Local Government Energy Audit Report

Cranford High School

July 23, 2024

Prepared for:
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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.

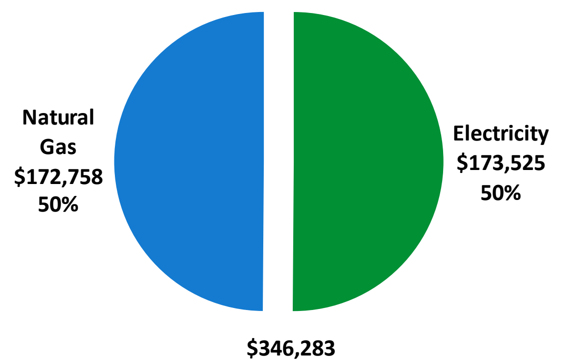
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

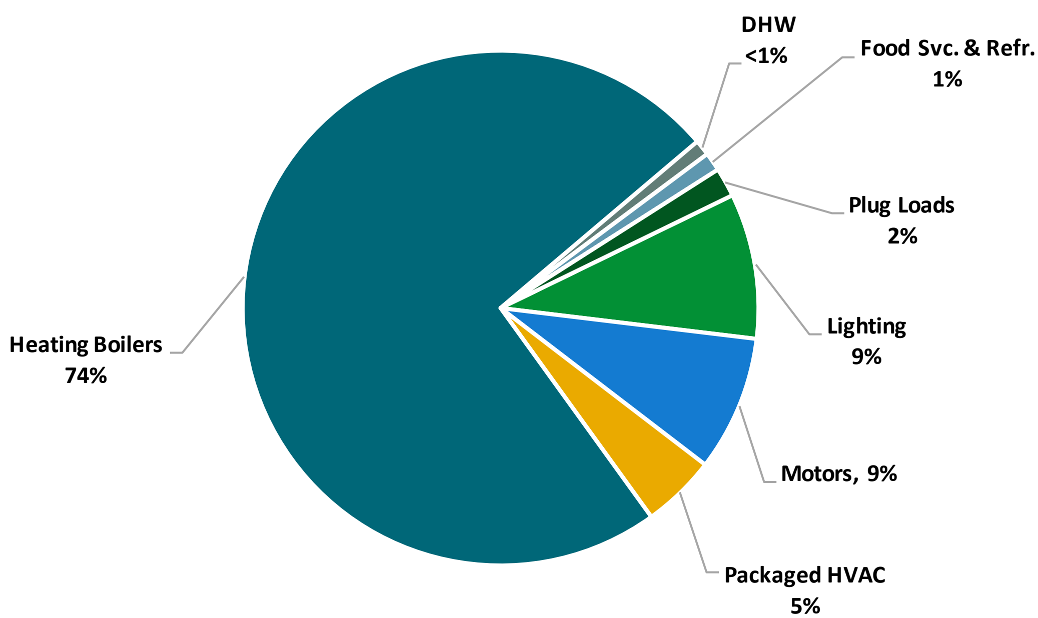
Table of Contents

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Cranford 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: $346,283 Electricity: 1,251,808 kWh Natural Gas: 134,552 Therms Water: 1,383,698 Gallons	
ENERGY STAR® Benchmarking Score	43 *(1-100 scale)*	This building performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.



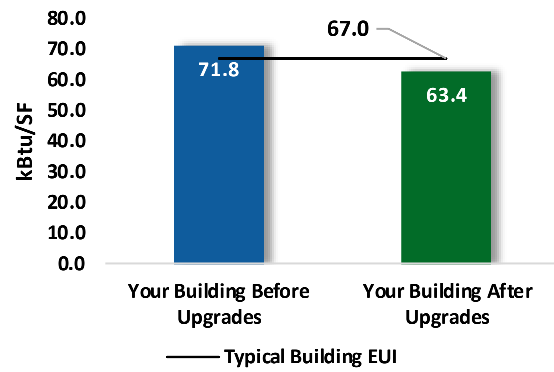
Energy Use by System

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.

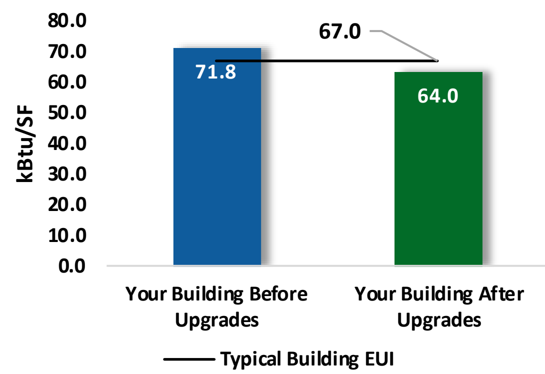
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$756,290
Potential Rebates & Incentives[1]	$61,630
Annual Cost Savings	$77,538
Annual Energy Savings	Electricity: 536,448 kWh Natural Gas: 2,474 Therms
Greenhouse Gas Emission Savings	285 Tons
Simple Payback	9.0 Years
Site Energy Savings (All Utilities)	12%



Scenario 2: Cost Effective Package[2]

Installation Cost	$371,970
Potential Rebates & Incentives	$57,780
Annual Cost Savings	$75,015
Annual Energy Savings	Electricity: 531,052 kWh Natural Gas: 1,091 Therms
Greenhouse Gas Emission Savings	274 Tons
Simple Payback	4.2 Years
Site Energy Savings (all utilities)	11%



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			**257,305**	**63.8**	**-54**	**$34,977**	**$142,740**	**$27,590**	**$115,150**	**3.3**	**252,805**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	249,885	63.2	-52	$33,968	$137,870	$27,590	$110,280	3.2	245,515
ECM 2	Install LED Exit Signs	Yes	7,420	0.6	-2	$1,009	$4,870	$0	$4,870	4.8	7,290
Lighting Control Measures			**42,183**	**9.0**	**-9**	**$5,734**	**$49,360**	**$14,000**	**$35,360**	**6.2**	**41,445**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	36,891	7.9	-8	$5,015	$35,010	$4,080	$30,930	6.2	36,246
ECM 4	Install High/Low Lighting Controls	Yes	5,292	1.1	-1	$719	$14,350	$9,920	$4,430	6.2	5,200
Variable Frequency Drive (VFD) Measures			**178,677**	**36.0**	**0**	**$24,768**	**$117,300**	**$14,800**	**$102,500**	**4.1**	**179,927**
ECM 5	Install VFDs on Constant Volume (CV) Fans	Yes	139,693	30.2	0	$19,364	$82,500	$10,900	$71,600	3.7	140,670
ECM 6	Install VFDs on Heating Water Pumps	Yes	38,985	5.8	0	$5,404	$34,800	$3,900	$30,900	5.7	39,257
Unitary HVAC Measures			**31,783**	**18.1**	**3**	**$4,448**	**$106,300**	**$3,700**	**$102,600**	**23.1**	**32,391**
ECM 7	Install High Efficiency Air Conditioning Units	No	4,664	3.3	3	$689	$59,400	$2,500	$56,900	82.6	5,083
ECM 8	Install High Efficiency Heat Pumps	Yes	27,119	14.7	0	$3,759	$46,900	$1,200	$45,700	12.2	27,309
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**111**	**$1,427**	**$296,700**	**$0**	**$296,700**	**207.9**	**13,015**
ECM 9	Install High Efficiency Steam Boilers	No	0	0.0	111	$1,427	$296,700	$0	$296,700	207.9	13,015
HVAC System Improvements			**25,313**	**0.0**	**162**	**$5,584**	**$14,770**	**$40**	**$14,730**	**2.6**	**44,415**
ECM 10	Implement Demand Control Ventilation (DCV)	Yes	25,313	0.0	149	$5,426	$14,500	$0	$14,500	2.7	42,973
ECM 11	Install Pipe Insulation	Yes	0	0.0	12	$158	$270	$40	$230	1.5	1,441
Domestic Water Heating Upgrade			**0**	**0.0**	**34**	**$435**	**$24,250**	**$1,270**	**$22,980**	**52.8**	**3,968**
ECM 12	Install Tankless Water Heater	No	0	0.0	24	$306	$24,100	$1,200	$22,900	74.8	2,792
ECM 13	Install Low-Flow DHW Devices	Yes	0	0.0	10	$129	$150	$70	$80	0.6	1,176
Food Service & Refrigeration Measures			**1,186**	**0.1**	**0**	**$164**	**$4,870**	**$230**	**$4,640**	**28.2**	**1,194**
ECM 14	Refrigerator/Freezer Case Electrically Commutated Motors	Yes	455	0.1	0	$63	$750	$80	$670	10.6	458
ECM 15	Refrigeration Controls	No	731	0.0	0	$101	$4,120	$150	$3,970	39.2	736
TOTALS (COST EFFECTIVE MEASURES)			**531,052**	**123.6**	**109**	**$75,015**	**$371,970**	**$57,780**	**$314,190**	**4.2**	**547,535**
TOTALS (ALL MEASURES)			**536,448**	**126.9**	**247**	**$77,538**	**$756,290**	**$61,630**	**$694,660**	**9.0**	**569,161**

* - 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 Cranford 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 February 19, 2024, TRC performed an energy audit at Cranford High School located in Cranford, New Jersey. TRC met with Mario Cunha to review the facility operations and help focus our investigation on specific energy-using systems.

Cranford High School is a 4-story, 247,000 square foot building built in 1937. Spaces include classrooms, gymnasium, auditorium, offices, cafeteria, corridors, stairwells, offices, a commercial kitchen, elevator machine room, and a basement mechanical space.

Recent Improvements and Facility Concerns

Over the last ten years, the facility has replaced all its existing T12 fluorescent fixtures with T8 fluorescent fixtures. The facility was renovated in 1971. The new wing is served by the building's hot-water boilers while the L Wing is heated with steam boilers. Facility staff is interested in a new BAS to combine the control logic as the existing BAS offers limited control over the building HVAC systems. Facility concerns include high energy bills.

2.2 Building Occupancy

The facility is occupied Monday through Friday during regular business hours. Janitorial services are performed after hours.

The school is fully occupied from September through June. Typical weekday occupancy is 152 staff and 1052 students. Summer occupancy includes continuing maintenance activities and occasional summer programs. There are no weekend activities.

The facility is occupied intermittently, as needed for maintenance and operations.

Building Name	Weekday/Weekend	Operating Schedule
Cranford High School Class Hours	Weekday	8:00 AM - 3:00 PM
	Weekend	Closed
Cranford High School Custodian Hours	Weekday	7:00 AM - 11:00 PM
	Weekend	Closed

Building Occupancy Schedule

2.3 Building Envelope

Building walls are concrete block over structural steel with a brick facade. The roof over the old school is sloped and the new school roof is flat and covered with white membrane, and it is in fair condition.

Most of the windows are double paned and have aluminum frames. Per facility staff, some of the areas in the school still have operable single paned windows. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition, showing little evidence of excessive wear. Exterior doors have aluminum frames and are in good condition with undamaged door seals.

Main entrance door

Façade

Classroom windows

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also a handful of areas with 28-Watt T5 fixtures. Fixture types include 1- 2- 3- or 4-lamp, 2-foot and 4-foot-long prismatic fixtures. Typically, T8 and T5 fluorescent lamps use electronic ballasts.

Some of the fixtures have been converted to operate LED tube lamps or have been replaced with LED fixtures. Additionally, there are some compact fluorescent lamps (CFL). Gymnasium fixtures use a combination of manually controlled high bay linear fluorescent T5 and T8 lamps. Auditorium fixtures have high bay LED fixtures that are manually controlled.

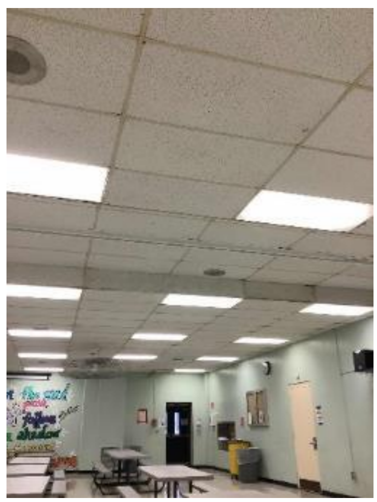
Most exit signs are incandescent; however, there are a couple LED units. Most fixtures are in fair condition. Interior lighting levels were generally sufficient.

Lighting fixtures in the school are controlled by occupancy sensors and wall switches. Lighting control sensors were installed around 10 years ago and most of the classrooms have failed or faulty sensors.

Classroom T8 fixtures

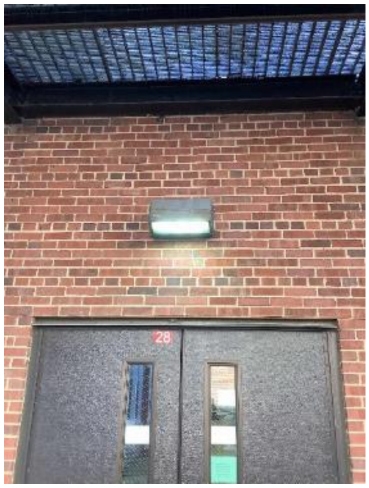
Gymnasium 4-foot fluorescent fixtures

Corridor 2-foot fluorescent fixtures



Cafeteria T8 fixtures

Exterior fixtures include LED wall packs and LED pole light fixtures illuminating doorways, roadways, and the parking lot. The exterior pole light fixtures are controlled by a time clock.



LED Wall pack

LED Pole light

2.5 Air Handling Systems

<u>Unit Ventilators</u>

Unit ventilators (UV) provide heating and ventilation to classrooms and office areas. They are equipped with fractional hp supply fan motors, motorized controlled outside air dampers and heating valves connected to either the steam or hot-water distribution system. Wings R, A and G are served by the hot water boilers and Wing L is served by the steam boilers. UVs provide heating and ventilation to the classrooms and some office spaces. These systems appear to be in fair operating condition and the facility has upgraded most units with control valves and has upgraded the motors. UVs are controlled using Schneider wall mounted thermostats.

<u>Unitary Electric HVAC Equipment</u>

Some classrooms and office spaces are cooled with window air conditioning (AC) units. Based on visual inspection, the units are in fair condition and vary in capacity. The capacity of the units could not be verified during the time of our site visit, but they are assumed to average approximately 1.0 ton per unit. Some of the window AC units are ENERGY STAR certified.

Typical window AC

Packaged Units

Two classrooms and two administrative office spaces are served with packaged terminal air conditioning (PTAC) units controlled by Schneider wall mounted thermostats. These 10.4 EER units have an electric resistance heating capacity of 13.3 MBh and a 1.2-ton cooling capacity.

The school library is served by a Trane packaged roof top unit (RTU-1). The unit has approximately 25-tons of cooling capacity and is equipped with a 284 MBh output capacity natural gas furnace. The unit was manufactured in 2012 and has a cooling setpoint of 74°F and heating 72°F. Per the information available from the BAS, this unit is controlled by Trane and only monitored using the facility BAS.

Unit ID	Location	Area Served	SF hp	RF hp	Heating Coil	Cooling Coil
RTU-1	Library Roof	Library	7.5	N/A	Gas 284 MBh	DX 25 Ton

Refer to Appendix A for detailed information about each unit.

Office PTAC unit

Library RTU-1

Air Handling Units (AHUs)

The facility is conditioned using multiple air handler units. These units can be categorized into two types: heating and ventilation only units and heating/cooling units. Heating is provided by the hot water distribution system and cooling is provided by direct expansion system. Supply and return fans are equipped with constant speed motors. Some of the units are also equipped with hot water distribution pumps, noted elsewhere. The units are controlled locally, and most of the units are in poor condition.

Unit ID	Location	Area Served	SF hp*	RF hp*	Heating Coil	Cooling Coil
Auditorium RTU	Auditorium attic	Auditorium	20.0	10.0	Hot water	Split DX 72 Ton
Staff Lounge AHU	Room A101	Room A101	1.0	N/A	N/A	Split DX 4 Ton
HV-9	Room R105	R wing hallway and woodshop	7.5	N/A	Hot water	N/A
HV-1	MER	Gym 1	10.0	7.5	Hot water	N/A
HV-2	MER	Gym 1	10.0	7.5	Hot water	N/A
HV-4	MER above gym	Gym 2	15.0	5.0	Hot water	N/A
Weight Room AHU	Weight room	Weight room	1.5	N/A	Electric 18.7 kW	Split DX 7.5 Ton
Counseling Room AHU-2	Storage floor 2	Counseling room	3.0	N/A	Hot water	Split DX 14.4 Ton

*Many motors were not accessible and fan horsepower has been estimated in most cases.

Unit HV-9

Unit HV-4

Unit HV-1

Staff lounge AHU

2.6 Hot Water and Steam Systems

Two Weil Mclain 5,520 MBh output capacity steam boilers and six Paterson Kelly 1,700 MBh output capacity non-condensing hot water boilers serve the building heating load. There is a service contract in place.

The steam boilers have a derated efficiency of 79.7 percent and use fully-modulating burners. The boilers are each equipped with a 5.0 hp combustion air fan. The boilers are configured in an automated control scheme. These boilers serve steam to the older L-wing steam radiators and unit ventilators. Only one boiler is required under high load conditions. Installed in 2003, they are in fair condition. The boilers are controlled using a heat timer with an outdoor air temperature cutoff.

Three 1.5 hp boiler feed pumps supply makeup water to the boilers and condensate is returned with the help of two 1.5 hp condensate pumps. A two-pipe steam distribution system serves the building heating terminals. Steam to the unit ventilators and radiators is supplied at 5 psi with a subtractive differential of 2 psi.

The hot-water boilers have a nominal efficiency of 85 percent with fully-modulating burners. These boilers serve hot-water to the new building R, A and G-wing unit ventilators and the facility heating and ventilation (HV) units. Per the facility staff, four boilers are required under high load conditions. Facility staff manually turn on the boilers during the heating season.

The boilers are in good operating condition and each boiler is equipped with 2.0 hp circulation pump with controls.

The boilers are configured in a constant flow primary distribution with three 20 hp constant speed hot water pumps operating with a manual control scheme. At a time, only two pumps are operating and the third pump acts as a stand-by for redundancy purposes. Several fractional horsepower Bell and Gossett booster pumps facilitate heating hot water flow to various RTU, HV, and AHU units.

Hot-water boilers

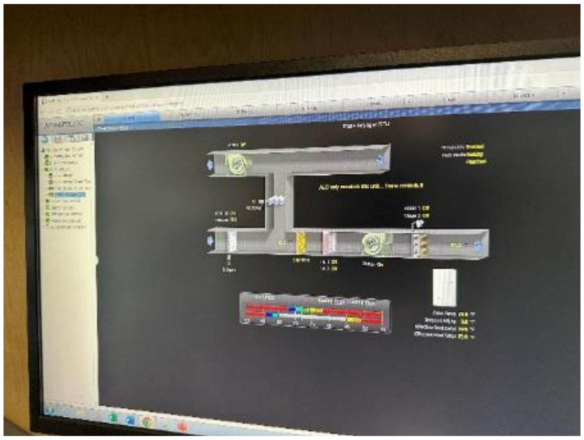
Steam boilers

Heat timer control

Hot-water pumps

2.7 Building Automation System (BAS)

An ALC BAS monitors the library packaged unit and the control points for radiators. The BAS does not provide control over other building HVAC systems. The site staff expressed an interest in expanding the level of control provided by the BAS, replacing the BAS, and receiving additional training on operating the BAS.



Library RTU-1 BAS

Library BAS screenshot

2.8 Domestic Hot Water

Hot water is produced by two natural gas-fired, AO Smith non-condensing boilers, each with an efficiency rating of 81.9 percent. Hot water produced by the boilers is stored in a storage tank. The capacity of the storage tank could not be verified at the time of the site visit.

There is one ½ hp Taco circulation pump between the boilers and the storage tank and three fractional hp recirculation pumps. The recirculation pumps operate continuously.

The domestic hot water pipes are partially insulated, and some sections are missing insulation.

DHW boilers

Recirculation pumps

2.9 Food Service Equipment

The kitchen has a mix of gas and electric equipment that is used to prepare lunches for students. The high school kitchen also prepares lunches for other elementary schools in the district. Most cooking is done using a gas-fired griddle, and there are several electric convection ovens. Bulk prepared foods are held in several electric holding cabinets. Equipment is not rated as high efficiency, and is in fair condition.

The dishwasher is a non-Energy STAR high temperature, door type unit.

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

Gas griddle

Electric convection oven

Dishwasher

2.10 Refrigeration

The kitchen has two walk-in refrigerators for food storage. The walk-ins each have an approximately 1.0-ton compressor located above the unit. There are no existing fan controls.

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

Walk-in refrigerator

2.11 Plug Load and Vending Machines

You may wish to consider paying particular attention to minimizing your plug load usage. This report makes suggestions for ECMs in this area as well as energy efficient best practices.

Plug loads include general cafe and office equipment. There are classroom typical loads such as laptops, smart boards, projectors, fans, and air purifiers. There are several residential style refrigerators throughout the building.

Air purifier

Smart board

Refrigerator

Desktop

2.12 Water-Using Systems

Water is provided by a municipal water supply company.

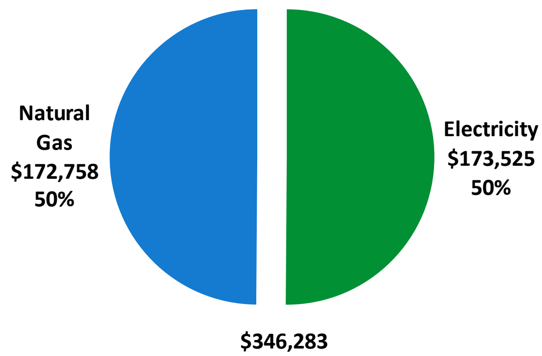
Potable water is used for drinking, cleaning, and occasional landscaping. At the time of the site visit, the facility did not report any water leaks.

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.

3 ENERGY AND WATER USE AND COSTS

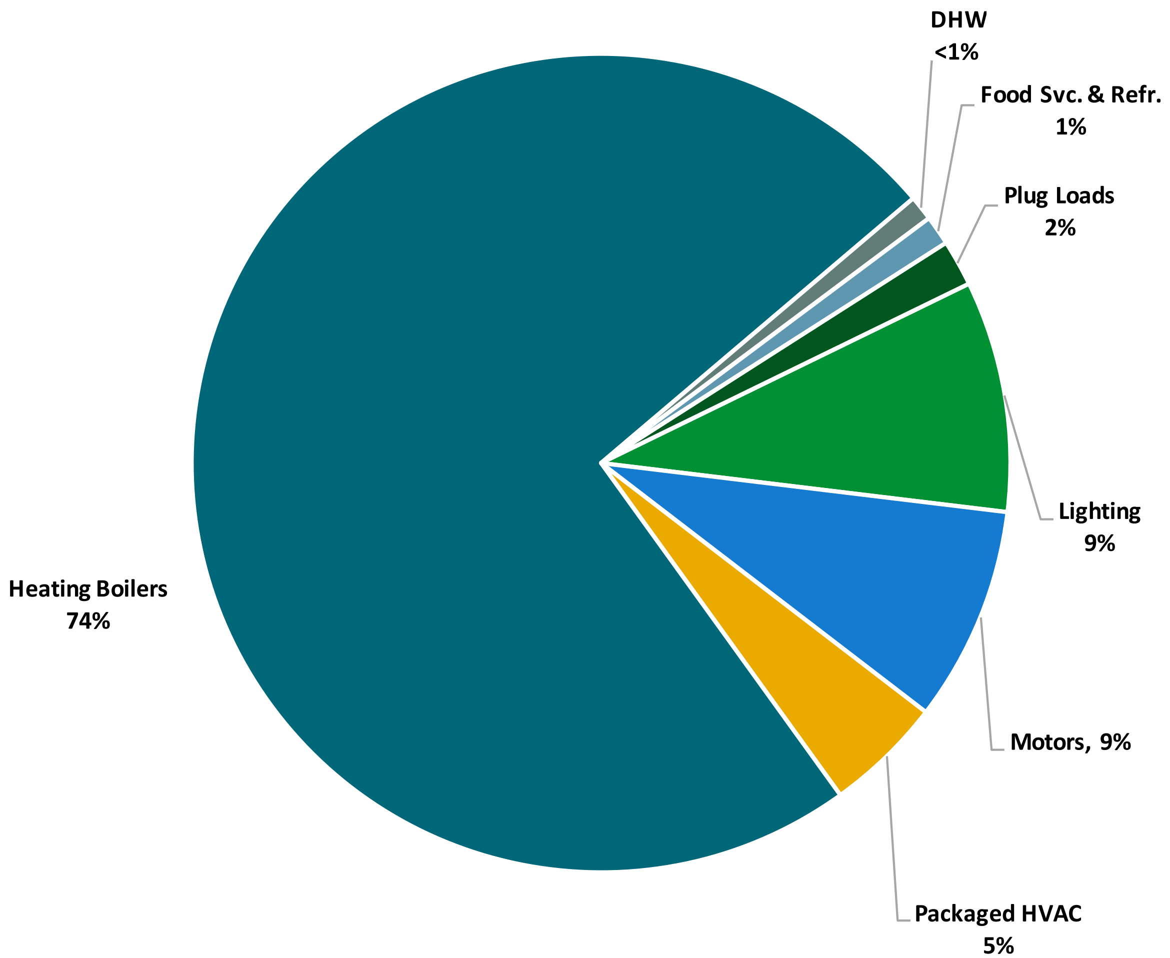
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	1,251,808 kWh	$173,525
Natural Gas	134,552 Therms	$172,758
Total		**$346,283**



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.

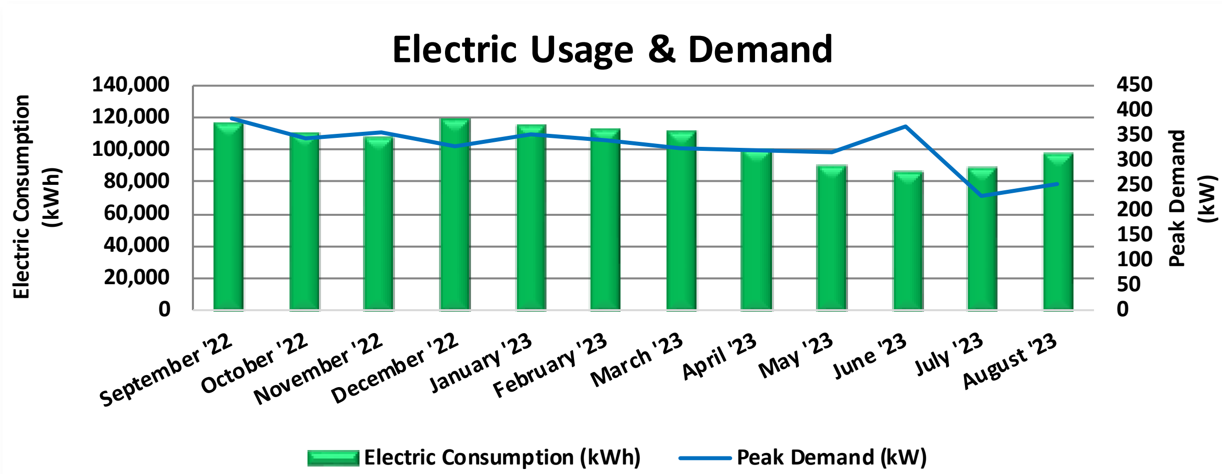
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated 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 Large Power & Lighting Primary (LPLP), with electric production provided by Constellation Energy, a third-party supplier.



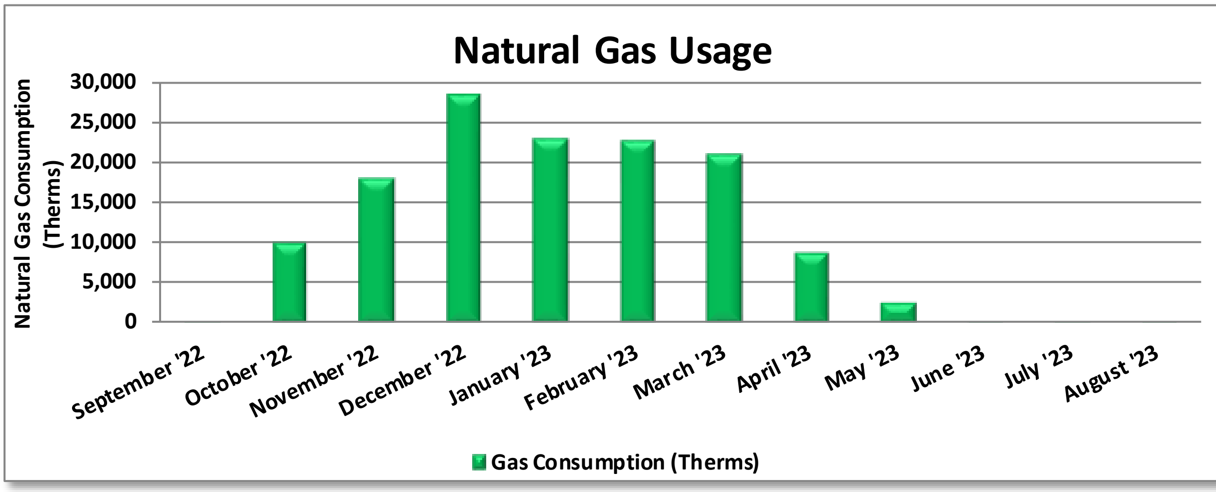
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
9/23/22	30	116,503	386	$686	$14,988
10/24/22	31	110,002	346	$614	$10,876
11/22/22	29	107,471	357	$635	$10,556
12/23/22	31	117,946	328	$583	$11,359
1/25/23	33	114,537	354	$629	$16,419
2/25/23	31	112,504	340	$604	$16,133
3/27/23	30	110,470	325	$578	$15,848
4/25/23	29	99,981	321	$572	$14,638
5/25/23	30	89,492	317	$566	$13,428
6/26/23	32	86,105	369	$4,322	$17,073
7/27/23	31	89,192	230	$2,701	$15,563
8/24/23	28	97,605	253	$2,971	$16,644
Totals	**365**	**1,251,808**	**386**	**$15,462**	**$173,525**
Annual	**365**	**1,251,808**	**386**	**$15,462**	**$173,525**

Notes:

- Peak demand of 386 kW occurred in September '22.
- Average demand over the past 12 months was 327 kW.
- The average electric cost over the past 12 months was $0.139/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

Elizabethtown Gas delivers natural gas under rate class General Delivery Service - Transportation (GDSINTVFT), with natural gas supply provided by Direct Energy Business Marketing, LLC (Hess), a third-party supplier.



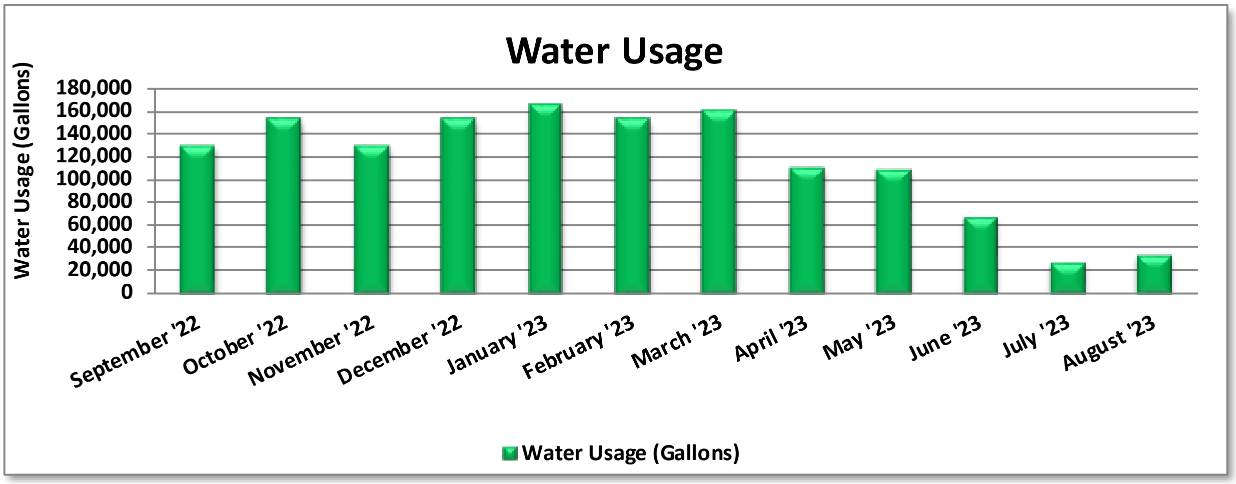
Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
9/30/22	30	83	$2,169
10/30/22	30	9,885	$14,392
11/30/22	31	18,019	$21,514
12/31/22	31	28,421	$37,356
1/31/23	31	23,008	$28,491
2/28/23	28	22,639	$26,320
3/31/23	31	20,813	$22,376
4/30/23	30	8,765	$9,218
5/31/23	31	2,414	$4,130
6/30/23	30	269	$2,347
7/31/23	31	114	$2,222
8/31/23	31	124	$2,224
Totals	**365**	**134,552**	**$172,758**
Annual	**365**	**134,552**	**$172,758**

Notes:

- The average gas cost for the past 12 months is $1.284/therm, which is the blended rate used throughout the analysis.

3.3 Water

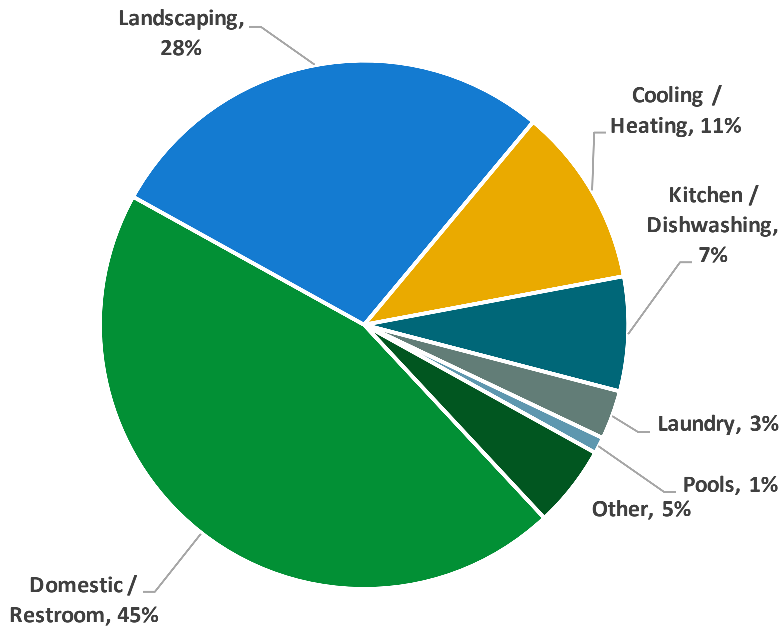
New Jersey American Water delivers water to the project site.



Water Billing Data			
Period Ending	**Days in Period**	**Water Usage (gallons)**	**Water Cost**
10/10/22	31	129,404	$1,562
11/8/22	29	152,592	$1,753
12/8/22	30	128,656	$1,556
1/9/23	32	152,592	$1,753
2/8/23	30	166,056	$1,864
3/8/23	28	153,340	$1,781
4/11/23	34	160,072	$1,841
5/9/23	28	109,956	$1,459
6/8/23	30	108,460	$1,452
7/11/23	33	68,068	$1,113
8/15/23	35	27,676	$774
9/11/23	27	34,408	$833
Totals	**367**	**1,391,280**	**$17,742**
Annual	**365**	**1,383,698**	**$17,645**

Notes:

- The average cost of water for the past 12 months is $0.0128/gal.



Typical Education Water End Use[4]

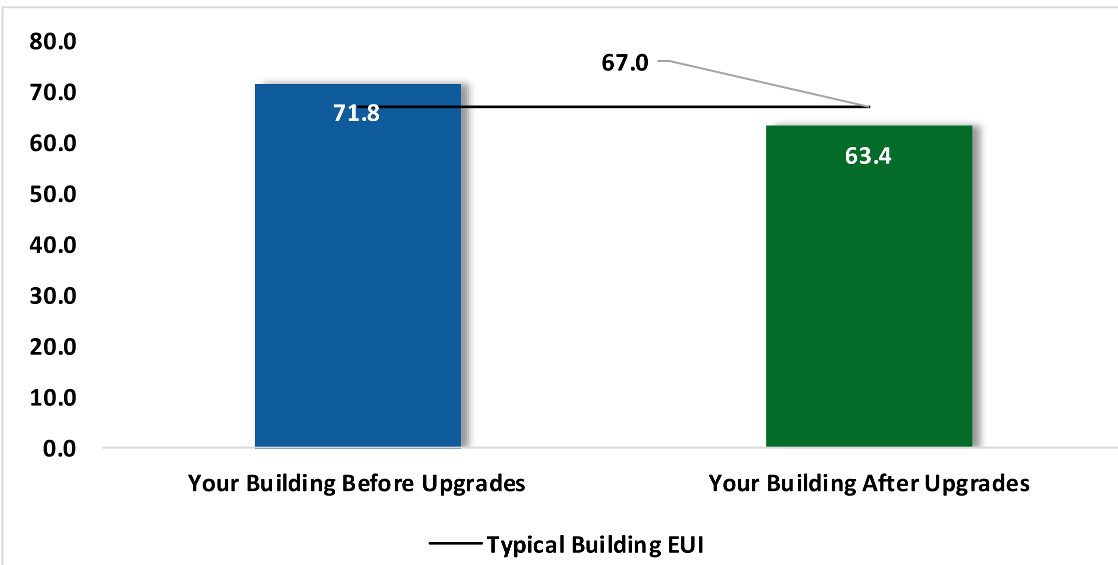
[4] Chart is of typical water end use and not specific to the facility.

3.4 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	43



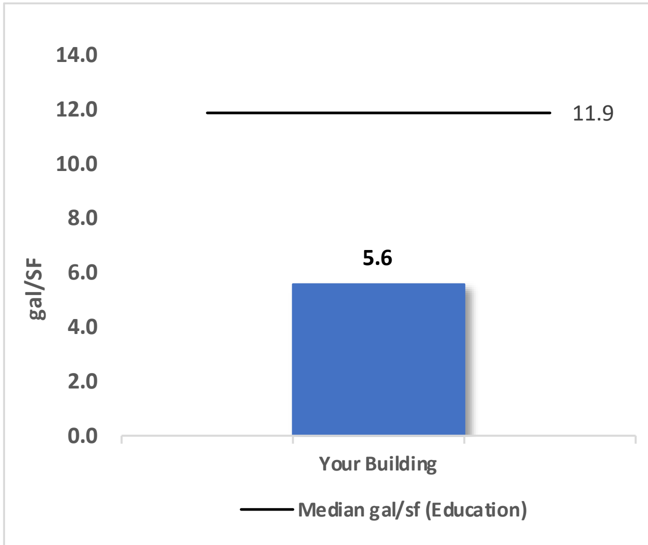
Energy Use Intensity Comparison[5]

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

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. 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.

[5] Based on all evaluated ECMs

Water Benchmarking



A benchmark is provided for your building's water use based on the annual water use in gallons per square foot of building area (gal/sf-yr). Your building is compared to other similar buildings based on average water usage as available from the 2012 Commercial Buildings Energy Consumption Survey (CBECS) and from the EPA ENERGY STAR DataTrends Water Use Tracking database.

Water use varies considerably depending mainly on the extent of outdoor water use and whether process water is used, such as for vehicle washing and for laboratory sterilizers. Cooling towers and steam boilers are also significant water users. Kitchens and sanitary fixtures may use varying amounts of water.

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.

3.5 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			**257,305**	**63.8**	**-54**	**$34,977**	**$142,740**	**$27,590**	**$115,150**	**3.3**	**252,805**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	249,885	63.2	-52	$33,968	$137,870	$27,590	$110,280	3.2	245,515
ECM 2	Install LED Exit Signs	Yes	7,420	0.6	-2	$1,009	$4,870	$0	$4,870	4.8	7,290
Lighting Control Measures			**42,183**	**9.0**	**-9**	**$5,734**	**$49,360**	**$14,000**	**$35,360**	**6.2**	**41,445**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	36,891	7.9	-8	$5,015	$35,010	$4,080	$30,930	6.2	36,246
ECM 4	Install High/Low Lighting Controls	Yes	5,292	1.1	-1	$719	$14,350	$9,920	$4,430	6.2	5,200
Variable Frequency Drive (VFD) Measures			**178,677**	**36.0**	**0**	**$24,768**	**$117,300**	**$14,800**	**$102,500**	**4.1**	**179,927**
ECM 5	Install VFDs on Constant Volume (CV) Fans	Yes	139,693	30.2	0	$19,364	$82,500	$10,900	$71,600	3.7	140,670
ECM 6	Install VFDs on Heating Water Pumps	Yes	38,985	5.8	0	$5,404	$34,800	$3,900	$30,900	5.7	39,257
Unitary HVAC Measures			**31,783**	**18.1**	**3**	**$4,448**	**$106,300**	**$3,700**	**$102,600**	**23.1**	**32,391**
ECM 7	Install High Efficiency Air Conditioning Units	No	4,664	3.3	3	$689	$59,400	$2,500	$56,900	82.6	5,083
ECM 8	Install High Efficiency Heat Pumps	Yes	27,119	14.7	0	$3,759	$46,900	$1,200	$45,700	12.2	27,309
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**111**	**$1,427**	**$296,700**	**$0**	**$296,700**	**207.9**	**13,015**
ECM 9	Install High Efficiency Steam Boilers	No	0	0.0	111	$1,427	$296,700	$0	$296,700	207.9	13,015
HVAC System Improvements			**25,313**	**0.0**	**162**	**$5,584**	**$14,770**	**$40**	**$14,730**	**2.6**	**44,415**
ECM 10	Implement Demand Control Ventilation (DCV)	Yes	25,313	0.0	149	$5,426	$14,500	$0	$14,500	2.7	42,973
ECM 11	Install Pipe Insulation	Yes	0	0.0	12	$158	$270	$40	$230	1.5	1,441
Domestic Water Heating Upgrade			**0**	**0.0**	**34**	**$435**	**$24,250**	**$1,270**	**$22,980**	**52.8**	**3,968**
ECM 12	Install Tankless Water Heater	No	0	0.0	24	$306	$24,100	$1,200	$22,900	74.8	2,792
ECM 13	Install Low-Flow DHW Devices	Yes	0	0.0	10	$129	$150	$70	$80	0.6	1,176
Food Service & Refrigeration Measures			**1,186**	**0.1**	**0**	**$164**	**$4,870**	**$230**	**$4,640**	**28.2**	**1,194**
ECM 14	Refrigerator/Freezer Case Electrically Commutated Motors	Yes	455	0.1	0	$63	$750	$80	$670	10.6	458
ECM 15	Refrigeration Controls	No	731	0.0	0	$101	$4,120	$150	$3,970	39.2	736
TOTALS			**536,448**	**126.9**	**247**	**$77,538**	**$756,290**	**$61,630**	**$694,660**	**9.0**	**569,161**

* - 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		**257,305**	**63.8**	**-54**	**$34,977**	**$142,740**	**$27,590**	**$115,150**	**3.3**	**252,805**
ECM 1	Retrofit Fixtures with LED Lamps	249,885	63.2	-52	$33,968	$137,870	$27,590	$110,280	3.2	245,515
ECM 2	Install LED Exit Signs	7,420	0.6	-2	$1,009	$4,870	$0	$4,870	4.8	7,290
Lighting Control Measures		**42,183**	**9.0**	**-9**	**$5,734**	**$49,360**	**$14,000**	**$35,360**	**6.2**	**41,445**
ECM 3	Install Occupancy Sensor Lighting Controls	36,891	7.9	-8	$5,015	$35,010	$4,080	$30,930	6.2	36,246
ECM 4	Install High/Low Lighting Controls	5,292	1.1	-1	$719	$14,350	$9,920	$4,430	6.2	5,200
Variable Frequency Drive (VFD) Measures		**178,677**	**36.0**	**0**	**$24,768**	**$117,300**	**$14,800**	**$102,500**	**4.1**	**179,927**
ECM 5	Install VFDs on Constant Volume (CV) Fans	139,693	30.2	0	$19,364	$82,500	$10,900	$71,600	3.7	140,670
ECM 6	Install VFDs on Heating Water Pumps	38,985	5.8	0	$5,404	$34,800	$3,900	$30,900	5.7	39,257
Unitary HVAC Measures		**27,119**	**14.7**	**0**	**$3,759**	**$46,900**	**$1,200**	**$45,700**	**12.2**	**27,309**
ECM 8	Install High Efficiency Heat Pumps	27,119	14.7	0	$3,759	$46,900	$1,200	$45,700	12.2	27,309
HVAC System Improvements		**25,313**	**0.0**	**162**	**$5,584**	**$14,770**	**$40**	**$14,730**	**2.6**	**44,415**
ECM 10	Implement Demand Control Ventilation (DCV)	25,313	0.0	149	$5,426	$14,500	$0	$14,500	2.7	42,973
ECM 11	Install Pipe Insulation	0	0.0	12	$158	$270	$40	$230	1.5	1,441
Domestic Water Heating Upgrade		**0**	**0.0**	**10**	**$129**	**$150**	**$70**	**$80**	**0.6**	**1,176**
ECM 13	Install Low-Flow DHW Devices	0	0.0	10	$129	$150	$70	$80	0.6	1,176
Food Service & Refrigeration Measures		**455**	**0.1**	**0**	**$63**	**$750**	**$80**	**$670**	**10.6**	**458**
ECM 14	Refrigerator/Freezer Case Electrically Commutated Motors	455	0.1	0	$63	$750	$80	$670	10.6	458
TOTALS		**531,052**	**123.6**	**109**	**$75,015**	**$371,970**	**$57,780**	**$314,190**	**4.2**	**547,535**

* - 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		**257,305**	**63.8**	**-54**	**$34,977**	**$142,740**	**$27,590**	**$115,150**	**3.3**	**252,805**
ECM 1	Retrofit Fixtures with LED Lamps	249,885	63.2	-52	$33,968	$137,870	$27,590	$110,280	3.2	245,515
ECM 2	Install LED Exit Signs	7,420	0.6	-2	$1,009	$4,870	$0	$4,870	4.8	7,290

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 CFL 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: all areas with fluorescent fixtures with T8 tubes, gymnasium and classroom T5 tubes, CFLs in classroom, and dining room

ECM 2: Install LED Exit Signs

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

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**42,183**	**9.0**	**-9**	**$5,734**	**$49,360**	**$14,000**	**$35,360**	**6.2**	**41,445**
ECM 3	Install Occupancy Sensor Lighting Controls	36,891	7.9	-8	$5,015	$35,010	$4,080	$30,930	6.2	36,246
ECM 4	Install High/Low Lighting Controls	5,292	1.1	-1	$719	$14,350	$9,920	$4,430	6.2	5,200

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

ECM 3: Install Occupancy Sensor Lighting Controls

Install occupancy sensors to control lighting fixtures in areas that are frequently unoccupied, even for short periods. For most spaces, we recommend 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, classrooms, gymnasium, restrooms, stairs, dining room, and storage rooms

ECM 4: Install High/Low Lighting Controls

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

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety 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: corridors

4.3 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**178,677**	**36.0**	**0**	**$24,768**	**$117,300**	**$14,800**	**$102,500**	**4.1**	**179,927**
ECM 5	Install VFDs on Constant Volume (CV) Fans	139,693	30.2	0	$19,364	$82,500	$10,900	$71,600	3.7	140,670
ECM 6	Install VFDs on Heating Water Pumps	38,985	5.8	0	$5,404	$34,800	$3,900	$30,900	5.7	39,257

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

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

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

For air handlers with direct expansion (DX) cooling systems, the minimum air flow across the cooling coil required to prevent the coil from freezing must be determined during the final project design. The control system programming should maintain the minimum air flow whenever the compressor is operating. 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: auditorium RTU, library RTU-1, HV-9, HV-1, HV-2, HV-4, and counseling room AHU-2

ECM 6: Install VFDs on Heating Water Pumps

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

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

Affected Pumps: main heating hot water pumps

4.4 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		**31,783**	**18.1**	**3**	**$4,448**	**$106,300**	**$3,700**	**$102,600**	**23.1**	**32,391**
ECM 7	Install High Efficiency Air Conditioning Units	4,664	3.3	3	$689	$59,400	$2,500	$56,900	82.6	5,083
ECM 8	Install High Efficiency Heat Pumps	27,119	14.7	0	$3,759	$46,900	$1,200	$45,700	12.2	27,309

Replacing the unitary HVAC units has a long payback period and may not be justifiable based simply on energy considerations. However, most of the units 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 packaged window AC and RTU is eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 7: Install High Efficiency Air Conditioning Units

We evaluated the replacement of standard efficiency packaged air conditioning units with high efficiency packaged air conditioning units. The library RTU-1 replacement unit 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: evaluated for classroom window AC, library RTU-1, staff lounge AHU

ECM 8: Install High Efficiency Heat Pumps

Replace packaged and split system AC units equipped with electric resistance heating with high efficiency heat pumps. A higher EER or SEER rating indicates a more efficient cooling system, and replacement of the resistance heat (COP of 1) with a heat pump (HSPF of 8.5 or better) is a much more efficient heating strategy. For split systems, work with your installer to reconfigure the system control logic so the heat pump takes precedence over any electric resistance heating.

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 heating and cooling loads, and the estimated annual operating hours.

Affected Units: building PTAC units and weight room AHU

4.5 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**111**	**$1,427**	**$296,700**	**$0**	**$296,700**	**207.9**	**13,015**
ECM 9	Install High Efficiency Steam Boilers	0	0.0	111	$1,427	$296,700	$0	$296,700	207.9	13,015

ECM 9: Install High Efficiency Steam Boilers

We evaluated the replacement of older inefficient steam boilers with high-efficiency steam boilers. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

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

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

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		**25,313**	**0.0**	**162**	**$5,584**	**$14,770**	**$40**	**$14,730**	**2.6**	**44,415**
ECM 10	Implement Demand Control Ventilation (DCV)	25,313	0.0	149	$5,426	$14,500	$0	$14,500	2.7	42,973
ECM 11	Install Pipe Insulation	0	0.0	12	$158	$270	$40	$230	1.5	1,441

ECM 10: Implement Demand Control Ventilation (DCV)

Demand control ventilation (DCV) is a control strategy that monitors the indoor air's carbon dioxide (CO2) content to measure room occupancy. This data is used to regulate the amount of outdoor air provided to the space for ventilation.

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

Energy savings associated with DCV are based on hours of operation, space occupancy, outside air reduction, and other factors. Energy savings results from eliminating unnecessary ventilation and space conditioning. Implementation of this measure is dependent upon having a building automation system

(BAS) or other smart building control system connected to the space conditioning equipment serving the noted areas.

Affected Building Areas: HV-1, HV-2, and HV-4 serving the gym, auditorium RTU, and library RTU-1

ECM 11: Install Pipe Insulation

Install insulation on 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: domestic hot water piping

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**	**34**	**$435**	**$24,250**	**$1,270**	**$22,980**	**52.8**	**3,968**
ECM 12	Install Tankless Water Heater	0	0.0	24	$306	$24,100	$1,200	$22,900	74.8	2,792
ECM 13	Install Low-Flow DHW Devices	0	0.0	10	$129	$150	$70	$80	0.6	1,176

ECM 12: Install Tankless Water Heater

We evaluated the replacement of existing domestic hot water boilers and a storage tank with a high efficiency condensing tankless water heating system. Tankless water heaters (i.e., on-demand water heaters) only heat water when hot water is needed. Water is heated as it flows through the pipe to the hot water tap. Energy savings from a tankless water heater are based on eliminating heat losses associated with maintaining unnecessary standby hot water capacity.

ECM 13: 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.

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		**1,186**	**0.1**	**0**	**$164**	**$4,870**	**$230**	**$4,640**	**28.2**	**1,194**
ECM 14	Refrigerator/Freezer Case Electrically Commutated Motors	455	0.1	0	$63	$750	$80	$670	10.6	458
ECM 15	Refrigeration Controls	731	0.0	0	$101	$4,120	$150	$3,970	39.2	736

ECM 14: Refrigerator/Freezer Case Electrically Commutated Motors

Replace shaded pole or permanent split capacitor (PSC) motors with electronically commutated (EC) motors in walk-in coolers. 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 15: Refrigeration Controls

We evaluated the installation of additional controls to optimize the operation of walk-in coolers and freezers.

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

Energy savings for each of the control measures account for reduction in compressor and fan operating hours as well as reduction in the refrigeration heat load as appropriate.

4.9 Measures for Future Consideration

There are additional opportunities for improvement that Cranford Public Schools 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.

Cranford Public Schools 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.

Heating System Conversion from Steam to Hot Water

Replacing the steam boilers with natural gas fired, high-efficiency water boilers was of interest to facility personnel. This type of system upgrade/conversion has significant up-front capital costs. However, there are benefits with modular hot water boiler system designs with advanced control strategies. Advantages associated with configuring a boiler plant around several modular boilers include the better system performance at low load conditions, and the modular boilers will often take less space than multiple old large boilers.

Steam and condensate return piping will need to be capped off, removed, or replaced in most cases. If distribution systems are mainly hydronic, replacing a steam boiler will likely be more cost effective than for situations where steam is supplied to the end uses, for instance, where steam coils or fin tube radiators are used. In such cases, end use distribution points will need to be modified to accommodate the circulation of hot water.

As the existing boilers are approaching the end of their useful life, it is recommended that reconfiguring the boiler plant be further evaluated. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load.

Replacing the boilers has a long payback, and it may not be justifiable based simply on energy considerations. However, the boilers are nearing the end of their normal useful life, and the facility has reported an interest in converting from steam to hot water. We also recommend working with your mechanical design team to determine whether a hot water heating system can operate with return water temperatures below 130°F, which would allow for operating condensing boilers at efficiencies above 90%. Energy savings results from improved combustion efficiency and reduced standby losses at low loads. Further analysis should be conducted for the feasibility of this measure. This measure is a capital improvement measure for future consideration.

Upgrade to a Heat Pump System

Electric resistance heating units work by passing an electric current through wires to heat them. The system is 100% efficient since for every unit of electricity consumed, one unit of heat is produced.

But there is a way to convert electricity to create heat at better than a 1:1 ratio. Heat pumps operate on a more efficient principle, the refrigeration cycle. Instead of directly converting electricity to heat, electricity does the work, via a compressor, of moving refrigerant through a system that transfers heat from a cooler place to a warmer place. That system can move three to five as much energy as is available using electric resistance heating methods. Heat pumps work in a similar manner to an air conditioner, except they reverse the cooling process to circulate warm air instead of cold air. Also, heat pumps are generally capable of dispensing refrigerated air as they can typically be operated in air conditioning mode.

An electric furnace or boiler has no flue loss through a chimney. The AFUE rating for an all-electric furnace or boiler is between 95% and 100%. The lower values are for units installed outdoors because they have greater jacket heat loss. However, despite their high efficiency, the higher cost of electricity in most parts of the country makes all-electric furnaces or boilers an uneconomic choice. If you are interested in electric heating, consider installing a heat pump system.

Electric resistance heat, including electric furnaces and baseboard heaters, can be inexpensive to install but often expensive to run. Facilities with these systems can save substantial energy at a moderate cost by installing a heat pump when they replace a central air conditioner.

Even in buildings without central air-conditioning, there are opportunities to save energy when an existing electric furnace needs to be replaced, as well as opportunities to install ductless electric heat pumps in buildings with baseboard electric heaters and electric fan coils. Unit ventilators with built-in electric resistance heaters can be replaced with unit ventilators with integrated heat pumps.

Electric heat pumps have high coefficient of performance (COP) ratings and are substantially more efficient than traditional electric heating systems. Further investigation is required to determine whether installing a heat pump system is a cost-effective solution when replacing existing electrical heating systems.

Replacing vs. Repairing a Built-up Air Handler

The facility staff asked for guidance regarding replacing versus continuing to repair the old built-up air handling units (AHUs) at this site.

All equipment will eventually reach the end of its useful life (EUL) at which time it will need to be replaced. The difficulty is determining when a built-up AHU, which is basically multiple independent components in one housing, has reached its EUL. Three indications that an AHU has reached its EUL are:

- Replacement parts are no longer available or require custom orders.
- Critical parts of the AHU can no longer be repaired.
- If there is significant corrosion in the frames or walls of the AHU. Indications may be visible holes in pressurized portions of the AHU, difficulty repairing structural members due to physical degradation, or corrosion is impacting the quality of the airstream.

Some external factors that may weigh in favor of replacing an AHU rather than repairing or replacing the components are:

- Conditions within the space or the use of the space served by the AHU have changed and the AHU can no longer meet the ventilation or thermal requirements.
- The AHU can longer meet current code requirements, particularly for indoor air quality.
- The life cycle cost of replacing the AHU is less than the life cycle cost of continuing to repair and replace components of the AHU.

Replacing an AHU often involves more than just the physical unit. Some potential complications of replacing an AHU include:

- Required electrical infrastructure upgrades.
- Control system upgrades to fully utilize expanded onboard features.
- Structural supports if the new unit is heavier.
- For roof mounted units, reconfiguration of roof penetrations and associated roof repairs if the new unit footprint differs from the original.
- For interior units, difficulties in physically removing and/or installing the units due to space constraints.
- Duct testing may be required for new units. New transitional ductwork may be required and additional repairs to existing ductwork may be warranted.
- Replacing an AHU typically requires a longer shut-down period than just repairing or replacing components of an AHU.

Repair Strategies

If the decision is made to replace AHU components, we recommend considering the following:

- If fans need to be replaced, consider using a plenum style fan array which consists of multiple fans in the cross section of the AHU. A fan array provides built in redundancy since there are multiple fans rather than a single fan and can provide more even flow across heating and cooling coils which will improve the effectiveness of the coils. Fan arrays also typically use direct drive fans with sealed bearings, greatly diminishing fan maintenance requirements.
- Consider replacing coils with more effective coils and drip pans.
- Where possible improve access to the components to facilitate maintenance.
- While making repairs, consider replacing other components which are at or beyond their useful life.

Code Compliance

New Jersey uses the ASHRAE Standard 90.1-2019 as the state energy code for commercial buildings (https://www.energycodes.gov/status/states/new-jersey). Section 6.1.1.3.1 of Standard 90.1-2019 addresses replacement of HVAC equipment and incorporates key electrical safety and air quality elements. Additional federal, state, and local codes may apply. In summary, ASHRAE compliance requirements are notable with expanded requirements for controls and fan efficiency as compared to prior code versions. While many of the unit code requirements are met at the point of purchase, expanded external controls may be required to fully meet code performance metrics.

The Standard excludes code compliance requirements for repairs or modifications as noted:

1. for *equipment* that is being modified or repaired but not replaced, provided that such modifications and/or *repairs* will not result in an increase in the annual *energy* consumption of the *equipment* using the same *energy* type;
2. where a replacement or *alteration of equipment* requires extensive revisions to other *systems, equipment*, or elements of a *building*, and such replaced or altered *equipment* is a like-for-like replacement;
3. for a refrigerant change of *existing equipment*;
4. for the relocation of *existing equipment*;
5. for ducts and *pipin*g where there is insufficient *space* or access to meet these requirements.

Therefore, in general if an air handler or a component of an air handler is being replaced it must meet the current energy code. Regarding air handlers Standard 90.1-2019 specifically addresses fans, fan control, motors, economizers, furnaces, duct furnaces, exhaust air energy recovery, controls, ductwork and piping but does not specifically address coils or control valves.

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.

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 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.

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.

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

HVAC Filter Cleaning and Replacement

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

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.

Steam Trap Repair and Replacement

Steam traps are a crucial part of delivering heat from the boiler to the space heating units. Steam traps are automatic valves that remove condensate from the system. If the traps fail closed, condensate can build up in the steam supply side of the trap, which reduces the flow in the steam lines and thermal capacity of the radiators. Or they may fail open, allowing steam into the condensate return lines resulting in wasted energy, water, and hammering. Losses can be significantly reduced by testing and replacing equipment as they start to fail. Repair or replace traps that are blocked or allowing steam to pass. Inspect steam traps as part of a regular steam system maintenance plan.

Boiler Maintenance

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

Label HVAC Equipment

For improved coordination in maintenance practices, we recommend labeling or re-labeling the site HVAC equipment. Maintain continuity in labeling by following labeling conventions as indicated in the facility drawings or 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.

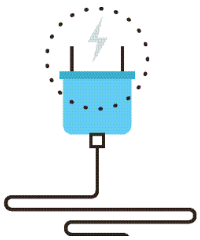
Refrigeration Equipment Maintenance

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.

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

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[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.

Steam Boiler System

Typically, boilers that produce hot water are closed loop systems and do not have significant water losses as long as there are no leaks in the boiler or distribution piping. Therefore, this section focuses on boilers that produce steam. Steam is typically used for space heating, indirectly to heat domestic water and for process heating.

As steam is distributed, its heat is transferred to the process or the ambient environment and, as a result, the steam condenses to water. This condensate is then either discharged to the sewer or captured and returned to the boiler for reuse.

As water is converted to steam within the boiler, dissolved solids, such as calcium, magnesium, chloride, and silica, are left behind. With evaporation, the total dissolved solids (TDS) concentration increases. If the concentration gets too high, the TDS can cause scale to form within the system or can lead to corrosion. The concentration of TDS is controlled by removing (i.e., blowing down) a portion of the water that has a high concentration of TDS and replacing that water with make-up water, which has a lower concentration of TDS. Some boiler operators practice continuous blowdown by leaving the blowdown valve partially open, requiring a continuous feed of make-up water.

Proper control of boiler blowdown water is critical to ensure efficient boiler operation and minimize make-up water use. Insufficient blowdown can lead to scaling and corrosion, while excessive blowdown wastes water, energy, and chemicals. The optimum blowdown rate is influenced by several factors, including boiler type, operating pressure, water treatment, and quality of make-up water. Generally, blowdown rates range from 4% to 8% of the make-up water flow rate, although they can be as high as 10% if the make-up water is poor quality with high concentrations of solids.

Blowdown is typically assessed and controlled by measuring the conductivity of the boiler make-up water compared to that in the boiler blowdown water. Conductivity provides an indication of the overall TDS concentration in the boiler. The blowdown percentage can be calculated as indicated below. The boiler water quality is often expressed in terms of cycles of concentration, which is the inverse of the blowdown percentage. See figure below.

Blowdown Percentage = Make-up Water Conductivity / Blowdown Conductivity

Blowdown Percentage

Controlling the blowdown percentage and maximizing the cycles of concentration will reduce make-up water use; however, this can only be done within the constraints of the make-up and boiler water chemistry. As the TDS concentration in the blowdown water increases, scaling and corrosion problems can occur, unless carefully controlled.

For optimum steam boiler water efficiency, there are several operations, maintenance, and user education strategies to consider.

- Check steam, hot water, and condensate lines for leaks regularly and make repairs promptly.
- Regularly clean and inspect boiler water and fire tubes.
- Develop and implement an annual boiler tune-up program.
- Provide proper insulation on piping and the central storage tank to conserve heat.
- Implement a steam trap inspection program for boiler systems with condensate recovery. Repair leaking traps as soon as possible.
- Choose a water treatment vendor that will work with you to minimize water use, chemical use, and cost, while maintaining appropriate water chemistry for efficient scale and corrosion control.
- Have the water treatment vendor produce a report every time they evaluate the water chemistry in the boiler. Review the reports to ensure that characteristics, such as conductivity and cycles of concentration, are within the target range.
- To minimize blowdown, calculate and understand the boiler's cycles of concentration.
- Consider pre-treating boiler make-up water to remove impurities, which can increase the cycles of concentration the boiler can achieve.

There are also retrofits to consider if the steam system is not already equipped with these items.

- Install and maintain a condensate recovery system to return condensate to the boiler for reuse. If there already is a condensate recovery system inspect and maintain it regularly to maintain the maximum level of condensate return possible. Maximizing condensate return to the boiler is the most effective way to reduce water use. Recovering condensate:
    - Reduces the amount of make-up water required,
    - Reduces the frequency of blowdown,

    - Reduces boiler fuel use since the temperature of the condensate is considerably higher than the temperature of the make-up water.
- Where condensate cannot be returned to the boiler and must be discharged to the sanitary sewer, consider one of the following options:
    - Installing a heat exchanger to recover heat from the condensate to preheat the make-up water,
    - Install an expansion tank to temper hot condensate rather than adding water to cool it.
- Install an automatic blowdown control system, particularly on boilers that are more than 200 horsepower (6,700 kBtu/hr), to control the amount and frequency of blowdown rather than relying on continuous blowdown. Control systems with a conductivity controller will initiate blowdown only when the TDS concentrations in the boiler have built up to a specified concentration.
- Install flow meters on the make-up water line and the condensate return line to monitor the amount of make-up water added to the boiler.
- Install automated chemical feed systems to monitor conductivity, control blowdown, and add chemicals based on make-up water flow. These systems minimize water and chemical use while protecting against scale buildup and corrosion.

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.

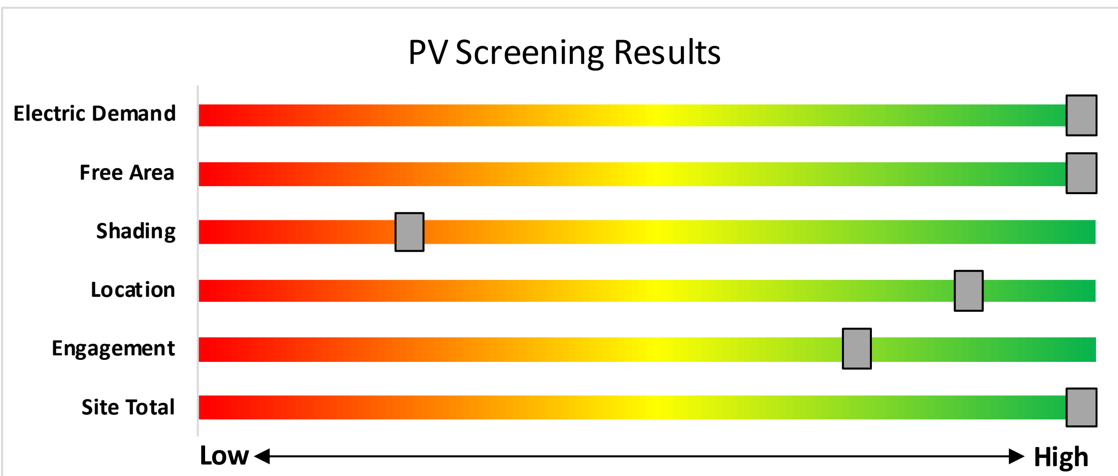
7.1 Solar Photovoltaic

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

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



Potential	High	
System Potential	327	kW DC STC
Electric Generation	246,049	kWh/yr
Displaced Cost	$34,110	/yr
Installed Cost	$935,200	

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.

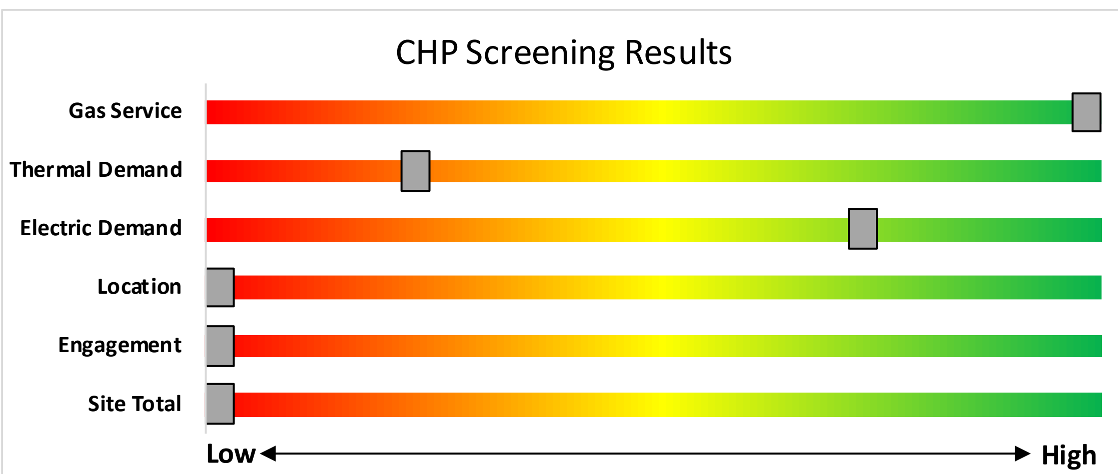
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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

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

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



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

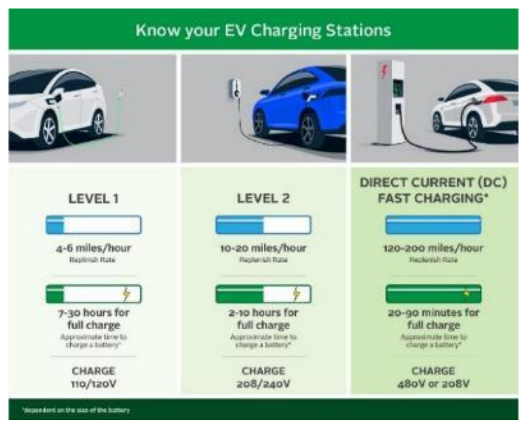
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes 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 medium potential for adding EV chargers to the facility's parking, based on potential costs of installation and other site factors.

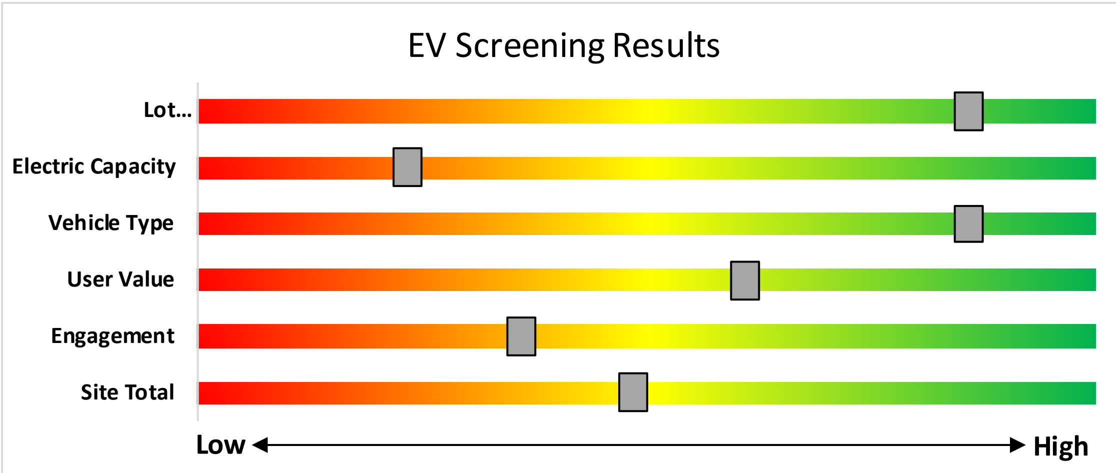
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

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 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

- 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]

Eligible Technology	Size (Installed Rated Capacity)	Incentive ($/Watt)[5]	% of Total Cost Cap per Project	$ Cap per Project
CHPs powered by non-renewable or renewable fuel source, or a combination:[4] - Gas Internal Combustion Engine - Gas Combustion Turbine - Microturbine Fuel Cells ≥60%	≤500 kW[1]	$2.00	30-40%[2]	$2 million
	>500 kW - 1 MW[1]	$1.00		
	> 1 MW - 3 MW[1]	$0.55	30%	$3 million
	>3 MW[1]	$0.35		
Fuel Cells ≥40%	Same as above[1]	Applicable amount above	30%	$1 million
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)	≤1MW[1]	$1.00	30%	$2 million
	> 1MW[1]	$.50	30%	$3 million

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[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.

[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.

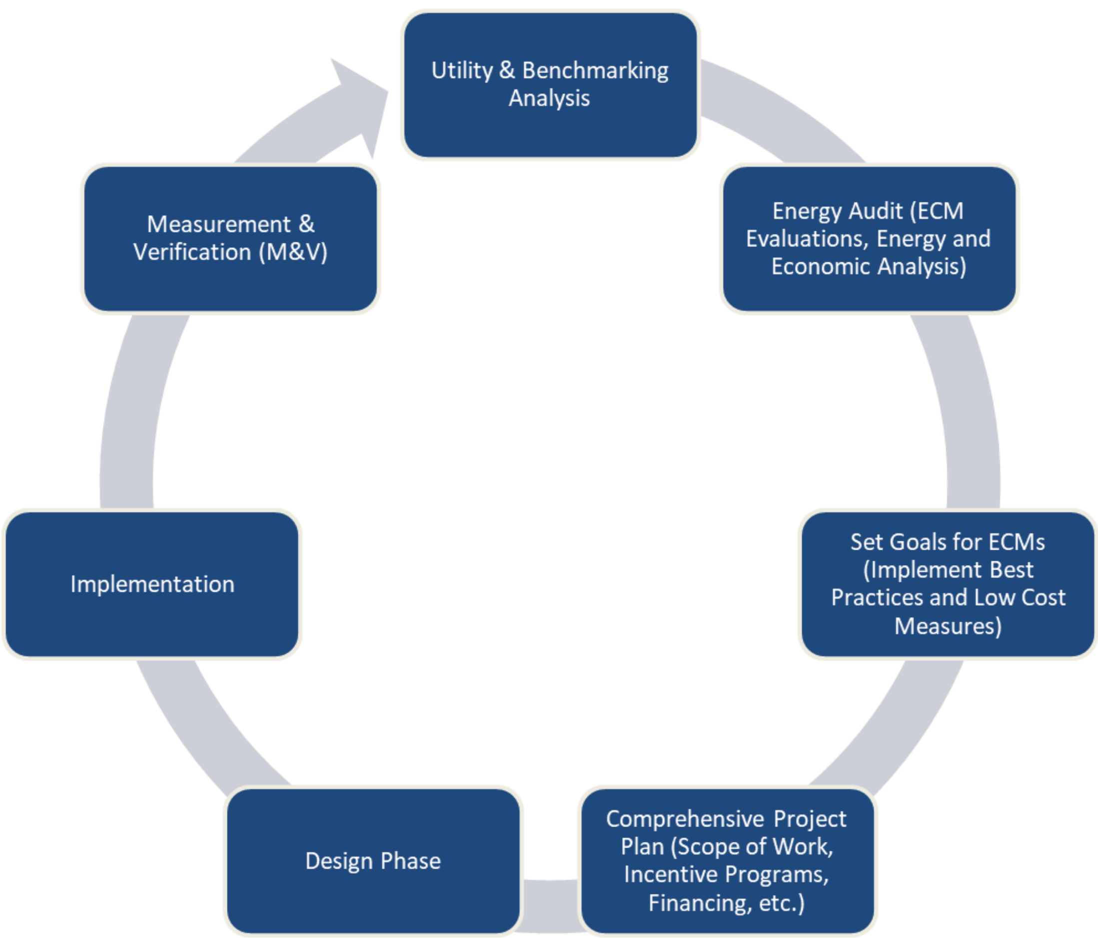
Engineered Solutions

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
Classroom 108	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.2	851	0	$116	$630	$100	4.6
Classroom A101	13	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,650	1	Relamp	No	13	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,650	0.5	1,876	0	$255	$820	$200	2.4
Classroom A102	36	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,650	1	Relamp	No	36	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,650	0.9	3,462	-1	$471	$1,820	$360	3.1
Classroom A103	32	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,650	1	Relamp	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,650	0.8	3,078	-1	$418	$1,620	$320	3.1
Classroom A104	26	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,650	1	Relamp	No	26	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,650	0.6	2,501	-1	$340	$1,310	$260	3.1
Classroom A104 B	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,650	1	Relamp	No	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,650	0.2	866	0	$118	$380	$90	2.5
Classroom A105	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,650	1	Relamp	No	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,650	0.5	1,924	0	$261	$1,010	$200	3.1
Classroom A106	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,650	1	Relamp	No	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,650	0.4	1,731	0	$235	$760	$180	2.5
Classroom A107	12	Compact Fluorescent: (1) 50W A-Series Screw-In Lamp	Wall Switch	S	50	3,072	1, 3	Relamp	Yes	12	LED Lamps: A19 Lamps	Occupancy Sensor	35	2,120	0.2	1,048	0	$142	$630	$50	4.1
Classroom A107	1	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	135	0	$18	$90	$0	4.9
Classroom A107	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.1	284	0	$39	$250	$40	5.4
Classroom A107	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.6	2,980	-1	$405	$1,210	$250	2.4
Classroom A117	18	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,120	1	Relamp	No	18	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.6	2,077	0	$282	$1,140	$270	3.1
Classroom conference	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,120	1	Relamp	No	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.2	577	0	$78	$320	$80	3.1
Classroom L101	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.6	1,847	0	$251	$1,210	$240	3.9
Classroom L103	30	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,650	1	Relamp	No	30	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,650	0.7	2,885	-1	$392	$1,520	$300	3.1
Classroom L103	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.1	639	0	$87	$520	$90	5.0
Classroom L104	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.6	1,847	0	$251	$1,210	$240	3.9
Classroom L106	15	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,120	1	Relamp	No	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,120	0.6	1,959	0	$266	$1,330	$300	3.9
Classroom L108	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.1	639	0	$87	$520	$90	5.0
Classroom L108	15	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,650	1	Relamp	No	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,650	0.6	2,448	-1	$333	$1,330	$300	3.1
Classroom L110	32	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,650	1	Relamp	No	32	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,650	1.1	4,617	-1	$628	$2,020	$480	2.5
Classroom L110	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.2	851	0	$116	$580	$100	4.1
Classroom L112	32	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,120	1	Relamp	No	32	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	1.1	3,693	-1	$502	$2,020	$480	3.1
Classroom L113	30	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	30	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.7	2,308	0	$314	$1,520	$300	3.9

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Classroom L115	30	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	30	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.7	2,308	0	$314	$1,520	$300	3.9
Classroom R101	16	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,120	1	Relamp	No	16	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.6	1,847	0	$251	$1,010	$240	3.1
Classroom R102	34	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,120	1	Relamp	No	34	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	1.2	3,924	-1	$533	$2,150	$510	3.1
Classroom R103	24	Linear Fluorescent - T5: 4' T5 (28W) - 3L	Occupancy Sensor	S	90	2,120	1	Relamp	No	24	LED - Linear Tubes: (3) 4' T5 (14.5W) Lamps	Occupancy Sensor	45	2,120	0.8	2,518	-1	$342	$2,430	$360	6.0
Classroom R104	50	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	50	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	1.5	7,095	-1	$964	$3,850	$640	3.3
Classroom R105	45	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	45	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	2.0	9,578	-2	$1,302	$3,830	$790	2.3
Classroom R106	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.1	426	0	$58	$480	$70	7.1
Classroom R106	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.3	1,277	0	$174	$790	$130	3.8
Classroom R106	23	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,072	1, 3	Relamp	Yes	23	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,120	1.2	5,750	-1	$782	$2,690	$530	2.8
Classroom R107	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.5	1,539	0	$209	$1,010	$200	3.9
Classroom R108	28	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,650	1	Relamp	No	28	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,650	0.7	2,693	-1	$366	$1,420	$280	3.1
Classroom R108	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.1	568	0	$77	$530	$80	5.8
Classroom R108	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.1	568	0	$77	$530	$80	5.8
Corridor 5	20	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	20	LED Exit Signs: 2 W Lamp	None	6	8,760	0.2	2,698	-1	$367	$1,770	$0	4.8
Corridor 5	118	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	3,072	1, 4	Relamp	Yes	118	LED - Linear Tubes: (2) 2' Lamps	High/Low Control	17	2,120	1.8	8,481	-2	$1,153	$10,100	$4,840	4.6
Corridor 5	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 4	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,120	0.2	993	0	$135	$910	$320	4.4
Dining Area 1	7	Compact Fluorescent: (1) 120W Plug-in Lamps	Wall Switch	S	120	3,072	1, 3	Relamp	Yes	7	LED Lamps: LED Plug-In Lamp	Occupancy Sensor	84	2,120	0.3	1,468	0	$199	$420	$50	1.9
Dining Area 1	7	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	3,072	1, 3	Relamp	Yes	7	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,120	0.1	503	0	$68	$600	$80	7.6
Dining Area 1	35	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	35	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	1.6	7,449	-2	$1,013	$3,200	$640	2.5
Dining Area 2	26	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	26	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	1.2	5,534	-1	$752	$2,300	$460	2.4
Exterior 1	18	LED - Fixtures: Wall Pack	Wall Switch		90	3,072		None	No	18	LED - Fixtures: Wall Pack	Wall Switch	90	3,072	0.0	0	0	$0	$0	$0	0.0
Gymnasium - Court	4	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	4	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	540	0	$73	$350	$0	4.8
Gymnasium - Court	54	Linear Fluorescent - T5: 4' T5 (28W) - 4L	Wall Switch	S	120	3,072	1, 3	Relamp	Yes	54	LED - Linear Tubes: (4) 4' T5 (14.5W) Lamps	Occupancy Sensor	60	2,120	3.1	14,343	-3	$1,950	$8,830	$1,220	3.9
Gymnasium - Court	32	Linear Fluorescent - T5: 4' T5 (28W) - 3L	Wall Switch	S	90	3,072	1, 3	Relamp	Yes	32	LED - Linear Tubes: (3) 4' T5 (14.5W) Lamps	Occupancy Sensor	45	2,120	1.4	6,375	-1	$867	$4,230	$590	4.2
Gymnasium - Court	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.5	2,270	0	$309	$1,470	$230	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
Gymnasium - Court	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.1	426	0	$58	$280	$50	4.0
Gymnasium 2	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.3	1,419	0	$193	$840	$140	3.6
Gymnasium 2	32	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,650	1	Relamp	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,650	0.8	3,078	-1	$418	$1,620	$320	3.1
Gymnasium 2	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,650	1	Relamp	No	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,650	0.1	433	0	$59	$190	$50	2.4
Gymnasium weight room	1	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	135	0	$18	$90	$0	4.9
Gymnasium weight room	50	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	3,072	3	None	Yes	50	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.5	2,278	0	$310	$1,320	$140	3.8
Gymnasium weight room	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	3,072	3	None	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.0	182	0	$25	$330	$40	11.7
Janitorial 2	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.1	426	0	$58	$280	$50	4.0
Kitchen 1	60	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	60	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	1.8	8,514	-2	$1,157	$4,350	$740	3.1
Kitchen 1	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.1	639	0	$87	$520	$90	5.0
Mechanical - Boiler 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
Mechanical - Boiler Room	10	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	768	3	None	Yes	10	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	530	0.0	38	0	$5	$330	$40	56.2
Mechanical - Boiler Room	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	768	1, 3	Relamp	Yes	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	530	0.6	687	0	$93	$1,300	$260	11.1
Office - custodian	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	3,456		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,456	0.0	0	0	$0	$0	$0	0.0
Office - custodian	9	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	3,456	3	None	Yes	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.1	461	0	$63	$330	$40	4.6
Office - custodian	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	3,456	3	None	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,385	0.0	137	0	$19	$150	$20	7.0
Office - it	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.2	958	0	$130	$580	$100	3.7
Office - PE	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,456	1, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,385	0.2	798	0	$108	$580	$90	4.5
Restroom - Male 4	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,304	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,590	0.1	319	0	$43	$480	$70	9.4
Restroom - Male 5	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,304	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,590	0.1	319	0	$43	$480	$70	9.4
Stairs 1	1	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	135	0	$18	$90	$0	4.9
Stairs 1	6	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch		30	3,072	3	None	Yes	6	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	30	2,120	0.0	189	0	$26	$330	$40	11.3
Stairs A	6	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch		30	3,072	3	None	Yes	6	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	30	2,120	0.0	189	0	$26	$330	$40	11.3
Stairs A	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	3,072	1, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.1	568	0	$77	$530	$80	5.8
Stairs B	6	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch		30	3,072	3	None	Yes	6	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	30	2,120	0.0	189	0	$26	$330	$40	11.3

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Stairs B	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	3,072	1, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.1	568	0	$77	$530	$80	5.8
Basketball	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,986	0	$270	$1,040	$180	3.2
Basketball	24	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,072	1, 3	Relamp	Yes	24	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,120	1.3	6,000	-1	$816	$2,780	$550	2.7
Classroom 203	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	S	33	2,120	1	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,120	0.0	37	0	$5	$40	$10	5.9
Classroom 203	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,154	0	$157	$760	$150	3.9
Classroom 204	46	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	46	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	1.1	3,539	-1	$481	$2,330	$460	3.9
Classroom 205	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.5	1,539	0	$209	$1,010	$200	3.9
Classroom 206 Arts	36	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	36	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.9	2,770	-1	$377	$1,820	$360	3.9
Classroom 207 Arts	36	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	36	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	1.1	5,108	-1	$694	$2,810	$470	3.4
Classroom 207 Arts	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.2	1,064	0	$145	$650	$120	3.7
Classroom G201	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,231	0	$167	$810	$160	3.9
Classroom G202	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,120	1	Relamp	No	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.4	1,385	0	$188	$760	$180	3.1
Classroom L206	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.6	1,847	0	$251	$1,210	$240	3.9
Classroom L207	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.2	692	0	$94	$460	$90	3.9
Classroom L208	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.5	1,616	0	$220	$1,060	$210	3.9
Classroom L209	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.2	1,135	0	$154	$730	$120	4.0
Classroom L210	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.7	3,405	-1	$463	$1,870	$310	3.4
Classroom L211	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.6	1,847	0	$251	$1,210	$240	3.9
Classroom L212	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.6	1,847	0	$251	$1,210	$240	3.9
Classroom L213	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L214	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L215	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L218	18	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,120	1	Relamp	No	18	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.6	2,077	0	$282	$1,140	$270	3.1
Corridor 3 gym	10	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	3,072	1, 4	Relamp	Yes	10	LED - Linear Tubes: (2) 2' Lamps	High/Low Control	17	2,120	0.2	719	0	$98	$940	$410	5.4
Corridor 4	11	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	11	LED Exit Signs: 2 W Lamp	None	6	8,760	0.1	1,484	0	$202	$970	$0	4.8

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Corridor 4	73	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	3,072	1, 4	Relamp	Yes	73	LED - Linear Tubes: (2) 2' Lamps	High/Low Control	17	2,120	1.1	5,247	-1	$713	$6,430	$3,000	4.8
Office - attendance office	10	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,120	1	Relamp	No	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.4	1,154	0	$157	$630	$150	3.1
Office - CHS welcome center	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.1	718	0	$98	$520	$90	4.4
Office - Counseling	22	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	22	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.5	1,693	0	$230	$1,110	$220	3.9
Office - counseling 2	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,456	1, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,385	0.2	958	0	$130	$630	$100	4.1
Office - counseling 2	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,456	1, 3	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,385	0.2	1,125	0	$153	$680	$120	3.7
Office - counseling 3	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.2	1,197	0	$163	$650	$120	3.3
Office - Enclosed 212A	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,456	1	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,456	0.0	125	0	$17	$50	$10	2.3
Office - Enclosed 9	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.2	958	0	$130	$580	$100	3.7
Office - Enclosed 9.1	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.2	958	0	$130	$580	$100	3.7
Office - health office	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,456	1, 3	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,385	0.5	2,554	-1	$347	$1,470	$230	3.6
Office - health office	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,456	0.0	188	0	$26	$60	$20	1.6
Office - L217	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,456	1, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,385	0.1	639	0	$87	$530	$80	5.2
Office - L217	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.2	958	0	$130	$580	$100	3.7
Office - Nurse office	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,456	0.0	188	0	$26	$60	$20	1.6
Restroom - Male 3	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,304	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,590	0.1	319	0	$43	$480	$70	9.4
Theater	3	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	3	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	405	0	$55	$270	$0	4.9
Theater	86	LED - Fixtures: Ambient - 6' - Direct Fixture	Wall Switch	S	16	3,072	3	None	Yes	86	LED - Fixtures: Ambient - 6' - Direct Fixture	Occupancy Sensor	16	2,120	0.3	1,441	0	$196	$1,620	$210	7.2
Classroom L301	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L302	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L303	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L304	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L305	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L312	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,120	1	Relamp	No	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,120	0.5	1,567	0	$213	$1,060	$240	3.8
Classroom L313	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Classroom L314	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L315	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L316	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L317	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L318	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L319	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L321	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L322	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Computer Lab L320	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Corridor 3	6	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	6	LED Exit Signs: 2 W Lamp	None	6	8,760	0.1	809	0	$110	$530	$0	4.8
Corridor 3	38	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	3,072	1, 4	Relamp	Yes	38	LED - Linear Tubes: (2) 2' Lamps	High/Low Control	17	2,120	0.6	2,731	-1	$371	$3,410	$1,560	5.0
Library 1	3	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	3	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	405	0	$55	$270	$0	4.9
Library 1	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.2	851	0	$116	$630	$100	4.6
Library 1	38	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,072	1, 3	Relamp	Yes	38	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,120	2.0	9,500	-2	$1,291	$4,350	$870	2.7
Library 1	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,072	1, 3	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,120	0.6	3,000	-1	$408	$1,390	$280	2.7
Office - library	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.2	1,197	0	$163	$650	$120	3.3
Office - mathematics	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,456	1, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,385	0.2	958	0	$130	$630	$100	4.1
Office - supervisor of language arts	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.1	718	0	$98	$520	$90	4.4
Restroom - faculty Female	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,304	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,590	0.1	319	0	$43	$480	$70	9.4
Restroom - Female	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,304	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,590	0.1	319	0	$43	$480	$70	9.4
Restroom - Male	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,304	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,590	0.1	319	0	$43	$480	$70	9.4
Classroom L401	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L402	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.6	1,847	0	$251	$1,210	$240	3.9
Classroom L403	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L404	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Classroom L405	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L413	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.5	1,616	0	$220	$1,060	$210	3.9
Classroom L414	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L415	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L416	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L417	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,120	1	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.4	1,385	0	$188	$910	$180	3.9
Classroom L418	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,120	1	Relamp	No	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.2	692	0	$94	$380	$90	3.1
Classroom L419	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,072	1, 3	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,120	0.3	1,277	0	$174	$710	$130	3.3
Classroom L421	8	Linear Fluorescent - T5: 4' T5 (28W) - 3L	Wall Switch	S	90	3,072	1, 3	Relamp	Yes	8	LED - Linear Tubes: (3) 4' T5 (14.5W) Lamps	Occupancy Sensor	45	2,120	0.3	1,594	0	$217	$1,140	$160	4.5
Classroom L421	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,072	1, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,120	0.1	284	0	$39	$250	$40	5.4
Corridor 4	5	Exit Signs: Incandescent	None		20	8,760	2	Fixture Replacement	No	5	LED Exit Signs: 2 W Lamp	None	6	8,760	0.1	675	0	$92	$440	$0	4.8
Corridor 4	37	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	3,840	1, 4	Relamp	Yes	37	LED - Linear Tubes: (2) 2' Lamps	High/Low Control	17	2,650	0.6	3,324	-1	$452	$3,370	$1,520	4.1
Janitorial 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	768	1	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	768	0.0	15	0	$2	$30	$10	10.0
Office - Enclosed 412	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,650	1	Relamp	No	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,650	0.2	769	0	$105	$400	$80	3.1
Office - Enclosed 412A	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.1	718	0	$98	$520	$90	4.4
Office - Enclosed L400	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.1	479	0	$65	$280	$50	3.5
Office - Enclosed L421A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,456	1, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,385	0.1	319	0	$43	$250	$40	4.8
Office - Enclosed L421A	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.1	718	0	$98	$520	$90	4.4
Office - Enclosed L421A	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,456	1, 3	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,385	0.2	844	0	$115	$600	$100	4.4
Office - Enclosed L422	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,456	1, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,385	0.1	718	0	$98	$520	$90	4.4
Restroom - Female 1	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,304	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,590	0.1	319	0	$43	$480	$70	9.4
Restroom - Male 1	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,304	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,590	0.1	319	0	$43	$480	$70	9.4
Exterior 1	7	LED - Fixtures: Cobrahead Pole Mount	Timeclock		90	2,860		None	No	7	LED - Fixtures: Cobrahead Pole Mount	Timeclock	90	2,860	0.0	0	0	$0	$0	$0	0.0
Exterior 1	2	LED - Fixtures: Cobrahead Pole Mount	Timeclock		90	2,860		None	No	2	LED - Fixtures: Cobrahead Pole Mount	Timeclock	90	2,860	0.0	0	0	$0	$0	$0	0.0

Motor Inventory & Recommendations

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	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
Mechanical - Boiler Room	Boiler Feed Water Pump	3	Boiler Feed Water Pump	1.50	70.0%	No	STA-RITE	J218-563A	W	1,000		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	Combustion Air Fan	1	Combustion Air Fan	5.00	85.5%	No	Baldor	894-04267000	B	1,000		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	Combustion Air Fan	1	Combustion Air Fan	5.00	85.5%	No	Baldor	89404267000	B	1,000		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	Condensate Pump	2	Condensate Pump	1.50	70.0%	No	-	-	B	1,000		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	Heating Hot Water Pump	3	Heating Hot Water Pump	20.00	93.0%	No	Marathon	256TTDCA6026	B	2,160	6	No	93.0%	Yes	3	5.8	38,985	0	$5,404	$34,800	$3,900	5.7
Classroom A105	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom A117	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L101	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L103	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L104	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L106	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L108	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L113	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L115	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Corridor 5	Unit Ventilator	4	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Office - PE	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 203	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 204	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 205	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 206 Arts	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		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**
Classroom 207 Arts	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L206	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L207	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L208	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L209	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L210	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L211	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L212	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L213	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L214	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L215	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L218	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	Century	F48Z30A01	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Corridor 3 gym	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Office - Enclosed 212A	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	UV	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Office - health office	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Theater	Auditorium RTU	1	Supply Fan	20.00	93.6%	No	A.O. Smith	-	B	4,320	5	No	93.6%	Yes	1	5.7	25,823	0	$3,580	$12,200	$1,300	3.0
Classroom L301	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L302	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L303	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L304	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		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
Classroom L305	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L313	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L314	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L315	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L316	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L317	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L318	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L319	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L321	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L322	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Computer Lab L320	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	-	-	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Library 1	RTU-1	1	Supply Fan	7.50	88.5%	No	Marathon	WVF184T	W	4,320	5	No	88.5%	Yes	1	2.1	10,242	0	$1,420	$6,700	$1,000	4.0
Classroom L401	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L402	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L403	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L404	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L405	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L413	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L414	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L415	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		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
Classroom L416	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom L417	Unit Ventilator	1	Supply Fan	0.13	65.0%	No	MagneTek	HF4H005N	B	4,320		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	Boiler Circulation Pump	6	Other	2.00	65.0%	Yes	Grundfos	C	B	2,160		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	Recirculation Pump	1	DHW Circulation Pump	0.50	65.0%	No	Taco	ZXM101050A	B	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	Recirculation Pump	1	DHW Circulation Pump	0.04	65.0%	No	Taco	-	B	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	Recirculation Pump	1	DHW Circulation Pump	0.04	65.0%	No	Taco	008Bf6	B	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	Tank Circulation Pump	1	DHW Circulation Pump	0.50	65.0%	No	Taco	2400-305-3P	B	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Room A101	Staff Lounge AHU	1	Supply Fan	1.00	70.0%	No	Carrier	50EC-006-507	B	4,320		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Room R105	HV-9 R Wing Hallway and Woodshop	1	Supply Fan	7.50	91.0%	No	Century	No Data	B	4,320	5	No	91.0%	Yes	1	2.1	9,960	0	$1,381	$6,700	$1,000	4.1
Room R105	HV-9 R Wing Hallway and Woodshop	1	Heating Hot Water Pump	0.25	65.0%	No	No Data	No Data	B	2,160		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
MER Room	HV-1 Gym Court	1	Supply Fan	10.00	89.5%	No	US Eletronics	No Data	B	4,320	5	No	91.7%	Yes	1	3.0	14,086	0	$1,953	$7,500	$1,100	3.3
MER Room	HV-1 Gym Court	1	Heating Hot Water Pump	0.50	65.0%	No	B&G	1B31	W	2,160		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
MER Room	HV-2 Gym Court	1	Supply Fan	10.00	89.5%	No	No Data	No Data	B	4,320	5	No	91.7%	Yes	1	3.0	14,086	0	$1,953	$7,500	$1,100	3.3
MER Room	HV-2 Gym Court	1	Heating Hot Water Pump	0.50	65.0%	No	B&G	1B31	W	2,160		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
MER Room	HV-1 Gym Court	1	Return Fan	7.50	89.5%	No	Champion Blower	330-BBI VP	B	4,320	5	No	91.0%	Yes	1	2.3	10,428	0	$1,445	$6,700	$1,000	3.9
MER Room	HV-2 Gym Court	1	Return Fan	7.50	89.5%	No	Champion Blower	330-BBI VP	B	4,320	5	No	91.0%	Yes	1	2.3	10,428	0	$1,445	$6,700	$1,000	3.9
MER Room Above Gym	HV-4 Gym-2	1	Supply Fan	15.00	93.0%	No	Century	E450M2	B	4,320	5	No	93.0%	Yes	1	4.3	19,492	0	$2,702	$10,300	$1,200	3.4
MER Room Above Gym	HV-4 Gym-2	1	Heating Hot Water Pump	0.33	65.0%	No	B&G	1L71	B	2,160		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
MER Room Above Gym	HV-4 Gym-2 Common Return	1	Return Fan	5.00	89.5%	No	Century	P4AA48AUTC	B	4,320	5	No	89.5%	Yes	1	1.5	6,752	0	$936	$5,600	$900	5.0
Theater	Auditorium RTU	1	Heating Hot Water Pump	0.75	65.0%	No	B&G	AVF48T17D173A	B	2,160		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
Weight Room	Weight Room AHU	1	Supply Fan	1.50	84.0%	No	No Data	No Data	B	4,320		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage Fl 2	Counseling Room AHU-2	1	Supply Fan	3.00	87.5%	No	No Data	No Data	B	4,320	5	No	89.5%	Yes	1	0.9	4,310	0	$597	$5,100	$200	8.2
Storage Fl 2	Counseling Room AHU-2	1	Heating Hot Water Pump	0.33	65.0%	No	B&G	No Data	B	2,160		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Theater	Auditorium RTU	1	Return Fan	10.00	89.5%	No	Greenheck	No Data	B	4,320	5	No	91.7%	Yes	1	3.1	14,086	0	$1,953	$7,500	$1,100	3.3
Roof	Exhaust Fan	5	Exhaust Fan	0.33	65.0%	No	No Data	No Data		4,320		No	65.0%	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
Theater	Auditorium RTU	1	Split-System	72.00	972.00	11.20		Trane	MCCB040UA0D0UA	B		No							0.0	0	0	$0	$0	$0	0.0
Library 1	RTU-1	1	Package Unit	25.00	284.00	11.20	0.811428571428571 Ec	Trane	YCH301F3K0AB	W	7	Yes	1	Package Unit	25.00	284.00	12.50	0.82 Et	1.4	1,950	3	$313	$39,300	$2,100	119.0
Room A101	Staff Lounge AHU	1	Split-System	4.00		11.00		Carrier	50EC-006-507	B	7	Yes	1	Split-System	4.00		16.00		0.7	955	0	$132	$8,100	$400	58.2
Weight Room	Weight Room AHU	1	Split-System	7.50	63.81	11.50	1 COP	Odyssey	TWE090A300CA	B	8	Yes	1	Split-System Air-Source HP	7.50	63.81	12.80	3.5 COP	5.8	12,592	0	$1,745	$15,700	$600	8.7
Storage Fl 2	Counseling Room AHU-2	1	Split-System	14.40	194.40	12.50		Trane	LPCAA08D1	B		No							0.0	0	0	$0	$0	$0	0.0
Classroom L218	Classroom L218	2	Packaged Terminal AC	1.20	13.30	10.40	1 COP	Trane	PTHF1501HAA	W	8	Yes	2	Packaged Air-Source HP	1.20	13.30	15.50	8.5 HSPF	3.0	4,842	0	$671	$10,400	$200	15.2
Office - attendance office	Office - attendance office	1	Packaged Terminal AC	1.20	13.30	10.40	1 COP	Trane	-	W	8	Yes	1	Packaged Air-Source HP	1.20	13.30	15.50	8.5 HSPF	1.5	2,421	0	$336	$5,200	$100	15.2
Office - CHS welcome center	Office - CHS welcome center	1	Packaged Terminal AC	1.20	13.30	10.40	1 COP	Trane	-	W	8	Yes	1	Packaged Air-Source HP	1.20	13.30	15.50	8.5 HSPF	1.5	2,421	0	$336	$5,200	$100	15.2
Computer Lab L320	Computer Lab L320	2	Packaged Terminal AC	1.20	13.30	10.40	1 COP	Friedrich	-	W	8	Yes	2	Packaged Air-Source HP	1.20	13.30	15.50	8.5 HSPF	3.0	4,842	0	$671	$10,400	$200	15.2
Classroom 108	Classroom 108	1	Window AC	1.00		9.70		Honeywell	-	W	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5
Classroom A104 B	Classroom A104 B	1	Window AC	1.00		9.70		-	-	W	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5
Office - custodian	Office - custodian	1	Window AC	1.00		9.70		-	-	W	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5
Classroom L212	Classroom L212	1	Window AC	1.00		11.20		Frigidaire	-	W		No							0.0	0	0	$0	$0	$0	0.0
Office - Enclosed 212A	Office - Enclosed 212A	1	Window AC	1.00		11.20		Frigidaire	-	B		No							0.0	0	0	$0	$0	$0	0.0
Classroom L312	Classroom L312	1	Window AC	1.00		9.70		Friedrich	-	B	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5
Office - mathematics	Office - mathematics	1	Window AC	1.00		9.70		Frigidaire	-	B	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5
Office - supervisor of language arts	Office - supervisor of language arts	1	Window AC	1.00		9.70		Friedrich	-	B	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5
Classroom L418	Classroom L418	1	Window AC	1.00		9.70		Quasar	-	B	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5
Classroom L419	Classroom L419	1	Window AC	1.00		9.70		Quasar	-	W	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5
Office - Enclosed 412	Office - Enclosed 412	1	Window AC	1.00		9.70		Friedrich	-	B	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5

		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
Office - Enclosed 412A	Office - Enclosed 412A	1	Window AC	1.00		11.20		Frigidaire	-	B	7	Yes	1	Window AC	1.00		12.00		0.0	50	0	$7	$1,000	$0	144.3
Office - Enclosed L400	Office - Enclosed L400	1	Window AC	1.00		9.70		GE	-	W	7	Yes	1	Window AC	1.00		12.00		0.1	166	0	$23	$1,000	$0	43.5
Office - Enclosed L422	Office - Enclosed L422	1	Window AC	1.00		11.20		Frigidaire	-	B	7	Yes	1	Window AC	1.00		12.00		0.0	50	0	$7	$1,000	$0	144.3

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
Mechanical - Boiler Room	R-wing, A-wing and G-wing	6	Non-Condensing Hot Water Boiler	1,700	Paterson Kelly	N-2000-2	W		No						0.0	0	0	$0	$0	$0	0.0
Mechanical - Boiler Room	L-wing	2	Forced Draft Steam Boiler	5,520	Weil McLain	2094	B	9	Yes	2	Forced Draft Steam Boiler	5,520	81.00%	Et	0.0	0	111	$1,427	$296,700	$0	207.9

Demand Control Ventilation Recommendations

		Recommendation Inputs					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Number of Zones	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Theater	Theater	10	2.00	72.00	0.00	972.00	0.0	18,789	52	$3,266	$2,900	$0	0.9
Library 1	Library	10	2.00	25.00	0.00	284.00	0.0	6,524	16	$1,107	$2,900	$0	2.6
MER Room	HV-1 Gym Court	10	2.00	0.00	0.00	508.80	0.0	0	27	$346	$2,900	$0	8.4
MER Room	HV-2 Gym Court	10	2.00	0.00	0.00	518.40	0.0	0	27	$353	$2,900	$0	8.2
MER Room Above Gym	HV-4 Gym-2	10	2.00	0.00	0.00	520.11	0.0	0	28	$354	$2,900	$0	8.2

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 - Boiler Room	Main Buildng DHW	11	20	1.50	0.0	0	12	$158	$270	$40	1.5

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
Mechanical - Boiler Room	Main Building DHW	2	Boiler	A.O. Smith	HW-420200	W	12	Yes	4	Tankless Water Heater	Natural Gas	95.00%	Et	0.0	0	24	$306	$24,100	$1,200	74.8

Low-Flow Device Recommendations

	Recommendation 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
Main Building	13	18	Faucet Aerator (Lavatory)	1.50	0.50	0.0	0	10	$129	$150	$70	0.6

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	2	Cooler (35F to 55F)	Frank	-	14, 15	Yes	No	Yes	0.1	1,186	0	$164	$4,870	$230	28.2

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 Griddle (3 Feet Width)	General Electric	-	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	6	Electric Convection Oven (Full Size)	Vulcan	VC4ED	No		No	0.0	0	0	$0	$0	$0	0.0

Dishwasher Inventory & Recommendations

	Existing Conditions							Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Dishwasher Type	Manufacturer	Model	Water Heater Fuel Type	Booster Heater Fuel Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Payback w/ Incentives in Years
Kitchen	1	Multi-Tank Conveyor (High Temp)	Hobart	-	Natural Gas	Electric	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**
Classroom A103	1	Clothes Dryer	2,200	No	-	-
Classroom A103	1	Clothes Washer	800	No	-	-
Office - Enclosed L421A	1	Coffee Machine	75	No	Cuisinart	-
Classroom/Office	123	Desktop	100	No	Dell	-
Dining/Gym	18	Fan (Ceiling)	90	No	-	-
Classroom/Office	50	Laptop	54	No	Dell	-
Classroom/Office	25	Microwave	1,000	No	Hamilton/Insignia	-
Classroom/Office	18	Air Purifier	68	No	Medify Air	-
Office	1	Paper Shredder	200	No	Fellowes	-
Classroom/Office	21	Printer (Medium/Small)	150	No	Hp/Cannon	-
Office	7	Printer/Copier (Large)	600	No	Xerox	-
Classroom	2	Projector	300	No	-	-
Classroom/Office	21	Refrigerator (Mini)	325	No	Whirlpool/GE	-
Office	12	Refrigerator (Residential)	650	No	GE/Frigidaire	-
Classroom	2	Scanner/Fax Machine	25	No	Hp	-
Classroom	71	Smart Board	114	Yes	Smart	-
Classroom 204	1	Speakers (Large)	100	No	Fender	-
Classroom	2	Speakers (Medium/Small)	15	No	-	-
Classroom	2	3D Printer	350	No	Makerbot	-
School	1	Miscellaneous Loads	5,000	No		

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]

Cranford High School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 247,000
Built: 1937

For Year Ending: July 31, 2023
Date Generated: May 28, 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
Cranford High School 201 West End Place Cranford, New Jersey 07016	Cranford Public Schools 132 Thomas Street Cranford, NJ 07016 (908) 709-6213	Robert Carfagno 132 Thomas Street Cranford, NJ 07016 (908) 709-6213 carfagno@cranfordschools.org

Property ID: 32316050

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
71.8 kBtu/ft²

Source EUI
105.8 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	4,286,778 (24%)
Natural Gas (kBtu)	13,450,244 (76%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	67
National Median Source EUI (kBtu/ft²)	98.7
% Diff from National Median Source EUI	7%
Annual Emissions	
Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	1,100

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.