S	15	1,000		None	No	1	LED - Fixtures: Cove Mount	Occupancy Sensor	15	1,000	0.0	0	0	$0	$0	$0	0.0
Restroom - male - WT	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,000	2	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	30	0	$6	$330	$40	47.3
Restroom - Male 2	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,000	2	None	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	59	0	$12	$330	$40	23.6
Restroom - Male 3	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,000	2	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	30	0	$6	$330	$40	47.3
Restroom - mens faculty	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500	2	None	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.0	35	0	$7	$330	$40	40.5
Restroom - Nurse	1	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	S	9	500		None	No	1	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	9	500	0.0	0	0	$0	$0	$0	0.0
Restroom - training room	1	LED - Fixtures: Cove Mount	Occupancy Sensor	S	15	200		None	No	1	LED - Fixtures: Cove Mount	Occupancy Sensor	15	200	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Restroom - Womens faculty	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500	2	None	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.0	30	0	$6	$330	$40	47.3
Restroom 2 - training room	1	LED - Fixtures: Cove Mount	Occupancy Sensor	S	15	200		None	No	1	LED - Fixtures: Cove Mount	Occupancy Sensor	15	200	0.0	0	0	$0	$0	$0	0.0
Server room	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	500		None	No	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	500	0.0	0	0	$0	$0	$0	0.0
Storage - training room	1	LED - Fixtures: Linear Strip	Occupancy Sensor	S	40	200		None	No	1	LED - Fixtures: Linear Strip	Occupancy Sensor	40	200	0.0	0	0	$0	$0	$0	0.0
Storage 8	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	200		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	200	0.0	0	0	$0	$0	$0	0.0
Storage band	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800	2	None	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	552	0.0	47	0	$10	$330	$40	29.5
Storage band	7	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	800	1, 2	Relamp	Yes	7	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	552	0.3	388	0	$80	$770	$150	7.7
Storage band closet	1	LED - Fixtures: Ambient - 2' - Direct Fixture	Wall Switch	S	20	800		None	No	1	LED - Fixtures: Ambient - 2' - Direct Fixture	Wall Switch	20	800	0.0	0	0	$0	$0	$0	0.0
Storage Closet 1	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	200	2	None	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	138	0.1	16	0	$3	$330	$40	88.6
Storage Closet 2	5	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	200	2	None	Yes	5	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	138	0.1	20	0	$4	$330	$40	70.9
Storage Closet 2	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	500	1	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	500	0.0	31	0	$6	$90	$20	11.0
Storage gym	10	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	500	1, 2	Relamp	Yes	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	345	0.5	407	0	$84	$1,210	$240	11.5
Storage kitchen	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500	2	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.0	10	0	$2	$150	$20	63.6
Storage kitchen (1)	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500	2	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.0	10	0	$2	$150	$20	63.6
Storage WT	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500	2	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.0	20	0	$4	$330	$40	70.9
Theater 1	6	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	6	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Theater 1	36	Incandescent: (1) 200W PAR30 Screw-In Lamp	Wall Switch	S	200	200	1	Relamp	No	36	LED Lamps: PAR30 Lamps	Wall Switch	30	200	4.4	1,346	0	$278	$910	$110	2.9
Theater 1	12	LED Lamps: (2) 9W A19 Screw-In Lamps	Wall Switch	S	18	1,000		None	No	12	LED Lamps: (2) 9W A19 Screw-In Lamps	Wall Switch	18	1,000	0.0	0	0	$0	$0	$0	0.0
Theater 1	64	LED - Fixtures: Cove Mount	Wall Switch	S	15	1,000		None	No	64	LED - Fixtures: Cove Mount	Wall Switch	15	1,000	0.0	0	0	$0	$0	$0	0.0
Theater 1	24	LED - Fixtures: Track or Mono-Point Directional Lighting Fixtures	Wall Switch	S	100	1,000		None	No	24	LED - Fixtures: Track or Mono-Point Directional Lighting Fixtures	Wall Switch	100	1,000	0.0	0	0	$0	$0	$0	0.0
Theater 1	16	LED - Fixtures: Track or Mono-Point Directional Lighting Fixtures	Wall Switch	S	200	1,000		None	No	16	LED - Fixtures: Track or Mono-Point Directional Lighting Fixtures	Wall Switch	200	1,000	0.0	0	0	$0	$0	$0	0.0
Theater 1	22	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,000		None	No	22	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.0	0	0	$0	$0	$0	0.0
Theater 1	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,000	1, 2	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	690	0.1	86	0	$18	$330	$40	16.2
Theater Lobby	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Theater Lobby	4	Incandescent: (1) 60W PAR16 Screw-In Lamp	Wall Switch	S	60	4,800	1, 2	Relamp	Yes	4	LED Lamps: PAR16 Lamps	Occupancy Sensor	9	3,312	0.2	1,136	0	$235	$430	$50	1.6

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Theater Lobby	17	LED - Fixtures: Ambient - 2' - Direct Fixture	Wall Switch	S	20	4,800	2	None	Yes	17	LED - Fixtures: Ambient - 2' - Direct Fixture	Occupancy Sensor	20	3,312	0.1	557	0	$115	$660	$70	5.1
Training Room	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Training Room	21	LED - Fixtures: Linear Strip	Occupancy Sensor	S	40	8,760		None	No	21	LED - Fixtures: Linear Strip	Occupancy Sensor	40	8,760	0.0	0	0	$0	$0	$0	0.0
Weight training	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Weight training	44	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	8,760		None	No	44	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	8,760	0.0	0	0	$0	$0	$0	0.0
Woodshop spray booth room	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	100		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	100	0.0	0	0	$0	$0	$0	0.0
Mechanical- Fan Room #1	3	Incandescent: (1) 80W A19 Screw-In Lamp	Wall Switch	S	80	800	1, 2	Relamp	Yes	3	LED Lamps: A19 Lamps	Occupancy Sensor	12	552	0.2	189	0	$39	$410	$40	9.4
Mechanical- Fan Room #2	3	Compact Fluorescent: (1) 26W Spiral Plug-In Lamp	Wall Switch	S	26	800	1, 2	Relamp	Yes	3	LED Lamps: (2) 23W Biax Lamps	Occupancy Sensor	19	552	0.0	34	0	$7	$410	$40	52.6
Mechanical- Fan Room #2	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	800	1, 2	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	552	0.1	74	0	$15	$250	$40	13.7

Motor Inventory & Recommendations

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Woodshop spray booth room	Woodshop spray booth room	1	Exhaust Fan	0.16	60.0%	No			W	100		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical- Fan Room #1	gym	1	Exhaust Fan	0.50	78.2%	Yes			W	2,550		No	78.2%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	2	Exhaust Fan	1.00	85.5%	No			W	3,000	6	No	85.5%	Yes	2	0.6	1,963	0	$411	$7,900	$200	18.7
Roof	various	4	Exhaust Fan	0.25	69.5%	Yes			W	2,745		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	7	Exhaust Fan	0.17	65.0%	No			W	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	1	Exhaust Fan	1.00	85.5%	Yes			W	2,550		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	3	Exhaust Fan	0.75	81.1%	Yes			W	2,550		No	81.1%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Ticket Booth	1	Exhaust Fan	0.13	65.0%	No			W	200		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	2	Exhaust Fan	0.13	65.0%	No			W	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	1	Exhaust Fan	0.25	69.5%	No			W	3,000		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	2	Exhaust Fan	0.33	73.4%	No			W	3,000		No	73.4%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	1	Exhaust Fan	0.25	69.5%	No			W	3,000		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	1	Exhaust Fan	0.33	73.4%	Yes			W	2,550		No	73.4%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	2	Exhaust Fan	0.50	78.2%	Yes			W	2,550		No	78.2%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	2	Exhaust Fan	0.25	69.5%	No			W	3,000		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	4	Exhaust Fan	0.17	65.0%	No			W	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Lab Fume hood	1	Exhaust Fan	0.33	73.4%	No			W	2,000		No	73.4%	No		0.0	0	0	$0	$0	$0	0.0
Roof	various	2	Exhaust Fan	0.33	73.4%	Yes			W	2,550		No	73.4%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Workroom	1	Exhaust Fan	0.17	65.0%	No			W	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Upper rooves	gym	1	Exhaust Fan	1.00	85.5%	Yes			W	2,550		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Upper rooves	gym	1	Exhaust Fan	0.50	78.2%	Yes			W	2,550		No	78.2%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Boiler 1	2	Heating Hot Water Pump	7.50	91.7%	Yes	Armstrong	43801VS-10 0310-007.5	W	2,190		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Boiler 2	2	Heating Hot Water Pump	5.00	89.5%	Yes	Armstrong	43801VS-6 0206-005.0	W	2,190		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Boiler 3	2	Heating Hot Water Pump	7.50	91.7%	Yes	Armstrong	43801VS-10 0310-007.5	W	2,190		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Kitchen	Kitchen	1	Kitchen Hood Exhaust Fan	15.00	92.4%	No				1,800	5, 6	Yes	93.0%	Yes	1	0.0	10,629	52	$2,864	$10,200	$1,200	3.1
Classroom 42 WOOD SHOP	Classroom 42 WOOD SHOP	2	Exhaust Fan	0.50	85.5%	No				300		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Exterior	Classroom 42 WOOD SHOP	1	Exhaust Fan	2.00	86.5%	No	Baldor			300		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical- Fan Room #1	gym	2	Ventilation Fan	2.00	86.5%	Yes				2,745		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical- Fan Room #2	theater	1	Supply Fan	10.00	89.5%	Yes	GE	5KE215AC205C		3,000		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical- Fan Room #2	theater	1	Return Fan	3.00	89.5%	Yes				3,000		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical- Fan Room #2	gym	2	Ventilation Fan	2.00	86.5%	Yes				2,745		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical- Fan Room #2	various	1	Heating Hot Water Pump	1.00	85.5%	No		M99076		2,745	7	No	85.5%	Yes	1	0.1	898	0	$188	$4,300	$100	22.3
Roof	various	4	Supply Fan	1.00	85.5%	No				500		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Locker Rooms	8	Supply Fan	0.75	81.1%	No				500		No	81.1%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Team Rooms, Locker Rooms	7	Supply Fan	0.50	85.5%	Yes	Genteq	5SME39NS HB742		1,500		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Various Classrooms	Various Classrooms	42	Fan Coil Unit	0.24	75.0%	Yes	Trane	X70371318010B	N	2,400		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Various Classrooms	Various Classrooms	24	Fan Coil Unit	0.08	65.0%	No	Genteq	5KCP39FG	B	3,000	5	Yes	80.0%	No		0.2	968	0	$203	$7,600	$0	37.5
Various Classrooms	Various Classrooms	6	Fan Coil Unit	0.13	65.0%	No			B	3,000	5	Yes	80.0%	No		0.1	363	0	$76	$1,900	$0	25.0
Boiler Room, Kitchen	Boiler Room, Kitchen	2	Fan Coil Unit	0.17	65.0%	No			W	100		No	65.0%	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?	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Corridors	Corridors	10	Fan Coil Unit	0.25	69.5%	No			W	2,745	4	Yes	80.0%	No		0.2	725	0	$152	$3,200	$0	21.1
Roof	RTU	1	Supply Fan	5.00	89.5%	Yes	Baldor	36M439T139G1	W	2,400		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU	2	Ventilation Fan	0.33	73.4%	No			W	1,800		No	73.4%	No		0.0	0	0	$0	$0	$0	0.0
Roof	SP Services	1	Supply Fan	2.00	86.5%	No	AO Smith	H181L	W	3,000	5	No	86.5%	Yes	1	0.6	1,940	0	$406	$4,700	$100	11.3
Roof	Board Office	1	Supply Fan	2.00	86.5%	No	Marathon electric	5K49WN4551Z	W	3,000	5	No	86.5%	Yes	1	0.6	1,940	0	$406	$4,700	$100	11.3
Roof	Cafeteria	1	Supply Fan	5.00	90.2%	No	Baldor	EM3218T	W	3,000	5	No	90.2%	Yes	1	1.4	4,652	0	$974	$5,600	$900	4.8
Roof	Cafeteria	1	Return Fan	3.00	89.5%	No			W	3,000	5	No	89.5%	Yes	1	0.9	2,813	0	$589	$5,100	$200	8.3
Roof	Library	1	Supply Fan	3.80	89.5%	Yes			W	2,400		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Main Office	1	Supply Fan	3.00	87.5%	Yes	Baldor	526283	W	2,400	4	Yes	89.5%	No		0.0	103	0	$22	$900	$0	41.8
Roof	Main Office	2	Ventilation Fan	0.75	81.1%	No			W	1,800		No	81.1%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Band Room	1	Supply Fan	2.00	85.5%	Yes			W	3,000		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Band Room	1	Return Fan	1.00	85.5%	Yes	Baldor	EMs116T	W	1,500		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Boilers	3	Combustion Air Fan	2.00	86.5%	No			W	500		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	gyms	2	Supply Fan	3.00	85.5%	Yes	Marathon electric	VQC 56T17D15631A	W	3,000	4	Yes	89.5%	No		0.1	526	0	$110	$2,400	$0	21.8
Boiler Room	DWH	2	DHW Circulation Pump	0.33	73.4%	No			W	4,380		No	73.4%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Band Room	1	Supply Fan	2.00	85.5%	Yes			W	0		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Band Room	1	Return Fan	1.00	85.5%	Yes	Baldor	EMs116T	W	0		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0

Packaged 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)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Manufacturer	Model	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/IEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
South Courtyard	Classroom	1	Ductless Mini-Split HP	2.50	32.00	19.00	10 HSPF	Friedrich	MR30Y3J	W		No							0.0	0	0	$0	$0	$0	0.0
South Courtyard	Classroom	2	Ductless Mini-Split HP	3.00	36.00	16.40	8.8 HSPF	Friedrich	FPHSR36A3A	B		No							0.0	0	0	$0	$0	$0	0.0
South Courtyard	Classroom	1	Ductless Mini-Split HP	1.83	23.00	16.00	9 HSPF	Luxaire	DHP24CSB21S	W		No							0.0	0	0	$0	$0	$0	0.0
South Courtyard	Classroom 39	1	Ductless Mini-Split AC	1.92		12.22		Friedrich	MR24C3E	B	8	Yes	1	Ductless Mini-Split AC	1.92		18.00		0.3	181	0	$38	$4,200	$0	110.6
North Courtyard	Classroom 15	1	Ductless Mini-Split HP	1.83	23.00	16.00	9 HSPF	Luxaire	DHP24CSB21S	W		No							0.0	0	0	$0	$0	$0	0.0
North Courtyard	Classroom 11	1	Ductless Mini-Split HP	0.75	10.50	28.00	12.5 HSPF	Friedrich	MRH09Y3JA	W		No							0.0	0	0	$0	$0	$0	0.0
North Courtyard	Classroom 13	1	Ductless Mini-Split AC	1.92		12.22		Friedrich	MR24C3E	B		No							0.0	0	0	$0	$0	$0	0.0
North Courtyard	Classroom	1	Ductless Mini-Split HP	1.83	23.00	17.00	8.5 HSPF	LG	LSU240HEV	W		No							0.0	0	0	$0	$0	$0	0.0
North Courtyard	Asst Prin	1	Ductless Mini-Split HP	1.83	27.00	21.50	11 HSPF	Friedrich	MR24Y3J	W		No							0.0	0	0	$0	$0	$0	0.0
North Courtyard	Classroom	1	Ductless Mini-Split AC	2.83		16.00		Panasonic	CU-KS36NKUA	B		No							0.0	0	0	$0	$0	$0	0.0
North Courtyard	Classroom 49	1	Ductless Mini-Split AC	1.92		12.22		Friedrich	MR24C3E	B	8	Yes	1	Ductless Mini-Split AC	1.92		18.00		0.3	181	0	$38	$4,200	$0	110.6
Classroom 27, Copy Room 2, Storage Closet 1	Classroom 27, Copy Room 2, Storage Closet 1	3	Window AC	0.75		9.50		various	various	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior	Classroom 10	3	Ductless Mini-Split AC	1.83		20.00		Friedrich	MR24C3J	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior	Classroom 12	1	Split-System Air-Source HP	1.83	23.00	16.00	9 HSPF	Luxaire	DHP24CSB21S	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior	Classroom 14	1	Split-System Air-Source HP	3.00	36.00	16.40	8.8 HSPF	Friedrich	FPHSR36A3A	B		No							0.0	0	0	$0	$0	$0	0.0
Exterior	Classroom 16	2	Split-System Air-Source HP	2.80	34.60	18.00	9 HSPF	Luxaire	DHP36CSB21S	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior	Computer Lab 26, Classroom 40	3	Ductless Mini-Split AC	1.83		20.00		Friedrich	MR24C3J	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior	Classroom 30	1	Ductless Mini-Split AC	1.92		12.22		Friedrich	MR24C3E	B	8	Yes	1	Ductless Mini-Split AC	1.92		18.00		0.3	181	0	$38	$4,200	$0	110.6
Exterior	Classroom 34	1	Ductless Mini-Split AC	2.00		11.15		Friedrich	MR24C3G	B	8	Yes	1	Ductless Mini-Split AC	2.00		18.00		0.4	246	0	$51	$4,300	$0	83.6
Exterior	Classroom 38	1	Ductless Mini-Split AC	2.57		16.50		Friedrich	MR30C3G	B		No							0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/ EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Roof	Classroom	1	Ductless Mini-Split AC	1.92		12.22		Friedrich	MR24C3E	W	8	Yes	1	Ductless Mini-Split AC	1.92		18.00		0.3	181	0	$38	$4,200	$0	110.6
Roof	Classroom	1	Ductless Mini-Split AC	2.02		16.00		Sanyo	CL2472	B	8	Yes	1	Ductless Mini-Split AC	2.02		18.00		0.1	50	0	$11	$4,300	$0	407.4
Roof	Classroom	1	Ductless Mini-Split AC	0.75		11.00		Friedrich	unknown	B	8	Yes	1	Ductless Mini-Split AC	0.75		18.00		0.2	95	0	$20	$2,500	$0	125.1
Roof	Classroom	1	Ductless Mini-Split AC	1.50		19.00		Friedrich	MR18C3F	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Classrooms	4	Ductless Mini-Split HP	6.00	80.00	13.50	4.34 COP	Mitsubishi Electric Trane	TUHYP0724AN40AN	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Classrooms	4	Ductless Mini-Split HP	8.00	108.00	14.60	4.34 COP	Mitsubishi Electric Trane	TUHYP0964AN40AN	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Classrooms	4	Ductless Mini-Split HP	10.00	135.00	13.30	4.05 COP	Mitsubishi Electric Trane	TUHYP1204AN40AN	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Various	1	Split-System	3.00		11.50		Trane	4TTA7036A	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Various	3	Split-System	4.00		11.50		Trane	4TTA7048A	W	8	Yes	3	Split-System	4.00		16.00		1.8	1,057	0	$221	$24,300	$1,300	104.0
Roof	RTU	1	Package Unit	12.50	115.20	11.20	0.8 Et	York - Johnson Controls	J12ZRN20W4	W	8	Yes	1	Package Unit	12.50	115.20	14.00	0.82 Et	1.3	804	2	$190	$21,000	$1,100	104.9
Roof	RTU-1 - SP Services	1	Package Unit	15.00	147.60	15.00	0.82 Et	Carrier	48HJUD012	B		No							0.0	0	0	$0	$0	$0	0.0
Roof	RTU-2 - Board Office	1	Package Unit	15.00	147.60	15.00	0.82 Et	Carrier	48HJUD012	B		No							0.0	0	0	$0	$0	$0	0.0
Roof	RTU-3 - Cafeteria	1	Package Unit	18.00	210.00	11.50	0.79 Et	Aaon	RM-018-3-0-BB02-349	B	8	Yes	1	Package Unit	18.00	210.00	14.00	0.82 Et	1.7	1,342	5	$340	$26,400	$1,600	72.8
Roof	RTU-4 - Library	1	Package Unit	8.93		11.20		Trane	TSC120F3	W	8	Yes	1	Package Unit	8.93		14.00		1.0	766	0	$160	$13,000	$700	76.7
Roof	RTU-5 - Main Office	1	Package Unit	10.00	196.80	11.20	0.82 Et	York - Johnson Controls	J10ZRN20W4TZZ70001A	W	8	Yes	1	Package Unit	10.00	196.80	14.00	0.82 Et	1.1	857	0	$179	$19,000	$800	101.4
Roof	RTU-6 - Band Room	1	Package Unit	8.00	93.00	14.00	0.8 Et	Aaon	RN-008-3-0-EA09-329	B		No							0.0	0	0	$0	$0	$0	0.0
Roof - Band Room	RTU-7	1	Package Unit	8.00	93.00	14.00	0.8 Et	Aaon	RN-008-3-0-EA09-329	B		No							0.0	0	0	$0	$0	$0	0.0
Roof	RTU-HS-1, 2 - gyms	2	Package Unit	15.00	147.60	12.10		Trane	THD180G4R0B1206C	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	ACC-1	1	Split-System	35.00		10.70		Carrier	38AH-044	B	8	Yes	1	Split-System	35.00		12.50		2.8	1,696	0	$355	$68,300	$3,000	183.9
Roof	ACC-1A,2A - Locker Rooms	2	Split-System	20.00		11.10		York - Johnson Controls	J20YDC00A4JAA4A	W		No							0.0	0	0	$0	$0	$0	0.0

Space Heating Boiler Inventory & Recommendations

		Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Primary Heating Load	3	Condensing Hot Water Boiler	1,880	Aerco	BMK 2000	W		No						0.0	0	0	$0	$0	$0	0.0

Pipe Insulation Recommendations

		Recommendation Inputs			Energy Impact & Financial Analysis						
Location	**Area(s)/System(s) Affected**	**ECM #**	**Length of Uninsulated Pipe (ft)**	**Pipe Diameter (in)**	**Total Peak kW Savings**	**Total Annual kWh Savings**	**Total Annual MMBtu Savings**	**Total Annual Energy Cost Savings**	**Estimated M&L Cost ($)**	**Total Incentives**	**Simple Payback w/ Incentives in Years**
Mechanical- Fan Room #2	HHW	9	40	3.50	0.0	0	53	$650	$610	$80	0.8
Boiler Room	DHW	9	1	3.50	0.0	0	1	$16	$20	$0	1.2
Kitchen	HHW pendent heater	9	2	1.00	0.0	0	1	$11	$30	$0	2.7

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	**Area(s)/System(s) Served**	**System Quantity**	**System Type**	**Manufacturer**	**Model**	**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**	**Estimated M&L Cost ($)**	**Total Incentives**	**Simple Payback w/ Incentives in Years**
Boiler Room	DHW in building	2	Storage Tank Water Heater (> 50 Gal)	Lochinvar LLC	SNA501-125	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	**ECM #**	**Device Quantity**	**Device Type**	**Existing Flow Rate (gpm)**	**Proposed Flow Rate (gpm)**	**Total Peak kW Savings**	**Total Annual kWh Savings**	**Total Annual MMBtu Savings**	**Total Annual Energy Cost Savings**	**Estimated M&L Cost ($)**	**Total Incentives**	**Simple Payback w/ Incentives in Years**
Break Rooms	10	2	Faucet Aerator (Kitchen)	2.00	1.50	0.0	0	0	$3	$20	$0	5.9
Kitchen	10	2	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	1	$10	$20	$0	2.1
Office - Nurse back	10	1	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	0	$2	$10	$0	4.2
Restroom - Nurse	10	1	Faucet Aerator (Lavatory)	1.00	0.50	0.0	0	0	$2	$10	$0	5.9
Restroom - Band, Kitchen	10	2	Faucet Aerator (Lavatory)	1.20	0.50	0.0	0	0	$5	$20	$10	2.1
Restroom - Faculty, Male2	10	3	Faucet Aerator (Lavatory)	1.50	0.50	0.0	0	1	$10	$30	$10	2.0
Restroom - 17, 301, 302, Boiler, Girls, faculty	10	16	Faucet Aerator (Lavatory)	2.00	0.50	0.0	0	13	$164	$130	$60	0.4

Walk-In Cooler/Freezer Inventory & Recommendations

	Existing Conditions				Proposed Conditions				Energy Impact & Financial Analysis						
Location	Cooler/ Freezer Quantity	Case Type/Temperature	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Low Temp Freezer (-35F to -5F)	Norlake		12	Yes	No	No	0.0	305	0	$64	$370	$40	5.2
Kitchen	1	Cooler (35F to 55F)	Norlake		12	Yes	No	No	0.0	305	0	$64	$370	$40	5.2

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	1	Stand-Up Freezer, Solid Door (31 - 50 cu. ft.)	Arctic Air		No	13	Yes	0.1	1,296	0	$271	$2,700	$300	8.8
Kitchen	1	Freezer Chest			No	13	Yes	0.6	4,953	0	$1,037	$3,000	$0	2.9
Locker Room	1	Stand-Up Refrigerator, Solid Door (≤15 cu. ft.)			No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Freezer, Solid Door (31 - 50 cu. ft.)	Kenmore	253.280528	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	3	Stand-Up Refrigerator, Glass Door (≤15 cu. ft.)	Imbera	G315	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Glass Door (≤15 cu. ft.)	Habco	ESM2B	No		No	0.0	0	0	$0	$0	$0	0.0
Training Room	1	Stand-Up Refrigerator, Glass Door (≤15 cu. ft.)	QBD Cooling Systems	DC6-HC	No	13	Yes	0.1	721	0	$151	$1,700	$100	10.6

Cooking Equipment Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Gas Convection Oven (Full Size)	Vulcan		No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	2	Insulated Food Holding Cabinet (Full Size)	Metro	C5 3 Deries	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Griddle (3 Feet Width)			No	11	Yes	0.9	1,550	0	$325	$2,100	$300	5.5
Kitchen	2	Gas Rack Oven (Double)	Vulcan		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Rack Oven (Double)	Vulcan		No	11	Yes	0.0	0	86	$1,057	$10,800	$2,000	8.3
Kitchen	1	Electric Fryer			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?	Manufacturer	Model
Various Break Areas and Offices	11	Coffee Machine	800	No	-	
Classroom 10 computer lab	31	Desktop	200	No	-	
Various Classrooms	33	Desktop	200	No	-	
Classroom 26	32	Desktop	200	No	-	
Classroom woodshop computer lab	29	Desktop	200	No	-	
Copy Room 2	1	Desktop	200	No	-	
Kitchen 1	3	Desktop	200	No	-	
Library	4	Desktop	200	No	-	
Library gaming lab	7	Desktop	400	No	-	
Various Offices	39	Desktop	200	No	-	
Office - 114A (1)	1	Desktop	200	No	-	
Server room	3	Desktop	200	No	-	
Office - 114A (1)	2	Electric Space Heater	1,500	No	-	
Weight training	4	Fan (Ceiling)	80	No	-	
Kitchen 1	2	Fan (Large)	150	No	-	
Office - Boiler room	1	Fan (Large)	200	No	-	
Boiler Room	2	Fan (Portable)	20	No	-	
Classroom 36 - art room	1	Kiln	6,656	No	-	
Classroom 36 - art room	2	Kiln	4,900	No	-	
Various Classrooms	6	Laptop	75	No	-	
Library	20	Laptop	75	No	-	
Various Offices	18	Laptop	75	No	-	
Office - Band	3	Laptop	75	No	-	
Various Break Areas and Offices	10	Microwave	1,500	No	-	
Boiler Room	5	Hand tool chargers	330	No	-	
Classrooms	37	Air Purifier	120	No	Medify Air	
Classroom 36 - art room	1	Server equipment	800	No	-	
Classroom 42 WOOD SHOP	1	Shop tools	10,000	No	-	
Classroom 55	1	Server equipment	1,000	No	-	
Classroom woodshop computer lab	1	Laser cutter	800	No	-	
Office - Band	1	Air Purifier	120	No	-	
Office - Board 114	1	Air Purifier	120	No	Medify Air	
Office - Main	2	Air Purifier	120	No	Medify Air	
Training Room	1	Trainer Room Equipment	2,000	No	-	
Training Room	1	Air Purifier	120	No	Medify Air	

Existing Conditions

Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Training Room	1	Dish Washer	500	No	-	
Training Room	1	Electric Washer Dryer	500	No		
Server room	1	Server equipment	1,000	No	-	
Storage Closet 2	1	Server equipment	800	No	-	
Theater 1	1	Sound equipment, sound boards	5,000	No	-	
Various Offices	3	Paper Shredder	200	No	-	
Classroom 10 computer lab	1	Printer (Medium/Small)	120	No	-	
Classroom woodshop computer lab	1	Printer (Medium/Small)	120	No	-	
Kitchen 1	1	Printer (Medium/Small)	120	No	-	
Various Offices	11	Printer (Medium/Small)	120	No	-	
Classroom 10 computer lab	1	Printer/Copier (Large)	600	Yes	-	
Classroom 26	2	Printer/Copier (Large)	600	No	-	
Copy Room	1	Printer/Copier (Large)	600	No	-	
Copy Room 2	1	Printer/Copier (Large)	600	No	-	
Library	1	Printer/Copier (Large)	600	No	-	
Office - Board 114	1	Printer/Copier (Large)	600	No	-	
Office - Main	1	Printer/Copier (Large)	600	No	-	
Various Classrooms	39	Projector	220	No	-	
Various Break Areas and Offices	6	Refrigerator (Mini)	200	No	-	
Various	5	Refrigerator (Residential)	380	No	-	
Classroom 27	1	Television	200	No	-	
Library	2	Television	200	No	-	
Library gaming lab	1	Television	200	No	-	
Office - 114A	1	Television	200	No	-	
Office - 114B	1	Television	200	No	-	
Office - 115A	1	Television	100	No	-	
Office - IT Manager	1	Television	200	No	-	
Office - Library	1	Television	200	No	-	
Office - Principal	1	Television	200	No	-	
Training Room	2	Television	300	No	-	
Various Break Rooms	3	Toaster Oven	1,500	No		
Office - Director of Facilities	1	Water Cooler	200	No		
Corridors, Locker Rooms	7	Water Fountain	200	No		
Kitchen 1	1	Comercial Coffee Machine	1,800	No		
Kitchen 1	3	Food Warming Tables	1,414	No	Hatco	

Existing Conditions

Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Kitchen 1	1	Food Warming Tables	1,640	No	Hatco	
Kitchen 1	1	Meat Slicer	700	No	Hobart	2712
Kitchen 1	1	Food Warming Tables	2,980	No	Hatco	

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**	**Estimated M&L Cost ($)**	**Total Incentives**	**Simple Payback w/ Incentives in Years**
Cafeteria	1	Refrigerated	N/A	No	0.0	0	0	$0	$0	$0	0.0

APPENDIX B: ENERGY STAR STATEMENT OF ENERGY PERFORMANCE

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

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ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Verona High School - Main Building

Primary Property Type: K-12 School
Gross Floor Area (ft²): 120,245
Built: 1956

For Year Ending: March 31, 2023
Date Generated: February 19, 2024

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
Verona High School - Main Building 151 Fairveiw Avenue Verona, New Jersey 07044	Verona Board of Education 121 Fairview Avenue Verona, NJ 07044 (973) 571-2029	Henry Bottiglierie, CEFM 121 Fairview Avenue Verona, NJ 07044 (973) 571-2029 hbottiglierie@veronaschools.org

Property ID: 30587122

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
56.5 kBtu/ft²

Source EUI
93.9 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	4,410,626 (65%)
Electric - Grid (kBtu)	2,378,063 (35%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	77
National Median Source EUI (kBtu/ft²)	128.1
% Diff from National Median Source EUI	-27%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	448

Signature & Stamp of Verifying Professional

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

LP Signature: ______________________Date: ___________

Licensed Professional

____ ________
,
(____)____-______
____

Professional Engineer or Registered Architect Stamp
(if applicable)

APPENDIX C: GLOSSARY

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

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

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR Portfolio Manager.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC (II)	*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.