



Local Government Energy Audit Report

Conover Road Primary School

October 15, 2020

Prepared for:

Colts Neck Township School District
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Disclaimer

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

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

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

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

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

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1 EXECUTIVE SUMMARY

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

BUILDING PERFORMANCE REPORT

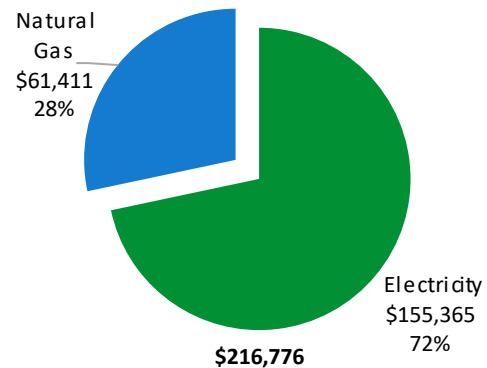


Annual Utilities

Costs: \$216,776

Electricity:
1,330,445 kWh

Natural Gas:
61,841 Therms



ENERGY STAR®
Benchmarking Score

19
(1-100 scale)

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

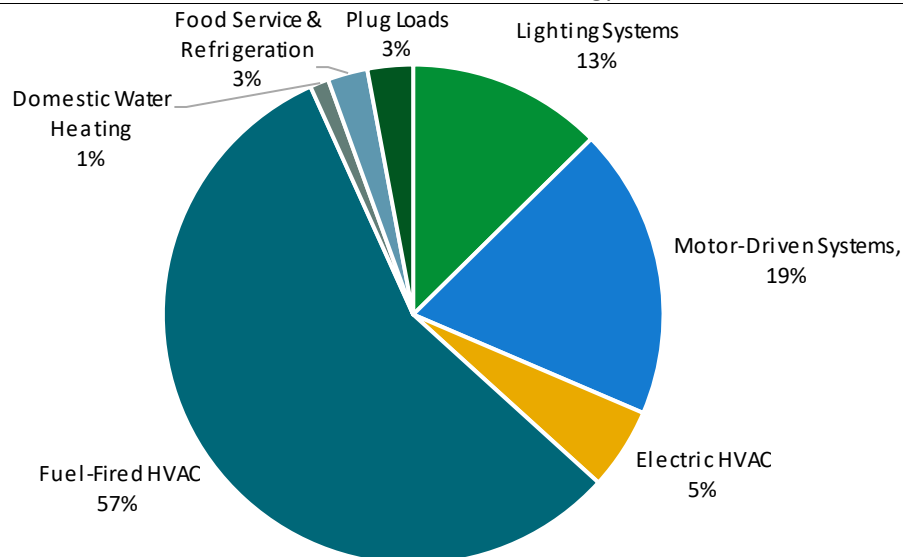


Figure 1 - Energy Use by System

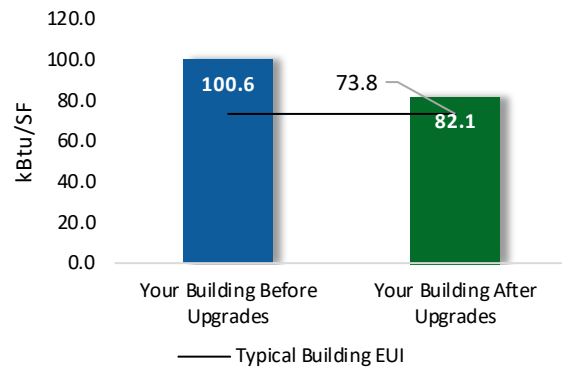
POTENTIAL IMPROVEMENTS



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

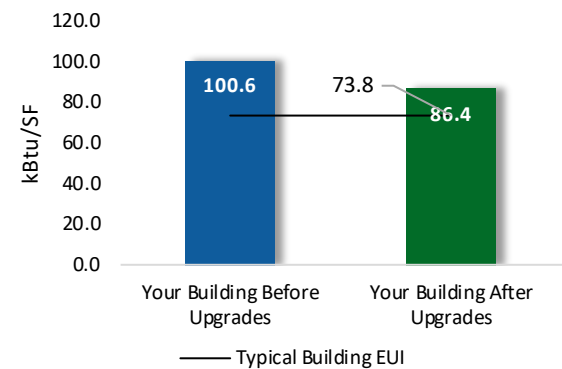
Scenario 1: Full Package (all evaluated measures)

Installation Cost	\$839,980
Potential Rebates & Incentives ¹	\$144,133
Annual Cost Savings	\$58,102
Annual Energy Savings	Electricity: 464,332 kWh Natural Gas: 3,906 Therms
Greenhouse Gas Emission Savings	257 Tons
Simple Payback	12.0 Years
Site Energy Savings (all utilities)	18%



Scenario 2: Cost Effective Package²

Installation Cost	\$298,757
Potential Rebates & Incentives	\$101,199
Annual Cost Savings	\$51,628
Annual Energy Savings	Electricity: 441,746 kWh Natural Gas: 43 Therms
Greenhouse Gas Emission Savings	223 Tons
Simple Payback	3.8 Years
Site Energy Savings (all utilities)	14%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	None

¹ Incentives are based on current SmartStart Prescriptive incentives. Other program incentives may apply.

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades			233,689	42.4	-46	\$26,835	\$113,232	\$46,970	\$66,262	2.5	229,963
ECM 1	Install LED Fixtures	Yes	85,626	10.9	-15	\$9,847	\$63,009	\$22,800	\$40,209	4.1	84,437
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	5,732	1.4	-1	\$657	\$1,894	\$640	\$1,254	1.9	5,632
ECM 3	Retrofit Fixtures with LED Lamps	Yes	142,331	30.2	-29	\$16,330	\$48,330	\$23,530	\$24,800	1.5	139,895
Lighting Control Measures			44,148	7.3	-9	\$5,064	\$36,678	\$20,970	\$15,708	3.1	43,376
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	21,294	4.4	-4	\$2,442	\$20,028	\$4,320	\$15,708	6.4	20,921
ECM 5	Install High/Low Lighting Controls	Yes	22,855	2.9	-5	\$2,621	\$16,650	\$16,650	\$0	0.0	22,455
Variable Frequency Drive (VFD) Measures			162,296	36.1	42	\$19,367	\$148,086	\$32,800	\$115,286	6.0	168,315
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	109,026	31.9	0	\$12,732	\$76,435	\$27,200	\$49,235	3.9	109,788
ECM 7	Install VFDs on Heating Water Pumps	Yes	49,797	4.2	0	\$5,815	\$67,838	\$5,200	\$62,638	10.8	50,145
ECM 8	Install VFDs on Kitchen Hood Fan Motors	Yes	3,473	0.1	42	\$820	\$3,812	\$400	\$3,412	4.2	8,381
Electric Unitary HVAC Measures			16,385	23.7	0	\$1,913	\$434,992	\$28,598	\$406,394	212.4	16,499
ECM 9	Install High Efficiency Air Conditioning Units	No	16,385	23.7	0	\$1,913	\$434,992	\$28,598	\$406,394	212.4	16,499
Gas Heating (HVAC/Process) Replacement			0	0.0	349	\$3,468	\$93,227	\$13,936	\$79,291	22.9	40,886
ECM 10	Install High Efficiency Hot Water Boilers	No	0	0.0	349	\$3,468	\$93,227	\$13,936	\$79,291	22.9	40,886
HVAC System Improvements			1,875	0.0	37	\$587	\$8,157	\$0	\$8,157	13.9	6,232
ECM 11	Implement Demand Control Ventilation (DCV)	No	1,875	0.0	37	\$587	\$8,157	\$0	\$8,157	13.9	6,232
Domestic Water Heating Upgrade			0	0.0	18	\$175	\$531	\$359	\$171	1.0	2,059
ECM 12	Install Low-Flow DHW Devices	Yes	0	0.0	18	\$175	\$531	\$359	\$171	1.0	2,059
Food Service & Refrigeration Measures			5,938	0.7	0	\$693	\$5,077	\$500	\$4,577	6.6	5,980
ECM 13	Refrigerator/Freezer Case Electrically Commutated Motors	No	983	0.1	0	\$115	\$1,517	\$400	\$1,117	9.7	990
ECM 14	Replace Refrigeration Equipment	No	3,343	0.4	0	\$390	\$3,330	\$0	\$3,330	8.5	3,367
ECM 15	Vending Machine Control	Yes	1,612	0.2	0	\$188	\$230	\$100	\$130	0.7	1,623
TOTALS (COST EFFECTIVE MEASURES)			441,746	86.0	4	\$51,628	\$298,757	\$101,199	\$197,558	3.8	445,336
TOTALS (ALL MEASURES)			464,332	110.3	391	\$58,102	\$839,980	\$144,133	\$695,846	12.0	513,310

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

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

Figure 2 – Evaluated Energy Improvements

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

1.1 Planning Your Project

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

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

Pick Your Installation Approach

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

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

Energy Conservation Measure		SmartStart	Direct Install	Pay For Performance
ECM 1	Install LED Fixtures	X		X
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	X		X
ECM 3	Retrofit Fixtures with LED Lamps	X		X
ECM 4	Install Occupancy Sensor Lighting Controls	X		X
ECM 5	Install High/Low Lighting Controls	X		X
ECM 6	Install VFDs on Constant Volume (CV) Fans	X		X
ECM 7	Install VFDs on Heating Water Pumps	X		X
ECM 8	Install VFDs on Kitchen Hood Fan Motors	X		X
ECM 9	Install High Efficiency Air Conditioning Units	X		X
ECM 10	Install High Efficiency Hot Water Boilers	X		X
ECM 11	Implement Demand Control Ventilation (DCV)			X
ECM 12	Install Low-Flow DHW Devices	X		X
ECM 13	Refrigerator/Freezer Case Electrically Commutated Motors	X		X
ECM 14	Replace Refrigeration Equipment			X
ECM 15	Vending Machine Control	X		X

Figure 3 – Funding Options



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

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

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

Individual Measures with SmartStart

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

Turnkey Installation with Direct Install

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

Whole Building Approach with Pay for Performance

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

More Options from Around the State

Financing and Planning Support with the Energy Savings Improvement Program

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

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

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

Ongoing Electric Savings with Demand Response

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

2 EXISTING CONDITIONS

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

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

2.1 Site Overview

On June 23, 2020, TRC performed an energy audit at Conover Road Primary School located in Colts Neck, New Jersey. TRC met with Thomas Giglio to review the facility operations and help focus our investigation on specific energy-using systems. Mr. Giglio was very helpful throughout the energy audit process and made sure TRC had all the necessary information.

Conover Road Primary School is a one-story, 106,565 square foot building built in 2001. Spaces include classrooms, a gymnasium, a cafeteria, a media center, offices, corridors, stairwells, a kitchen, basement mechanical and storage space, and a wastewater treatment room in the basement.

2.2 Building Occupancy

The facility is occupied regular hours from September through June (the school season is 10 months) and has reduced occupancy during July and August. The gymnasium is occupied on Sundays from October through March. Typical weekday occupancy is approx. 100 staff and 360 students.

During summer (late June, July, and August), school is occupied by students until 2:00 pm for extended school and recreational programs.

Building Name	Weekday/Weekend	Operating Schedule
Conover Road Primary School (School Hours)	Weekday	7:00 AM to 4:00 PM
	Weekend	7:00 AM to 3:00 PM
	Summer	Varies
Conover Road Primary School (Custodian Hours)	Weekday	7:00 AM to 11:00 PM
	Weekend	7:00 AM to 3:00 PM
	Summer	Varies

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are concrete block over structural steel with a stone facade. The roof over the gymnasium, cafeteria, kitchen, and Rooms 40, 41 and 42 are flat and covered with white membrane. The roof on the remaining sections of the school is pitched. Roof in all sections is in good condition.

Site staff did not report any issues with the building envelope.

Most of the windows are double glazed and have aluminum frames. The glass-to-frame seals are in good condition. All windows in classrooms are operable and most of them are the sliding type. Window weather seals are in good. Exterior doors have aluminum frames and are in good condition with undamaged weather stripping.



Exterior wall



Flat roof



Pitched roof

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several compact fluorescent lamps and a few 40-Watt T12 fixtures plus some 32-Watt U-shaped T8 fluorescent lamps. Additionally, there are fixtures with metal halide lamps in the corridors, gymnasium, and cafeteria. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts.

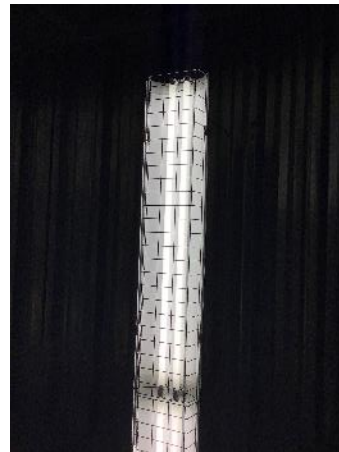
Fixture types include 1- 2- 4-lamp, 4-foot long troffer, recessed, and surface mounted fixtures. There are also 2-foot fixtures with U-bend tube lamps. Most fixtures are in good condition.

Most of the exit signs are LED; however, there are a few exit signs with CFL lamps.

Interior lighting levels were generally sufficient.



2' x 4' T8 3-lamp fixture



4' fixture with 2 T8 lamps



2' x 2' U-shaped T8 lamp fixture



CFL in recessed can fixture

Lighting fixtures in thirteen classrooms were noted to be controlled by wall-mounted occupancy sensors. All the remaining interior lighting is manually controlled by wall switches.



Metal halide fixture in gymnasium



LED fixture in stairwell



Metal halide fixture in cafetorium



Metal halide lamps in pole-mounted fixtures in a corridor

Exterior fixtures include LED wall packs, wall-mounted LED flood fixtures, pole-mounted fixtures with metal halide bulbs, recessed can fixtures, and under-canopy fixtures with CFL and LED lamps. There are 4-foot, 32W T8 lamps in exterior mechanical rooms. While the fixtures with T8 lamps in exterior mechanical rooms are manually controlled by wall switches, all remaining exterior fixtures are timer controlled.



LED flood light



Exterior wall pack with CFL



Exterior LED lamp in recessed can



Exterior pole-mounted metal halide lamps



Wall-mounted LED fixture

2.5 Air Handling Systems

Cabinet Unit Heaters

There are 12 small cabinet unit heaters installed in the ceiling near hallway exits. They have hot water coils and small blowers to provide heating to spaces near building exits.

Electric Resistance Heat

An office in the gymnasium and a stairwell in the basement leading to the 1st floor have electric baseboard heating. The heating capacity of both baseboard heaters is 1 kW.

Air Handling Units and Split AC Condensing Units

Space cooling for all areas of the building on the main floor is provided by air handling units (AHUs) and McQuay condensing units. There are total of 14 AHUs and condensing units. Nine AHUs are located outside in small dedicated AHU mechanical rooms. The remaining 5 AHUs are in located in the building on first floor (2 AHUs) and on the mezzanine level (3 AHUs). Most condensing units are installed outside on ground level, but some are installed on the roof. Cooling capacities of the McQuay condensing units range from 13 to 40-ton. AHU supply fan motor horsepower ranges from 3 hp to 10 hp. The EER ratings of the McQuay condensing units range between 9.5 and 10.5. All McQuay condensing units are original to the building and are beyond their useful life.

The table below lists AHU tag names along with the areas served by these units.

Unit	Area Served	Cooling Capacity	Efficiency (EER)
AHU-1	Office area	13-ton	9.8
AHU-2	Classrooms 8 to 11	40-ton	10.0
AHU-3	Classrooms 20 to 23	40-ton	10.0
AHU-4	Classrooms 27 to 32B	40-ton	10.0
AHU-5	Classrooms 3 to 6	20-ton	9.8
AHU-6	Classrooms 13 to 16	20-ton	9.8
AHU-7	Classrooms 34 to 37B	20-ton	9.8
AHU-8A	Media Center, media lab & nearby rooms	25-ton	9.5
AHU-8B	Media Center, media lab & nearby rooms	13-ton	9.8
AHU-9	Faculty room, art room	25-ton	9.5
AHU-10	Kitchen area	25-ton	9.5
AHU-11	Cafetorium & Gymnasium	20-ton	9.8
AHU-12	Cafetorium & Gymnasium	33-ton	10.5
AHU-13	Gymnasium offices	40-ton	10.4

Air Conditioners (AC) and Heat Pump Systems

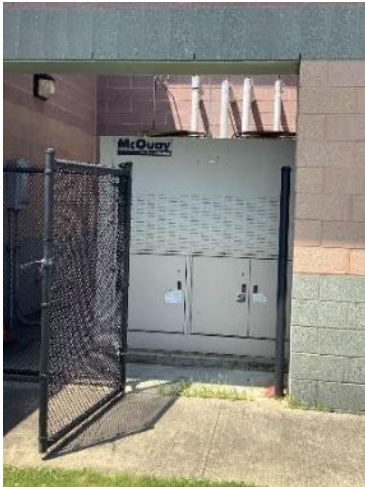
There is one window AC unit serving the break/storage room in the basement with a cooling capacity of 1.5-ton. A Sanyo split air conditioner with 2.5-ton cooling capacity serves the IT equipment room. The SEER rating for the window AC and split AC units range between 9.8 and 10.7.

There is one packaged terminal heat pump (PTHP) system installed in the facility manager's office on the basement level. This unit has a cooling capacity of 0.6-ton and heating capacity of 6 MBh. The unit also has 3.6 kW of supplemental electric resistance heating capacity.

The window AC and the PTHP units are old and beyond useful life.

Exhaust Fans

There are seven exhaust fans installed on the flat section of the roof. The exhaust fans serve the kitchen cooking area, dishwashing area, restrooms, and a storage room. Fan motors range from 0.25 hp to 0.5 hp. The exhaust fans are in fair condition.



40-ton condensing unit for classrooms



20-ton condensing unit for classrooms



Air handling unit



Condensing unit on roof



Packaged terminal heat pump



Exhaust fan

2.6 Heating Hot Water Systems

Two Cleaver-Brooks 2,680 output MBh hot water boilers serve the building space heating load. The boilers are non-condensing type with efficiency of 80 percent. The boilers are configured in an automated lead-lag control scheme. The boilers were installed in 2000 and are in fair condition.

Heating hot water is supplied throughout the building by two 20 hp constant speed hot water pumps. The pumps operate in an automated lead-lag control scheme. The boilers and pumps provide hot water to cabinet units heaters and all AHUs, and they reheat coils in classrooms.

Hot water supply temperature remains between 160°F and 170°F during peak winter periods and is lowered based on increase in outdoor air temperature. The hot water heating system is locked out at outdoor air temperatures above 67°F.



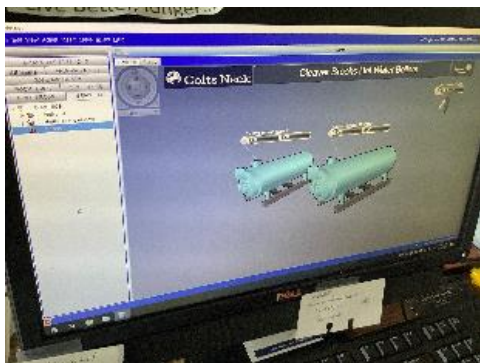
Cleaver-Brooks boilers



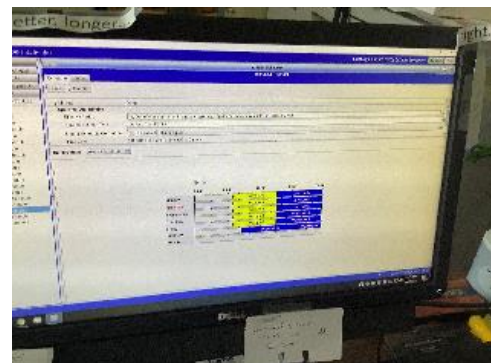
20 hp heating hot water pumps

2.7 Building Energy Management Systems (EMS)

A Johnson Controls Metasys EMS controls the boilers, the AHUs, and condensing units. The EMS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, heating water loop temperatures, and boiler outdoor air reset scheme.



Screenshot of EMS showing boilers



Screenshot of EMS showing equipment schedule

2.8 Domestic Hot Water

Hot water for use in kitchen and restrooms/break room areas is produced by two domestic hot water heaters. A 100 gallon, 400 MBh gas-fired storage water heater with a 79.4 percent efficiency rating supplies hot water for the kitchen. A 100 gallon, 275 MBh gas-fired hot water heater with an 80 percent efficiency rating provides the hot water to restrooms, break rooms, and other spaces. Two one-quarter hp circulation pumps distribute water to end uses. The circulation pumps operate continuously.

The domestic hot water pipes are insulated, and the insulation is in good condition.



DHW heaters for kitchen and restrooms



DHW circulation pump

2.9 Food Service Equipment

The kitchen has a mix of gas and electric equipment that is used to prepare and store meals for students. Most cooking is done using the convection gas-fired oven and gas cooktop. Also, there is one electric insulated food holding cabinet.

A high temperature type dishwasher unit is also installed in the kitchen and it also has an electric booster water heater. The dishwasher is not ENERGY STAR® rated.

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



Full-sized gas-fired oven



Gas cooktop with oven



Dishwasher in kitchen



Electric food holding cabinet

2.10 Refrigeration

The kitchen has a stand-up refrigerator with solid doors, a refrigerator chest, and a freezer chest. All equipment is in fair condition.

There is one walk-in cooler and one walk-in freezer (0°F to 30°F). The walk-in cooler has two evaporator fans, and the walk-in freezer has three fans.

There is also one commercial ice making machine.

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



Solid door stand-up refrigerator



Refrigerator Chest



Walk-in cooler



Freezer Chest

2.11 Plug Load and Vending Machines

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

There are approximately 350 desktop computer workstations and laptop computers throughout the facility. Other plug loads throughout the building include general café and office equipment. Café equipment includes heated/chilled serving tables in the kitchen, microwave ovens and toaster ovens, residential style refrigerators, an under-counter dishwasher, coffee makers, and a water cooler in the break room. Office and other equipment include printers, copiers, and a television. There are also typical classroom plug load equipment such as smart boards, projectors, and fans.

There is one refrigerated beverage vending machine in the faculty break room.



Chilled serving table in kitchen



Microwave ovens in faculty break room



Refrigerated beverage vending machine



Refrigerator

2.12 Water-Using Systems

Faucet flow rates in restrooms are at 2.2 gallons per minute (gpm). Faucet flow rates in the kitchen are at 2.5 gpm and in other areas such as the classrooms and faculty break room are at 2.0 gpm.



2.2 gpm faucet in restroom



2.5 gpm faucet in kitchen

2.13 Process Equipment

In the basement level of the building, there is wastewater treatment room with 11 pumps and other equipment. Pump motor horsepower ranges from 0.5 hp and 10 hp. There is no septic tank in this building; therefore, all water from restrooms, the kitchen, and other areas is processed in this room and then discharged. All wastewater pumps run continuously, except for those on standby. All equipment is connected to the single electric meter for the school building.



Wastewater treatment room



Wastewater pumps



Wastewater sump

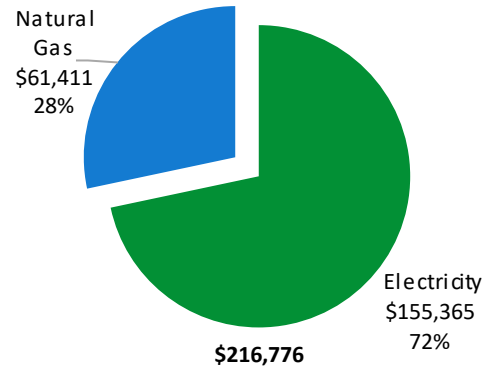


Wastewater pumps

3 ENERGY USE AND COSTS

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

Utility Summary		
Fuel	Usage	Cost
Electricity	1,330,445 kWh	\$155,365
Natural Gas	61,841 Therms	\$61,411
Total		\$216,776



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

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

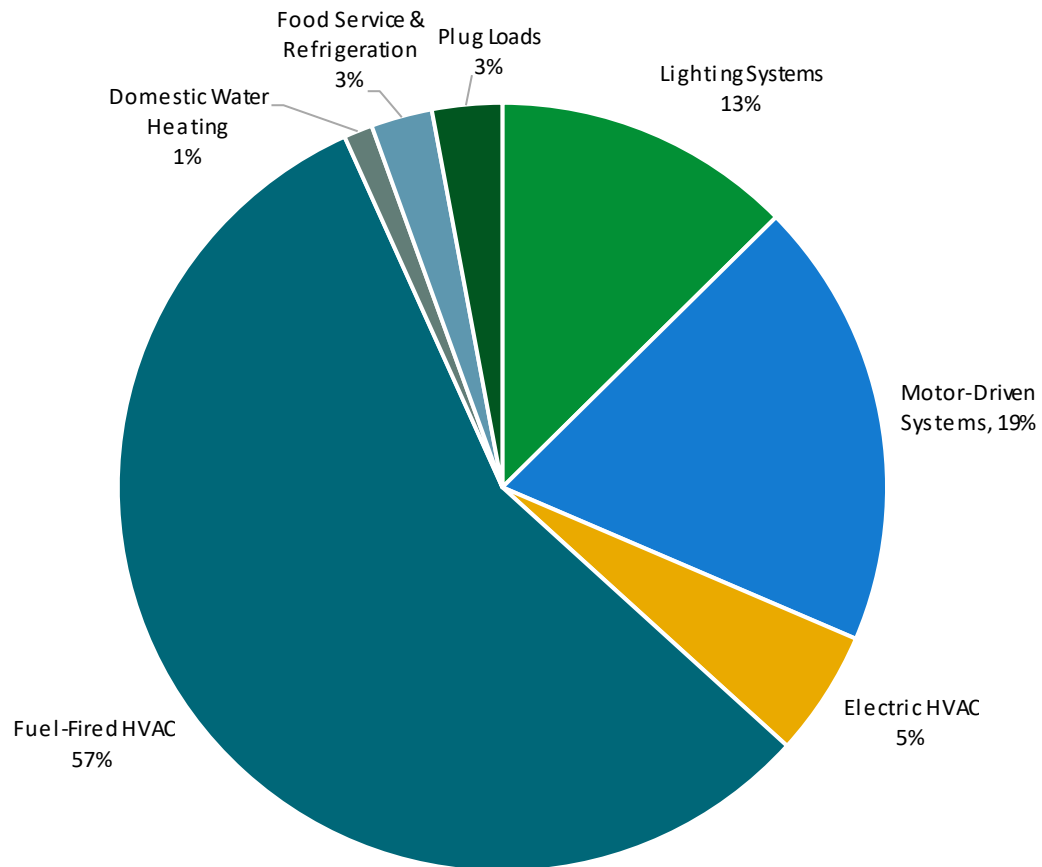
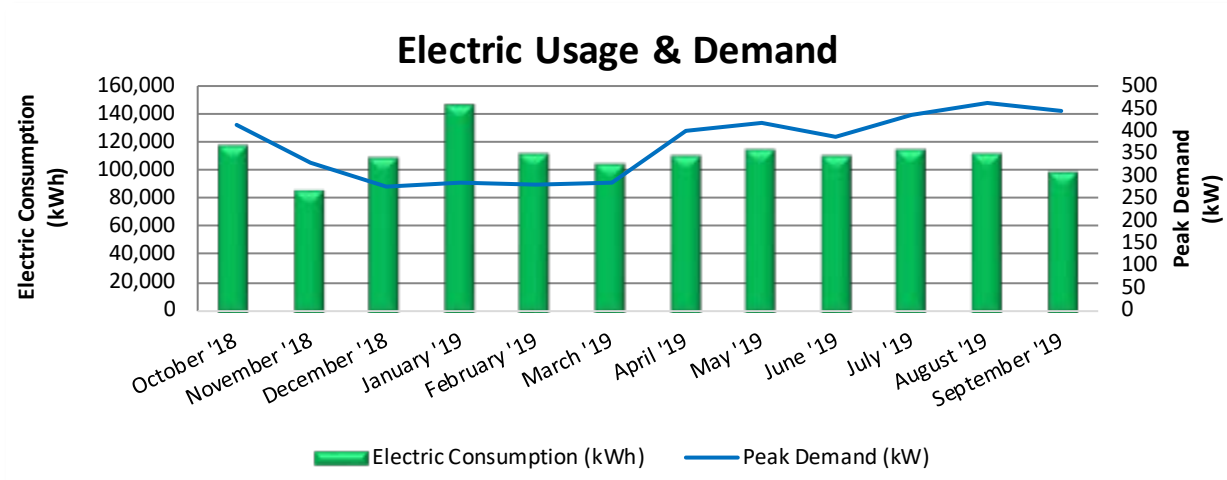


Figure 5 - Energy Balance

3.1 Electricity

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



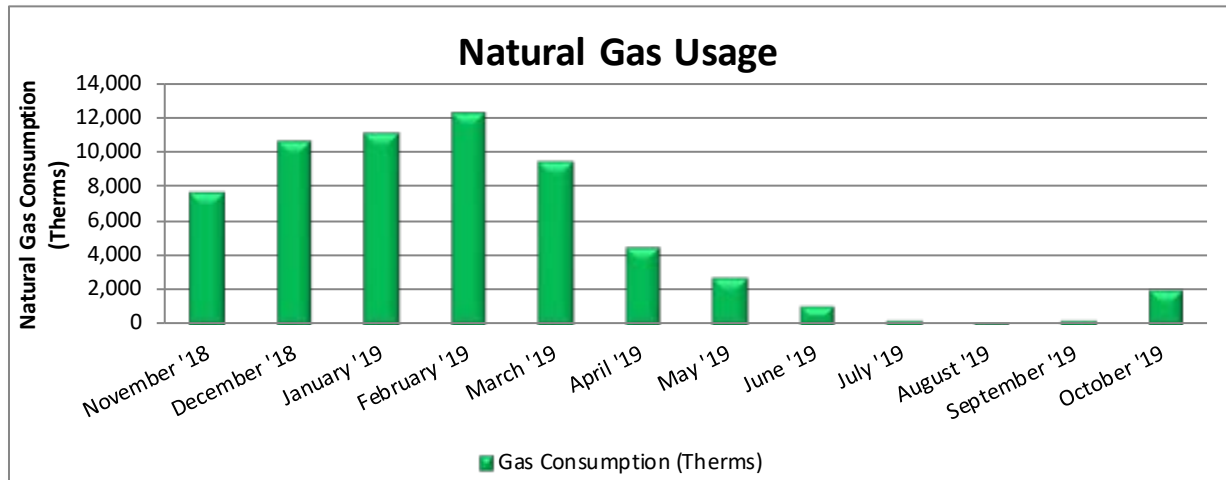
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
11/8/18	29	116,400	413	\$2,528	\$14,745
12/8/18	30	86,000	329	\$1,999	\$10,968
1/10/19	33	108,000	278	\$1,680	\$11,734
2/8/19	29	145,600	286	\$1,728	\$15,338
3/11/19	31	110,400	279	\$1,685	\$11,902
4/9/19	29	103,600	285	\$1,723	\$11,314
5/9/19	30	110,000	400	\$2,448	\$12,972
6/10/19	32	114,000	420	\$2,722	\$13,260
7/10/19	30	110,000	388	\$2,509	\$13,054
8/8/19	29	113,600	435	\$2,816	\$13,776
9/10/19	33	111,200	463	\$3,002	\$13,732
10/9/19	29	98,000	445	\$2,685	\$12,144
Totals	364	1,326,800	463	\$27,526	\$154,939
Annual	365	1,330,445	463	\$27,602	\$155,365

Notes:

- Peak demand of 463 kW occurred in August '19.
- Average demand over the past 12 months was 368 kW.
- The average electric cost over the past 12 months was \$0.117/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

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



Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
11/26/18	33	7,650	\$6,685
12/28/18	32	10,524	\$8,891
1/25/19	28	11,054	\$11,593
2/26/19	32	12,248	\$11,618
3/27/19	29	9,391	\$8,302
4/26/19	30	4,439	\$4,310
5/28/19	32	2,710	\$2,906
6/26/19	29	1,157	\$1,713
7/29/19	33	224	\$978
8/27/19	29	211	\$966
9/25/19	29	313	\$1,101
10/25/19	30	2,090	\$2,517
Totals	366	62,011	\$61,579
Annual	365	61,841	\$61,411

Notes:

- The average gas cost for the past 12 months is \$0.993/therm, which is the blended rate used throughout the analysis.

3.3 Benchmarking

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

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

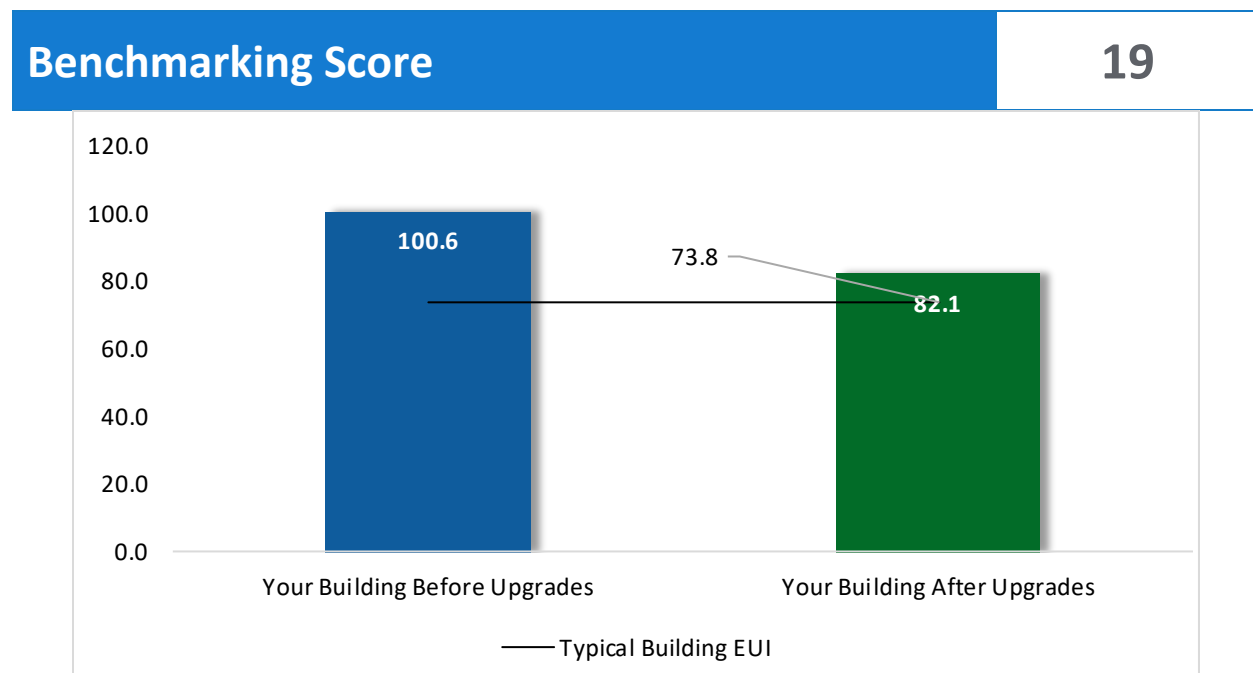


Figure 6 - Energy Use Intensity Comparison³

At 100.6 kBTU/ft², this building's energy usage exceeds the national average of 73.8.1 kBTU/ft² for schools, meaning building performance is slightly below the national average.

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

For wastewater treatment plants the energy use intensity is the total source energy use of the property divided by the average influent flow (in gallons per day).

³ Based on all evaluated ECMs

Tracking Your Energy Performance

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

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

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

For more information on ENERGY STAR® and Portfolio Manager®, visit their website⁴.

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

4 ENERGY CONSERVATION MEASURES

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

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

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

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

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades			233,689	42.4	-46	\$26,835	\$113,232	\$46,970	\$66,262	2.5	229,963
ECM 1	Install LED Fixtures	Yes	85,626	10.9	-15	\$9,847	\$63,009	\$22,800	\$40,209	4.1	84,437
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	5,732	1.4	-1	\$657	\$1,894	\$640	\$1,254	1.9	5,632
ECM 3	Retrofit Fixtures with LED Lamps	Yes	142,331	30.2	-29	\$16,330	\$48,330	\$23,530	\$24,800	1.5	139,895
Lighting Control Measures			44,148	7.3	-9	\$5,064	\$36,678	\$20,970	\$15,708	3.1	43,376
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	21,294	4.4	-4	\$2,442	\$20,028	\$4,320	\$15,708	6.4	20,921
ECM 5	Install High/Low Lighting Controls	Yes	22,855	2.9	-5	\$2,621	\$16,650	\$16,650	\$0	0.0	22,455
Motor Upgrades			0	0.0	0	\$0	\$0	\$0	\$0	0.0	0
ECM 0	Premium Efficiency Motors	Yes	0	0.0	0	\$0	\$0	\$0	\$0	0.0	0
Variable Frequency Drive (VFD) Measures			162,296	36.1	42	\$19,367	\$148,086	\$32,800	\$115,286	6.0	168,315
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	109,026	31.9	0	\$12,732	\$76,435	\$27,200	\$49,235	3.9	109,788
ECM 7	Install VFDs on Heating Water Pumps	Yes	49,797	4.2	0	\$5,815	\$67,838	\$5,200	\$62,638	10.8	50,145
ECM 8	Install VFDs on Kitchen Hood Fan Motors	Yes	3,473	0.1	42	\$820	\$3,812	\$400	\$3,412	4.2	8,381
Electric Unitary HVAC Measures			16,385	23.7	0	\$1,913	\$434,992	\$28,598	\$406,394	212.4	16,499
ECM 9	Install High Efficiency Air Conditioning Units	No	16,385	23.7	0	\$1,913	\$434,992	\$28,598	\$406,394	212.4	16,499
Gas Heating (HVAC/Process) Replacement			0	0.0	349	\$3,468	\$93,227	\$13,936	\$79,291	22.9	40,886
ECM 10	Install High Efficiency Hot Water Boilers	No	0	0.0	349	\$3,468	\$93,227	\$13,936	\$79,291	22.9	40,886
HVAC System Improvements			1,875	0.0	37	\$587	\$8,157	\$0	\$8,157	13.9	6,232
ECM 11	Implement Demand Control Ventilation (DCV)	No	1,875	0.0	37	\$587	\$8,157	\$0	\$8,157	13.9	6,232
Domestic Water Heating Upgrade			0	0.0	18	\$175	\$531	\$359	\$171	1.0	2,059
ECM 12	Install Low-Flow DHW Devices	Yes	0	0.0	18	\$175	\$531	\$359	\$171	1.0	2,059
Food Service & Refrigeration Measures			5,938	0.7	0	\$693	\$5,077	\$500	\$4,577	6.6	5,980
ECM 13	Refrigerator/Freezer Case Electrically Commutated Motors	No	983	0.1	0	\$115	\$1,517	\$400	\$1,117	9.7	990
ECM 14	Replace Refrigeration Equipment	No	3,343	0.4	0	\$390	\$3,330	\$0	\$3,330	8.5	3,367
ECM 15	Vending Machine Control	Yes	1,612	0.2	0	\$188	\$230	\$100	\$130	0.7	1,623
TOTALS			464,332	110.3	391	\$58,102	\$839,980	\$144,133	\$695,846	12.0	513,310

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

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

Figure 7 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades		233,689	42.4	-46	\$26,835	\$113,232	\$46,970	\$66,262	2.5	229,963
ECM 1	Install LED Fixtures	85,626	10.9	-15	\$9,847	\$63,009	\$22,800	\$40,209	4.1	84,437
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	5,732	1.4	-1	\$657	\$1,894	\$640	\$1,254	1.9	5,632
ECM 3	Retrofit Fixtures with LED Lamps	142,331	30.2	-29	\$16,330	\$48,330	\$23,530	\$24,800	1.5	139,895
Lighting Control Measures		44,148	7.3	-9	\$5,064	\$36,678	\$20,970	\$15,708	3.1	43,376
ECM 4	Install Occupancy Sensor Lighting Controls	21,294	4.4	-4	\$2,442	\$20,028	\$4,320	\$15,708	6.4	20,921
ECM 5	Install High/Low Lighting Controls	22,855	2.9	-5	\$2,621	\$16,650	\$16,650	\$0	0.0	22,455
Variable Frequency Drive (VFD) Measures		162,296	36.1	42	\$19,367	\$148,086	\$32,800	\$115,286	6.0	168,315
ECM 6	Install VFDs on Constant Volume (CV) Fans	109,026	31.9	0	\$12,732	\$76,435	\$27,200	\$49,235	3.9	109,788
ECM 7	Install VFDs on Heating Water Pumps	49,797	4.2	0	\$5,815	\$67,838	\$5,200	\$62,638	10.8	50,145
ECM 8	Install VFDs on Kitchen Hood Fan Motors	3,473	0.1	42	\$820	\$3,812	\$400	\$3,412	4.2	8,381
Domestic Water Heating Upgrade		0	0.0	18	\$175	\$531	\$359	\$171	1.0	2,059
ECM 12	Install Low-Flow DHW Devices	0	0.0	18	\$175	\$531	\$359	\$171	1.0	2,059
Food Service & Refrigeration Measures		1,612	0.2	0	\$188	\$230	\$100	\$130	0.7	1,623
ECM 15	Vending Machine Control	1,612	0.2	0	\$188	\$230	\$100	\$130	0.7	1,623
TOTALS		441,746	86.0	4	\$51,628	\$298,757	\$101,199	\$197,558	3.8	445,336

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

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

Figure 8 – Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades		233,689	42.4	-46	\$26,835	\$113,232	\$46,970	\$66,262	2.5	229,963
ECM 1	Install LED Fixtures	85,626	10.9	-15	\$9,847	\$63,009	\$22,800	\$40,209	4.1	84,437
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	5,732	1.4	-1	\$657	\$1,894	\$640	\$1,254	1.9	5,632
ECM 3	Retrofit Fixtures with LED Lamps	142,331	30.2	-29	\$16,330	\$48,330	\$23,530	\$24,800	1.5	139,895

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

ECM 1: Install LED Fixtures

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

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

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

Affected building areas: fixtures with metal halide lamps in gymnasium, cafeteria, corridor near cafetorium and exterior pole-mounted fixtures.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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

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

Affected building areas: fluorescent fixtures with T12 tubes in music room and art room.

ECM 3: Retrofit Fixtures with LED Lamps

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

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, incandescent lamps on cafeteria stage, and compact fluorescent lamps in cafeteria, main office area, media center, and corridors.

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Control Measures		44,148	7.3	-9	\$5,064	\$36,678	\$20,970	\$15,708	3.1	43,376
ECM 4	Install Occupancy Sensor Lighting Controls	21,294	4.4	-4	\$2,442	\$20,028	\$4,320	\$15,708	6.4	20,921
ECM 5	Install High/Low Lighting Controls	22,855	2.9	-5	\$2,621	\$16,650	\$16,650	\$0	0.0	22,455

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

ECM 4: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected building areas: offices, classrooms (ones which already don't have occupancy sensors), gymnasium, media center, faculty room, kitchen, restrooms, basement storage area.

ECM 5: Install High/Low Lighting Controls

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

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

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

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

Affected building areas: all corridors.

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

4.3 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		162,296	36.1	42	\$19,367	\$148,086	\$32,800	\$115,286	6.0	168,315
ECM 6	Install VFDs on Constant Volume (CV) Fans	109,026	31.9	0	\$12,732	\$76,435	\$27,200	\$49,235	3.9	109,788
ECM 7	Install VFDs on Heating Water Pumps	49,797	4.2	0	\$5,815	\$67,838	\$5,200	\$62,638	10.8	50,145
ECM 8	Install VFDs on Kitchen Hood Fan Motors	3,473	0.1	42	\$820	\$3,812	\$400	\$3,412	4.2	8,381

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

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

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: all AHUs serving the building (AHU-1, 2, 3, 4, 5, 6, 7, 8A, 8B, 9, 10, 11, 12 & 13).

ECM 7: 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: two 20 hp heating hot water pumps.

ECM 8: Install VFDs on Kitchen Hood Fan Motors

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

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

4.4 Electric Unitary Heating, Ventilation, and Air Conditioning (HVAC)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		16,385	23.7	0	\$1,913	\$434,992	\$28,598	\$406,394	212.4	16,499
ECM 9	Install High Efficiency Air Conditioning Units	16,385	23.7	0	\$1,913	\$434,992	\$28,598	\$406,394	212.4	16,499

Replacing the split AC system (McQuay condensing units and AHUs) has a long payback period and may not be justifiable based simply on energy considerations. However, all the split AC systems at this school are beyond normal useful life (the units are more than 25 years old). Typically, the marginal cost of purchasing a high efficiency unit can be justified by the marginal savings from the improved efficiency. When the split AC units are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 9: Install High Efficiency Air Conditioning Units

We evaluated replacing the 14 McQuay split AC units with high efficiency split AC units. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average cooling load, and the estimated annual operating hours.

Affected units: all 14 McQuay split AC units.

4.5 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		0	0.0	349	\$3,468	\$93,227	\$13,936	\$79,291	22.9	40,886
ECM 10	Install High Efficiency Hot Water Boilers	0	0.0	349	\$3,468	\$93,227	\$13,936	\$79,291	22.9	40,886

ECM 10: Install High Efficiency Hot Water Boilers

We evaluated replacing the older, Cleaver-Brooks hot water boilers with high efficiency hot water boilers. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

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

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

Replacing the boilers has a long payback and may not be justifiable based simply on energy considerations. However, the boilers are nearing the end of their normal useful life (the boilers are 20 years old). Typically, the marginal cost of purchasing high efficiency boilers can be justified by the marginal savings from the improved efficiency. When the boiler is eventually replaced, consider purchasing boilers that exceed the minimum efficiency required by building codes. We also recommend working with your mechanical design team to determine whether the heating system can operate with return water temperatures below 130°F, which would allow the use of condensing boilers.

4.6 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
HVAC System Improvements		1,875	0.0	37	\$587	\$8,157	\$0	\$8,157	13.9	6,232
ECM 11	Implement Demand Control Ventilation (DCV)	1,875	0.0	37	\$587	\$8,157	\$0	\$8,157	13.9	6,232

ECM 11: Implement Demand Control Ventilation (DCV)

We evaluated installing Demand control ventilation (DCV). DCV 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.

Affected building areas: gymnasium and cafeteria.

4.7 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		0	0.0	18	\$175	\$531	\$359	\$171	1.0	2,059
ECM 12	Install Low-Flow DHW Devices	0	0.0	18	\$175	\$531	\$359	\$171	1.0	2,059

ECM 12: Install Low-Flow DHW Devices

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

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

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing. Additional cost savings may result from reduced water usage.

4.8 Food Service & Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		5,938	0.7	0	\$693	\$5,077	\$500	\$4,577	6.6	5,980
ECM 13	Refrigerator/Freezer Case Electrically Commutated Motors	983	0.1	0	\$115	\$1,517	\$400	\$1,117	9.7	990
ECM 14	Replace Refrigeration Equipment	3,343	0.4	0	\$390	\$3,330	\$0	\$3,330	8.5	3,367
ECM 15	Vending Machine Control	1,612	0.2	0	\$188	\$230	\$100	\$130	0.7	1,623

ECM 13: Refrigerator/Freezer Case Electrically Commutated Motors

We evaluated replacing shaded pole or permanent split capacitor (PSC) motors with electronically commutated (EC) motors in the walk-in cooler and freezer. Fractional horsepower EC motors are significantly more efficient than mechanically commutated, brushed motors, particularly at low speeds or partial load. By using variable-speed technology, EC motors can optimize fan usage. Because these motors are brushless and use DC power, losses due to friction and phase shifting are eliminated.

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

ECM 14: Replace Refrigeration Equipment

We evaluated replacing the existing freezer chest with new ENERGY STAR® rated equipment. The energy savings associated with this measure come from reduced energy usage, due to more efficient technology, and reduced run times.

ECM 15: Vending Machine Control

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

4.9 Measures for Future Consideration

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

Colts Neck Township Board of Education may wish to consider ESIP for a 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 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.

Retro-Commissioning Study

Due to the complexity of today's HVAC systems and controls, a thorough analysis and rebalance of heating, ventilation, and cooling systems should periodically be conducted. There are indications at this site that systems may be not be operating correctly or as efficiently as they could be. One important tool available to building operators to ensure proper system operation is retro-commissioning.

Retro-commissioning is a common practice recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers to be implemented every few years. We recommend contacting a reputable engineering firm that specializes in energy control systems and retro-commissioning. Ask them to propose a scope of work and an outline of the procedures and processes to be implemented, including a schedule and the roles of all responsible parties.

Once goals and responsibilities are established, the objective of the investigation process is to understand how the building is currently operating, identify the issues, and determine the most cost-effective way to improve performance. The retro-commissioning agent will review building documentation, interview building occupants, and inspect and test the equipment. Information is then compiled into a report and shared with facility staff, who will select which recommendations to implement after reviewing the findings.

The implementation phase puts the selected processes into place. Typical measures may include sensor calibration, equipment schedule changes, damper linkage repair, and similar relatively low-cost adjustments—although more expensive sophisticated programming and building control system upgrades may be warranted. Approved measures may be implemented by the agent, the building staff, or by subcontractors. Typically, a combination of these individuals makes up the retro-commissioning team.

After the approved measures are implemented, the team will verify that the changes are working as expected. Baseline and post-case measurements will allow building staff to monitor equipment and ensure that the benefits are maintained.

Electric Sub Metering

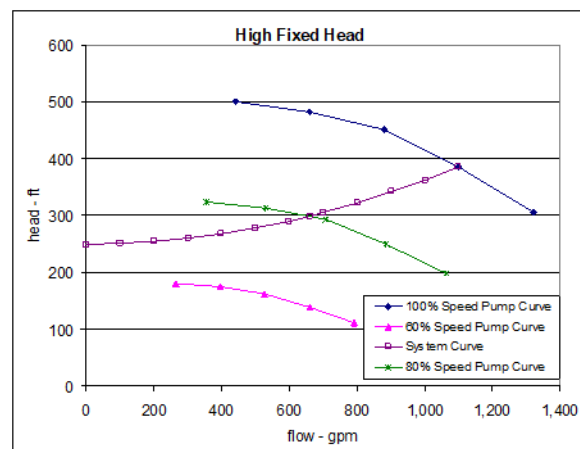
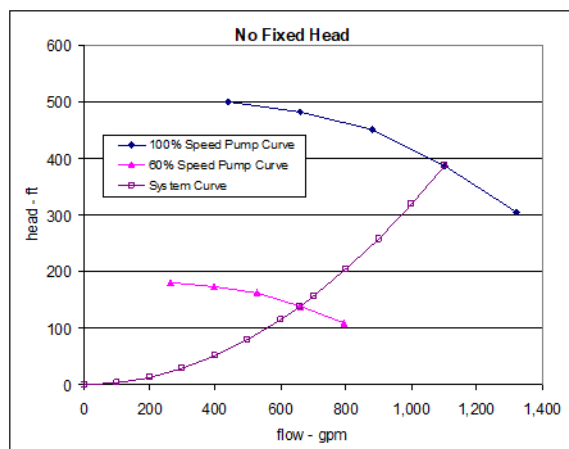
Currently, the building is master metered (single electric meter). Your operations may benefit from installing an electric sub-meter for the wastewater treatment room, so you can better understand the cost of the wastewater operations. Electric submeters alone do not save energy, but they are a useful tool under the right circumstances. Electric sub-meters can provide facility staff with real-time energy use data for specific buildings, information that enhances the potential for greater energy management activities. Revenue grade submeters are a tool that allow owners to bill tenants or departments for the energy consumed in the spaces they occupy. Better resolution on building system performance can lead to occupant behavioral changes, which often result in reduced energy use. Alternatively, temporary metering could be installed as part of a study to ascertain the cost of handling the wastewater.

VFDs to Control Fixed Head Pump Motors

The school has a few pumps in the wastewater treatment room, which operate with fixed head. Investigation of potential energy savings measures for these pumps is beyond the scope of this study. School staff may want to conduct further investigation of potential savings for variable speed pumping controls.

VFDs regulate pump flow by regulating the speed of the drive motor. This is a more efficient way of regulating a pump than throttling the discharge of the pump. In systems with minimal fixed system head (for example a closed loop circulation system) pump power follows the affinity laws. This means that the required pump power varies approximately with the cube of the motor speed. As a result, a small change in pump speed will produce a significant reduction in motor power. In pumping systems with a fixed head, that must be overcome regardless of the flow rate the affinity laws no longer apply. Examples of fixed head systems are well and lift pumps. The lift required to move the water out of a well or sump to the surface is such a fixed head.

The figures below demonstrate the differences between a system with no fixed head and high fixed head. A pump will always operate at the intersection of the pump curve and the system curve. The pump curve is dictated by the pump design and operating speed, while the system curve is dictated by the physical system, and the pump is distributing water through such as the length of pipe, flow restrictions, and fixed head.



With no fixed head as the pump speed is reduced, the pump operation follows the system curve. In the no fixed head example above, reducing the pump speed from 100 percent to 60 percent reduces the flow

from 1,100 gpm to 660 gpm with an associated head of approximately 140 ft. In addition, the pump efficiency will remain the same at the two different flows. The reduced speed operation requires significantly less power than throttling the pump to 660 gpm which would require 480 ft of head.

With the high fixed head condition, the system curve does not intersect the 60 percent speed curve. As a result, the pump cannot operate at 60 percent speed with this level of fixed head. Reducing the pump speed to 60 percent in this case would result in no flow, and the pump would overheat. In order to achieve 660 gpm by reducing the pump speed, the pump must operate at 80 percent speed now (see the intersection of the system curve and the 80 percent speed curve). In this case, the pump will produce 300 ft of head to achieve the 660 gpm flow. The pump will also most likely be operating at a different efficiency than when it was producing 1,100 gpm. The pump efficiency at the new operation at 80 percent speed will be a function of the pump design and may be higher or lower than at the full speed, 1,100 gpm operation. However, if the pump was sized for optimal performance at full speed and 1,100 gpm, it is likely that the pump efficiency will be lower when it is operating at 80 percent speed.

The following information is required to determine if installing a VFD to control a fixed head pump is feasible. The pump curves for the associated pump, the full speed flow and head, and the system fixed head. With that information the minimum feasible pump speed and associated power draw can be determined. To determine the potential energy savings, the typical flow pattern of the system is required. With well or sump systems reducing the pump flow will increase the pump operating hours. Some system configurations will work with the pump operating at lower flow for longer hours. An example would be a well pump with excess flow capacity that is used to fill a large tank or reservoir. Other systems cannot function at significant reduced flows. An example would be a pump transferring fluid between two holding tanks if there are time constraints to the fluid transfer. If any of the pump systems at this site with motor capacities of 5 hp or more and a space to locate a VFD can operate for longer hours at reduced flow, then the feasibility of installing a VFD could be evaluated.

Upgrade to a Heat Pump System

An electric furnace, baseboard heater, or boiler has no flue loss through a chimney. The AFUE rating for an all-electric furnace or boiler is between 95 percent and 100 percent. 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, such as the electric baseboard heater gymnasium office, can be inexpensive to install but expensive to run. Often, there are opportunities to install ductless electric heat pumps in buildings with baseboard electric heaters. Electric heat pumps have high coefficient of performance 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 in this case.

5 ENERGY EFFICIENT BEST PRACTICES

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

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

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

Energy Tracking with ENERGY STAR® Portfolio Manager®



You've heard it before - you can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions⁵. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Weatherization

Caulk or weather strip leaky doors and windows to reduce drafts and loss of heated or cooled air. Sealing cracks and openings can reduce heating and cooling costs, improve building durability, and create a healthier indoor environment. Materials used may include caulk, polyurethane foam, and other weather-stripping materials. There is an energy savings opportunity by reducing the uncontrolled air exchange between the outside and inside of the building. Blower door assisted comprehensive building air sealing will reduce the amount of air exchange which will in turn reduce the load on the buildings heating and cooling equipment and thus providing energy savings and increased occupant comfort.

Doors and Windows

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

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

Window Treatments/Coverings

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

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 percent while still drawing full power.

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

Lighting Controls

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

Motor Maintenance

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

Thermostat Schedules and Temperature Resets



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

Economizer Maintenance

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

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

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

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

Ductwork Maintenance

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

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

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

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

Boiler Maintenance

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

Label HVAC Equipment

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

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

Optimize HVAC Equipment Schedules

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

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

Water Heater Maintenance

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

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

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

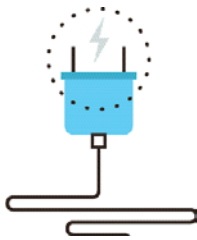
Refrigeration Equipment Maintenance

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

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

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

Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips⁶. Your local utility may offer incentives or rebates for this equipment.

Computer Power Management Software

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

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

Water Conservation



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

For more information regarding water conservation go to the EPA's WaterSense® website⁷ or download a copy of EPA's "WaterSense® at Work: Best Management Practices for Commercial and Institutional Facilities"⁸ to get ideas for creating a water management plan and best practices for a wide range of water using systems.

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

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

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

Procurement Strategies

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

⁷ <https://www.epa.gov/watersense>.

⁸ <https://www.epa.gov/watersense/watersense-work-0>.

6 ON-SITE GENERATION

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

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

6.1 Solar Photovoltaic

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

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

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

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

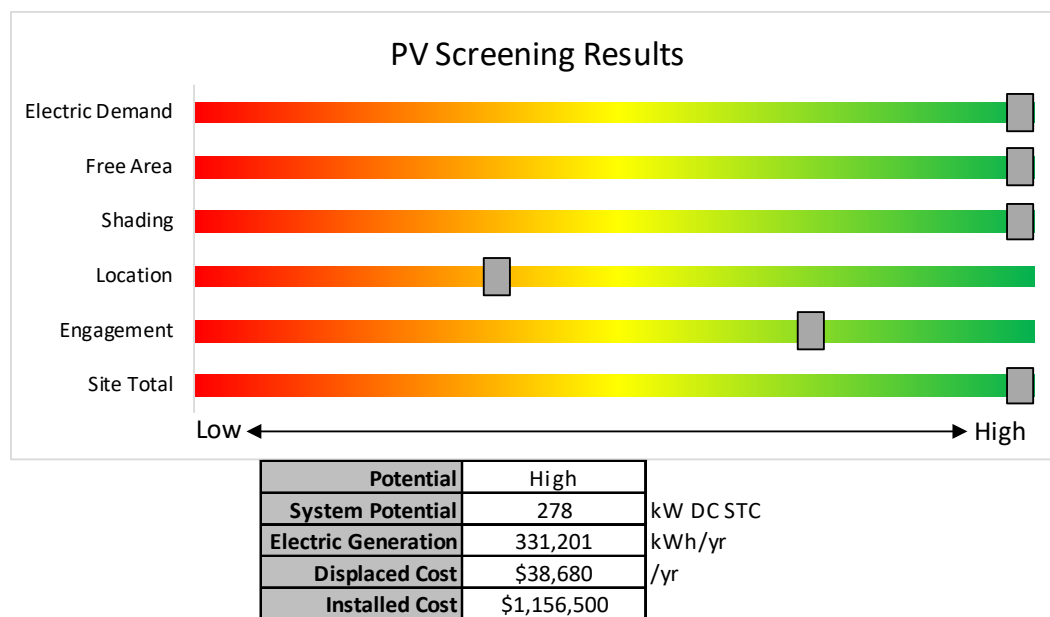


Figure 9 - Photovoltaic Screening

Transition Incentive (TI) Program

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

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

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

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

6.2 Combined Heat and Power

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

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

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

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

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

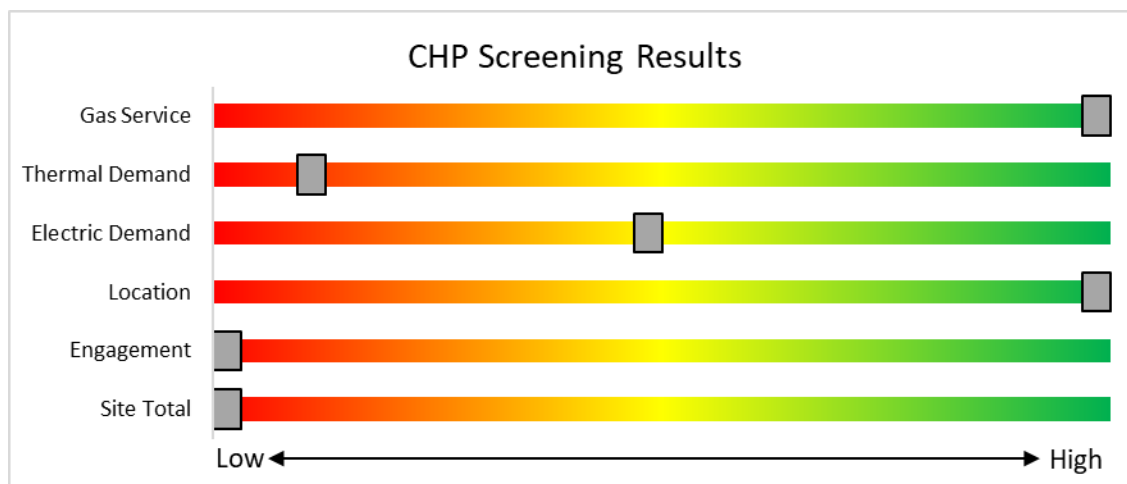


Figure 10 – Combined Heat & Power Screening

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

7 PROJECT FUNDING AND INCENTIVES

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

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

7.1 SmartStart



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

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

Equipment with Prescriptive Incentives Currently Available:

Electric Chillers
Electric Unitary HVAC
Gas Cooling
Gas Heating
Gas Water Heating
Ground Source Heat Pumps
Lighting

Lighting Controls
Refrigeration Doors
Refrigeration Controls
Refrigerator/Freezer Motors
Food Service Equipment
Variable Frequency Drives

Incentives

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

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

How to Participate

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

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

7.2 Direct Install



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

installation of selected measures. Energy efficiency measures may include lighting and lighting controls, refrigeration, HVAC, motors, variable speed drives, and controls.

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

Incentives

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

How to Participate

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

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

7.3 Pay for Performance - Existing Buildings



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

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

Based on the site building and utility data provided, the facility meets the requirements of the current P4P program.

Incentives

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

How to Participate

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

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

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

7.4 Combined Heat and Power

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

Incentives

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

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

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

How to Participate

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

7.5 Energy Savings Improvement Program

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

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

How to Participate

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

- (1) Use an energy services company or "ESCO."
- (2) Use independent engineers and other specialists, or your own qualified staff, to provide and manage the requirements of the program through bonds or lease obligations.
- (3) Use a hybrid approach of the two options described above where the ESCO is used for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

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

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

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

7.6 Transition Incentive (TI) Program

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

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

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

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

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

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

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

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

8 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

8.1 Retail Electric Supply Options

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

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

A list of licensed third-party electric suppliers is available at the NJBPU website⁹.

8.2 Retail Natural Gas Supply Options

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

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

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

A list of licensed third-party natural gas suppliers is available at the NJBPU website¹⁰.

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

Location	Existing Conditions						Proposed Conditions						Energy Impact & Financial Analysis								
	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
AHUs(outside) / Roof	2	LED - Fixtures: 84W Flood Light LED Fixtures	Timeclock	S	84	4,000		None	No	2	LED - Fixtures: 84W Flood Light LED Fixtures	Timeclock	84	4,000	0.0	0	0	\$0	\$0	\$0	0.0
AHUs(outside)	28	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3	Relamp	No	28	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.0	924	0	\$108	\$1,022	\$560	4.3
Cafetorium / Stage	24	Compact Fluorescent: (2) 26W Plug-In Lamps	Wall Switch	S	52	1,000	3	Relamp	No	24	LED Lamps: (2) 18.5W Plug-In Lamps	Wall Switch	37	1,000	0.3	396	0	\$45	\$600	\$96	11.1
Cafetorium	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Cafetorium	3	Halogen Incandescent: (30) 75W Halogen Incandescent BR38 lamps	Wall Switch	S	2,250	100	3	Relamp	No	3	LED Lamps: (30) 12W Screw-In Lamps	Wall Switch	360	100	4.1	624	0	\$72	\$2,322	\$540	24.9
Cafetorium / Dining area	35	Linear Fluorescent - T8: 2' T8 (17W) - 3L	Wall Switch	S	53	4,400	3, 4	Relamp	Yes	35	LED - Linear Tubes: (3) 2' Lamps	Occupancy Sensor	26	3,036	0.9	5,998	-1	\$688	\$3,327	\$1,050	3.3
Cafetorium / Storage room	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.1	139	0	\$16	\$226	\$60	10.4
Cafetorium / Dining area	20	Metal Halide: (1) 150W Lamp	Wall Switch	S	190	4,400	1, 4	Fixture Replacement	Yes	20	LED - Fixtures: High-Bay	Occupancy Sensor	45	3,036	2.3	15,386	-3	\$1,765	\$16,578	\$6,280	5.8
Classroom 11 / Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 11 / Class	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.4	1,403	0	\$161	\$803	\$440	2.3
Classroom 18A 18B	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 18A 18B	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,760	3, 4	Relamp	Yes	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,904	0.6	2,471	-1	\$283	\$1,343	\$580	2.7
Classroom 19	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 19	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.4	1,403	0	\$161	\$803	\$440	2.3
Classroom 21	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 21	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,760	3, 4	Relamp	Yes	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,904	0.6	2,471	-1	\$283	\$1,343	\$580	2.7
Classroom 22	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 22	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.4	1,403	0	\$161	\$803	\$440	2.3
Classroom 23 / Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 23 / Class	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.4	1,403	0	\$161	\$803	\$440	2.3
Classroom 27 / Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 27 / Class	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.4	1,403	0	\$161	\$803	\$440	2.3
Classroom 28	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 28	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.4	1,403	0	\$161	\$803	\$440	2.3
Classroom 29	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0

Existing Conditions														Energy Impact & Financial Analysis							
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Classroom 29	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,760	3, 4	Relamp	Yes	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,904	0.6	2,471	-1	\$283	\$1,343	\$580	2.7
Classroom 30	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 30	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.4	1,403	0	\$161	\$803	\$440	2.3
Classroom 31	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 31	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.4	1,403	0	\$161	\$803	\$440	2.3
Classroom 34	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.5	1,530	0	\$176	\$876	\$480	2.3
Classroom 35	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.5	1,530	0	\$176	\$876	\$480	2.3
Classroom 36	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.5	1,530	0	\$176	\$876	\$480	2.3
Classroom 40 Music Room	3	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,760	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,904	0.0	194	0	\$22	\$98	\$36	2.8
Classroom 40 Music Room	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,904	0.1	382	0	\$44	\$380	\$130	5.7
Classroom 40 Music Room	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,760	3, 4	Relamp	Yes	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,904	0.5	2,103	0	\$241	\$1,142	\$470	2.8
Classroom 40 Music Room	8	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,760	2, 4	Relamp & Reballast	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,904	0.8	3,303	-1	\$379	\$1,217	\$390	2.2
Classroom 41 Art Room	3	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,760	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,904	0.0	194	0	\$22	\$98	\$36	2.8
Classroom 41 Art Room / Storage room	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,904	0.1	382	0	\$44	\$226	\$60	3.8
Classroom 41 Art Room	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,760	3, 4	Relamp	Yes	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,904	0.5	2,103	0	\$241	\$1,142	\$470	2.8
Classroom 41 Art Room	8	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,760	2, 4	Relamp & Reballast	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,904	0.8	3,303	-1	\$379	\$947	\$320	1.7
Classroom 6	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.5	1,530	0	\$176	\$876	\$480	2.3
Classroom 8 / Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 8 / Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Classroom 8 / Class	15	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	2,070	3	Relamp	No	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.6	1,913	0	\$219	\$1,095	\$600	2.3
Copy room	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,000	3, 4	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	690	0.1	208	0	\$24	\$280	\$130	6.3
Corridor 42 to rm 38	17	Compact Fluorescent: (2) 32W Bi axial Plug-In Lamps	Wall Switch	S	64	4,400	3, 5	Relamp	Yes	17	LED Lamps: (2) 23W Bi ax Lamps	High/Low Control	46	3,036	0.4	2,654	-1	\$304	\$1,134	\$743	1.3
Corridor 42 to rm 38	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
Corridor 42 to rm 38	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,400	3, 5	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,036	0.2	1,219	0	\$140	\$444	\$345	0.7
Corridor 42 to rm 38	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,400	3, 5	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,036	0.2	1,423	0	\$163	\$706	\$590	0.7

Location	Existing Conditions						Proposed Conditions						Energy Impact & Financial Analysis								
	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Corridor 42 to rm 38	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	4,400	3, 5	Relamp	Yes	8	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	3,036	0.4	2,439	-1	\$280	\$888	\$690	0.7
Corridor Cafetorium to Rm 3	16	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	4,400	3, 5	Relamp	Yes	16	LED Lamps: (2) 23W Biax Lamps	High/Low Control	46	3,036	0.4	2,498	-1	\$287	\$1,107	\$739	1.3
Corridor Cafetorium to Rm 3	43	Compact Fluorescent: (1) 40W Biaxial Plug-In Lamp	Wall Switch	S	40	4,400	3, 5	Relamp	Yes	43	LED Lamps: (1) 28W Biax Lamp	High/Low Control	28	3,036	0.6	4,304	-1	\$494	\$2,381	\$1,886	1.0
Corridor Cafetorium to Rm 3	12	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	12	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Corridor Cafetorium to Rm 3	27	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,400	3, 5	Relamp	Yes	27	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,036	0.8	5,487	-1	\$629	\$2,111	\$1,665	0.7
Corridor Cafetorium to Rm 3	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,400	3, 5	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,036	0.2	1,626	0	\$186	\$742	\$610	0.7
Corridor Cafetorium to Rm 3	18	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	4,400	3, 5	Relamp	Yes	18	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	3,036	0.8	5,487	-1	\$629	\$1,661	\$1,215	0.7
Corridor Cafetorium to Rm 3	14	Metal Halide: (1) 100W Lamp	Wall Switch	S	128	4,400	1, 5	Fixture Replacement	Yes	14	LED - Fixtures: Low-Bay	High/Low Control	30	3,036	1.1	7,271	-2	\$834	\$9,432	\$4,875	5.5
Corridor Near Gym	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,400	3, 5	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,036	0.2	1,626	0	\$186	\$742	\$610	0.7
Corridor rm 10 to IDF 1	9	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	4,400	3, 5	Relamp	Yes	9	LED Lamps: (2) 23W Biax Lamps	High/Low Control	46	3,036	0.2	1,405	0	\$161	\$693	\$486	1.3
Corridor rm 10 to IDF 1	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
Corridor rm 10 to IDF 1	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,400	3, 5	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,036	0.3	1,829	0	\$210	\$779	\$630	0.7
Corridor rm 10 to IDF 1	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	4,400	3, 5	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	3,036	0.2	1,432	0	\$164	\$517	\$385	0.8
Corridor rm 20 to Rm 24	1	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	4,400	3, 5	Relamp	Yes	1	LED Lamps: (2) 23W Biax Lamps	High/Low Control	46	3,036	0.0	156	0	\$18	\$27	\$4	1.3
Corridor rm 20 to Rm 24	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
Corridor rm 20 to Rm 24	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,400	3, 5	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,036	0.3	1,829	0	\$210	\$779	\$630	0.7
Corridor rm 20 to Rm 24	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	4,400	3, 5	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	3,036	0.3	2,148	0	\$246	\$663	\$465	0.8
Corridor rm 30 to Rm 26	1	Compact Fluorescent: (2) 32W Biaxial Plug-In Lamps	Wall Switch	S	64	4,400	3, 5	Relamp	Yes	1	LED Lamps: (2) 23W Biax Lamps	High/Low Control	46	3,036	0.0	156	0	\$18	\$27	\$4	1.3
Corridor rm 30 to Rm 26	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
Corridor rm 30 to Rm 26	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,400	3, 5	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,036	0.3	1,829	0	\$210	\$779	\$630	0.7
Corridor rm 30 to Rm 26	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	4,400	3, 5	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	3,036	0.3	2,148	0	\$246	\$663	\$465	0.8
Corridor rm 6 to rm 4	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
Corridor rm 6 to rm 4	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,400	3, 5	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,036	0.2	1,626	0	\$186	\$742	\$610	0.7
Exterior lighting	7	Compact Fluorescent: (1) 40W Biaxial Plug-In Lamp	Timeclock	S	40	4,000	3	Relamp	No	7	LED Lamps: (1) 28W Biax Lamp	Timeclock	28	4,000	0.0	336	0	\$39	\$95	\$14	2.1
Exterior lighting	33	LED - Fixtures: 40W Wall Pack LED Fixtures	Timeclock	S	40	4,000		None	No	33	LED - Fixtures: 40W Wall Pack LED Fixtures	Timeclock	40	4,000	0.0	0	0	\$0	\$0	\$0	0.0

Existing Conditions							Proposed Conditions							Energy Impact & Financial Analysis							
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Exterior lighting	19	LED Lamps: (1) 15W PAR30 Screw-In Lamp	Timedclock	S	15	4,000		None	No	19	LED Lamps: (1) 15W PAR30 Screw-In Lamp	Timedclock	15	4,000	0.0	0	0	\$0	\$0	\$0	0.0
Exterior lighting	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Timedclock	S	114	4,000	3	Relamp	No	4	LED - Linear Tubes: (4) 4' Lamps	Timedclock	58	4,000	0.0	896	0	\$105	\$292	\$160	1.3
Exterior lighting	15	Metal Halide: (2) 150W E37 Screw-In Lamps	Timedclock	S	300	4,000	1	Fixture Replacement	No	15	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Timedclock	90	4,000	0.0	12,600	0	\$1,471	\$13,958	\$3,000	7.4
Faculty Dining	20	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,200	3, 4	Relamp	Yes	20	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,518	0.3	1,065	0	\$122	\$1,445	\$480	7.9
Faculty Dining	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,200	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,518	0.1	305	0	\$35	\$380	\$130	7.1
Faculty Dining / Restroom	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.1	185	0	\$21	\$416	\$150	12.6
Faculty Dining	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,380	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	952	0.0	60	0	\$7	\$188	\$20	24.7
Faculty Dining / Restroom	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,380	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	952	0.1	119	0	\$14	\$145	\$40	7.7
Faculty work room	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,760	3, 4	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,904	0.2	956	0	\$110	\$544	\$220	3.0
Gymnasium / Gym area fixtures	32	Metal Halide: (1) 400W Lamp	Wall Switch	S	458	4,400	1, 4	Fixture Replacement	Yes	32	LED - Fixtures: High-Bay	Occupancy Sensor	120	3,036	8.6	58,111	-12	\$6,665	\$25,606	\$9,810	2.4
Gymnasium / Near gym restrooms	3	Compact Fluorescent: (2) 18W Plug-In Lamps	Wall Switch	S	36	1,000	3, 4	Relamp	Yes	3	LED Lamps: (2) 12W Plug-In Lamps	Occupancy Sensor	24	690	0.0	64	0	\$7	\$351	\$82	36.6
Gymnasium / Girls & Boys Restrooms	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.1	185	0	\$21	\$416	\$150	12.6
Gymnasium / Gym office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,904	0.1	510	0	\$58	\$416	\$150	4.5
Gymnasium / Gym office Bathroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,904	0.1	255	0	\$29	\$189	\$40	5.1
Kitchen / Kitchen main area	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,904	0.1	382	0	\$44	\$380	\$130	5.7
Kitchen / Kitchen main area	18	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,760	3, 4	Relamp	Yes	18	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,904	0.8	3,442	-1	\$395	\$1,526	\$680	2.1
Kitchen / Kitchen main area	8	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,904	0.2	953	0	\$109	\$1,120	\$300	7.5
Library break room	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,380	3, 4	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	952	0.2	337	0	\$39	\$489	\$190	7.7
Library office	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,760	3, 4	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,904	0.1	574	0	\$66	\$434	\$160	4.2
Library Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Main Office / Enclosed office	1	Compact Fluorescent: (3) 40W BiAx Lamps	Wall Switch	S	120	2,760	3, 4	Relamp	Yes	1	LED Lamps: (3) 28W BiAx Lamp	Occupancy Sensor	84	1,904	0.0	188	0	\$22	\$157	\$6	7.0
Main Office / Open office area	18	Compact Fluorescent: (3) 40W BiAx Lamps	Wall Switch	S	120	2,760	3, 4	Relamp	Yes	18	LED Lamps: (3) 28W BiAx Lamp	Occupancy Sensor	84	1,904	0.8	3,390	-1	\$389	\$1,269	\$248	2.6
Main Office / Principal's office	1	Compact Fluorescent: (3) 40W BiAx Lamps	Wall Switch	S	120	2,760	3, 4	Relamp	Yes	1	LED Lamps: (3) 28W BiAx Lamp	Occupancy Sensor	84	1,904	0.0	188	0	\$22	\$157	\$6	7.0
Main Office	4	Compact Fluorescent: (1) 26W Plug-In Lamp	Wall Switch	S	26	2,760	3, 4	Relamp	Yes	4	LED Lamps: (1) 18.5W Plug-In Lamp	Occupancy Sensor	19	1,904	0.0	161	0	\$18	\$320	\$78	13.1
Main Office / Conf. Room	8	Compact Fluorescent: (2) 26W Plug-In Lamps	Wall Switch	S	52	2,760	3, 4	Relamp	Yes	8	LED Lamps: (2) 18.5W Plug-In Lamps	Occupancy Sensor	37	1,904	0.2	643	0	\$74	\$470	\$102	5.0

Existing Conditions							Proposed Conditions							Energy Impact & Financial Analysis							
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Main Office / Main office vestibule	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,904	0.1	510	0	\$58	\$416	\$150	4.5
Main Office / Men Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Main Office / Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Main Office / Women's restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Main Office / Conf. Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,904	0.1	255	0	\$29	\$189	\$40	5.1
Main Office / Enclosed Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,760	3, 4	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,904	0.1	382	0	\$44	\$226	\$100	2.9
Main Office / Principal's office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,760	3, 4	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,904	0.1	382	0	\$44	\$226	\$100	2.9
Main Office / Electric closet	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,904	0.0	119	0	\$14	\$188	\$20	12.3
Media Center	13	Compact Fluorescent: (2) 26W Plug-In Lamps	Wall Switch	S	52	3,300	3, 4	Relamp	Yes	13	LED Lamps: (2) 18.5W Plug-In Lamps	Occupancy Sensor	37	2,277	0.2	1,249	0	\$143	\$595	\$122	3.3
Media Center	6	Compact Fluorescent: (2) 26W Plug-In Lamps	Wall Switch	S	52	3,300	3, 4	Relamp	Yes	6	LED Lamps: (2) 18.5W Plug-In Lamps	Occupancy Sensor	37	2,277	0.1	577	0	\$66	\$420	\$94	4.9
Media Center	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Media Center	30	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,300	3, 4	Relamp	Yes	30	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,277	0.9	4,573	-1	\$524	\$1,635	\$740	1.7
Media Center	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,300	3, 4	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,277	0.6	3,201	-1	\$367	\$1,037	\$490	1.5
Media Lab	24	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,760	3, 4	Relamp	Yes	24	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,904	0.4	1,603	0	\$184	\$978	\$380	3.3
Nurse Office / Nurse office open area	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,760	3, 4	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,904	0.6	2,695	-1	\$309	\$1,146	\$550	1.9
Nurse Office exam room	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,760	3, 4	Relamp	Yes	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,904	0.1	225	0	\$26	\$189	\$40	5.8
Nurse office Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,760	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,904	0.0	127	0	\$15	\$153	\$20	9.1
Reading room	4	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	2,760	3, 4	Relamp	Yes	4	LED Lamps: (1) 23W Plug-In Lamp	Occupancy Sensor	22	1,904	0.0	201	0	\$23	\$320	\$78	10.5
Reading room	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,760	3, 4	Relamp	Yes	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,904	0.1	225	0	\$26	\$189	\$40	5.8
Restroom - Nurse office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,000	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	690	0.0	46	0	\$5	\$153	\$20	25.0
Server Room #26	5	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,380	3, 4	Relamp	Yes	5	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	952	0.3	562	0	\$64	\$635	\$270	5.7
Stairwell From basement	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Stairwell From basement	1	LED - Fixtures: 20W Wall Pack LED Fixture	Wall Switch	S	20	8,760		None	No	1	LED - Fixtures: 20W Wall Pack LED Fixture	Wall Switch	20	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Stairwell From basement	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	3, 5	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	6,044	0.1	1,618	0	\$186	\$371	\$305	0.4
Electrical Room 1 / Phone Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,380	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	952	0.1	127	0	\$15	\$189	\$40	10.2

Motor Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions							Proposed Conditions					Energy Impact & Financial Analysis						
		Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Mezzanine	AHU 11/Cafetorium	1	Supply Fan	7.5	88.5%	No	W	2,943	6	No	91.7%	Yes	1	2.3	7,414	0	\$866	\$4,761	\$2,000	3.2
Mechanical Mezzanine	AHU 12- GYM + Cafeteria	1	Supply Fan	7.5	88.5%	No	W	2,943	6	No	91.7%	Yes	1	2.3	7,414	0	\$866	\$4,761	\$2,000	3.2
Mechanical Mezzanine	AHU 13/Gym	1	Supply Fan	10.0	89.5%	No	W	3,383	6	No	91.7%	Yes	1	3.0	11,029	0	\$1,288	\$5,375	\$2,200	2.5
AHUs(outside)	AHU 1	1	Supply Fan	5.0	87.5%	No	W	3,163	6	No	89.5%	Yes	1	1.5	5,259	0	\$614	\$4,197	\$1,800	3.9
AHUs(outside)	AHU 10 / Kitchen	1	Supply Fan	7.5	88.5%	No	W	2,833	6	No	91.7%	Yes	1	2.3	7,137	0	\$833	\$4,761	\$2,000	3.3
AHUs(outside)	AHU 4 & 3 & 2	3	Supply Fan	7.5	88.5%	No	W	3,273	6	No	91.7%	Yes	3	6.8	24,737	0	\$2,889	\$14,282	\$6,000	2.9
AHUs(outside)	AHU 5	1	Supply Fan	3.0	86.5%	No	W	2,943	6	No	89.5%	Yes	1	0.9	3,027	0	\$354	\$3,812	\$400	9.7
AHUs(outside)	AHU 6	1	Return Fan	3.0	86.5%	No	W	2,943	6	No	89.5%	Yes	1	0.9	3,027	0	\$354	\$3,812	\$400	9.7
AHUs(outside)	AHU 7	1	Return Fan	3.0	86.5%	No	W	2,943	6	No	89.5%	Yes	1	0.9	3,027	0	\$354	\$3,812	\$400	9.7
AHUs(outside)	AHU 8A	1	Supply Fan	7.5	88.5%	No	W	2,723	6	No	91.7%	Yes	1	2.3	6,860	0	\$801	\$4,761	\$2,000	3.4
AHUs(outside)	AHU 8B	1	Supply Fan	5.0	87.5%	No	W	2,723	6	No	89.5%	Yes	1	1.5	4,527	0	\$529	\$4,197	\$1,800	4.5
AHUs(outside)	AHU 9	1	Supply Fan	7.5	88.5%	No	W	2,943	6	No	91.7%	Yes	1	2.3	7,414	0	\$866	\$4,761	\$2,000	3.2
AHUs(outside)	AHU 6	1	Supply Fan	7.5	88.5%	No	W	3,163	6	No	91.7%	Yes	1	2.3	7,968	0	\$931	\$4,761	\$2,000	3.0
AHUs(outside)	AHU 7	1	Supply Fan	7.5	88.5%	No	W	3,163	6	No	91.7%	Yes	1	2.3	7,968	0	\$931	\$4,761	\$2,000	3.0
AHUs(outside)	AHU 8B	1	Return Fan	2.0	84.0%	No	W	3,163	6	No	86.5%	Yes	1	0.6	2,216	0	\$259	\$3,623	\$200	13.2
Roof	Bathroom EF	1	Exhaust Fan	0.3	62.5%	No	W	2,745		No	62.5%	No		0.0	0	0	\$0	\$0	\$0	0.0
Roof	Dishwasher EF	2	Exhaust Fan	0.5	62.5%	No	W	2,745		No	62.5%	No		0.0	0	0	\$0	\$0	\$0	0.0
Roof	Storage Room EF	1	Exhaust Fan	0.3	62.5%	No	W	2,745		No	62.5%	No		0.0	0	0	\$0	\$0	\$0	0.0
Roof	Bathroom EF	1	Exhaust Fan	0.3	62.5%	No	W	2,745		No	62.5%	No		0.0	0	0	\$0	\$0	\$0	0.0
Roof	Kitchen hood EF	1	Kitchen Hood Exhaust Fan	3.0	86.5%	No	W	1,800	8	No	89.5%	Yes	1	0.1	3,473	42	\$820	\$3,812	\$400	4.2



Electric HVAC Inventory & Recommendations

		Existing Conditions						Proposed Conditions						Energy Impact & Financial Analysis							
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
AHUs(outside)	AHU 1	1	Split-System AC	13.00		B	9	Yes	1	Split-System AC	13.00		11.50		1.2	834	0	\$97	\$15,078	\$2,054	133.7
AHUs(outside)	AHU 10	1	Split-System AC	25.00		B	9	Yes	1	Split-System AC	25.00		11.00		2.2	1,502	0	\$175	\$29,769	\$3,950	147.2
AHUs(outside)	AHU 11	1	Split-System AC	20.00		B	9	Yes	1	Split-System AC	20.00		11.00		1.3	931	0	\$109	\$23,815	\$3,160	190.0
AHUs(outside)	AHU 12	1	Split-System AC	33.00		B	9	Yes	1	Split-System AC	33.00		11.00		0.9	618	0	\$72	\$36,305	\$0	503.4
AHUs(outside)	AHU 13	1	Split-System AC	40.00		B	9	Yes	1	Split-System AC	40.00		11.00		1.4	935	0	\$109	\$44,006	\$0	403.1
AHUs(outside)	AHU 2, 3 & 4	3	Split-System AC	40.00		B	9	Yes	3	Split-System AC	40.00		11.00		6.5	4,464	0	\$521	\$132,018	\$0	253.3
AHUs(outside)	AHU 5	1	Split-System AC	20.00		B	9	Yes	1	Split-System AC	20.00		11.00		1.3	931	0	\$109	\$23,815	\$3,160	190.0
AHUs(outside)	AHU 6	1	Split-System AC	20.00		B	9	Yes	1	Split-System AC	20.00		11.00		1.3	931	0	\$109	\$23,815	\$3,160	190.0
AHUs(outside)	AHU 7	1	Split-System AC	20.00		B	9	Yes	1	Split-System AC	20.00		11.00		1.3	931	0	\$109	\$23,815	\$3,160	190.0
AHUs(outside)	AHU 8A	1	Split-System AC	25.00		B	9	Yes	1	Split-System AC	25.00		11.00		2.2	1,502	0	\$175	\$29,769	\$3,950	147.2
AHUs(outside)	AHU 8B	1	Split-System AC	13.00		B	9	Yes	1	Split-System AC	13.00		11.50		1.2	834	0	\$97	\$15,078	\$2,054	133.7
AHUs(outside)	AHU 9	1	Split-System AC	25.00		B	9	Yes	1	Split-System AC	25.00		11.00		2.2	1,502	0	\$175	\$29,769	\$3,950	147.2
Ground Level Outside	Sanyo unit	1	Ductless Mini-Split AC	2.50		W	9	Yes	1	Ductless Mini-Split AC	2.50		18.00		0.6	390	0	\$45	\$6,849	\$0	150.5
Ground Floor	Facility Manager's Office	1	Through-The-Wall HP	0.58	6.01	B		No							0.0	0	0	\$0	\$0	\$0	0.0
Ground Floor	Storage/Break Room	1	Window AC	1.00		B	9	Yes	1	Window AC	1.00		12.00		0.1	80	0	\$9	\$1,089	\$0	117.1
Stairwell from Basement	Stairwell	1	Electric Resistance Heat		3.41	W		No							0.0	0	0	\$0	\$0	\$0	0.0
Gymnasium	Office	1	Electric Resistance Heat		3.41	W		No							0.0	0	0	\$0	\$0	\$0	0.0
Ground Floor	Facility Manager's Office	1	Electric Resistance Heat		12.28	W		No							0.0	0	0	\$0	\$0	\$0	0.0

Fuel Heating Inventory & Recommendations

		Existing Conditions				Proposed Conditions							Energy Impact & Financial Analysis							
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years	
Basement	HHW system	2	Non-Condensing Hot Water Boiler	2,680	W	10	Yes	2	Non-Condensing Hot Water Boiler	2,680	85.00%	Ec	0.0	0	349	\$3,468	\$93,227	\$13,936	22.9	

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	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Gymnasium	Gymnasium / AHU 13	11	2.00	40.00	0.00	223.33	0.0	800	12	\$216	\$2,719	\$0	12.6
Gym + Cafeteria	Gym + Cafeteria / AHU 12	11	2.00	33.00	0.00	223.33	0.0	652	12	\$199	\$2,719	\$0	13.7
Cafeteria	Cafeteria / AHU 11	11	2.00	20.00	0.00	223.33	0.0	423	12	\$172	\$2,719	\$0	15.8

DHW Inventory & Recommendations

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

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	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Classrooms	12	35	Faucet Aerator (Kitchen)	2.00	1.50	0.0	0	5	\$49	\$251	\$140	2.3
Kitchen	12	4	Faucet Aerator (Kitchen)	2.50	1.50	0.0	0	1	\$11	\$29	\$16	1.1
Restrooms	12	20	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	9	\$94	\$143	\$143	0.0
Other	12	15	Faucet Aerator (Kitchen)	2.00	1.50	0.0	0	2	\$21	\$108	\$60	2.3

Walk-In Cooler/Freezer Inventory & Recommendations

Existing Conditions		Proposed Conditions					Energy Impact & Financial Analysis						
Location	Cooler/Freezer Quantity	Case Type/Temperature	ECM #	Install EC Evaporator Fan Motors?	Install Electric Defrost Control?	Install Evaporator Fan Control?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Low Temp Freezer (-35F to -5F)	13	Yes	No	No	0.1	590	0	\$69	\$910	\$240	9.7
Kitchen	1	Cooler (35F to 55F)	13	Yes	No	No	0.0	393	0	\$46	\$607	\$160	9.7

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Freezer Chest	No	14	Yes	0.3	2,325	0	\$272	\$1,700	\$0	6.3
Kitchen	1	Refrigerator Chest	No	14	Yes	0.1	1,018	0	\$119	\$1,630	\$0	13.7
Kitchen	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	No		No	0.0	0	0	\$0	\$0	\$0	0.0

Commercial Ice Maker Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Ice Maker Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Ice Making Head (<450 lbs/day). Batch	No		No	0.0	0	0	\$0	\$0	\$0	0.0

Cooking Equipment Inventory & Recommendations

Existing Conditions				Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	High Efficiency Equipment?	ECM #	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	2	Gas Convection Oven (Full Size)	No		No	0.0	0	0	\$0	\$0	\$0	0.0
Kitchen	1	Gas Combination Oven/Steam Cooker (<15 Pans)	No		No	0.0	0	0	\$0	\$0	\$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (Full Size)	No		No	0.0	0	0	\$0	\$0	\$0	0.0

Dishwasher Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Dishwasher Type	Water Heater Fuel Type	Booster Heater Fuel Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Payback w/ Incentives in Years
Kitchen	1	Single Tank Conveyor (High Temp)	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 ?
Classes/Offices	220	Desktop Computer	26	Yes
Classes/Offices/Library	120	Notebook Computer	15	Yes
Classrooms/Break room	8	Microwave	1,200	No
Copy room	1	Large Printer/Copier	500	Yes
Main Office	1	Large Printer/Copier	500	Yes
Classrooms/Break room	8	Refrigerator	550	No
Classrooms/Offices	6	Small Printers	50	Yes
Classrooms/Offices	35	Projectors	250	Yes
Offices	2	Television	23	Yes
Offices	2	Water Cooler	600	No
Kitchen	1	Coffee Brewer	12,000	No
Kitchen	1	Serving Table (heated)	4,000	No
Kitchen	1	Serving Table (chilled)	1,000	No

Vending Machine Inventory & Recommendations

Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis							
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Faculty Dining Room	1	Refrigerated	15	Yes	0.2	1,612	0	\$188	\$230	\$100	0.7

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

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



ENERGY STAR® Statement of Energy Performance

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ENERGY STAR®
Score¹

Conover Road Primary School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 106,565
Built: 2001

For Year Ending: September 30, 2019
Date Generated: August 25, 2020

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

Property & Contact Information			
Property Address Conover Road Primary School 56 Conover Road Colts Neck, New Jersey 07722	Property Owner Colts Neck Township Board of Education 70 Conover Road Colts Neck, NJ 07722 (732) 946-0055	Primary Contact Vincent Marasco 70 Conover Road Colts Neck, NJ 07722 (732) 946-0055 ext.4101 marasco@coltsneckschools.org	
Property ID: 10189275			

Energy Consumption and Energy Use Intensity (EUI)			
Site EUI	Annual Energy by Fuel	National Median Comparison	
102.5 kBtu/ft²	Natural Gas (kBtu)	National Median Site EUI (kBtu/ft²)	74.5
	Electric - Grid (kBtu)	National Median Source EUI (kBtu/ft²)	133.5
		% Diff from National Median Source EUI	38%
Source EUI		Annual Emissions	
183.6 kBtu/ft²		Greenhouse Gas Emissions (Metric Tons CO2e/year)	777

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	<i>British thermal unit</i> : 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	<i>Combined heat and power</i> . Also referred to as cogeneration.
COP	<i>Coefficient of performance</i> : 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	<i>Demand control ventilation</i> : a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need.
US DOE	<i>United States Department of Energy</i>
EC Motor	<i>Electronically commutated motor</i>
ECM	<i>Energy conservation measure</i>
EER	<i>Energy efficiency ratio</i> : a measure of efficiency in terms of cooling energy provided divided by electric input.
EUI	<i>Energy Use Intensity</i> : 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	<i>United States Environmental Protection Agency</i>
Generation	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
GHG	<i>Greenhouse gas</i> 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	<i>Gallons per flush</i>

gpm	<i>Gallon per minute</i>
HID	<i>High intensity discharge</i> : high-output lighting lamps such as high-pressure sodium, metal halide, and mercury vapor.
hp	<i>Horsepower</i>
HPS	<i>High-pressure sodium</i> : a type of HID lamp
HSPF	<i>Heating seasonal performance factor</i> : a measure of efficiency typically applied to heat pumps. Heating energy provided divided by seasonal energy input.
HVAC	<i>Heating, ventilating, and air conditioning</i>
IHP 2014	US DOE Integral Horsepower rule. The current ruling regarding required electric motor efficiency.
IPLV	<i>Integrated part load value</i> : a measure of the part load efficiency usually applied to chillers.
kBtu	One thousand British thermal units
kW	<i>Kilowatt</i> : equal to 1,000 Watts.
kWh	<i>Kilowatt-hour</i> : 1,000 Watts of power expended over one hour.
LED	<i>Light emitting diode</i> : a high-efficiency source of light with a long lamp life.
LGEA	<i>Local Government Energy Audit</i>
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	<i>Metal halide</i> : a type of HID lamp
MBh	<i>Thousand Btu per hour</i>
MBtu	<i>One thousand British thermal units</i>
MMBtu	<i>One million British thermal units</i>
MV	<i>Mercury Vapor</i> : a type of HID lamp
NJBPU	<i>New Jersey Board of Public Utilities</i>
NJCEP	<i>New Jersey's Clean Energy Program</i> : 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	<i>Pounds per square inch gauge</i>
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	<i>Photovoltaic</i> : refers to an electronic device capable of converting incident light directly into electricity (direct current).

SEER	<i>Seasonal energy efficiency ratio:</i> a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	<i>Statement of energy performance:</i> 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	<i>Solar renewable energy credit:</i> a credit you can earn from the state for energy produced from a photovoltaic array.
TREC	<i>Transition Incentive Renewable Energy Certificate:</i> a factorized renewable energy certificate you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of 1/8 th 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	<i>Variable air volume</i>
VFD	<i>Variable frequency drive:</i> 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.