


Local Government Energy Audit Report

Wastewater Treatment Plant

February 24, 2025

Prepared for:
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Disclaimer

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

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

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

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

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

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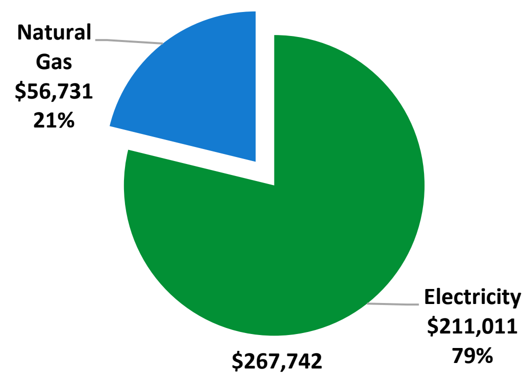
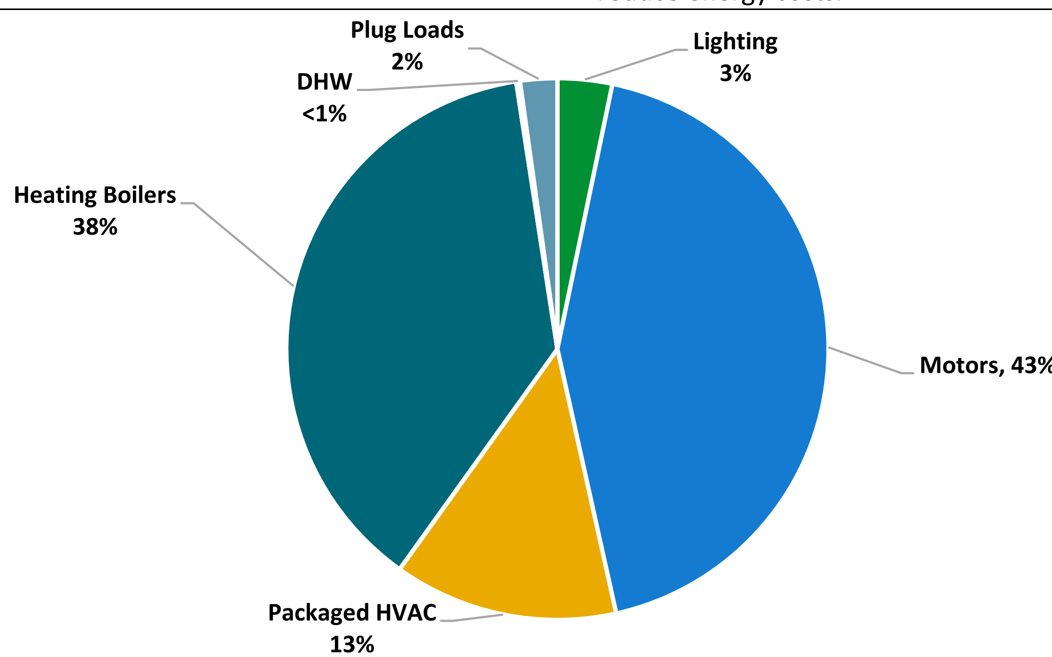
1 Executive Summary

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

BUILDING PERFORMANCE REPORT

Annual Energy Utilities	Costs: $267,742 Electricity: 1,726,300 kWh Natural Gas: 60,669 Therms	
ENERGY STAR® Benchmarking Score	11 *(1-100 scale)*	This building performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.



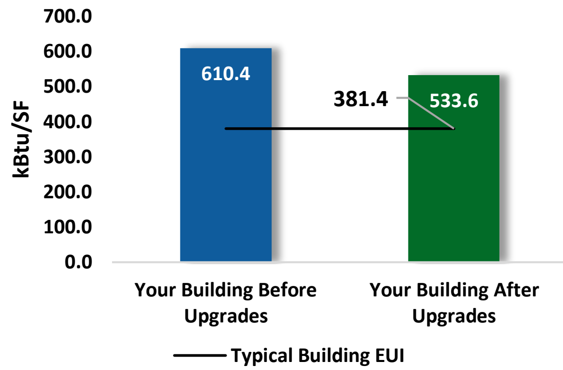
Energy Use by System

POTENTIAL IMPROVEMENTS

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

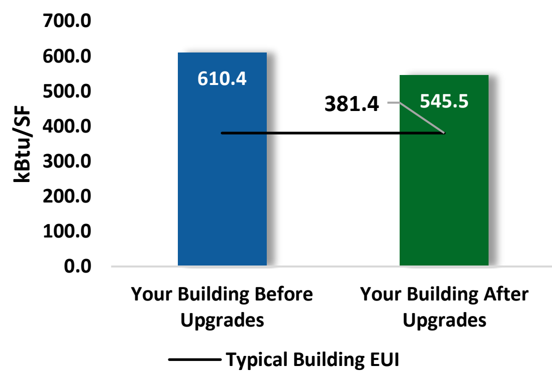
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$228,960
Potential Rebates & Incentives[1]	$11,860
Annual Cost Savings	$44,863
Annual Energy Savings	Electricity: 340,986 kWh Natural Gas: 3,405 Therms
Greenhouse Gas Emission Savings	192 Tons
Simple Payback	4.8 Years
Site Energy Savings (All Utilities)	13%



Scenario 2: Cost Effective Package[2]

Installation Cost	$148,060
Potential Rebates & Incentives	$8,860
Annual Cost Savings	$42,156
Annual Energy Savings	Electricity: 335,134 kWh Natural Gas: 1,275 Therms
Greenhouse Gas Emission Savings	176 Tons
Simple Payback	3.3 Years
Site Energy Savings (all utilities)	11%



On-site Generation Potential

Photovoltaic	Low
Combined Heat and Power	None

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

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**41,007**	**9.7**	**-3**	**$4,981**	**$39,460**	**$5,320**	**$34,140**	**6.9**	**40,897**
ECM 1	Install LED Fixtures	Yes	32,606	4.5	-2	$3,966	$27,810	$3,420	$24,390	6.1	32,588
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	348	0.3	0	$42	$620	$70	$550	13.1	342
ECM 3	Retrofit Fixtures with LED Lamps	Yes	8,053	5.0	-1	$973	$11,030	$1,830	$9,200	9.5	7,967
Lighting Control Measures			**2,109**	**1.0**	**0**	**$254**	**$5,430**	**$990**	**$4,440**	**17.5**	**2,071**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	1,912	0.9	0	$230	$4,110	$490	$3,620	15.7	1,878
ECM 5	Install Photocell Controls	Yes	0	0.0	0	$0	$480	$0	$480	0.0	0
ECM 6	Install High/Low Lighting Controls	Yes	197	0.1	0	$24	$840	$500	$340	14.4	193
Motor Upgrades			**1,221**	**0.3**	**0**	**$149**	**$3,800**	**$0**	**$3,800**	**25.5**	**1,229**
ECM 7	Premium Efficiency Motors	No	1,221	0.3	0	$149	$3,800	$0	$3,800	25.5	1,229
Variable Frequency Drive (VFD) Measures			**293,957**	**50.4**	**0**	**$35,931**	**$102,000**	**$1,700**	**$100,300**	**2.8**	**296,012**
ECM 8	Install VFDs on Constant Volume (CV) Fans	Yes	12,624	4.6	0	$1,543	$17,900	$1,500	$16,400	10.6	12,713
ECM 9	Install VFDs on Heating Water Pumps	No	3,551	0.4	0	$434	$9,400	$200	$9,200	21.2	3,576
ECM 10	Install VFDs on Process Pumps	Yes	277,782	45.4	0	$33,954	$74,700	$0	$74,700	2.2	279,724
Unitary HVAC Measures			**2,429**	**2.0**	**0**	**$297**	**$12,300**	**$700**	**$11,600**	**39.1**	**2,446**
ECM 11	Install High Efficiency Air Conditioning Units	No	2,429	2.0	0	$297	$12,300	$700	$11,600	39.1	2,446
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**321**	**$3,005**	**$60,400**	**$3,100**	**$57,300**	**19.1**	**37,622**
ECM 12	Install High Efficiency Hot Water Boilers	No	0	0.0	190	$1,777	$50,100	$2,100	$48,000	27.0	22,247
ECM 13	Install High Efficiency Furnaces	Yes	0	0.0	131	$1,228	$10,300	$1,000	$9,300	7.6	15,375
Food Service & Refrigeration Measures			**1,612**	**0.2**	**0**	**$197**	**$270**	**$50**	**$220**	**1.1**	**1,623**
ECM 14	Vending Machine Control	Yes	1,612	0.2	0	$197	$270	$50	$220	1.1	1,623
Custom Measures			**-1,348**	**0.0**	**23**	**$50**	**$5,300**	**$0**	**$5,300**	**106.0**	**1,336**
ECM 15	Replace Electric Water Heater with Heat Pump Water Heater	No	809	0.0	0	$99	$2,500	$0	$2,500	25.3	815
ECM 16	Replace Gas Fired Water Heater with Heat Pump Water Heater***	No	-2,157	0.0	23	-$49	$2,800	$0	$2,800	-57.1	521
TOTALS (COST EFFECTIVE MEASURES)			**335,134**	**60.9**	**127**	**$42,156**	**$148,060**	**$8,860**	**$139,200**	**3.3**	**352,403**
TOTALS (ALL MEASURES)			**340,986**	**63.6**	**340**	**$44,863**	**$228,960**	**$11,860**	**$217,100**	**4.8**	**383,236**

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

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

*** - Negative payback explained in section 4.8

All Evaluated Energy Improvements[3]

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

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

1.1 Planning Your Project

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

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

Pick Your Installation Approach

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

Options from Your Utility Company

Prescriptive and Custom Rebates

For facilities wishing to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the Prescriptive and Custom Rebates program. To participate, you can use internal resources or an outside firm or contractor to perform the final design of the ECM(s) and install the equipment. Program pre-approval may be required for some incentives. Contact your utility company for more details prior to project installation.

Direct Install

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

Engineered Solutions

The Engineered Solutions program provides tailored energy-efficiency assistance and turnkey engineering services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. The program provides all professional services from audit, design, construction administration, to commissioning and measurement and verification for custom whole-building energy-efficiency projects. Engineered Solutions allows you to install as many measures as possible under a single project as well as address measures that may not qualify for other programs.

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

Options from New Jersey's Clean Energy Program

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

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

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

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

Successor Solar Incentive Program (SuSI)

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

Ongoing Electric Savings with Demand Response

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

Large Energy User Program (LEUP)

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

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

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Wastewater Treatment Plant. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs.

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

2.1 Site Overview

On June 26, 2024, TRC performed an energy audit at Wastewater Treatment Plant located in Verona, New Jersey. TRC met with facility staff to review the facility operations and help focus our investigation on specific energy-using systems.

The Wastewater Treatment Plant is a multi-building, 19,588 square foot complex built in 1990. The complex is comprised of a main building, ozone pump station, old control building, recirculation pump station, sludge pump station, grit building, digester building, and primary clarifier pump station. Spaces include offices, corridors, stairwells, electrical rooms, and mechanical rooms, plus exterior treatment areas.

2.2 Building Occupancy

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

Building Name	Weekday/Weekend	Operating Schedule
Waste Water Treatment Plant	Weekday	7:30:00 AM - 4:30 PM
	Weekend	7:30:00 AM - 4:30 PM

Building Occupancy Schedule

2.3 Building Envelope

Most building walls are concrete block over structural steel with a stone façade. Roof areas are flat and covered with black membrane and in fair condition.

Roof

Building Exterior

Most windows are single glazed and have aluminum frames without a thermal break. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition, showing little evidence of excessive wear. Exterior doors have aluminum frames and are in fair condition with undamaged door seals. Degraded window and door seals increase drafts and outside air infiltration.

Window

Glass Curtain Wall

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several 34-Watt T12 fixtures. Fixture types include 2-lamp or 4-lamp, 4-foot-long recessed troffer and surface mounted fixtures and 2-foot fixtures with U-bend tube lamps. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts.

There are a few LED and incandescent screw-based lamps and some plug-in compact fluorescent lamps (CFL). The main building workshop and ozone pump station use metal halide sources.

Some areas incorporate explosion proof fixtures due to the nature of wastewater processing requirements. These fixtures are typically more expensive to retrofit and or replace than non-classified fixtures.

All exit signs are LED. Most fixtures are in fair condition. Interior lighting levels were generally sufficient.

Incandescent Light Fixtures

Recessed Can Light Fixtures

Exterior fixtures include wall packs, floodlights, canopy lights with high intensity discharge (HID) lamps, and LED wall pack fixtures.

Exterior light fixtures are controlled by time clock, switch, or photocell, depending on the fixture.

Wall Pack Fixtures

2.5 Air Handling Systems

Unitary Heating Equipment

The water processing room is heated with suspended gas-fired furnaces. The capacity of both units is 150 MBh. The units are in fair condition. Equipment is controlled by a manual dial thermostat.

The ozone pump station has several electric resistance heaters.

Gas-Fired Furnace

Packaged Units

The main building is served by packaged roof top units (RTUs). The units range in size from 3.0 tons to 8.5 tons of cooling. These units are equipped with economizers that are in fair condition. A split system serves the UV water treatment system.

Refer to Appendix A for detailed information about each unit.

Packaged RTU

Air Handling Units (AHUs)

The main building and the grit building are partially conditioned by air handling units. These units are equipped with supply fan motors and hot water heating coils for heating. Supply fan motors are mainly fractional hp, constant speed, and standard efficiency. The main building AHU mounted at the building exterior has a 10 hp, constant speed motor.

The HVAC systems are controlled by the facility BAS.

Air Handling Units

2.6 Heating Hot Water Systems

The digester building has a 934 MBh Weil-McLain hot water boiler that serves the building's heating load. The burners are fully-modulating with a nominal efficiency of 80.6%. The old control building has a 175 MBh Utica hot water boiler that serves the building's heating load. The main building has two, 600 MBh Hydrotherm hot water boilers that serve the building heating load.

The boilers are configured in an automated control scheme. Each boiler has a heating hot water pump that distributes water to end uses.

Boilers

2.7 Domestic Hot Water

Hot water in the main building is produced by a 48-gallon, 65 MBh gas-fired storage water heater with an efficiency rating of 80%. The ozone pump station hot water is provided by a 20-gallon, 2.5 kW electric hot water heater.

Hot Water Storage Unit

Unit Label

2.8 Plug Load and Vending Machines

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

There are 14 computer workstations throughout the facility. Plug loads include general cafe and office equipment. There are classroom typical loads such as smartboards, projectors, and fans.

There are several refrigerators throughout the building. These vary in condition and efficiency.

There is one refrigerated beverage vending machine. The vending machine is not equipped with occupancy-based controls.

Lab Plug Loads

Copier

2.9 Water-Using Systems

Water is mainly provided by a municipal water supply company. Potable water is used for drinking, cleaning, sanitary fixtures, and building conditioning.

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

Kitchen Sink

Lavatory Sink

2.10 Wastewater Treatment Equipment

Motors account for over 85% of the electrical energy used at this plant, and they are predominantly associated with the water treatment process. The treatment plant consists of an ozone pump station, recirculation pump station, sludge pump station, grit building, digester building, and clarifier pump station.

The grit building has two, 75 hp process motors. They run constantly and use substantially more electricity than any other system. They have been evaluated for VFD control. The pump motors associated with the trickling filler and the RAS pump system are substantial energy users. These motors were evaluated for VFD, but speed control was not recommended to motor application.

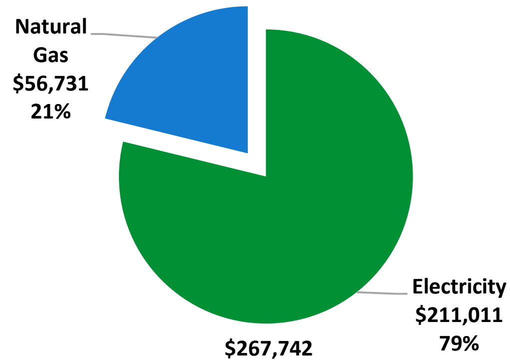
Primary Clarifier

UV Lighting Controls

3 Energy and Water Use and Costs

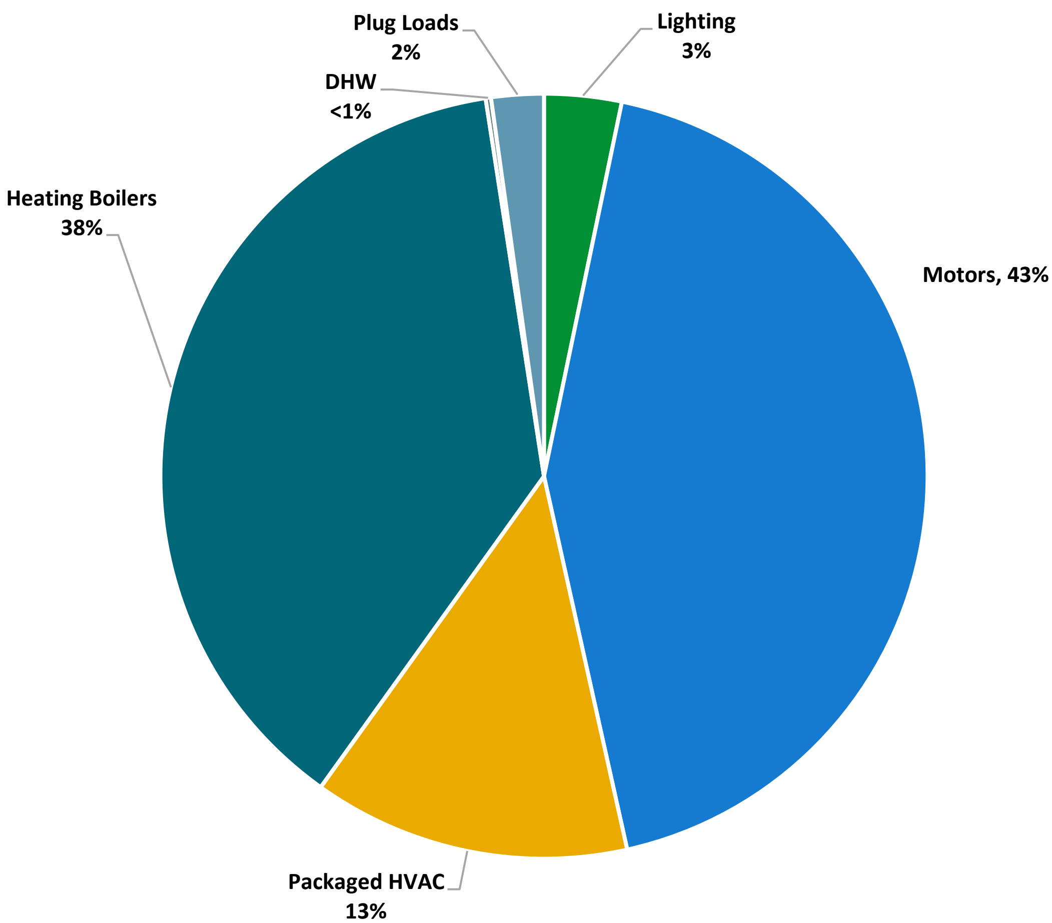
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	1,726,300 kWh	$211,011
Natural Gas	60,669 Therms	$56,731
Total		**$267,742**



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

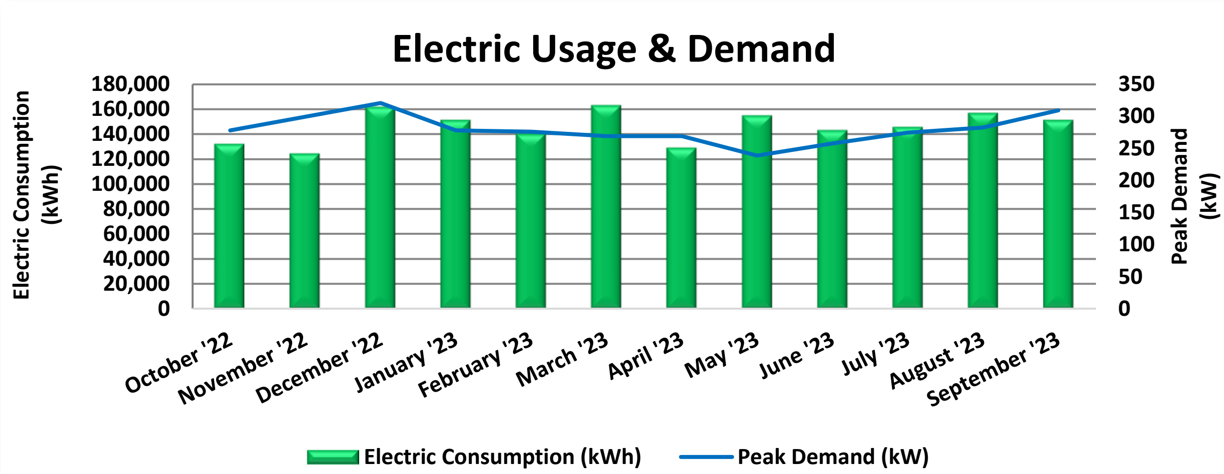
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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



Energy Balance by System

3.1 Electricity

JCP&L delivers electricity under rate class Large Power & Lighting Secondary, with electric production provided by Constellation, a third-party supplier.



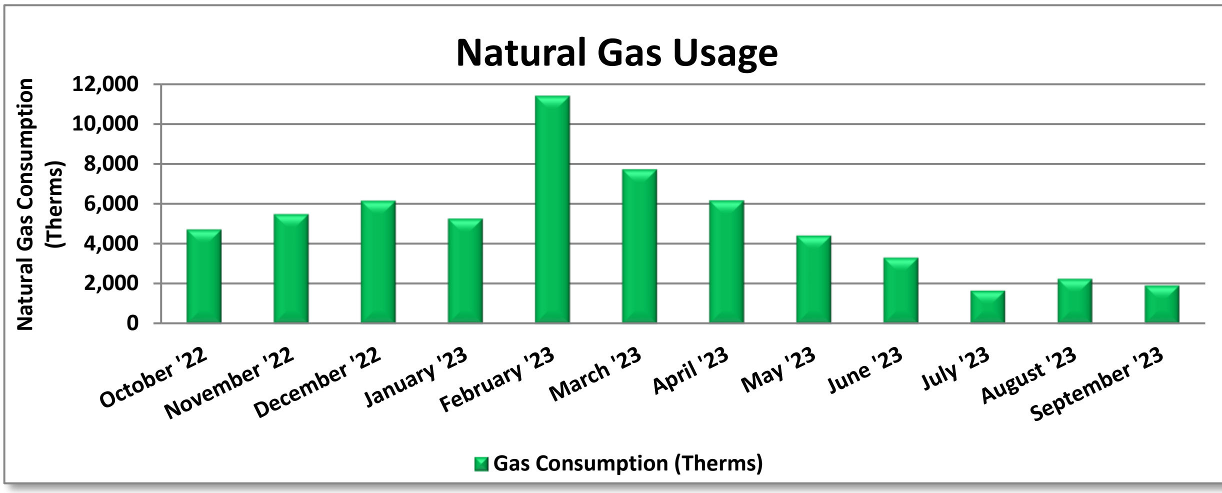
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
10/28/22	30	132,146	278	$1,243	$15,822
11/22/22	25	124,615	300	$1,348	$14,920
12/29/22	37	161,876	321	$1,433	$17,928
1/30/23	32	151,241	278	$1,243	$16,793
3/1/23	30	140,469	276	$1,234	$16,072
4/5/23	35	163,107	269	$1,203	$18,374
5/5/23	30	129,143	269	$1,204	$15,632
6/6/23	32	154,868	239	$3,206	$19,991
7/6/23	30	143,167	258	$3,582	$20,088
8/4/23	29	145,762	275	$3,604	$20,333
9/5/23	32	157,028	282	$3,599	$21,110
10/4/23	29	151,256	309	$1,528	$17,418
Totals	**371**	**1,754,678**	**321**	**$24,429**	**$214,480**
Annual	**365**	**1,726,300**	**321**	**$24,034**	**$211,011**

Notes:

- Peak demand of 321 kW occurred in December '22.
- Average demand over the past 12 months was 280 kW.
- The average electric cost over the past 12 months was $0.122/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

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



Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
11/5/22	31	4,722	$4,629
12/5/22	30	5,483	$5,720
1/5/23	31	6,158	$6,204
2/3/23	29	5,256	$5,459
3/7/23	32	11,406	$10,879
4/5/23	29	7,733	$6,581
5/5/23	30	6,168	$5,233
6/6/23	32	4,422	$3,662
7/6/23	30	3,309	$2,833
8/4/23	29	1,671	$1,593
9/5/23	32	2,257	$2,018
10/4/23	29	1,918	$1,766
Totals	**364**	**60,503**	**$56,576**
Annual	**365**	**60,669**	**$56,731**

Notes:

- The average gas cost for the past 12 months is $0.935/therm, which is the blended rate used throughout the analysis.

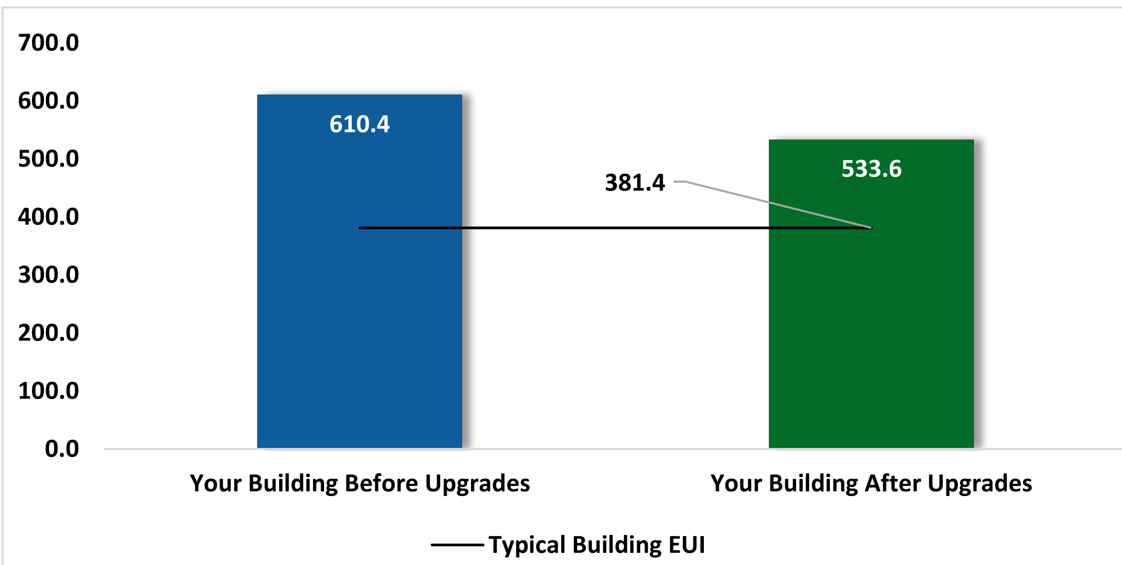
3.3 Benchmarking

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.

Benchmarking Score	11

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



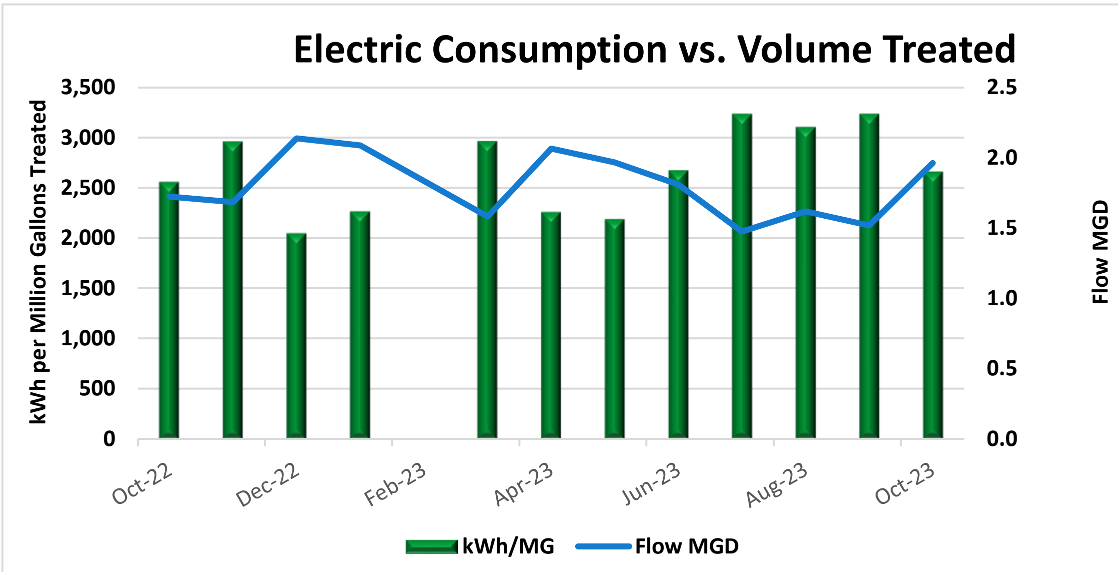
Energy Use Intensity Comparison[4]

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

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

[4] Based on all evaluated ECMs

Wastewater treatment plant energy use is typically dominated by electricity use with most of the electricity accounted for by pumps, blowers, and fans. Plant electricity use varies for many reasons including type of treatment, process volume, equipment efficiency, energy management practices, and climate. In the case of wastewater treatment plants, the score applies to treatment facilities that process more than 0.6 MGD. The score looks at energy performance while controlling for operating parameters such as influent flow, BOD levels, load factor, application of trickle filters and nutrient removal, and weather.



WWTP: kWh vs MGD

The data highlights variations in energy efficiency (kWh/MG) relative to flow (MGD) over the months, with flow rates not always correlating to energy use. For example, July, with a relatively low flow of about 1.6 MGD, has the highest energy consumption per million gallons, while higher flow months like December and January are more energy efficient. Higher kWh/MG during low volume periods suggests that pumps may not be operating at optimal efficiency, possibly due to being oversized for reduced loads. Implementing variable-speed drives or improving pump controls could help adjust operations to match flow more closely, reducing energy consumption. Regular maintenance and equipment optimization could further enhance energy efficiency, particularly during periods of fluctuating or lower flows.

The energy use intensity (EUI) of plants that participated in the EPA's ENERGY STAR program through 2013 ranged from less than 5 to more than 50 kBtu/GPD. Generally, plants that have higher influent biological oxygen demand (BOD) use more energy. The following table from the 2015 ENERGY STAR Data Trends "Energy Use in Wastewater Treatment Plants" provides a high-level view of the effect of various parameters on wastewater plant energy use. The 5th percentile represents plants with lower EUIs.

	Range of Values		
Property Characteristic	5th percentile	Median	95th percentile
Influent Flow (MGD)	0.2	3	74
Influent Biological Oxygen Demand (mg/L)	102	200	391
Effluent Biological Oxygen Demand (mg/L)	1	5	20
Plant Load Factor (%)	25	60	100

Tracking your Energy Performance

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

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

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

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

3.4 Understanding Your Utility Bills

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

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

Why Utility Bills Vary

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

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

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

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

4 ENERGY CONSERVATION MEASURES

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

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

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

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

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**41,007**	**9.7**	**-3**	**$4,981**	**$39,460**	**$5,320**	**$34,140**	**6.9**	**40,897**
ECM 1	Install LED Fixtures	Yes	32,606	4.5	-2	$3,966	$27,810	$3,420	$24,390	6.1	32,588
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	348	0.3	0	$42	$620	$70	$550	13.1	342
ECM 3	Retrofit Fixtures with LED Lamps	Yes	8,053	5.0	-1	$973	$11,030	$1,830	$9,200	9.5	7,967
Lighting Control Measures			**2,109**	**1.0**	**0**	**$254**	**$5,430**	**$990**	**$4,440**	**17.5**	**2,071**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	1,912	0.9	0	$230	$4,110	$490	$3,620	15.7	1,878
ECM 5	Install Photocell Controls	Yes	0	0.0	0	$0	$480	$0	$480	0.0	0
ECM 6	Install High/Low Lighting Controls	Yes	197	0.1	0	$24	$840	$500	$340	14.4	193
Motor Upgrades			**1,221**	**0.3**	**0**	**$149**	**$3,800**	**$0**	**$3,800**	**25.5**	**1,229**
ECM 7	Premium Efficiency Motors	No	1,221	0.3	0	$149	$3,800	$0	$3,800	25.5	1,229
Variable Frequency Drive (VFD) Measures			**293,957**	**50.4**	**0**	**$35,931**	**$102,000**	**$1,700**	**$100,300**	**2.8**	**296,012**
ECM 8	Install VFDs on Constant Volume (CV) Fans	Yes	12,624	4.6	0	$1,543	$17,900	$1,500	$16,400	10.6	12,713
ECM 9	Install VFDs on Heating Water Pumps	No	3,551	0.4	0	$434	$9,400	$200	$9,200	21.2	3,576
ECM 10	Install VFDs on Process Pumps	Yes	277,782	45.4	0	$33,954	$74,700	$0	$74,700	2.2	279,724
Unitary HVAC Measures			**2,429**	**2.0**	**0**	**$297**	**$12,300**	**$700**	**$11,600**	**39.1**	**2,446**
ECM 11	Install High Efficiency Air Conditioning Units	No	2,429	2.0	0	$297	$12,300	$700	$11,600	39.1	2,446
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**321**	**$3,005**	**$60,400**	**$3,100**	**$57,300**	**19.1**	**37,622**
ECM 12	Install High Efficiency Hot Water Boilers	No	0	0.0	190	$1,777	$50,100	$2,100	$48,000	27.0	22,247
ECM 13	Install High Efficiency Furnaces	Yes	0	0.0	131	$1,228	$10,300	$1,000	$9,300	7.6	15,375
Food Service & Refrigeration Measures			**1,612**	**0.2**	**0**	**$197**	**$270**	**$50**	**$220**	**1.1**	**1,623**
ECM 14	Vending Machine Control	Yes	1,612	0.2	0	$197	$270	$50	$220	1.1	1,623
Custom Measures			**-1,348**	**0.0**	**23**	**$50**	**$5,300**	**$0**	**$5,300**	**106.0**	**1,336**
ECM 15	Replace Electric Water Heater with Heat Pump Water Heater	No	809	0.0	0	$99	$2,500	$0	$2,500	25.3	815
ECM 16	Replace Gas Fired Water Heater with Heat Pump Water Heater***	No	-2,157	0.0	23	-$49	$2,800	$0	$2,800	-57.1	521
TOTALS			**340,986**	**63.6**	**340**	**$44,863**	**$228,960**	**$11,860**	**$217,100**	**4.8**	**383,236**

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

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

*** - Negative payback explained in section 4.8

All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**41,007**	**9.7**	**-3**	**$4,981**	**$39,460**	**$5,320**	**$34,140**	**6.9**	**40,897**
ECM 1	Install LED Fixtures	32,606	4.5	-2	$3,966	$27,810	$3,420	$24,390	6.1	32,588
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	348	0.3	0	$42	$620	$70	$550	13.1	342
ECM 3	Retrofit Fixtures with LED Lamps	8,053	5.0	-1	$973	$11,030	$1,830	$9,200	9.5	7,967
Lighting Control Measures		**2,109**	**1.0**	**0**	**$254**	**$5,430**	**$990**	**$4,440**	**17.5**	**2,071**
ECM 4	Install Occupancy Sensor Lighting Controls	1,912	0.9	0	$230	$4,110	$490	$3,620	15.7	1,878
ECM 5	Install Photocell Controls	0	0.0	0	$0	$480	$0	$480	0.0	0
ECM 6	Install High/Low Lighting Controls	197	0.1	0	$24	$840	$500	$340	14.4	193
Variable Frequency Drive (VFD) Measures		**290,406**	**50.0**	**0**	**$35,497**	**$92,600**	**$1,500**	**$91,100**	**2.6**	**292,437**
ECM 8	Install VFDs on Constant Volume (CV) Fans	12,624	4.6	0	$1,543	$17,900	$1,500	$16,400	10.6	12,713
ECM 10	Install VFDs on Process Pumps	277,782	45.4	0	$33,954	$74,700	$0	$74,700	2.2	279,724
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**131**	**$1,228**	**$10,300**	**$1,000**	**$9,300**	**7.6**	**15,375**
ECM 13	Install High Efficiency Furnaces	0	0.0	131	$1,228	$10,300	$1,000	$9,300	7.6	15,375
Food Service & Refrigeration Measures		**1,612**	**0.2**	**0**	**$197**	**$270**	**$50**	**$220**	**1.1**	**1,623**
ECM 14	Vending Machine Control	1,612	0.2	0	$197	$270	$50	$220	1.1	1,623
TOTALS		**335,134**	**60.9**	**127**	**$42,156**	**$148,060**	**$8,860**	**$139,200**	**3.3**	**352,403**

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

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

Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**41,007**	**9.7**	**-3**	**$4,981**	**$39,460**	**$5,320**	**$34,140**	**6.9**	**40,897**
ECM 1	Install LED Fixtures	32,606	4.5	-2	$3,966	$27,810	$3,420	$24,390	6.1	32,588
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	348	0.3	0	$42	$620	$70	$550	13.1	342
ECM 3	Retrofit Fixtures with LED Lamps	8,053	5.0	-1	$973	$11,030	$1,830	$9,200	9.5	7,967

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

ECM 1: 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 fixture(s).

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

Affected Building Areas: exterior fixtures

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Retrofit fluorescent fixtures 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: T-12 lamps in grit building (mechanical area) and main building (stairwell)

ECM 3: Retrofit Fixtures with LED Lamps

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

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

Affected Building Areas: all areas with fluorescent fixtures with T8 tubes, CFL, and the ditch area

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**2,109**	**1.0**	**0**	**$254**	**$5,430**	**$990**	**$4,440**	**17.5**	**2,071**
ECM 4	Install Occupancy Sensor Lighting Controls	1,912	0.9	0	$230	$4,110	$490	$3,620	15.7	1,878
ECM 5	Install Photocell Controls	0	0.0	0	$0	$480	$0	$480	0.0	0
ECM 6	Install High/Low Lighting Controls	197	0.1	0	$24	$840	$500	$340	14.4	193

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, conference rooms, and storage rooms

ECM 5: Install Photocell Controls

Install photocells to eliminate exterior lighting use during daytime periods.

Photocells or photocell sensors are lighting controls used for dusk to dawn applications to automatically turn the fixtures on or off. Photo controls detect the amount of light outside and once the light level reaches a low point, the fixture will switch on. During the day, the photocell will detect higher amounts of light and will turn the fixture off. Photocells may be fixture mounted or wired externally and connected by line voltage to a single light fixture or to a series of fixtures.

This measure reduces energy use in exterior areas to restrict operation to non-daylight periods. Note: we have conservatively assumed no savings, however, fixtures were observed to be operating during daylight hours.

Affected Building Areas: main building exterior switched fixtures

ECM 6: Install High/Low Lighting Controls

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

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

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

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

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

Affected Building Areas: hallways and stairwells

4.3 Motors

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Motor Upgrades		**1,221**	**0.3**	**0**	**$149**	**$3,800**	**$0**	**$3,800**	**25.5**	**1,229**
ECM 7	Premium Efficiency Motors	1,221	0.3	0	$149	$3,800	$0	$3,800	25.5	1,229

ECM 7: Premium Efficiency Motors

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

Affected Motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
RAS - Mechanical 2	RAS - Mechanical Room - Duct Furnace	1	Supply Fan	0.8	
Recirculation Building - Mechanical 2	Recirculation Building Building - Mechanical Room - AHU	1	Supply Fan	0.8	
Recirculation Buidling - Mechanical 2	Recirculation Buidling	1	Process Pump	7.5	

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

4.4 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**293,957**	**50.4**	**0**	**$35,931**	**$102,000**	**$1,700**	**$100,300**	**2.8**	**296,012**
ECM 8	Install VFDs on Constant Volume (CV) Fans	12,624	4.6	0	$1,543	$17,900	$1,500	$16,400	10.6	12,713
ECM 9	Install VFDs on Heating Water Pumps	3,551	0.4	0	$434	$9,400	$200	$9,200	21.2	3,576
ECM 10	Install VFDs on Process Pumps	277,782	45.4	0	$33,954	$74,700	$0	$74,700	2.2	279,724

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 8: 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.

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

Affected Air Handlers: main building (three units)

ECM 9: Install VFDs on Heating Water Pumps

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

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

Affected Pumps: main building only

ECM 10: Install VFDs on Process Pumps

Install VFDs to control Ditch process motors. Process flow requirements vary considerably based on the requirements of the process. For some processes, high- and low-speed operation may be all that is required. In some cases, sensors will be required to optimize flow. Other pumping applications may require water level or other sensing devices to optimize pump operations. If the system has fixed head requirements (e.g., well pumps or open systems with an elevated tank or pond) the pump speed will have to be controlled to maintain the minimum fixed head requirement for the system.

Energy savings result from reducing the pump speed during low demand periods. Ensure that your control system includes the sensors and inputs required to optimize water flow in your water supply.

4.5 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**2,429**	**2.0**	**0**	**$297**	**$12,300**	**$700**	**$11,600**	**39.1**	**2,446**
ECM 11	Install High Efficiency Air Conditioning Units	2,429	2.0	0	$297	$12,300	$700	$11,600	39.1	2,446

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

ECM 11: Install High Efficiency Air Conditioning Units

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

Affected Units: main building RTU

4.6 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**321**	**$3,005**	**$60,400**	**$3,100**	**$57,300**	**19.1**	**37,622**
ECM 12	Install High Efficiency Hot Water Boilers	0	0.0	190	$1,777	$50,100	$2,100	$48,000	27.0	22,247
ECM 13	Install High Efficiency Furnaces	0	0.0	131	$1,228	$10,300	$1,000	$9,300	7.6	15,375

ECM 12: Install High Efficiency Hot Water Boilers

We evaluated replacing older inefficient hot water boilers with high efficiency hot water boilers. Energy savings resulted from improved combustion efficiency and reduced standby losses at low loads.

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, have reached] the end of their normal useful life. Typically, the marginal cost of purchasing high efficiency boilers can be justified by the marginal savings from the improved efficiency. When the boiler is eventually replaced, consider purchasing boilers that exceed the minimum efficiency required by building codes. 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.

Affected units: main building boilers, old control building boiler

ECM 13: Install High Efficiency Furnaces

Replace standard efficiency furnaces with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases, which can significantly improve furnace efficiency. Savings result from improved system efficiency.

Note: these units produce acidic condensate that require proper drainage.

Affected Units: RAS and recirculating buildings

4.7 Food Service and Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**1,612**	**0.2**	**0**	**$197**	**$270**	**$50**	**$220**	**1.1**	**1,623**
ECM 14	Vending Machine Control	1,612	0.2	0	$197	$270	$50	$220	1.1	1,623

ECM 14: 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 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.

4.8 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**-1,348**	**0.0**	**23**	**$50**	**$5,300**	**$0**	**$5,300**	**106.0**	**1,336**
ECM 15	Replace Electric Water Heater with Heat Pump Water Heater	809	0.0	0	$99	$2,500	$0	$2,500	25.3	815
ECM 16	Replace Gas Fired Water Heater with Heat Pump Water Heater***	-2,157	0.0	23	-$49	$2,800	$0	$2,800	-57.1	521

ECM 15: Replace Electric Water Heater with Heat Pump Water Heater

We evaluated replacing the existing electric water heater with a heat pump water heater (HPWH).

A typical electric water heater uses electric resistance coils to heat water at a coefficient of performance (COP) of 1. Air source heat pump water heaters use a refrigeration cycle to transfer heat from the surrounding air to the domestic water. The typical average COP for a HPWH is about 2.5, so they require significantly less electricity to produce the same amount of hot water as a traditional electric water heater. There are two types of HPWH, those integrated with the heat pump and storage tank in the same unit, and those that are split into two sections (with the storage tank separate from the heat pump). The following addresses integrated HPWH.

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation. Ideal locations are garages, large enclosed, unconditioned storage areas, or areas with excess heat such as a furnace or boiler room.[5] The HPWH will also produce condensate so accommodations for draining the condensate need to be provided.

Most HPWH operate effectively down to an air temperature of 40 °F. Below that temperature, an electric resistance booster heater is typically required to achieve full heating capacity. It is critical that the HPWH controls are set up so that the electric resistance heat only engages when the air temperature is too cold for the HPWH to extract heat from it. HPWHs have a slow recovery. During periods of high demand, the electric resistance heating element, if enabled, may be energized to maintain set point, thus reducing the overall efficiency of the unit. It is recommended that a careful analysis of the hot water demand be conducted to determine if the application makes economic sense, and the HPWH heating capacity and storage are properly sized.

HPWH operate most effectively when the temperature difference between the incoming and outgoing water is high. Generally, this means that cold make-up water should be piped to the bottom of the tank and return water should be piped to the top of the tank to maintain stratification within the storage tank. Water should be drawn from the bottom of the tank to be heated. If there is a DHW recirculation pump, it should only be operated during high hot water demand periods.

Affected Units: ozone pump station.

[5] https://basc.pnnl.gov/code-compliance/heat-pump-water-heaters-code-compliance-brief#:~:text=HPWH%20must%20have%20unrestricted%20airflow,depending%20on%20size%20of%20system

ECM 16: Replace Gas Fired Water Heater with Heat Pump Water Heater

We evaluated replacing the existing the gas water heater with a heat pump water heater (HPWH).

A gas fired water heater uses a burner to heat water. Air source heat pump water heaters use a refrigeration cycle to transfer heat from the surrounding air to the domestic water. Water heater efficiency is rated by the uniform energy factor (UEF). For a relative comparison of water heater UEFs, the criteria for certifying a water heater in the ENERGY STAR program are provided below. These values indicate that HPWH heaters are significantly more efficient than gas fired water heaters.

There are two types of HPWH: those integrated with the heat pump and storage tank in the same unit, and those that are split into two sections (with the storage tank separate from the heat pump). The measure considers an integrated HPWH.

ENERGY STAR Uniform Energy Factor (UEF) Criteria for Certified Water Heaters *

Water Heater Type	*Minimum UEF*	*Other*
Integrated HPWH	3.3	
Integrated HPWH	2.2	120 Volt, 15 Amp circuit
Split System HPWH	2.2	
Gas Fired Storage	0.64	≤ 55 gal, Medium Draw Pattern
Gas Fired Storage	0.68	≤ 55 gal, High Draw Pattern
Gas Fired Storage	0.78	> 55 gal, Medium Draw Pattern
Gas Fired Storage	0.80	> 55 gal, High Draw Pattern
Gas Fired Storage	0.80	Residential Duty
Gas Fired Instantaneous	0.87	

** Note: Uniform Energy Factor (UEF): The newest measure of water heater overall efficiency. The higher the UEF value is, the more efficient the water heater. UEF is determined by the Department of Energy's test method outlined in 10 CFR Part 430, Subpart B, Appendix E.*[6]

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation[7]. Ideal locations are garages, large enclosed, unconditioned storage areas, or areas with excess heat such as a furnace or boiler room. The HPWH will also produce condensate so accommodations for draining the condensate need to be provided.

Most HPWH operate effectively down to an air temperature of 40 °F. Below that temperature, an electric resistance booster heater is typically required to achieve full heating capacity. It is critical that the HPWH controls are set up so that the electric resistance heat only engages when the air temperature is too cold for the HPWH to extract heat from it. HPWHs have a slow recovery. During periods of high demand, the electric resistance heating element, if enabled, may be energized to maintain set point, thus reducing the overall efficiency of the unit. It is recommended that a careful analysis of the hot water demand be

[6] https://www.energy.gov/sites/prod/files/2014/06/f17/rwh_tp_final_rule.pdf

[7] https://basc.pnnl.gov/code-compliance/heat-pump-water-heaters-code-compliance-brief#:~:text=HPWH%20must%20have%20unrestricted%20airflow,depending%20on%20size%20of%20system

conducted to determine if the application makes economic sense, and the HPWH heating capacity and storage are properly sized.

HPWH operate most effectively when the temperature difference between the incoming and outgoing water is high. Generally, this means that cold make-up water should be piped to the bottom of the tank and return water should be piped to the top of the tank to maintain stratification within the storage tank. Water should be drawn from the bottom of the tank to be heated. If there is a DHW recirculation pump, it should only be operated during high hot water demand periods.

Switching from a gas fired water heater to a HPWH has the potential to reduce the sites overall greenhouse gas emissions. If the electricity for the HPWH is provided by an on-site photovoltaic (PV) system then there are essentially no greenhouse gas (GHG) emissions. A 2016 study conducted at Cornell[8] calculated the kg of methane (CH_4) and carbon dioxide (CO_2) produced per GJ of water heated. The study compared HPWH to gas and electric fired, storage and tankless water heaters. The study also considered electricity produced from natural gas and coal fired electric plants. In all cases the study found that HPWHs produced less methane than all of the other water heaters. The study also found that HPWH produced less carbon dioxide than electric resistance water heaters but more carbon dioxide than tankless gas water heaters and about the same amount of carbon dioxide as storage gas water heaters. The summary tables provide the reduction in CO2 equivalent emissions based on the typical New Jersey electric utility.

This measure has a negative simple payback due to the relative cost of electricity to natural gas. At this site the cost per Btu for natural gas is significantly lower than for electricity. Therefore, even though this measure will result in a net energy savings in terms of Btu at this site it will increase the overall cost for providing domestic hot water.

Affected Units: main building.

4.9 Wastewater Process Energy Considerations

"Electricity constitutes between 25 and 40 percent of a typical wastewater treatment plant's (WWTP's) operating budget,"[9] and process motors and blowers often consume 75% or more of the energy used in plant operations. Regardless of your plant's size and treatment processes there are fundamental ways to approach operations, controls, retrofits, and planned upgrades to ensure reliable operations that match energy use to your production requirements.

Energy Management

Strategic investments in improved plant efficiency require organizational commitment and a partnership between stakeholders including management, engineers, operators, and the public. The Public Service Commission of Wisconsin, for example, offers the following outline for an Energy Management Plan:

1. Establish an organizational commitment
2. Assemble and initiate an energy team
3. Develop a baseline of facility energy use
4. Develop equipment energy use profiles
5. Identify and assess project opportunities
6. Prioritize implementation opportunities
7. Develop and implement the plan
8. Track and report progress
9. Continually update the plan and achieve energy management goals[10]

[8] Greenhouse gas emissions from domestic hot water: Heat pumps compared to most commonly used systems. Bongghi Hong, Robert W. Howarth. Department of Ecology and Evolutionary Biology, Cornell University. Energy Science and Engineering 2016.

[9] Statewide Assessment of Energy Use by the Municipal Water and Wastewater Sector - New York State Energy Research and Development Authority, November 2008.

[10] Energy Best Practices Guide: Water & Wastewater Industry, Public Service Commission of Wisconsin, 2020

Baseline Measurements

A process improvement plan begins with collecting information and establishing a baseline. In Section 3.0, we provided a graph comparing monthly electricity consumption and production records (kWh per million gallons treated). This energy baseline can help you understand the relative efficiency of the plant over time and in consideration of seasonal variations. A daily baseline can be established to determine how energy use varies with diurnal flow; such a correlation requires real-time data for both power and flow. Measurement tools include smart meters, SCADA systems, and sub metering approaches.

Assess and Identify

After determining how energy is spent, consider system changes (equipment or operations) that reduce energy consumption or power demand. Also consider renewable energy opportunities that can displace purchased energy. Calculate the costs and savings for proposed measures. Opportunities can be categorized by process area or funding approach and should take into consideration the existing equipment condition and expected life.

Prioritize, Implement, Track, and Report

Evaluate costs and benefits of proposed changes and prioritize the opportunities. An Energy Management Plan should reflect the priorities of the stakeholders and be effectively executed to realize energy benefits. Preferred implementation strategies may vary depending on measure and scope. Tracking and reporting mechanisms should be put in place to report results.

Best Practices

The following is a list of Operation and Maintenance practices, arranged by systems, to consider. The list is organized by system (blower aeration, mechanical aeration, mixing, pumping, etc.) in approximate order from highest to lowest energy use. Because some measures are common to multiple systems, they are repeated, so that each system has a complete list.

Blower Aeration System
Fix air piping leaks. For exposed pipes, apply soapy water to create bubbles. For underground pipes, look for air bubbles surfacing through soil during or just after rain events.
Reduce air demand – take excess aeration basins off line; eliminate air flow to empty aeration basins; reduce air flow in aerated channels to that necessary to keep solids in suspension; reduce air flow in aerated grit chamber to that necessary to separate organics from grit.
Eliminate air flow restrictions – clean intake air filters, fix sticking check valves, open or eliminate throttling valves, enlarge undersized valves or piping.
Minimize inlet air temperature for centrifugal blowers, especially those which draw air from inside buildings (such as turbo blowers). Consider piping blower intake to outside of building.
Dissolved Oxygen (DO) Control Sensors – clean and check DO Probe calibration twice a month; airflow meters and pressure sensors annually.
Check placement of DO probe in basin for representative DO reading.
Lower DO set point to lowest possible setting which results in proper treatment. (That should be less than 2 PPM. However, if either ammonia or nitrogen removal is required, higher set point may be required, especially during cold weather).
Lower blower output pressure by fully opening air valve to highest demand aeration zone, and then balancing other air valves to obtain uniform DO set point concentration across remainder of aeration basin; check and tune the settings annually. Use Most Open Valve control strategy for plants with centrifugal blowers and more than three aeration basins.
Monitor Blower Performance – check air flow and pressure against blower curve to determine if units are operating at most efficient point.
Identify most efficient blower (highest SCFM/kW) and program controls to run that unit as primary blower.

If different capacity blowers are available, program blower operation to match diurnal air demand. If blowers are positive displacement units, adjust belts and sheaves to match output to diurnal air demand.
Monitor SCADA System to identify if two or more blowers operate at reduced speed. Determine if one unit at higher speed will satisfy demand while drawing less kW. If so, take excess equipment off line.
Diffuser air flow – check CFM/diffuser rate. If it exceeds manufacturer's recommendation, add diffusers or reduce air flow per diffuser to restore oxygen transfer efficiency.
Diffuser maintenance – every week, look for air "boils" which could indicate broken pipes or diffusers; measure air pressure of each drop leg (at a set SCFM blower air flow rate) to detect distribution piping resistance and diffuser fouling. Flex diffuser membranes with air pulses or clean diffusers as needed to reduce pressure and increase oxygen transfer efficiency.
If nitrification is not required, lower Mean Cell Residence Time to 4 - 5 days and turn off aeration system from 1 to 2 hours during the early morning low flow period in order to inhibit nitrifying bacteria.
Convert first zone of aeration basin to anoxic selector (if nitrifying) or to anaerobic selector (if not nitrifying). The selector helps remove surfactants, which increases oxygen transfer efficiency.
Mechanical Aeration Systems
Check that the submerged depth of the mechanical aerator is set to produce the maximum mixing and aeration at a lowest amperage draw.
Stage unit operation to match DO demand. If different capacity units are available, program operation to match diurnal air demand. Use timers to turn units ON/OFF or VFD's to change speed. Take excess units off line.
Monitor SCADA System to identify if two or more aerators operate at reduced speed. Determine if one unit at higher speed will satisfy demand while drawing less kW. If so, take excess equipment off line.
Dissolved Oxygen (DO) Controls - Lower DO set point to lowest possible setting which results in proper treatment (less than 2.0 PPM for aeration basins and as low as 0.2 PPM for aerobic digesters).
DO probe – clean and check calibration twice per month, replace parts as needed.
Identify most efficient unit (lbs. of O2 transferred/kWh) and program controls to run that unit as primary unit.
If nitrification is not required, lower Mean Cell Residence Time to 4 -5 days and turn off aeration system from 1 to 2 hours during the early morning low flow period in order to inhibit nitrifying bacteria.
Monitor units for excessive vibration and amp draw to detect fowling. Clean and recheck.
Secondary Treatment Mixing System (in anoxic or anaerobic cells of aeration system) **and Anaerobic Digester Mixing System**
Reduce number of aeration basin mixers and/or speed of units to point where solids settling is just beginning to be observed (visually on the surface or by tube sampler through tank depth). Take excess equipment off line.
Reduce number of anaerobic digester mixers (or pumps) and/or speed of units to optimize methane production. Monitor digester solids concentration at various levels and maintain sufficient mixing to ensure that solids separation is not occurring. Take excess units off line.
Identify most efficient unit (GPM/kW) and program controls to run that unit as primary unit.
Monitor units for excessive vibration and amp draw to detect fowling. Clean and recheck.
Pumping Systems – Lift Stations, RAS; WAS; Trickling Filter and Aeration Basin Recirculation
Reduce RAS, WAS, and Primary Sludge flow rates to minimum needed. This increases solids concentrations and reduces pumping of excess water
Reduce Trickling Filter and Aeration Basin recirculation rates to minimum needed. This reduces pumping of excess water.
Fix piping leaks and pump leaks (packing & seals).
Eliminate piping restrictions: throttling valves, unnecessary valves, sticking check valves.
Eliminate air from pipelines by checking and flushing air release valves.
Flush scum and sludge piping periodically to reduce head loss.
Reduce pumping head – raise liquid level at pump inlet to maximize suction pressure.
Monitor pump performance – check flow and total head (discharge pressure minus suction pressure) against pump curve to determine if units are operating on the curve and at most efficient point on the curve.
Where there are multiple pumps, identify most efficient pump (GPM/kW) and program controls to run that unit as primary pump. Take excess units off line.
Monitor pumps and motors for excessive vibration and amp draw to detect plugging and excessive wear. Clean and check clearance between impeller and volute. Replace impeller and/or wear rings if necessary.
Plant Water System for Non-potable Use

Reduce demand – adjust spray nozzles in clarifiers and aeration basins; use quick On/Off/adjustable flow nozzles on wash down hoses; adjust pump seal water flow to lowest recommended setting; reduce chlorine gas dilution water flow rate.
Fix piping leaks.
Eliminate piping restrictions, throttling valves, unnecessary valves, sticking check valves.
Tune pump control system – adjust pressure set point to minimum needed.
Install accumulator pressure tank to allow system to turn off when there is no demand.
Identify most efficient unit (GPM/kW) and program controls to run that unit as primary unit.
Monitor pumps and motors for excessive vibration and amp draw to detect plugging and excessive wear. Clean and check clearance between impeller and volute. Replace impeller and/or wear rings if necessary.
Program SCADA system to display total daily usage and to alarm for excessive use of plant water.
Ultra Violet Disinfection System
Replace lamps with low pressure, high output lamps, if possible.
Keep lamps clean and remove scaling.
Program light bank control for ON/OFF operation and intensity variation in proportion to plant flow
Check quarterly that UV intensity meter, water turbidity meter, and flow meter are clean, calibrated, and operating correctly.
Odor Control System
Reduce air flow to minimum needed to control odor and corrosion during warm weather and to ensure code required air changes per hour.
Consider enclosing odor sources so as to minimize the need to treat air for the entire building.
Consider turning system off during cool weather when odor production is minimal.
Consider using odor monitoring equipment to automatically control the system.
For biofilters, measure air pressure of each distribution pipe at a set SCFM blower flow rate, to detect piping resistance, and to determine if filter media is compacting and needs to be changed.
Other Measures
Use SCADA System to observe trends, including larger motor kW demand and monthly plant kWh/Million Gallons treated. Use information to tune the controls.
Use SCADA System to operate only the equipment needed, so blower, pumps and mixer outputs match demands.
Regularly check for manual overrides (HOA switch in HAND position) so control systems can do their jobs. Fix or tune control systems so manual overrides are not necessary.
Fix equipment that is not operating correctly or efficiently, such as worn bearings, failed control equipment and sensors, or improperly placed sensors.
Examine equipment which operates 24/7 or on a fixed schedule, like odor control and ventilation blowers. Adjust operation to meet needs and seasonal variation.
Rethink *Standard Operating Procedures* to maximize energy efficiency.

The following table developed by Wisconsin "Focus on Energy" shows the typical energy savings and payback periods for a variety of wastewater process measures and best practices, grouped by category. There is no one measure or mix of measures that is appropriate for every facility. Measures should not be assessed or implemented in isolation since there are often interactive effects that will impact the overall savings of the combined measures. A well-executed Energy Management Plan will lead you to the fundamental measures applicable to your site conditions.

Process	Best Practices Measure	Typical Energy Savings of unit of process (%)	Typical Payback (Years)
Operations	Operational Flexibility	10 – 25	< 2
	Staging of Treatment Capacity	10 – 30	< 2
	Manage for Seasonal/Tourist Peaks Variable	Variable	4 – 6
	Flexible Sequencing of Basin Use	15 – 40	2 – 5
	Cover Basins to Reduce Freezing and Aerosol or Odor Emissions	Variable	Variable
	Reduce Fresh Water Consumption through Final Effluent Recycling	10 – 50	2 – 3
Aeration	Optimize Aeration System	30 – 70	3 – 7
	Fine Bubble Aeration	20 – 75	1 – 5
	Variable Blower Air Flow Rate	15 – 50	<3
	Dissolved Oxygen Control	20 – 50	2 – 3
	Cascade Aeration	Variable	Variable
	Aerobic Digestion Options	20 – 50	Variable
	Blower Technology Options	10 – 25	1 – 7
	Assess Aeration System Configuration	Variable	Variable
Sludge and Biosolids	Improve Solids Capture in Dissolved Air Flotation (DAF)	Variable	Variable
	Evaluate Replacing Centrifuge with Screw Press	Variable	Variable
	Replace Centrifuge with Gravity Belt Thickener	Variable	Variable
	Digestion Options	Variable	Variable
	Mixing Options in Aerobic Digesters	10 – 50	1 – 3
	Mixing Options in Anaerobic Digesters	Variable	Variable
	Recover Heat from Wastewater	Variable	Variable
Special Treatment Options	Anoxic-Zone Mixing Options	25 – 50	3 – 5
	Side-stream De-ammonification	–	–
	Biotower Energy Efficiency	15 – 30	Variable
Biogas Enhancement	Optimize Anaerobic Digester Performance	Variable	Variable
	Use Biogas to Produce Combined Heat and/or Power (CHP)	Variable	Variable
	Assessment of Beneficial Utilization	Variable	Variable

Table based on information published by Wisconsin Focus on Energy in the "ENERGY BEST PRACTICES GUIDE: WATER & WASTEWATER INDUSTRY" (February 2020)– https://focusonenergy.com

Third Party Resources

DOE and EPA have developed several publicly available software tools that help wastewater treatment plant operators measure and track energy performance.

EPA ENERGY STAR Portfolio Manager

Portfolio Manager allows users to track and assess energy and water use at individual sites and across portfolios of buildings. Portfolio Manager uses survey data and regression analysis to calculate an ENERGY STAR score, which allows buildings and wastewater treatment plants to compare energy performance against peers.

In the case of wastewater treatment plants, the score applies to primary, secondary, and advanced treatment facilities that process more than 0.6 MGD, with or without nutrient removal capacity. The score looks at energy performance while controlling for operating parameters such as influent flow, BOD levels, load factor, application of trickle filters and nutrient removal, and weather. In addition to calculating the score, Portfolio Manager can track normalized energy performance over time, using the same operational parameters that generate the score. The tool represents energy performance as energy use intensity per flow (kBtu/mg) and can generate reports with a host of other metrics such as energy cost, greenhouse gas emissions, and energy use by type (e.g., electricity, natural gas, fuel oil) using downloadable templates. An ENERGY STAR Portfolio has been established for this facility and is discussed in more detail in Section 3 of this report.

https://www.energystar.gov/buildings/benchmark

EPA Energy Assessment Tool

The Energy Assessment Tool (EAT) is a spreadsheet-based tool developed by EPA's Region 4 office. The tool enables wastewater treatment facility operators to easily and quickly develop metrics for energy efficiency and energy savings. Facilities can develop absolute, flow-normalized, and BOD load-normalized values with this tool. This tool has limited data requirements and provides a quick look at energy usage and how it has changed over a period of up to five years.

https://www.epa.gov/sustainable-water-infrastructure/energy-efficiency-water-utilities

DOE Energy Performance Indicator (EnPI) Tool

The EnPI tool is a regression analysis tool developed by DOE to help energy managers establish a normalized baseline of energy consumption and track annual progress in energy intensity improvement and energy savings.

In constructing the regression models, users include the independent variables they believe impact energy consumption in their plants. This contrasts with Portfolio Manager, which hardwires those variables into the tool. The advantage of the EnPI approach is that it gives users greater flexibility to include the variables most relevant to their plants. On the other hand, it requires greater investigation from the user to determine what those variables are.

The tool generates several energy models, and it highlights the model with the greatest statistical validity, based on DOE-developed guidance. Outputs include energy performance improvement (in percentage terms) and annual and total energy savings (in Btu). The tool allows energy managers to roll up multiple treatment plants and other facility-level energy data and metrics to an enterprise level to determine organization-wide energy performance. DOE has also released an EnPI Lite tool.

https://www.energy.gov/eere/amo/articles/energy-performance-indicator-tool

DOE Wastewater Energy Management Toolkit (SWIFt)

This toolkit helps wastewater facilities establish and implement energy management and planning by collecting best practices and innovative approaches used by wastewater facilities who partnered with DOE's Sustainable Wastewater Infrastructure of the Future (SWIFt) Accelerator. The toolkit resources support best practices and innovative approaches successfully used by wastewater facilities to establish and implement energy management and planning. The kit includes sections on Energy Data Management, Measure Evaluation, Project Financing, and Improvement Planning.

https://betterbuildingssolutioncenter.energy.gov/wastewater-energy-management-toolkit

5 Energy Efficient Best Practices

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

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

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

Energy Tracking with ENERGY STAR Portfolio Manager

You've heard it before—you cannot manage what you do not measure. ENERGY STAR Portfolio Manager is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[11]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Lighting Maintenance

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

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

Motor Short Cycling Reduction

Frequent stopping and starting of motors places substantial stress on rotors and other parts. This leads to wear and tear, lower efficiency, and higher maintenance costs. Adjust the load on the motor to limit the amount of unnecessary stopping and starting to improve motor performance.

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.

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

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

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

Ductwork Maintenance

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

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

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

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

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.

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

Procurement Strategies

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

6 Water Best Practices

Getting Started

The commercial and institutional sector is the second largest consumer of publicly supplied water in the United States, accounting for 17% of the withdrawals from public water supplies[12]. In New Jersey, excluding water used for power generation, approximately 80% of total water use was attributed to potable supply during the period of 2009 to 2018. Water withdrawals for potable supply have not changed noticeably during the period from 1990 to 2018[13].

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

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

For more information regarding water conservation or additional details regarding the practices shown below go to the EPA's WaterSense website[14] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[15] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Toilets and Urinals

Toilets and urinals are considered sanitary fixtures and are found in most facilities. High efficiency fixtures are at least 20% more efficient than available standard products. Leaking or damaged equipment is a substantial source of water waste. Train users to report continuously flushing, leaking, or otherwise improperly operating equipment to the appropriate personnel. Depending on the age of the equipment and the frequency of use, it may be cost effective to replace older inefficient fixtures with current generation WaterSense labeled equipment.

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

Most urinals use water to flush liquid. These standard single-user fixtures are present in most facilities. Non-water urinals use a specially designed trap that allows liquid waste to drain out of the fixture through

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

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

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

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

a trap seal, and into the drainage system. Flushing urinals should be inspected at least annually for proper valve and sensor operation. For non-water urinals, follow maintenance practices as directed by the manufacturer to ensure products perform as expected. Non-water urinals can be considered during urinal replacement, however, review the condition and design of the existing plumbing system and the expected usage patterns to ensure that these products will provide the anticipated performance.

Faucets and Showerheads

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

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

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

Laboratory and Medical Equipment

Laboratory and medical equipment systems can consume a significant amount of water through water purification, sterilization, photographic and X-ray processes, and vacuum systems. Equipment such as steam sterilizers and reverse osmosis systems can account for 5% of a laboratory's total water use. Hospitals can attribute more than 15% of their total water use to laboratory and medical equipment, including steam sterilizers and X-ray processing equipment.

Many older pieces of medical and laboratory equipment use single pass cooling continuously for the purpose of keeping equipment cool or for tempering hot water before it is discharged to the sewer. Laboratories and medical facilities face unique challenges because of the high quality of the water required for much of the equipment. Most of these facilities require the use of potable water at a minimum and more highly treated water in many cases.

For water purification equipment:

- Use only when necessary and match the process to the actual quality of water required.
- Clean and maintain carbon filtration, distillation, and deionization equipment in accordance with manufacturer's guidelines.
- When purchasing a new water purification system, choose the least intensive treatment needed to achieve the desired quality level and size the system correctly for the intended use.

For vacuum pump systems:

- Turn off the pump when it is not in use or needed.
- Ensure that the vacuum pump is set at manufacturer specifications to discharge only the amount of water necessary to remove impurities and cool the vacuum pump.

For autoclaves and steam sterilizers:

- Periodically review and adjust the tempering water needle valve flow rate to the minimum manufacturer recommendations.
- Change out the needle valve annually because they wear quickly. Worn valves can discharge excess water.
- If the steam sterilizer is already equipped with a thermostatically actuated valve to control tempering water flow, periodically check the valve to ensure it is opening and closing properly, so tempering water is not continuously discharged.
- Shut off the steam sterilizer unit when not in use.
- Use high-quality water to generate steam to improve the efficiency of the steam sterilizer.

For photographic and X-Ray equipment:

- Adjust the water flow to the film processor to flow at the minimum acceptable flow rate specified by the equipment manufacturer. Post minimum flow rates near the processor and educate users on how to adjust and operate the equipment.
- Check the solenoid valve on the X-ray equipment cooling water to ensure it is working properly and stop flow when the equipment is in standby mode. If necessary, install a flow meter in the supply line to monitor flow from the equipment.
- For X-ray equipment, turn off the cooling water flow when the unit is not in use.

Depending on the facility, laboratories or hospitals may employ additional water consuming equipment. Examples include vivarium washing and watering systems, fume hood filtration and wash-down systems, and glassware washers.

In general, use equipment only when needed and reduce flow rates and cycles to meet the needs of the process and to meet maintain health and safety.

7 On-Site Generation

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

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

7.1 Solar Photovoltaic

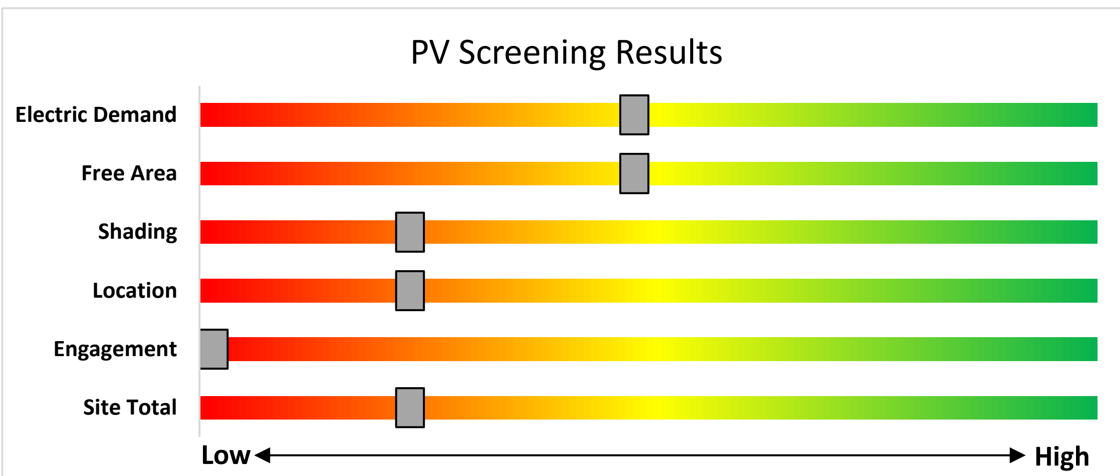
Photovoltaic (PV) panels convert sunlight into electricity. Individual panels are combined into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is then connected to the building's electrical distribution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

The site is equipped with a PV array. According to site staff, the array is not functional at this time. It is recommended to troubleshoot the array and assess the cost effectiveness of repairs.

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

This facility does not appear to meet the minimum criteria for a cost-effective solar PV installation. To be cost-effective, a solar PV array needs certain minimum criteria, such as sufficient and sustained electric demand and sufficient flat or south-facing rooftop or other unshaded space on which to place the PV panels.

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.



Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

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

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

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

7.2 Combined Heat and Power

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

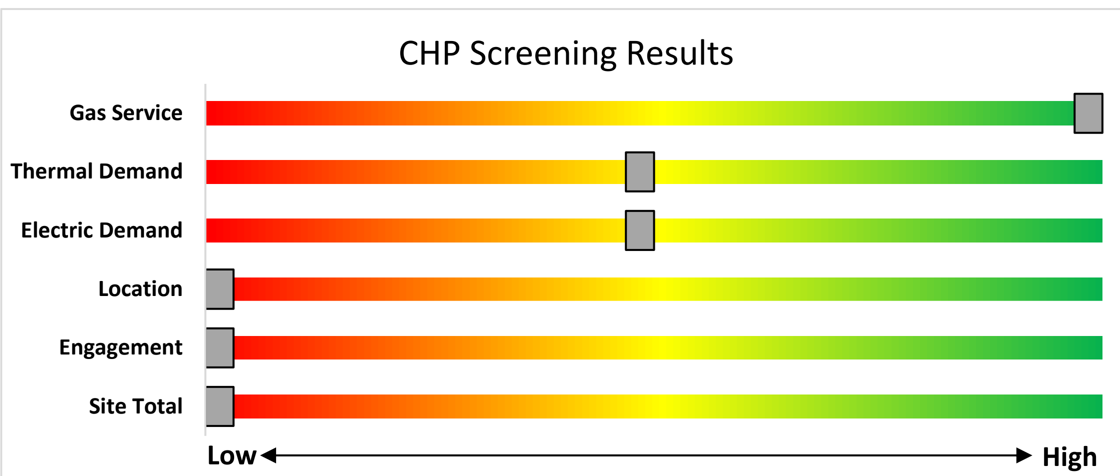
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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

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

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

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

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



Combined Heat and Power Screening

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

8 Electric Vehicles

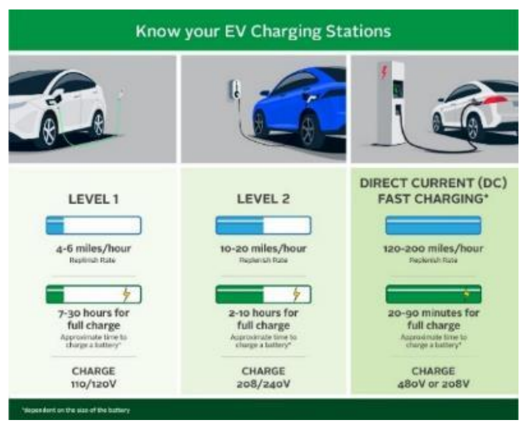
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes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

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

8.1 EV Charging

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

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



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

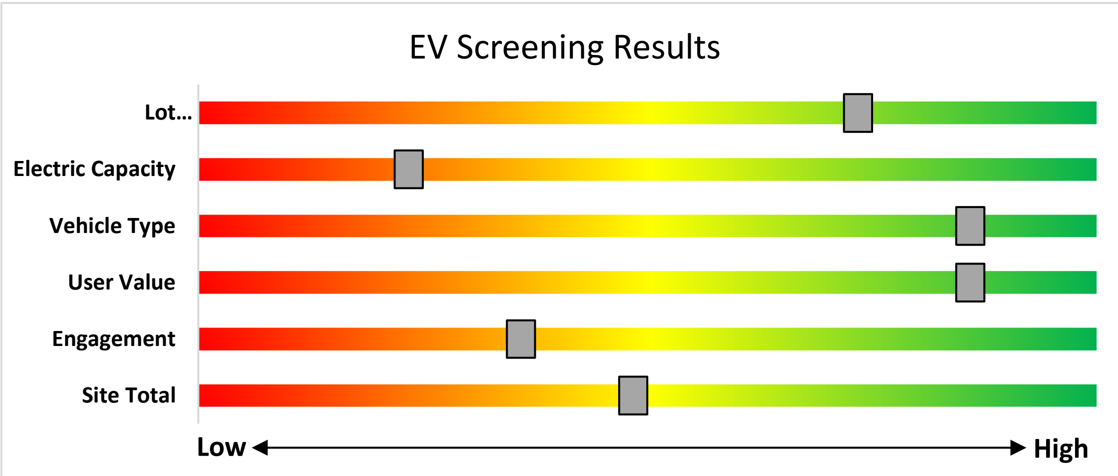
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

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

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

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

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



EV Charger Screening

Electric Vehicle Programs Available

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

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

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

9 Project Funding and Incentives

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

NJBPU and NJCEP Administered Programs

New Jersey's cleanenergy program™

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

*State facilities are also eligible for utility programs

Utility Administered Programs

atlantic city electric – An Exelon Company; Jersey Central Power & Light – A FirstEnergy Company; PSEG; Rockland Electric Company; Elizabethtown Gas; South Jersey Gas; New Jersey Natural Gas

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

9.1 New Jersey's Clean Energy Program

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

Large Energy Users

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

Incentives

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

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

How to Participate

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

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

Combined Heat and Power

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

Incentives[16]

Eligible Technology	Size (Installed Rated Capacity)	Incentive ($/Watt)[5]	% of Total Cost Cap per Project	$ Cap per Project
CHPs powered by non-renewable or renewable fuel source, or a combination:[4] - Gas Internal Combustion Engine - Gas Combustion Turbine - Microturbine Fuel Cells ≥60%	≤500 kW[1]	$2.00	30-40%[2]	$2 million
	>500 kW - 1 MW[1]	$1.00		
	> 1 MW - 3 MW[1]	$0.55	30%	$3 million
	>3 MW[1]	$0.35		
Fuel Cells ≥40%	Same as above[1]	Applicable amount above	30%	$1 million
Waste Heat to Power (WHP)[3] Powered by non-renewable fuel source. Heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine)	≤1MW[1]	$1.00	30%	$2 million
	> 1MW[1]	$.50	30%	$3 million

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

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

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

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

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

How to Participate

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

Successor Solar Incentive Program (SuSI)

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

Administratively Determined Incentive (ADI) Program

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

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

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

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

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

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

Competitive Solar Incentive (CSI) Program

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

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

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

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

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

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

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

Energy Savings Improvement Program

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

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

How to Participate

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

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

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

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

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

Demand Response (DR) Energy Aggregator

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

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

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

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

The first step toward participation in a DR program is to contact a curtailment service provider. A list of these providers is available on the website of the independent system operator, PJM, and it includes contact information for each company, as well as the states where they have active business[17]. PJM also posts training materials for program members interested in specific rules and requirements regarding DR activity along with a variety of other DR program information[18].

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

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

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

9.2 Utility Energy Efficiency Programs

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

Prescriptive and Custom

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

Equipment Examples

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

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

Direct Install

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

Incentives

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

How to Participate

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

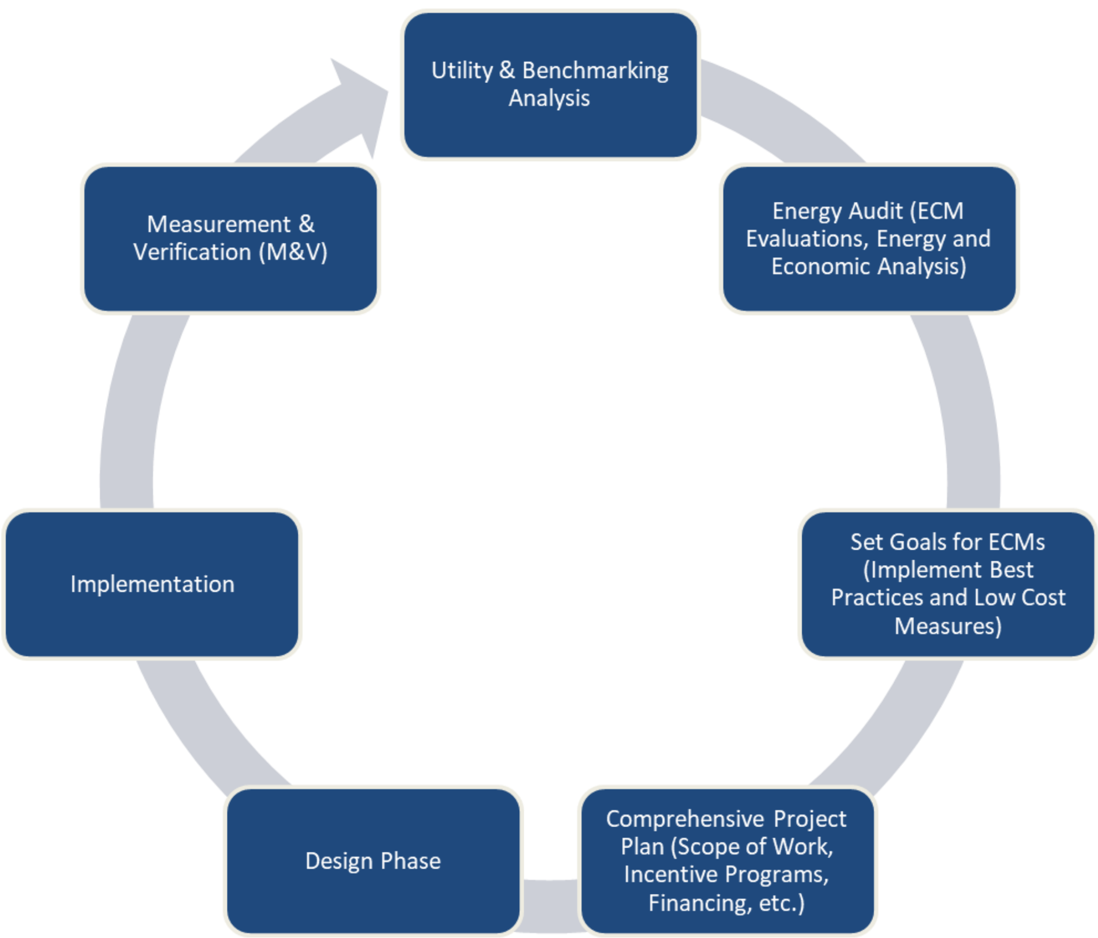
Engineered Solutions

The Engineered Solutions Program provides tailored energy-efficiency assistance and services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. Customers receive expert guided services, including investment-grade energy auditing, engineering design, installation assistance, construction administration, commissioning, and measurement and verification (M&V) services to support the implementation of cost-effective and comprehensive efficiency projects. Engineered Solutions is generally a good option for medium to large sized facilities with a peak demand over 200 kW looking to implement as many measures as possible under a single project to achieve deep energy savings. Engineered Solutions has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program. Incentives for this program are based on project scope and energy savings achieved.

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

10 Project Development

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



Project Development Cycle

11 Energy Purchasing and Procurement Strategies

11.1 Retail Electric Supply Options

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

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

A list of licensed third-party electric suppliers is available at the NJBPU website[19].

11.2 Retail Natural Gas Supply Options

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

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

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

A list of licensed third-party natural gas suppliers is available at the NJBPU website[20].

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Digester Building - Mechanical 1	7	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	S	9	500		None	No	7	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	9	500	0.0	0	0	$0	$0	$0	0.0
Digester Building - Mechanical 2	1	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	S	9	500		None	No	1	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	9	500	0.0	0	0	$0	$0	$0	0.0
Digester Building - Exterior 2	1	Metal Halide: (1) 250W Lamp	Wall Switch		295	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Architectural Flood/Spot Luminaire	Wall Switch	75	4,380	0.0	964	0	$118	$660	$50	5.2
Ditch - Exterior 1	1	High-Pressure Sodium: (1) 250W Lamp	Wall Switch		295	4,380	3	Relamp	No	1	LED Lamps - E39: ≤125 W Lamp	Wall Switch	75	4,380	0.0	964	0	$118	$300	$50	2.1
Ditch - Exterior 1	1	High-Pressure Sodium: (1) 250W Lamp	Wall Switch		295	4,380	3	Relamp	No	1	LED Lamps - E39: ≤125 W Lamp	Wall Switch	75	4,380	0.0	964	0	$118	$300	$50	2.1
Grit - Exterior 1	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch		50	4,380		None	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	50	4,380	0.0	0	0	$0	$0	$0	0.0
Grit - Mechanical 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
Grit - Mechanical 1	6	Linear Fluorescent - EST12: 4' T12 (34W) - 2L	Wall Switch	S	72	1,000	2	Relamp & Reballast	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.2	279	0	$34	$530	$60	14.0
Main Building - Conference 1	6	Compact Fluorescent: (1) 26W Double Biaxial Plug-In Lamp	Wall Switch	S	26	1,500	3, 4	Relamp	Yes	6	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	19	1,035	0.1	125	0	$15	$410	$50	23.9
Main Building - Conference 1	4	Compact Fluorescent: (2) 26W Double Biaxial Plug-In Lamps	Wall Switch	S	52	1,500	3, 4	Relamp	Yes	4	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	37	1,035	0.1	172	0	$21	$480	$50	20.8
Main Building - Corridor 1	5	Compact Fluorescent: (1) 26W Double Biaxial Plug-In Lamp	Wall Switch	S	26	1,500	3, 6	Relamp	Yes	5	LED Lamps: GX23 (Plug-In) Lamps	High/Low Control	19	1,035	0.1	104	0	$13	$340	$190	11.9
Main Building - Corridor 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
Main Building - Corridor 2	5	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	5	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Main Building - Corridor 2	1	LED Lamps: (1) 10W BR30 Screw-In Lamp	Wall Switch	S	10	1,500		None	No	1	LED Lamps: (1) 10W BR30 Screw-In Lamp	Wall Switch	10	1,500	0.0	0	0	$0	$0	$0	0.0
Main Building - Corridor 2	9	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,500	3, 6	Relamp	Yes	9	LED - Linear Tubes: (2) U-Lamp	High/Low Control	33	1,035	0.3	572	0	$69	$1,360	$410	13.8
Main Building - Electrical Room 1	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
Main Building - Electrical Room 1	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,500	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.2	408	0	$49	$630	$100	10.8
Main Building - Exterior 1 Switch Gear	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch		60	4,380	3, 5	Relamp	Yes	2	LED Lamps: A19 Lamps	Photocell	9	4,380	0.0	447	0	$55	$290	$0	5.3
Main Building - Exterior 1 Switch Gear	10	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch		9	4,380		None	No	10	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	9	4,380	0.0	0	0	$0	$0	$0	0.0
Main Building - Exterior 3	3	High-Pressure Sodium: (1) 150W Lamp	Timeclock		188	4,380	1	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	45	4,380	0.0	1,879	0	$230	$1,330	$150	5.1
Main Building - Exterior 3	4	Metal Halide: (1) 150W Lamp	Wall Switch		190	4,380	1, 5	Fixture Replacement	Yes	4	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell	45	4,380	0.0	2,540	0	$311	$1,860	$400	4.7
Main Building - Exterior 3	2	Metal Halide: (1) 250W Lamp	Timeclock		295	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	75	4,380	0.0	1,927	0	$236	$1,190	$100	4.6
Main Building - Exterior 3	2	Metal Halide: (1) 70W Lamp	Timeclock		95	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	21	4,380	0.0	648	0	$79	$530	$100	5.4
Main Building - Laboratory 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,500	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.0	53	0	$6	$50	$10	6.2
Main Building - Laboratory 1	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,500	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,035	0.1	191	0	$23	$600	$70	23.1

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Main Building - Mechanical 1	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
Main Building - Mechanical 1	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.2	107	0	$13	$300	$60	18.7
Main Building - Mechanical 1	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	500	0.0	16	0	$2	$90	$10	42.5
Main Building - Office - Enclosed 1	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,500	3, 4	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.2	340	0	$41	$580	$90	12.0
Main Building - Office - Enclosed 2	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
Main Building - Office - Enclosed 2	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,500	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.1	272	0	$33	$530	$80	13.8
Main Building - Office - Enclosed 2	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,500	3	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	1,500	0.0	47	0	$6	$90	$10	14.2
Main Building - Office - Enclosed 3	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
Main Building - Office - Enclosed 3	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,500	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.2	408	0	$49	$630	$100	10.8
Main Building - Office - Enclosed 3	12	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,500	3, 4	Relamp	Yes	12	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,035	0.4	763	0	$92	$1,390	$160	13.4
Main Building - Office - Enclosed 4	9	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,500	3, 4	Relamp	Yes	9	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,035	0.3	572	0	$69	$1,130	$130	14.5
Main Building - Restroom - Female 1	2	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	25	500		None	No	2	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	25	500	0.0	0	0	$0	$0	$0	0.0
Main Building - Restroom - Male 1	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	500	0.0	16	0	$2	$90	$10	42.5
Main Building - Restroom - Unisex 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.0	18	0	$2	$50	$10	18.7
Main Building - Server Room 1	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
Main Building - Server Room 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.1	36	0	$4	$100	$20	18.7
Main Building - Workshop ATP Building	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
Main Building - Workshop ATP Building	20	Metal Halide: (1) 250W Lamp	Wall Switch	S	295	2,000	1, 4	Fixture Replacement	Yes	20	LED - Fixtures: Low-Bay	Occupancy Sensor	75	1,380	4.3	10,508	-2	$1,264	$13,550	$1,070	9.9
Main Building - Workshop ATP Building	64	UV Linear: (1) 200W Lamp	Wall Switch	S	200	4,380		None	No	64	UV Linear: (1) 200W Lamp	Wall Switch	200	4,380	0.0	0	0	$0	$0	$0	0.0
Main Building - Workshop 2	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
Main Building - Workshop 2	35	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	35	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	1.0	624	0	$75	$1,770	$350	18.9
Main Building - Stairs 1	1	Linear Fluorescent - EST12: 4' T12 (34W) - 2L	Wall Switch		72	1,500	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.0	70	0	$8	$90	$10	9.6
Main Building - Stairs 1	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,500	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.1	204	0	$25	$480	$70	16.7
Old Control Building - Mechanical 1	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	500	3	Relamp	No	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	500	0.2	121	0	$15	$350	$80	18.6
Old Control Building - Corridor 1	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	1,500	3	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	1,500	0.0	83	0	$10	$30	$0	3.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Old Control Building - Corridor 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,500	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,500	0.0	91	0	$11	$90	$20	6.4
Old Control Building - Exterior 1	4	LED - Fixtures: Fuel Pump Canopy	Photocell		50	4,380		None	No	4	LED - Fixtures: Fuel Pump Canopy	Photocell	50	4,380	0.0	0	0	$0	$0	$0	0.0
Old Control Building - Storage 3	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.1	36	0	$4	$100	$20	18.7
Old Control Building - Storage 4	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.1	71	0	$9	$200	$40	18.7
Old Control Building - Storage 2	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	500	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	500	0.0	30	0	$4	$90	$20	19.3
Ozone Pump Station - Exterior 2	4	Metal Halide: (1) 70W Lamp	Timeclock		95	4,380	1	Fixture Replacement	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	21	4,380	0.0	1,296	0	$158	$1,060	$200	5.4
Ozone Pump Station - Mechanical 1	2	Exit Signs: LED - 2 W Lamp	None	S	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
Ozone Pump Station - Mechanical 1	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.3	178	0	$21	$510	$100	19.1
Ozone Pump Station - Workshop 1 Ozone Bar Rack	2	Metal Halide: (1) 250W Lamp	Wall Switch	S	295	500	1	Fixture Replacement	No	2	LED - Fixtures: Downlight Pendant	Wall Switch	75	500	0.4	238	0	$29	$380	$10	13.0
Ozone Pump Station - Workshop 1 Ozone Bar Lower	1	Metal Halide: (1) 250W Lamp	Wall Switch	S	295	500	1	Fixture Replacement	No	1	LED - Fixtures: Downlight Pendant	Wall Switch	75	500	0.2	119	0	$14	$190	$10	12.6
Ozone Pump Station - Mechanical 2	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.3	178	0	$21	$510	$100	19.1
Ozone Pump Station - Stairs 1	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
Ozone Pump Station - Stairs 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,500	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.0	53	0	$6	$50	$10	6.2
Primary Clarifying Pump Station - Exterior 1	2	LED - Fixtures: Wall Pack	Wall Switch		50	4,380		None	No	2	LED - Fixtures: Wall Pack	Wall Switch	50	4,380	0.0	0	0	$0	$0	$0	0.0
Primary Clarifying Pump Station - Mechanical 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
Primary Clarifying Pump Station - Mechanical 1	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.1	71	0	$9	$200	$40	18.7
RAS - Electrical Room 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
RAS - Electrical Room 1	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.1	71	0	$9	$200	$40	18.7
RAS - Exterior 1	3	LED - Fixtures: Wall Pack	Photocell		50	4,380		None	No	3	LED - Fixtures: Wall Pack	Photocell	50	4,380	0.0	0	0	$0	$0	$0	0.0
RAS - Exterior 2	14	Metal Halide: (1) 250W Lamp	Photocell		295	4,380	1	Fixture Replacement	No	14	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell	75	4,380	0.0	13,490	0	$1,649	$7,960	$1,400	4.0
RAS - Mechanical 2	1	Exit Signs: LED - 2 W Lamp	None		6	500		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	500	0.0	0	0	$0	$0	$0	0.0
RAS - Mechanical 2	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	4	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	500	0.1	63	0	$8	$350	$40	41.2
RAS - Mechanical 1	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
RAS - Mechanical 1	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3	Relamp	No	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.3	196	0	$24	$560	$110	19.1
RAS - Stairs 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,500	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.1	136	0	$16	$250	$40	12.8

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
RAS - Stairs 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None		62	8,760	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	None	29	8,760	0.0	312	0	$38	$50	$10	1.1
Recirculation Building - Mechanical 2	5	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	S	9	500		None	No	5	LED Lamps: (1) 9W A19 Screw-In Lamp	Wall Switch	9	500	0.0	0	0	$0	$0	$0	0.0
Recirculation Building - Mechanical 1	1	Incandescent: (1) 100W A19 Screw-In Lamp	None	S	100	500	3	Relamp	No	1	LED Lamps: A19 Lamps	None	15	500	0.1	46	0	$6	$30	$0	5.4

Motor Inventory & Recommendations

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Digester Buidling - Mechanical 2	Mechanical Roon Hydronic Boiler	1	Combustion Air Fan	0.33	56.6%	No	Marathon Electric	5KC37FN71HX	W	2,745		No	56.6%	No		0.0	0	0	$0	$0	$0	0.0
Grit Building - Mechanical 1	Mechanical Room AHU	1	Supply Fan	0.75	70.0%	No	Unkown	Unkown	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Grit Building - Mechanical 1	Mechanical Room UH	1	Supply Fan	0.25	65.0%	No	Unkown	Unkown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Exterior 2	Exterior 2 AHU	1	Supply Fan	10.00	91.7%	No	Baldor	EFM3714T	W	2,500	8	No	91.7%	Yes	1	2.9	7,627	0	$932	$7,500	$1,100	6.9
Main Building - Exterior 2	Exterior 2 AC - 1	1	Supply Fan	3.00	86.5%	No	Unkown	Unkown	W	2,500	8	No	89.5%	Yes	1	0.9	2,572	0	$314	$5,100	$200	15.6
Main Building - Exterior 2	Exterior 2 HV - 1	1	Supply Fan	3.00	86.5%	No	Unkown	Unkown	W	2,500	8	No	86.5%	Yes	1	0.9	2,426	0	$296	$5,300	$200	17.2
Main Building - Exterior 2	Exterior 2 - Package Unit	1	Exhaust Fan	0.17	67.0%	No	TRANE	Unkown	W	2,745		No	67.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Electrical 1	Main Buidling Break Room - HW AHU	1	Supply Fan	0.25	65.0%	No	Unkown	Unkown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Mechanical 1	Main Buidling Mechanical Room - HW AHU	1	Supply Fan	0.25	65.0%	No	Unkown	Unkown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Workshop ATP Building	Main Building - Workshop ATP Building - UH	2	Supply Fan	0.25	65.0%	No	TRANE	MOT07942	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station	Varied - UH	9	Supply Fan	0.05	65.0%	No	TPI	56825003	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Primary Clarifying Pump Station - Mechanical 1	Primary Clarifying Pump Station - Mechanical Room AHU	1	Supply Fan	0.75	70.0%	No	Unkown	Unkown	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Primary Clarifying Pump Station - Mechanical 1	Primary Clarifying Pump Station - Mechanical Room UH	1	Supply Fan	0.25	65.0%	No	Unkown	Unkown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
RAS - Mechanical 2	RAS - Mechanical Room - Duct Furnace	1	Supply Fan	0.75	70.0%	No	Unkown	Unkown	B	2,745	7	Yes	81.1%	No		0.1	225	0	$28	$900	$0	32.7
Recirculation Building - Mechanical 2	Recirculation Building Building - Mechanical Room - AHU	1	Supply Fan	0.75	70.0%	No	Unkown	Unkown	B	2,745	7	Yes	81.1%	No		0.1	225	0	$28	$900	$0	32.7
RAS	Electrical and Stairs - UH	1	Supply Fan	0.10	65.0%	No	Unkown	Unkown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Old Control Buidling - Mechanical 1	Old Control Buidling - Hydronic Boiler	1	Heating Hot Water Pump	0.17	60.0%	No	Bell & Gossett	Unkown	W	2,745		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Digester Buidling - Exterior 2 - Roof	Digester Building	2	Exhaust Fan	0.33	65.0%	No	Varied	Varied	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Digester Buidling - Mechanical 2	Digester - Water Circulation	1	Heating Hot Water Pump	0.75	70.0%	No	Bell & Gossett	Unkown	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Digester Buidling - Mechanical 2	Digester - Water Circulation	1	Heating Hot Water Pump	0.75	70.0%	No	Bell & Gossett	Unkown	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Digester Buidling - Exterior 2 - Roof	Digester Building	1	Process Pump	1.50	87.5%	No	Weg	00152XT3E182T	W	2,745		No	87.5%	No		0.0	0	0	$0	$0	$0	0.0
Ditch - Exterior 1	Ditch	2	Process Pump	1.00	77.0%	No	U.S. Electrical Motors	G15587	W	2,745		No	77.0%	No		0.0	0	0	$0	$0	$0	0.0
Ditch - Exterior 1	Ditch	2	Process Fan	75.00	94.1%	No	U.S. Electrical Motors	611988 / S08S0820563R-1	W	8,760	10	No	95.4%	Yes	2	45.4	277,782	0	$33,954	$74,700	$0	2.2
Grit Building - Mechanical 1	Air Compressor	2	Air Compressor	5.00	89.5%	No	SIEMENS	1MB21211CB31 4AG3	W	1,000		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Grit Building - Exterior 1	Grit Building	2	Exhaust Fan	0.25	70.0%	No	Varied	Varied	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Grit Building - Mechanical 1	Multi Rake Screen	1	Other	3.00	89.5%	No	Baldor	D48514749	W	2,745		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Grit Building - Mechanical 1	Multi Rake Screen	1	Other	3.00	89.5%	No	Baldor	D48514987	W	2,745		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Grit Building - Mechanical 1	Grit Disposal System	1	Process Pump	0.75	70.0%	No	Unkown	Unkown	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Workshop 2	Main Building Air Compressor	1	Air Compressor	5.00	89.5%	No	US Motor	23378805	W	1,000		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Workshop 2	Main Building Air Compressor	1	Air Compressor	5.00	89.5%	No	US Motor	23378805	W	1,000		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Workshop 2	Main Building Air Compressor	1	Air Compressor	1.00	77.0%	No	Baldor	EM31115	W	1,000		No	77.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Exterior 1 Switch Gear	Switch Gear Housing	1	Exhaust Fan	0.25	65.0%	No	Century Electric	7-168840-01	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Exterior 2	Main Building	7	Exhaust Fan	0.25	65.0%	No	Varied	Varied	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Exterior 2	Main Building	1	Exhaust Fan	0.50	70.0%	No	Varied	Varied	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Mechanical 1	Heating Hot Water System	2	Heating Hot Water Pump	2.00	86.5%	No	Baldor	EJMM3157T	W	2,745	9	No	86.5%	Yes	2	0.4	3,551	0	$434	$9,400	$200	21.2
Main Building - Workshop 2	Service Water Supply Pump	1	Water Supply Pump	25.00	91.7%	No	Siemens	89	W	800		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Main Building - Workshop 2	Service Water Supply Pump	1	Water Supply Pump	25.00	91.7%	No	Century	R407	W	800		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Old Control Buidling - Mechanical 1	Old Control Building	1	Process Pump	3.00	86.5%	No	Century	M2	W	2,745		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Workshop 1 Ozone Bar Rack	Ozone Bar Rack	1	Exhaust Fan	1.50	84.0%	No	Unkown	Unkown	W	2,745		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Exterior 1	Ozone Pump Station	2	Exhaust Fan	0.25	65.0%	No	Varied	Varied	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	**Area(s)/System(s) Served**	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Ozone Pump Station - Mechanical 2	Ozone Pump Station	2	Other	0.25	65.0%	No	Unkown	Unkown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Mechanical 2	Sanitary Sweage System	1	Process Pump	25.00	91.7%	Yes	Davis	FA107-230	W	2,920		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Mechanical 2	Sanitary Sweage System	1	Process Pump	25.00	91.7%	Yes	Davis	FA107-230	W	2,920		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Mechanical 2	Sanitary Sweage System	1	Process Pump	25.00	91.7%	Yes	Davis	FA107-230	W	2,920		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Primary Clarifying Pump Station - Exterior 1	Primary Clarifying Pump Station	1	Exhaust Fan	0.25	65.0%	No	Unkown	Unkown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Primary Clarifying Pump Station - Mechanical 1	Primary Clarifying Pump Station	2	Process Pump	30.00	94.1%	Yes	North American Electric	V1-30D4-W28610A	W	1,000		No	94.1%	No		0.0	0	0	$0	$0	$0	0.0
RAS - Exterior 1	RAS - Exterior Pools	2	Other	0.75	78.0%	No	Varied	Varied	W	2,745		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
RAS - Exterior 1	SCUM Pump Pit 1 & 2	2	Process Pump	5.40	86.5%	No	Davis	FA101-163	W	2,745		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
RAS - Mechanical 1	RAS Pump System	1	Process Pump	40.00	91.0%	No	General Electric	5K364AL308D1	W	2,920		No	91.0%	No		0.0	0	0	$0	$0	$0	0.0
RAS - Mechanical 1	RAS Pump System	1	Process Pump	40.00	91.0%	No	General Electric	5K364AL308D1	W	2,920		No	91.0%	No		0.0	0	0	$0	$0	$0	0.0
RAS - Mechanical 1	RAS Pump System	1	Process Pump	40.00	94.1%	No	Marathon	364TTDCB6086	W	2,920		No	94.1%	No		0.0	0	0	$0	$0	$0	0.0
RAS - Mechanical 1	Waste Pump	2	Process Pump	30.00	91.0%	No	General Electric	5K286AC205	W	50		No	91.0%	No		0.0	0	0	$0	$0	$0	0.0
Recirculation Buidling - Exterior 1	Recirculation Buidling	1	Exhaust Fan	0.25	65.0%	No	Varied	Varied	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Recirculation Buidling - Mechanical 2	Recirculation Buidling	1	Process Pump	7.50	86.0%	No	General Electric	5K6246XC243A	B	3,391	7	Yes	90.2%	No		0.2	770	0	$94	$2,000	$0	21.2
Recirculation Buidling - Mechanical 1	Recirculation Buidling	1	Process Pump	8.80	86.5%	Yes	HOMA	AMTR10TU/6	W	3,391		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Trickling Filter Pump Station - Exterior 1	Trickling Filter Pump Station	1	Process Pump	47.00	94.1%	No	Sulzer	XFP206J-CB2	W	2,920		No	94.1%	No		0.0	0	0	$0	$0	$0	0.0
Trickling Filter Pump Station - Exterior 1	Trickling Filter Pump Station	1	Process Pump	47.00	94.1%	No	Sulzer	XFP206J-CB2	W	2,920		No	94.1%	No		0.0	0	0	$0	$0	$0	0.0
Trickling Filter Pump Station - Exterior 1	Trickling Filter Pump Station	1	Process Pump	45.00	94.1%	No	Flygt	3000	W	2,920		No	94.1%	No		0.0	0	0	$0	$0	$0	0.0
Trickling Filter Pump Station - Exterior 1	Primary Clarifiers	3	Process Pump	0.33	65.0%	No	U.S. Electrical Motors	G11117/S08S05 50032F	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

Packaged HVAC Inventory & Recommendations

		Existing Conditions									Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/ EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/ EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Main Building - Exterior 2	Main Building	1	Package Unit	8.50		9.00		TRANE	PCCB-07AA	B	11	Yes	1	Package Unit	8.50		14.00		2.0	2,429	0	$297	$12,300	$700	39.1
Main Building - Exterior 2	Siemens UV WaterTreatment System	1	Split-System	1.50		13.00		Lennox	XC13N018-230A-4	W		No							0.0	0	0	$0	$0	$0	0.0
Main Building - Exterior 3	Main Building	1	Package Unit	3.00	64.00	11.50	0.8 AFUE	TRANE	YHC033A4EMAG G	B		No							0.0	0	0	$0	$0	$0	0.0
Main Building - Exterior 2	Workshop ATP Building	2	Unit Heater		124.50		0.83 AFUE	TRANE	GHNE015	W		No							0.0	0	0	$0	$0	$0	0.0
Main Building - Workshop ATP Building	Ozone Pump Station - Mechanical Room 1	1	Unit Heater		51.18		1 COP	TPI Corporation	P3P5115CA1N	W		No							0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Mechanical 1	Ozone Pump Station - Workshop 1	1	Unit Heater		34.12		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Workshop 1 Ozone Bar Rack	Ozone Pump Station - Workshop 1	1	Unit Heater		34.12		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Workshop 1 Ozone Bar Lower	Ozone Pump Station - Mechanical Room 2	1	Unit Heater		34.12		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Mechanical 2	Ozone Pump Station - Stairs	5	Unit Heater		34.12		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Stairs 1	RAS - Electrical Room	1	Fan Coil		13.65		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
RAS - Electrical Room 1	RAS - Stairs	1	Fan Coil		10.24		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
RAS - Stairs 1	RAS - Mechanical Room	1	Forced Air Furnace		133.00		0.8 AFUE	TRANE	GDNC017EFC20 00CDKLAS	B	13	Yes	1	Forced Air Furnace		133.00		0.97 AFUE	0.0	0	52	$490	$4,300	$500	7.7
RAS - Mechanical 2	Recirculation Building Building - Mechanical Room	1	Forced Air Furnace		200.00		0.8 AFUE	Carrier	46WD250129	B	13	Yes	1	Forced Air Furnace		200.00		0.97 AFUE	0.0	0	79	$737	$6,000	$500	7.5

Space Heating Boiler Inventory & Recommendations

		Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Digester Building - Mechanical 2	Digester Tanks	1	Non-Condensing Hot Water Boiler	753	Weil-McLain	780	W		No						0.0	0	0	$0	$0	$0	0.0
Main Building - Mechanical 1	Main Building	2	Non-Condensing Hot Water Boiler	474	HydroTherm	MR - 600B - PV	B	12	Yes	2	Non-Condensing Hot Water Boiler	474	85.00%	Et	0.0	0	169	$1,584	$39,900	$1,700	24.1
Old Control Buidling - Mechanical 1	Old Control Buidling	1	Non-Condensing Hot Water Boiler	140	Utica Boilers	MGB175HID	B	12	Yes	1	Non-Condensing Hot Water Boiler	140	85.00%	AFUE	0.0	0	21	$193	$10,200	$400	50.9

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Main Building - Mechanical 1	Main Building	1	Storage Tank Water Heater (≤ 50 Gal)	Fury	RHLN0310437306	W		No						0.0	0	0	$0	$0	$0	0.0
Ozone Pump Station - Mechanical 2	Ozone Pump Station	1	Storage Tank Water Heater (≤ 50 Gal)	A.O. SMITH	ELJF-20	B		No						0.0	0	0	$0	$0	$0	0.0

Plug Load Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Digester Building - Mechanical 1	2	Fan (Large)	240	No	Dayton	2MA12B
Main Control Building - Electrical 1	1	Coffee Machine	1,575	No	BUNN	VPR, BLK
Main Control Building - Office	14	Desktop	250	No	Varied	Varied
Main Control Building	4	Portable Fan	80	No	Varied	Varied
Main Control Building - Electrical 1	1	Microwave	1,500	No	NA	NA
Main Control Building - Lab	1	Mechanical Convection Laboratory Incubators	225	No	Thermo Scientific	3511
Main Control Building - Server Room	5	Servers	1,500	No	Varied	Varied
Main Control Building - Lab	1	Lab Equipment	3,420	No	Varied	Varied
Main Control Building - Workshop 2 Basement	1	Washer/Dryer	2,500	No	Varied	Varied
Main Control Building - Office	2	Printers (Medium/Small)	150	No	Varied	Varied
Main Control Building - Office	1	Printer/Copier (Large)	1,500	No	Sharp	MX-M3571
Main Control Building - Workshop ATP Building	1	Refrigerator (Large)	300	No	Fisher Scientific	13-986-151B
Main Control Building	2	Refrigerator (Mini)	126	No	Varied	Varied
Main Control Building - Electrical 1	1	Refrigerator (Residential)	250	No	NA	NA
Main Control Building	2	Television	100	No	Varied	Varied
Main Control Building - Electrical 1	1	Toaster Oven	1,500	No	NA	NA
Main Control Building - Corridor 2	1	Water Fountain	150	No	ELKAY	LZS8WSLK
Old Control Building	1	Gas pump & Pay station	200	No	Gasboy/Pertro Vend	Atlas M/200
RAS	1	Miscellaneous Tools	150	No	Varied	Varied

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Main Building	1	Refrigerated	14	Yes	0.2	1,612	0	$197	$270	$50	1.1

Custom (High Level) Measure Analysis

Electric Tank Water Heater to HPWH

NOTE: HPWH calculation should not be used for existing water heaters with a storage capacity greater than 120 gal or less than 30 gal.

Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis										
Description	Area(s)/System(s) Served	SF of Area Served	Fuel Type	Input Capacity per Unit (kW)	Tank Capacity per Unit (Gal)	Description	COP	Tank Capacity per Unit (Gal)	Estimated Unit Cost	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Base Incentives	Enhanced Incentives	Total Incentives	Total Net Cost	Payback w/o Incentives in Years	Payback w/ Incentives in Years
Storage Tank Water Heater (≤50 Gal)	Ozone Pump Station	2,000	Electric	2.5	20	Heat Pump Water Heater	2.5	20	$2,091.00	0.00	809	0	$99	$2,500	$0	$0	$0	$2,500	25.25	25.25
			Electric																	
			Electric																	

APPENDIX B: ENERGY STAR STATEMENT OF ENERGY PERFORMANCE

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

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ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Waste Water Treatment Plant (Campus)

Primary Property Type: Wastewater Treatment Plant
Gross Floor Area (ft²): 19,588
Built: 1928

For Year Ending: September 30, 2023
Date Generated: July 18, 2024

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

Property & Contact Information

Property Address
Waste Water Treatment Plant (Campus)
10 Commerce Court
Verona, New Jersey 07044

Property Owner
Verona Township
600 Bloomfield Avenue
Verona, NJ 07044
(973) 239-4921

Primary Contact
Kevin O'Sullivan
600 Bloomfield Avenue
Verona, NJ 07044
(973) 239-4921
kosullivan@veronanj.org

Property ID: 33524127

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
609.5 kBtu/ft²

Source EUI
1,166.1 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	6,050,870 (51%)
Electric - Grid (kBtu)	5,888,483 (49%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	381.4
National Median Source EUI (kBtu/ft²)	729.7
% Diff from National Median Source EUI	60%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	850

Signature & Stamp of Verifying Professional

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

LP Signature: ______________________Date: ___________

Licensed Professional

____ ________
,
(___)____-______
____

Professional Engineer or Registered Architect Stamp (if applicable)

APPENDIX C: GLOSSARY

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

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

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