Local Government Energy Audit Report

Butterworth Sewer Treatment Plant

January 20, 2022

Prepared for:
Township of Morris
48 Lake Valley Road
Morris Township, New Jersey 07960

Prepared by:
TRC
317 George Street
New Brunswick, NJ 08901

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 of 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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ENERGY EFFICIENCY INCENTIVE & REBATE TRANSITION

For the purposes of your LGEA, estimated incentives and rebates are included as placeholders for planning purposes. New Jersey utilities are rolling out their own energy efficiency programs, which your project may be eligible for depending on individual measures, quantities, and size of the building.

In 2018, Governor Murphy signed into law the landmark legislation known as the Clean Energy Act. The law called for a significant overhaul of New Jersey's clean energy systems by building sustainable infrastructure in order to fight climate change and reduce carbon emissions, which will in turn create well-paying local jobs, grow the state's economy, and improve public health while ensuring a cleaner environment for current and future residents.

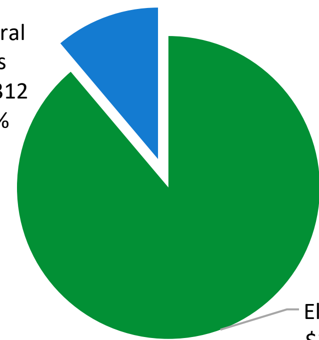
These next generation energy efficiency programs feature new ways of managing and delivering programs historically administered by New Jersey's Clean Energy Program™ (NJCEP). All of the investor-owned gas and electric utility companies will now also offer complementary energy efficiency programs and incentives directly to customers like you. NJCEP will still offer programs for new construction, renewable energy, the Energy Savings Improvement Program (ESIP), and large energy users.

New utility programs are under development. Keep up to date with developments by visiting the NJCEP website.

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Butterworth Sewer 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 Utilities	Costs: $253,729 Electricity: 2,118,436 kWh Natural Gas: 36,285 Therms	
ENERGY STAR® Benchmarking Score	11 *(1-100 scale)*	This plant performs below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

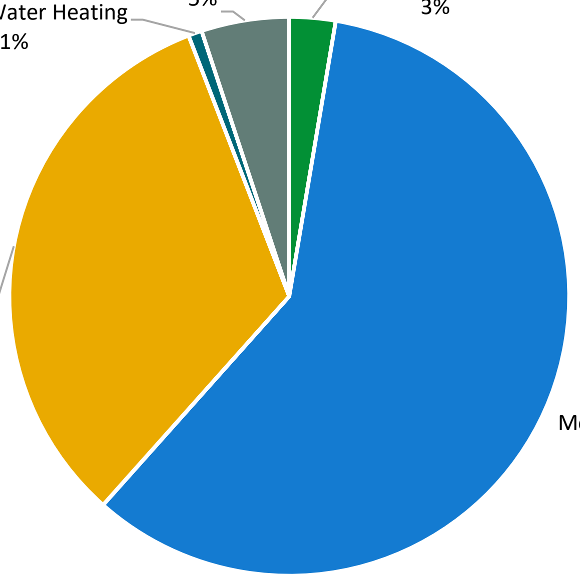


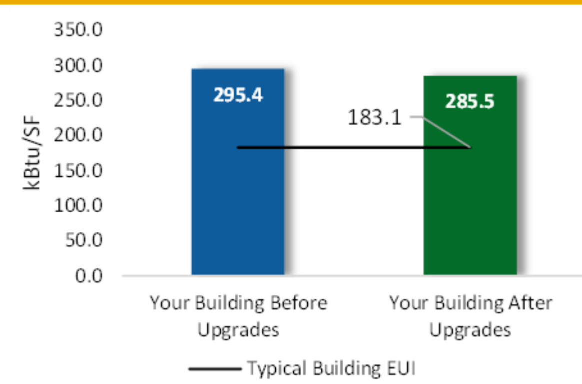
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

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

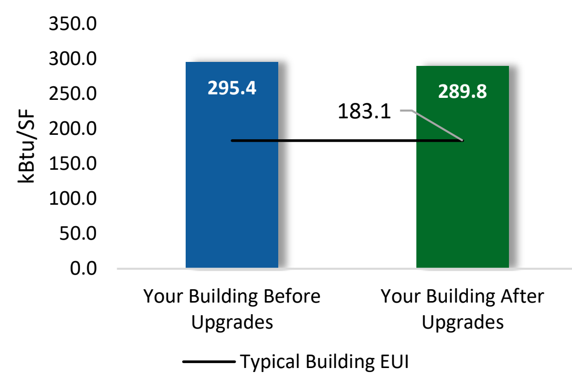
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$236,211
Potential Rebates & Incentives[1]	$9,104
Annual Cost Savings	$11,105
Annual Energy Savings	Electricity: 103,491 kWh Natural Gas: 119 Therms
Greenhouse Gas Emission Savings	53 Tons
Simple Payback	20.5 Years
Site Energy Savings (All Utilities)	3%



Scenario 2: Cost Effective Package[2]

Installation Cost	$56,180
Potential Rebates & Incentives	$7,804
Annual Cost Savings	$6,623
Annual Energy Savings	Electricity: 62,869 kWh Natural Gas: -85 Therms
Greenhouse Gas Emission Savings	31 Tons
Simple Payback	7.3 Years
Site Energy Savings (all utilities)	2%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	None

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

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**57,244**	**9.1**	**-10**	**$6,013**	**$47,467**	**$5,734**	**$41,733**	**6.9**	**56,476**
ECM 1	Install LED Fixtures	Yes	28,620	2.7	-3	$3,019	$36,200	$3,500	$32,700	10.8	28,420
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	18,146	3.6	-4	$1,898	$6,277	$930	$5,347	2.8	17,785
ECM 3	Retrofit Fixtures with LED Lamps	Yes	10,477	2.8	-2	$1,096	$4,989	$1,304	$3,685	3.4	10,271
Lighting Control Measures			**5,625**	**1.2**	**-1**	**$588**	**$8,673**	**$2,050**	**$6,623**	**11.3**	**5,513**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	5,072	1.0	-1	$531	$7,098	$1,140	$5,958	11.2	4,971
ECM 5	Install High/Low Lighting Controls	Yes	553	0.2	0	$58	$1,575	$910	$665	11.5	542
Motor Upgrades			**20,005**	**5.5**	**0**	**$2,129**	**$78,669**	**$0**	**$78,669**	**37.0**	**20,145**
ECM 6	Premium Efficiency Motors	No	20,005	5.5	0	$2,129	$78,669	$0	$78,669	37.0	20,145
Variable Frequency Drive (VFD) Measures			**20,617**	**90.6**	**0**	**$2,194**	**$85,705**	**$300**	**$85,405**	**38.9**	**20,761**
ECM 7	Install VFDs on Constant Volume (CV) Fans	No	3,096	1.5	0	$329	$7,145	$300	$6,845	20.8	3,117
ECM 8	Install VFDs on Process Blowers	No	17,521	89.1	0	$1,864	$78,560	$0	$78,560	42.1	17,643
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**20**	**$159**	**$15,657**	**$1,000**	**$14,657**	**92.2**	**2,384**
ECM 9	Install High Efficiency Unit Heaters	No	0	0.0	4	$35	$5,026	$0	$5,026	145.4	519
ECM 10	Install Infrared Heaters	No	0	0.0	16	$124	$10,631	$1,000	$9,631	77.5	1,866
HVAC System Improvements			**0**	**0.0**	**1**	**$7**	**$12**	**$4**	**$8**	**1.1**	**103**
ECM 11	Install Pipe Insulation	Yes	0	0.0	1	$7	$12	$4	$8	1.1	103
Domestic Water Heating Upgrade			**0**	**0.0**	**2**	**$15**	**$29**	**$16**	**$13**	**0.9**	**222**
ECM 12	Install Low-Flow DHW Devices	Yes	0	0.0	2	$15	$29	$16	$13	0.9	222
TOTALS (COST EFFECTIVE MEASURES)			**62,869**	**10.3**	**-8**	**$6,623**	**$56,180**	**$7,804**	**$48,376**	**7.3**	**62,313**
TOTALS (ALL MEASURES)			**103,491**	**106.4**	**12**	**$11,105**	**$236,211**	**$9,104**	**$227,107**	**20.5**	**105,604**

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

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

Figure 2 – Evaluated Energy Improvements

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

1.1 Planning Your Project

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

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

Pick Your Installation Approach

Utility-run energy efficiency programs, such as 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.

For details on these programs please visit New Jersey's Clean Energy Program website or contact your utility provider.

Options from Around the State

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

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

Resiliency with Return on Investment through Combined Heat 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 designed to promote self-investment in energy efficiency and combined heat and power or fuel cell projects. It 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.

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Butterworth Sewer 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 August 31, 2021, TRC performed an energy audit at Butterworth Sewer Treatment Plant located in Morris Township, New Jersey. TRC met with Mark Howarth to review the facility operations and help focus our investigation on specific energy-using systems.

Butterworth Sewer Treatment Plant, located at 48 Lake Valley Road, is one of the two sewer treatment plants serving the Township of Morris. The plant was constructed in 1975 with a design capacity of 3.3 million gallon per day (MGD). Treatment processes consist of primary sedimentation, activated sludge, secondary clarifiers, and ultraviolet disinfection for the final effluent. Residual (sludge) treatment is accomplished by gravity thickening of primary sludge and gravity belt thickening for waste activated sludge, followed by anaerobic digestion. Sludge is transported by trucks to a Newark dewatering facility, where it is prepared for ultimate disposal.

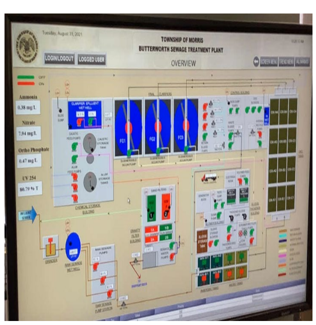
The plant is composed of several buildings including the Main Office and Sand Filter Building, Large Garage, Alum (or Chemical Feed) Building, Control Building, Raw Pump Building, Sludge and Blower Building, and Thickener and Generator Building, totaling approximately 36,750 square feet of enclosed area. The plant has a diesel emergency backup power generator. Diesel is only used for auxiliary power; therefore, diesel consumption is not tracked as a part of this study.

Recent improvements and Facility Concerns

The Township has just replaced all the rooftop gas-fired force air furnaces and exhaust air fans.

Facility concerns include aging and rebuilt pumps and motors, which are beyond their useful life and are in poor condition. Additionally, the Township has expressed interest in replacing the lighting systems with LED sources.

The following plant diagram provides an overview of the plant layout and operations.



Butterworth Sewer Treatment Plant Diagram

Butterworth Sewer Treatment Plant Aerial View

2.2 Building Occupancy

Butterworth Sewer Treatment plant operates continuously. The main offices' building houses offices that are open Monday through Friday during business hours. During a typical day, the facility is occupied by approximately ten staff. Process areas are intermittently occupied, primarily for inspection and maintenance.

Building Name	Weekday/Weekend	Operating Schedule
Butterworth Sewer Treatment Plant - Process Equipment	Weekday	12:00 AM -12:00 AM
	Weekend	12:00 AM -12:00 AM
Main Offices	Weekday	7:00 AM - 4:00 PM
	Weekend	Closed

Figure 3 - Building Occupancy Schedule

2.3 Building Envelope

Butterworth Sewer Treatment Plant is comprised of several buildings constructed of poured concrete and concrete masonry brick units (CMUs) with brick veneer facades. The building walls are in good condition. Most buildings have flat roof sections supported with steel trusses and reinforced concrete deck with coverings of white or black membranes and are in good condition. The large garage building has CMU walls and a gable roof covered with asphalt shingles that are in good condition.

The windows are double glazed and have metal frames with thermal break. The glass-to-frame seals are in good condition. The main offices entrance doors are glass with aluminum frames. Exterior doors have metal frames and are also in good condition.


Main Office Building


Main Office Building


Alum Building Façade


Alum Building Exterior Door


Large Garage Building


Large Garage Building Window

Roof

Roof

Roof

2.4 Lighting Systems

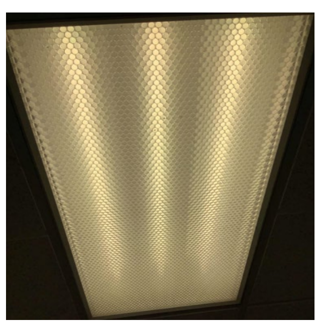
The primary interior lighting systems use both 32-Watt linear fluorescent T8 and 40-Watt fluorescent T12 lamps. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts. There are also several high-pressure sodium (HPS) fixtures in the main building lab areas. A few LED general purpose, compact fluorescent lamps (CFL), and incandescent lamps were noted in service spaces throughout.

Fluorescent fixture types include 2-lamp, 3-lamp, or 4-lamp, 4-foot or 8-foot-long troffer, recessed, or surface mounted fixtures, and 2-foot fixtures with U-bend tube lamps. The sand filter room of the main office building, laboratory of the Alum building, stairway #2, and restroom of the control building, large garage bays, office and storage room, small storage in the garage building, locker room, sludge pumps room, and laboratory of the thickener and generator building have spaces that are primarily lit with linear fluorescent T12 fixtures. The main offices and corridor, elevator lobby, stairway #1, conference room, day lab, and restrooms of the main office building are lit with linear fluorescent T8s, which also light the blower room, electrical room, and water control center of the control building, garage, raw pump building, and the stairs of the generator building. The sand filter room and UV room are lit with HPS lamps.

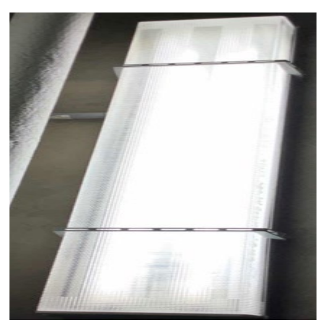
Most fixtures are in good condition, and interior lighting levels were generally sufficient. Exit signs are LED sources. Lighting fixtures in the main office building are controlled by both occupancy sensors and manual wall switches. Lighting fixtures in other building's spaces are controlled by manual wall switches. Lights were observed to be operating in some of process areas while unoccupied. Many of these fixtures would appear to be left operating out of safety concerns.

Exterior fixtures include wall packs, pole mounted with high intensity discharge (HID), and some LED lamps. Most exterior fixtures are controlled via manual wall switches, and only a few are controlled by photocells.

Linear Fluorescent Fixtures



Linear Fluorescent Fixtures



Linear Fluorescent Fixtures


Exterior LED Fixture


HID Wall Mounted Fixture


Linear T8 (8-Foot)


Linear T8 (8-Foot)


T12 (4-Foot)

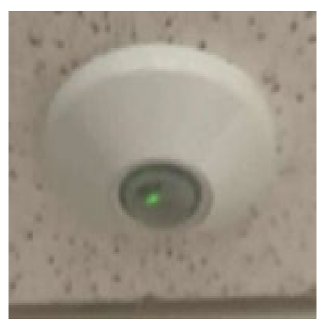

U-Bend


Exterior Wall Fixture


Recessed Fixture


Pole Mounted Fixture

LED Exit Sign


Ceiling Mounted Occupancy Sensor

2.5 Air Handling Systems

Unitary Electric HVAC Equipment

The large garage office is cooled by a newer 1-ton window air conditioning (AC) unit that is controlled by a manual thermostat.

Window AC

Unitary Heating Equipment

Areas heated by suspended gas fired unit heaters and controlled by a room thermostat are listed below:

Building	Areas Served	Qty	Capacity (MBh)	Manufacturer	Condition
Control Building	Blower Room	1	160	Reznor	New
Control Building	Electrical Room	1	60	Reznor	New
Control Building	Control Room	1	160	Reznor	New
Large Garage	Corridor	1	60	Nodine	Fair
Large Garage	Garage	2	80	Nodine	Fair
Sludge, Blower	Mechanical Room	1	20	Reznor	Fair
Thickener & Generator	Laboratory Room	1	50	Reznor	Good
	Polymer Control Room	1	60	Reznor	Fair
	Polymer Control Room	1	32	Reznor	Fair
	Locker Room	1	50	Reznor	Good

Supplemental heat is provided by electric resistance heaters, controlled by local thermostats as listed:

Building	Areas Served	Qty	Capacity (kW)	Condition
Main Offices	Corr. 3rd Flr. Waiting	1	4	Good
Main Offices	1st Flr. Elevator Lobby	1	4	Good
Main Offices	Stairs	2	6	Good
Main Offices	Restroom, M	1	6	Good
Alum /Chem Feed	Alum /Chem Feed	2	10	New
Control Building	Stairs	2	5	New
Large Garage	Storage	1	5	New

Garage Bay Modine Unit Heater

Garage Bay Modine Unit Heater Control


Typical Reznor Unit Heater

Typical Reznor Unit Heater


Electric Resistance Heater


Electric Resistance Heater


Electric Resistance Heater Control

Packaged Units

Two Lennox rooftop packaged units provide heating and cooling for the second-floor spaces of the main office building, controlled by programmable thermostats. These units have efficiency ratings of 12. 5 EER and 12 EER, respectively, and they are ten years old and in good condition. They are equipped with functional economizers.

A major heating equipment upgrade has been recently completed at the plant. This consists of the installation of six new Reznor roof mounted force air furnaces in various buildings throughout the plant. The units have an efficiency of 80% with heating capacity that range in size from 180 MBh to 1000 MBh. They are controlled by programmable thermostats.

Refer to the table below for additional information about these units.

Unit ID	Location	Areas Served	Cooling Capacity (Ton)	Heating Capacity (MBh)	Condition
N/A	Roof: Main Offices	2nd Floor Office	7.5	192	Good
N/A	Roof: Main Offices	2nd Floor Offices	10	192	Good
RTU-3	Roof: Control Building	Mechanical Equipment Room	N/A	320	New
RTU-4	Roof: Sludge & Blower Bldg	Belt Thickener Pump Room	N/A	640	New
RTU-5	Roof: Sludge & Blower Bldg	Pump Room	N/A	180	New
RTU-6	Roof: Alum Bldg	Alum Building	N/A	640	New
RTU-7	Main Offices	Filtration: UV Room	N/A	1000	New
RTU-8	Main Offices	Sand Filter Room	N/A	1000	New


Lennox RTU

Lennox RTU


Reznor Furnace


Reznor Furnaces


Thermostat


Thermostat

2.6 General Exhaust Air System

Air is exhausted from process areas via roof mounted exhaust fans and a fume hood with motors ranging in size from 0.1 hp to 3 hp. The fume hood serves the laboratory. The exhaust fans were part of the major heating equipment upgrade and are in good condition. They are controlled via manual switches.


Exhaust Fans


Exhaust Fans

2.7 Domestic Hot Water

Hot water is produced in the main office building by a 48-gallon, 65 MBh gas-fired storage water heater. Hot water for the large garage is produced with a 40-gallon, 38 MBh gas-fired storage water heater. Both heaters are made by Rheem and have efficiency ratings of 80%. They are in good condition. The control building has a 1.5 kW tankless water heater.

Some piping associated with the 48-gallon water heater is not insulated.


Storage Tank Water Heater


Storage Tank Water Heater

2.8 Plug Load and Vending Machines

Most of the plant plug load equipment is in the main office building and large garage. There are 10 computer workstations throughout the plant. Plug loads also include printers, copier, microwaves, toasters, fish tanks, a washing machine, and small, residential, and laboratory refrigerators. The main office building has UV lamps used for water treatment. The dining room area of the main office has a refrigerated vending machine without a control system.


Residential Refrigerator


Lab Refrigerator


Copier


Vending Machine

2.9 Water-Using Systems

There are restrooms in the main office and large garage with toilets, urinals, and sinks. Faucet flow rates are at 2.2 gallons per minute (gpm) or higher. Toilets are rated at 2.5 gallons per flush (gpf) and urinals are rated at 2.5 gpf.

Both buildings have a shower room with showerhead rated as low flow.


Sink


Sink

2.10 Process Equipment (Blowers, Motors, Pumps)

Motors account for approximately 87% of the calculated electrical energy use. Virtually all the motor load is associated with the treatment process. The primary process loads are outlined below.

The control building houses three, 150 hp blowers. The main blower (#2) is a positive displacement blower, and the motor is equipped with a variable speed drive. The other two blowers (#1 and #3) are backup blowers and used only when maintaining the main positive displacement blower. The blowers are typically used to provide aeration in activated sludge and to promote aerobic digestion. The blowers supply air to the aeration tanks, providing oxygen needed for metabolizing organic compounds in the tanks. The diffusers use tiny bubbles of air to efficiently dissolve oxygen into the tanks. The motors are in good condition.

The belt room of the sludge and blower building houses two positive displacement 30 hp sludge storage blowers. They are used for anaerobic digestion and run in a weekly lead/lag fashion with one running continuously. They appear in fair condition and have been evaluated for replacement.

Additionally, the belt room houses various pumps including two, 20 hp thickener feed pumps (P1 and P2), and two, 3 hp constant speed scum storage tank pumps. The thickener feed pump P1 is equipped with variable speed drive and is used only for heavy sludge backup, while P2 runs continuously. Each of the scum storage tank pump runs approximately 16 hours a week. The thickener feed pump motor P1 and scum storage tank pump motor P1 are in poor condition and have been evaluated for replacement.

The raw pump building houses three, 40 hp variable flow raw water pumps (P1, P2 and P3). The pumps are 28 years old and have been rebuilt according to the facility personnel. It was revealed that the facility is planning to decommission the raw pump building and build a new pump house. The pump motors have been evaluated for replacement.

The control building houses two, 60 hp internal recycling pumps (P1 and P2), two, 20 hp waste sludge pumps (P1 and P2), and four, 20 hp return sludge pumps (P1, P2, P3, and P4). The internal recycling pumps run in a lead/lag fashion, while only one of the waste sludge pumps runs ten minutes every hour. The return sludge pumps also run in a lead/lad fashion with P4 being used as a backup pump. The pump motors are equipped with variable speed drives, appear in poor condition, and have been evaluated for replacement.

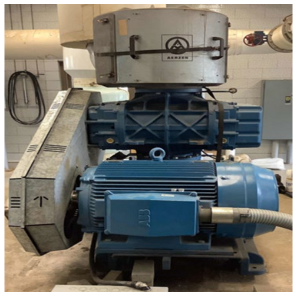
There are various process pumps located in the thickener and generator building. These include two, 15 hp thickened sludge pumps, one, 10 hp backup thickened sludge pump, and two, 5 hp scrubber recirculation pumps (P1 and P2). They run in a lead/lag fashion at constant speed. The pump motors appear in fair condition and have been evaluated for replacement. Additionally, the building houses two belt thickeners each equipped with a 3 hp constant speed pump, two, 1 hp variable speed polymer feed pumps (P1 and P2), and one, 1.5 hp constant pump mixing pump. Gravity belt thickeners are used for sludge volume reduction prior to digestion and dewatering. Polymers are used to coagulate suspended solids and produce large curds of solid materials.

The plant has eight anaerobic tanks with four tanks equipped each with an 8.3 hp submersible mixing pump. There are four, 3 hp constant speed sewer ejector pumps. Two are in the control building, and the other two are in the thickener and generator building. There are also two, 75 hp variable speed clarifier effluent pumps (P1 and P2) that run in a lead/lag fashion and are in good condition.

The UV room has two, 25 hp water wash pump motors (P1 and P2) that appear to be in fair condition and have been evaluated for replacement. There are three clarifier tanks each equipped with a 0.8 hp clarifier drive that runs continuously, and they are in good condition.

Other than upgrades to existing motors, we did not review or recommend potential process improvements. Please see general guidelines at the end of Section 4. We recommend that process adjustments and control strategies be evaluated by those with specialized wastewater experience.

150 hp Aeration Blowers (Positive Displacement Blower #2)



150 hp Aeration Blowers (Positive Displacement Blower #2)

Anaerobic Sludge Storage Blowers

Anaerobic Sludge Storage Blowers

Belt Thickener Pump #1

Belt Thickener Pump #1

SCUM Storage Pump

SCUM Storage Pump

Internal Recycling Pumps

Internal Recycling Pumps

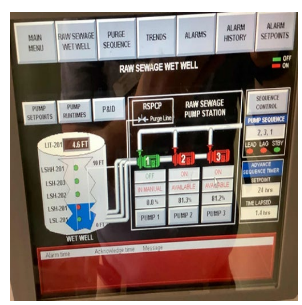
Return and Waste Sludge Pumps

VFD

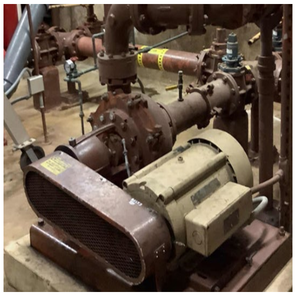
Raw Sewage Pumps

Raw Sewage Pumps

Raw Sewage Pumps

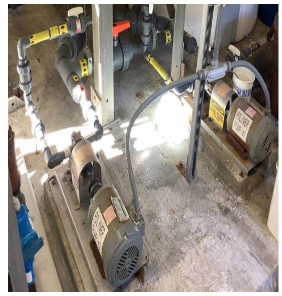


Raw Sewage Pumps

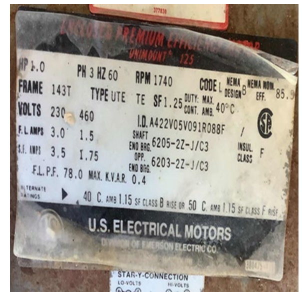


Thickener Sludge Pumps

Thickener Sludge Pumps



Polymer Pumps



Polymer Pumps

Thickener Belts

Thickener Belts

Water Wash Pumps

Water Wash Pumps

Clarifier Effluent Pumps

Clarifier Effluent Pumps

Sewage Pumps

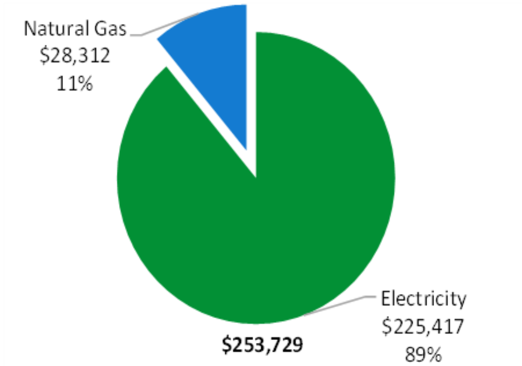
Sewage Pumps

Scrubber Recirculation Pumps & Exhaust Air Fans

3 ENERGY USE AND COSTS

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

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	2,118,436 kWh	$225,417
Natural Gas	36,285 Therms	$28,312
Total		**$253,729**



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

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

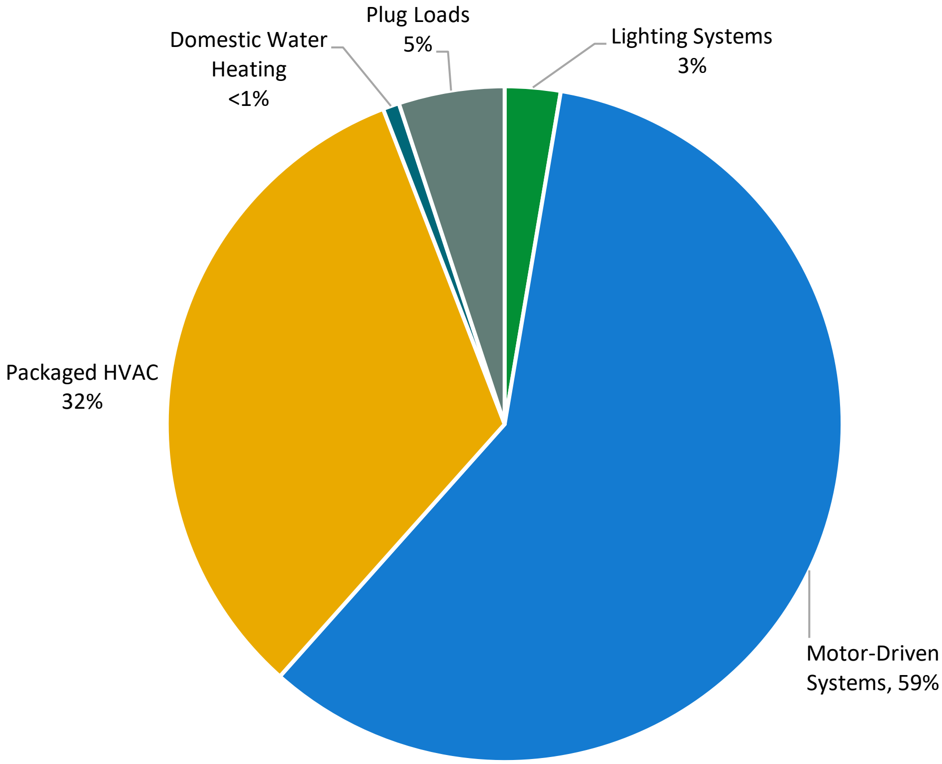
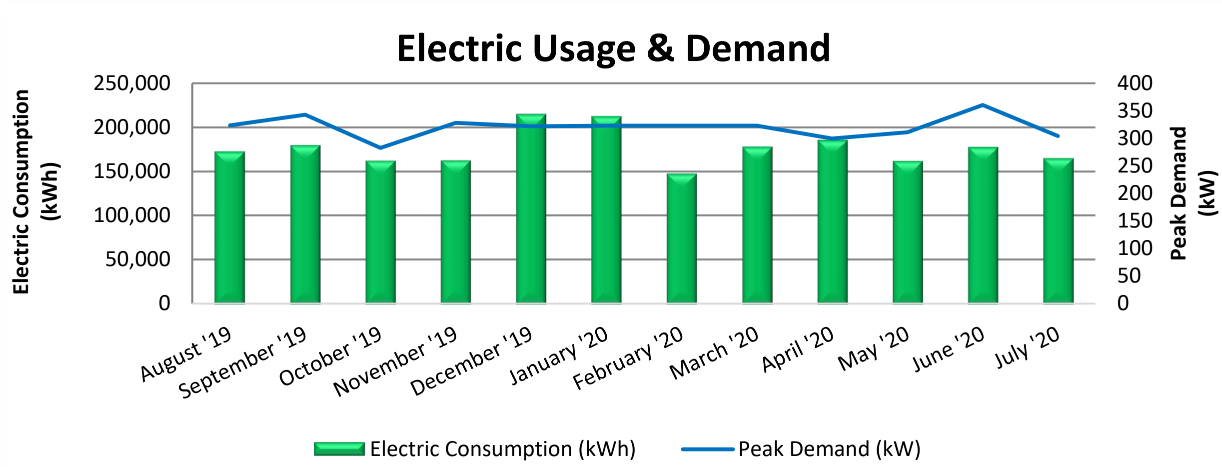


Figure 4 - Energy Balance

3.1 Electricity

JCP&L delivers electricity under rate class General Service Secondary.



Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**
8/20/19	31	172,880	323	$13,031	$19,017
9/18/19	29	180,160	343	$13,339	$19,764
10/19/19	31	162,560	283	$12,036	$17,529
11/18/19	30	163,040	328	$12,071	$17,876
12/19/19	31	215,040	322	$15,921	$22,476
1/20/20	32	212,800	323	$15,755	$21,915
2/18/20	29	148,000	323	$10,958	$15,814
3/19/20	30	178,080	323	$13,185	$18,646
4/20/20	32	185,920	300	$13,765	$19,250
5/19/20	29	162,400	311	$12,024	$17,120
6/19/20	31	177,760	360	$13,163	$19,061
7/20/20	31	165,600	304	$12,264	$17,568
Totals	**366**	**2,124,240**	**360**	**$157,511**	**$226,035**
Annual	**365**	**2,118,436**	**360**	**$157,080**	**$225,417**

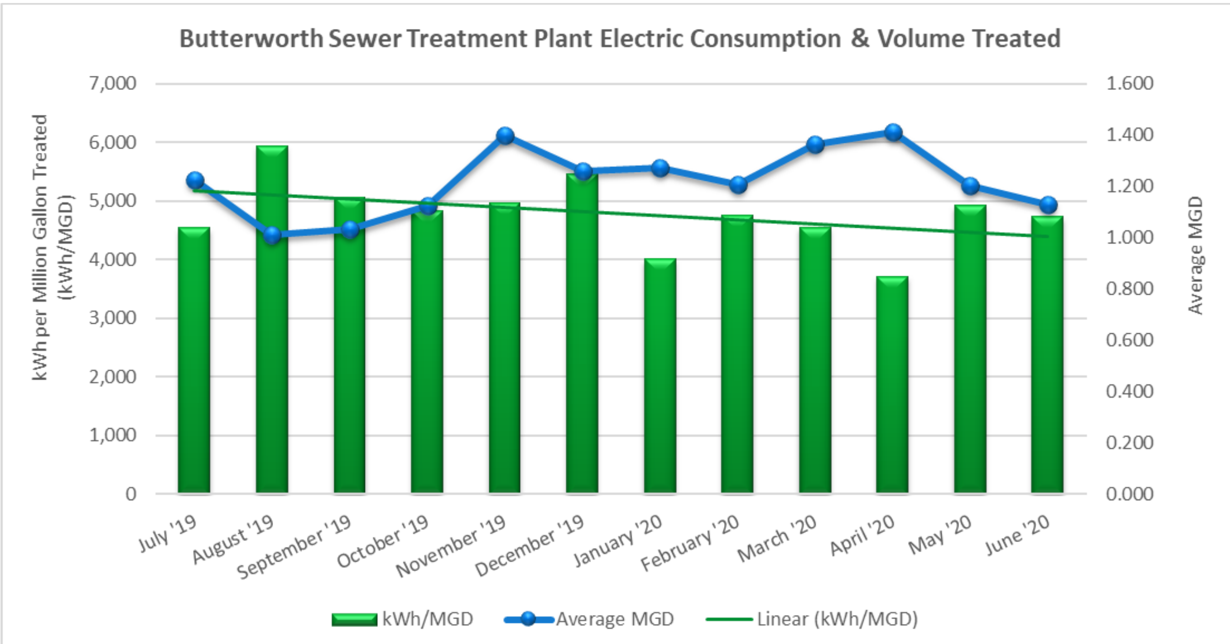
Notes:

- Peak demand of 360 kW occurred in June 2020.
- Average demand over the past 12 months was 320 kW.
- The average electric cost over the past 12 months was $0.106/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.

Electric Consumption vs. Volume Treated:

Wastewater treatment plant operators maintain records of daily volumes of treated wastewater flow, measured in terms of MGD. One way to measure energy efficiency in wastewater plants is to compare the amount of treated water, in MGD, with the amount of energy required for that treatment.

We drew a comparison for your site based on the utility bills and on production records supplied by plant operators. The solid line (blue) corresponds to the average treated monthly flow (Volume Treated). The bar graph (green) represents the amount of electricity used in a given month to process the flow.

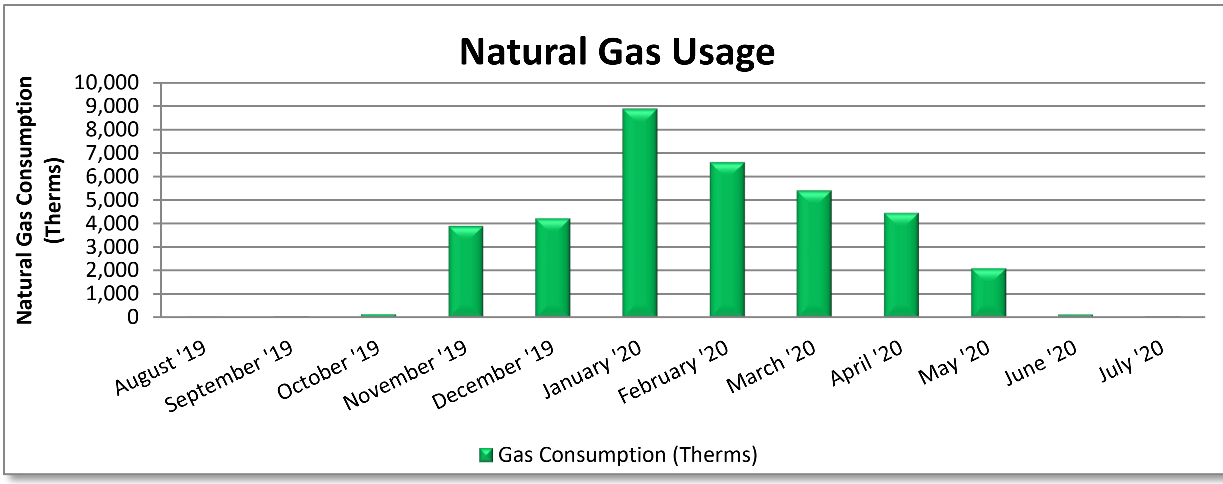


We reviewed the historical MGD data and electrical consumption and noted that "kWh per Million Gallons" stayed relatively constant throughout the year, averaging approximately 4,800 kWh/MGD. We noted a slight downward trend during the period data despite some variance in both volume and electric consumption. This trend may be a result of adjustments in the plant operations or due to equipment upgrades which have been implemented over the past year.

It is recommended that plant operations be reviewed in a systematic way. Further details are provided at the end of Section 4.

3.2 Natural Gas

PSE&G delivers natural gas under rate class Large Volume Gas.



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
8/19/19	27	47	$162
9/19/19	31	65	$172
10/17/19	28	162	$236
11/15/19	29	3,903	$3,676
12/18/19	33	4,223	$2,948
1/21/20	34	8,878	$6,919
2/19/20	29	6,613	$5,222
3/20/20	30	5,408	$4,413
4/21/20	32	4,471	$2,732
5/19/20	28	2,105	$1,286
6/18/20	30	149	$216
7/20/20	32	64	$174
Totals	**363**	**36,086**	**$28,157**
Annual	**365**	**36,285**	**$28,312**

Notes:

- The average gas cost for the past 12 months is $0.780/therm, which is the blended rate used throughout the analysis.
- Gas use is mainly for space heating with a small amount used to provide domestic hot water.

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**

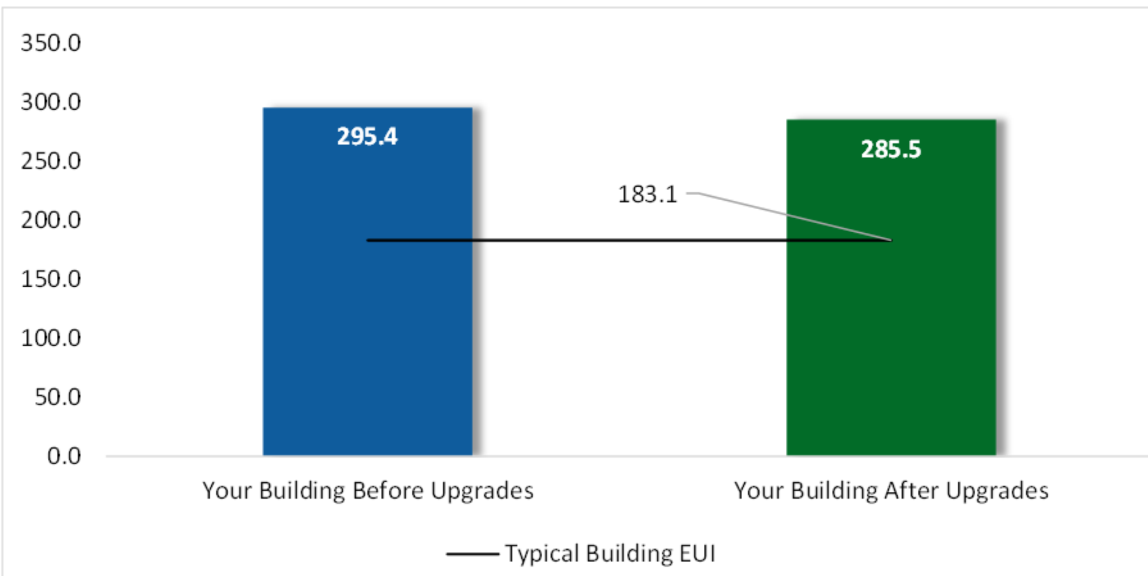


Figure 5 - Energy Use Intensity Comparison[3]

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). This facility was benchmarked by comparison to other wastewater treatment plants, and performs at, or below the national average.

[3] Based on all evaluated ECMs

Tracking Your Energy Performance

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

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

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

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

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 are based on previously run state rebate programs. New utility programs are expected to start rolling out in the spring and summer of 2021. Keep up to date with developments by visiting the NJCEP website. Some measures and proposed upgrades may be eligible for higher incentives than those shown below.

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			**57,244**	**9.1**	**-10**	**$6,013**	**$47,467**	**$5,734**	**$41,733**	**6.9**	**56,476**
ECM 1	Install LED Fixtures	Yes	28,620	2.7	-3	$3,019	$36,200	$3,500	$32,700	10.8	28,420
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	18,146	3.6	-4	$1,898	$6,277	$930	$5,347	2.8	17,785
ECM 3	Retrofit Fixtures with LED Lamps	Yes	10,477	2.8	-2	$1,096	$4,989	$1,304	$3,685	3.4	10,271
Lighting Control Measures			**5,625**	**1.2**	**-1**	**$588**	**$8,673**	**$2,050**	**$6,623**	**11.3**	**5,513**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	5,072	1.0	-1	$531	$7,098	$1,140	$5,958	11.2	4,971
ECM 5	Install High/Low Lighting Controls	Yes	553	0.2	0	$58	$1,575	$910	$665	11.5	542
Motor Upgrades			**20,005**	**5.5**	**0**	**$2,129**	**$78,669**	**$0**	**$78,669**	**37.0**	**20,145**
ECM 6	Premium Efficiency Motors	No	20,005	5.5	0	$2,129	$78,669	$0	$78,669	37.0	20,145
Variable Frequency Drive (VFD) Measures			**20,617**	**90.6**	**0**	**$2,194**	**$85,705**	**$300**	**$85,405**	**38.9**	**20,761**
ECM 7	Install VFDs on Constant Volume (CV) Fans	No	3,096	1.5	0	$329	$7,145	$300	$6,845	20.8	3,117
ECM 8	Install VFDs on Process Blowers	No	17,521	89.1	0	$1,864	$78,560	$0	$78,560	42.1	17,643
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**20**	**$159**	**$15,657**	**$1,000**	**$14,657**	**92.2**	**2,384**
ECM 9	Install High Efficiency Unit Heaters	No	0	0.0	4	$35	$5,026	$0	$5,026	145.4	519
ECM 10	Install Infrared Heaters	No	0	0.0	16	$124	$10,631	$1,000	$9,631	77.5	1,866
HVAC System Improvements			**0**	**0.0**	**1**	**$7**	**$12**	**$4**	**$8**	**1.1**	**103**
ECM 11	Install Pipe Insulation	Yes	0	0.0	1	$7	$12	$4	$8	1.1	103
Domestic Water Heating Upgrade			**0**	**0.0**	**2**	**$15**	**$29**	**$16**	**$13**	**0.9**	**222**
ECM 12	Install Low-Flow DHW Devices	Yes	0	0.0	2	$15	$29	$16	$13	0.9	222
TOTALS			**103,491**	**106.4**	**12**	**$11,105**	**$236,211**	**$9,104**	**$227,107**	**20.5**	**105,604**

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

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

Figure 6 – 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		**57,244**	**9.1**	**-10**	**$6,013**	**$47,467**	**$5,734**	**$41,733**	**6.9**	**56,476**
ECM 1	Install LED Fixtures	28,620	2.7	-3	$3,019	$36,200	$3,500	$32,700	10.8	28,420
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	18,146	3.6	-4	$1,898	$6,277	$930	$5,347	2.8	17,785
ECM 3	Retrofit Fixtures with LED Lamps	10,477	2.8	-2	$1,096	$4,989	$1,304	$3,685	3.4	10,271
Lighting Control Measures		**5,625**	**1.2**	**-1**	**$588**	**$8,673**	**$2,050**	**$6,623**	**11.3**	**5,513**
ECM 4	Install Occupancy Sensor Lighting Controls	5,072	1.0	-1	$531	$7,098	$1,140	$5,958	11.2	4,971
ECM 5	Install High/Low Lighting Controls	553	0.2	0	$58	$1,575	$910	$665	11.5	542
HVAC System Improvements		**0**	**0.0**	**1**	**$7**	**$12**	**$4**	**$8**	**1.1**	**103**
ECM 11	Install Pipe Insulation	0	0.0	1	$7	$12	$4	$8	1.1	103
Domestic Water Heating Upgrade		**0**	**0.0**	**2**	**$15**	**$29**	**$16**	**$13**	**0.9**	**222**
ECM 12	Install Low-Flow DHW Devices	0	0.0	2	$15	$29	$16	$13	0.9	222
TOTALS		**62,869**	**10.3**	**-8**	**$6,623**	**$56,180**	**$7,804**	**$48,376**	**7.3**	**62,313**

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

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

Figure 7 – 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		**57,244**	**9.1**	**-10**	**$6,013**	**$47,467**	**$5,734**	**$41,733**	**6.9**	**56,476**
ECM 1	Install LED Fixtures	28,620	2.7	-3	$3,019	$36,200	$3,500	$32,700	10.8	28,420
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	18,146	3.6	-4	$1,898	$6,277	$930	$5,347	2.8	17,785
ECM 3	Retrofit Fixtures with LED Lamps	10,477	2.8	-2	$1,096	$4,989	$1,304	$3,685	3.4	10,271

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 fixtures.

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

Affected building areas: Sand filter room, UV room, and 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: All areas with fluorescent fixtures with T12 tubes.

ECM 3: Retrofit Fixtures with LED Lamps

Replace fluorescent T8, CFL, and incandescent lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies. Be sure to specify replacement lamps that are compatible with existing dimming controls, where applicable. In some circumstances, you may need to upgrade your dimming system for optimum performance.

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

Affected Building Areas: All areas with fluorescent fixtures with T8 tubes, CFL in the main laboratory, and incandescent lamps in the restrooms.

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		**5,625**	**1.2**	**-1**	**$588**	**$8,673**	**$2,050**	**$6,623**	**11.3**	**5,513**
ECM 4	Install Occupancy Sensor Lighting Controls	5,072	1.0	-1	$531	$7,098	$1,140	$5,958	11.2	4,971
ECM 5	Install High/Low Lighting Controls	553	0.2	0	$58	$1,575	$910	$665	11.5	542

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: Day and main laboratories, sand filter room, garage, blower room, restroom, storage room, locker room, polymer, and mechanical rooms.

ECM 5: Install High/Low Lighting Controls

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

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

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		**20,005**	**5.5**	**0**	**$2,129**	**$78,669**	**$0**	**$78,669**	**37.0**	**20,145**
ECM 6	Premium Efficiency Motors	20,005	5.5	0	$2,129	$78,669	$0	$78,669	37.0	20,145

ECM 6: 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
UV Room	Water Wash Pump #1,2	2	Process Pump	25.0	Process Pump
Basement	Internal Recycle Pump #1,2	2	Process Pump	60.0	Process Pump
Basement	Waste Sludge Pump #1,2,	2	Process Pump	20.0	Process Pump
Basement	Return Sludge Pump #1,2,3,4	4	Process Pump	20.0	Process Pump
Workshop	Workshop - Raw Pump #1,2,2	3	Process Pump	40.0	Process Pump
Belt Room	SCUM Storage Tank Pump #1	1	Process Pump	3.0	Process Pump
Belt Room	Belt Thickener Feed Pump #1	1	Process Pump	20.0	Process Pump
Belt Room	Belt Thickener Feed Pump #2	1	Process Pump	20.0	Process Pump
Belt Room	Sludge Storage Blower Pump #1,2	2	Process Blower	30.0	Process Blower
Mechanical Room	Sewer Pumps	2	Process Pump	3.0	Process Pump
Sludge Pump Room	Thickened Sludge Pumps	2	Process Pump	15.0	Process Pump
Laboratory	Thickener Drive #1 & 2	2	Process Pump	3.0	Process Pump
Laboratory	Scrubber Exhaust Fans #1 & 2	2	Exhaust Fan	3.0	Exhaust Fan
Laboratory	Scrubber Recirculation Pumps #1 & 2	2	Process Pump	5.0	Process Pump
Polymer Room	Polymer Mixing Pump	1	Process Pump	1.5	Process Pump

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		**20,617**	**90.6**	**0**	**$2,194**	**$85,705**	**$300**	**$85,405**	**38.9**	**20,761**
ECM 7	Install VFDs on Constant Volume (CV) Fans	3,096	1.5	0	$329	$7,145	$300	$6,845	20.8	3,117
ECM 8	Install VFDs on Process Blowers	17,521	89.1	0	$1,864	$78,560	$0	$78,560	42.1	17,643

VFDs 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 7: Install VFDs on Constant Volume (CV) Fans

We evaluated Installing VFDs to control CV fan motor speeds of the Lennox roof top units (RTUs). This converts a constant-volume, single-zone air handling system into a variable-air-volume (VAV) system. A separate VFD is usually required to control the return fan motor or dedicated exhaust fan motor if the air handler has one.

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

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

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

Affected Units: two Lennox RTUs.

ECM 8: Install VFDs on Process Blowers

Install VFD to control 125 hp backup process blowers. In most cases sensors will be required to trigger adjustments to blower speed. Aeration blowers for water treatment ponds, for example, typically require dissolved oxygen sensors in order to optimize blower operation while maintaining the required oxygen level. The blower speed will have to be controlled to maintain any minimum fixed head requirement for the system. Be sure your process blower control strategy incorporates the proper sensor inputs in order to have a fully functional control system.

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

4.5 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**20**	**$159**	**$15,657**	**$1,000**	**$14,657**	**92.2**	**2,384**
ECM 8	Install High Efficiency Unit Heaters	0	0.0	4	$35	$5,026	$0	$5,026	145.4	519
ECM 9	Install Infrared Heaters	0	0.0	16	$124	$10,631	$1,000	$9,631	77.5	1,866

ECM 9: Install High Efficiency Unit Heaters

We evaluated replacing existing standard gas-fired unit heaters with high efficiency gas-fired unit heaters. Improved combustion technology and heat exchanger design optimize the heat recovery from the combustion gases, which can significantly improve unit heater efficiency. Savings result from improved system efficiency.

Affected Units: large garage corridor, mechanical room, and polymer control room.

ECM 10: Install Infrared Heaters

We evaluated replacing gas-fired unit heaters with low-intensity infrared heating units with an enclosed flame, rather than an open flame on a ceramic or metal surface.

Forced air unit heaters heat all of the air in the space served, which is inefficient for large volume spaces with relatively few occupants, areas with high ceilings, or areas with high outside air infiltration. Infrared heaters heat objects and surfaces directly, including the occupants of the space, rather than heating large volumes of air. Infrared heaters also heat the floor, which then re-radiates the heat. As a result, infrared heaters are more effective and efficient at maintaining occupant comfort at significantly lower cost for certain space types.

Affected Building Areas: large garage bays.

4.6 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**0**	**0.0**	**1**	**$7**	**$12**	**$4**	**$8**	**1.1**	**103**
ECM 10	Install Pipe Insulation	0	0.0	1	$7	$12	$4	$8	1.1	103

ECM 11: Install Pipe Insulation

Install insulation on domestic hot water system piping. Distribution system losses are dependent on system fluid temperature, the size of the distribution system, and the level of insulation of the piping. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is exposed to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Affected Systems: main office building domestic hot water piping.

4.7 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**2**	**$15**	**$29**	**$16**	**$13**	**0.9**	**222**
ECM 11	Install Low-Flow DHW Devices	0	0.0	2	$15	$29	$16	$13	0.9	222

ECM 12: Install Low-Flow DHW Devices

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

Device	Flow Rate
Faucet aerators (lavatory)	0.5 gpm

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

4.8 Wastewater Process Energy Considerations

"Electricity constitutes between 25% and 40% of a typical wastewater treatment plant's (WWTP's) operating budget,"[4] 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 & 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[5]

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 includes 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.

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

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

Example: Best Practices

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. As described above, a well-executed Energy Management Plan will lead you to the fundamental measures applicable to your site conditions. There is no one measure or mix of measures that is appropriate for every facility. Measures should not be implemented in isolation since there are often interactive effects that will impact the overall savings of the combined measures.

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

5 Energy Efficient Best Practices

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

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

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

Energy Tracking with ENERGY STAR Portfolio Manager

You've heard it before—you cannot manage what you do not measure. ENERGY STAR Portfolio Manager is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[6] . Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Lighting Maintenance

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

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

Lighting Controls

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

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

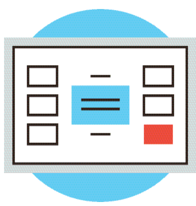
Motor Controls

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

Motor Maintenance

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

Thermostat Schedules and Temperature Resets



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

Economizer Maintenance

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

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

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

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

Furnace Maintenance

Preventative maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. Following the manufacturer's instructions, a yearly tune-up should check for gas / carbon monoxide leaks; change the air and fuel filters; check components for cracks, corrosion, dirt, or debris build-up; ensure the ignition system is working properly; test and adjust operation and safety controls; inspect electrical connections; and lubricate motors and bearings.

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.

Compressed Air System Maintenance

Compressed air systems require periodic maintenance to operate at peak efficiency. A maintenance plan for compressed air systems should include:

- Inspection, cleaning, and replacement of inlet filter cartridges.
- Cleaning of drain traps.
- Daily inspection of lubricant levels to reduce unwanted friction.
- Inspection of belt condition and tension.
- Check for leaks and adjust loose connections.
- Overall system cleaning.

Contact a qualified technician for help with setting up periodic maintenance schedule.

Water Conservation

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

For more information regarding water conservation go to the EPA's WaterSense website[7] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[8] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

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

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

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

Procurement Strategies

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

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

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

6 On-site Generation

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

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

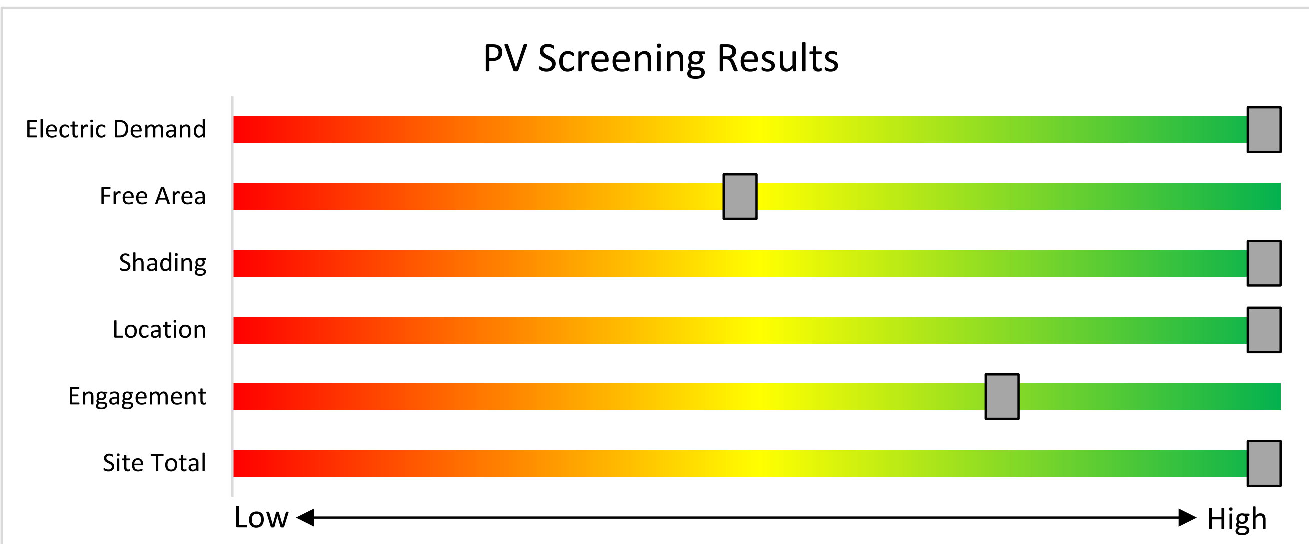
6.1 Solar Photovoltaic

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

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

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

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



Potential	High	
System Potential	86	kW DC STC
Electric Generation	102,458	kWh/yr
Displaced Cost	$10,900	/yr
Installed Cost	$223,600	

Figure 8 - 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**: www.njcleanenergy.com/whysolar
- **NJ Solar Market FAQs**: www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs.
- **Approved Solar Installers in the NJ Market**: www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/?id=60&start=1

6.2 Combined Heat and Power

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

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

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

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

Based on a preliminary analysis, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation. The 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.

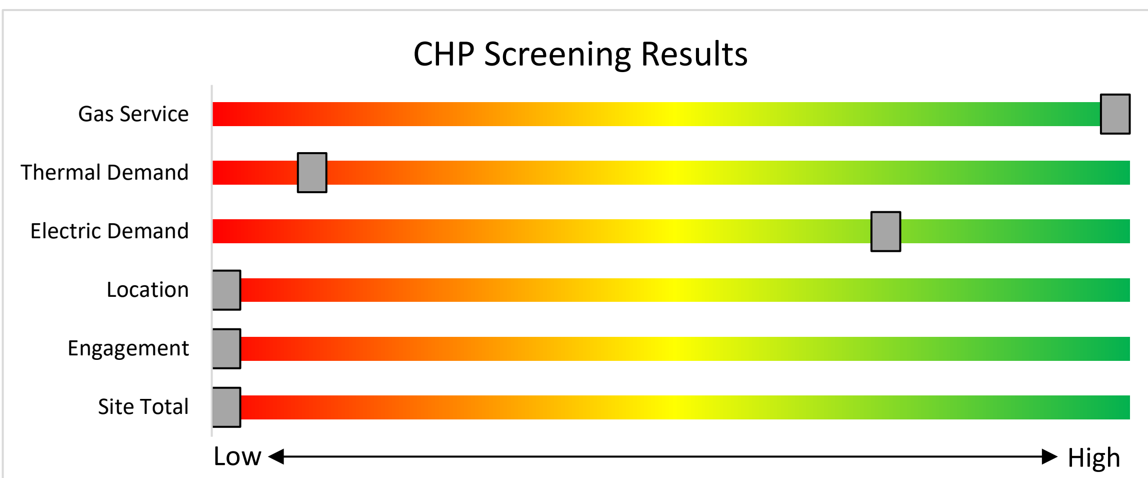


Figure 9 - Combined Heat and Power Screening

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/

7 Project Funding and Incentives

Ready to improve your building's performance? Your utility provider may be able to help.

7.1 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.

These new utility programs are rolling out in the spring and summer of 2021. Keep up to date with developments by visiting:

https://www.njcleanenergy.com/transition

8 NEW JERSEY'S CLEAN ENERGY PROGRAMS

New Jersey's Clean Energy Program will continue to offer some energy efficiency programs.

8.1 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 that annually contribute at least $200,000 to the NJCEP aggregate of all buildings/sites. This equates to roughly $5 million in 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: www.njcleanenergy.com/LEUP

8.2 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

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

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

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

How to Participate

You 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 www.njcleanenergy.com/CHP.

8.3 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 effective August 28, 2021.

Competitive Solar Incentive Program

The Competitive Solar Incentive (CSI) Program will provide competitively set incentives for grid supply projects and net metered non-residential projects greater than 5MW. The program is currently under development with the goal of holding the first solicitation by early-to-mid 2022. For updates, please continue to check the Solar Proceedings page on the New Jersey's Clean Energy Program website.

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 photovoltaics on your building, visit the following link for more information: https://njcleanenergy.com/renewable-energy/programs/susi-program.

8.4 Energy Savings Improvement Program

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

9 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.

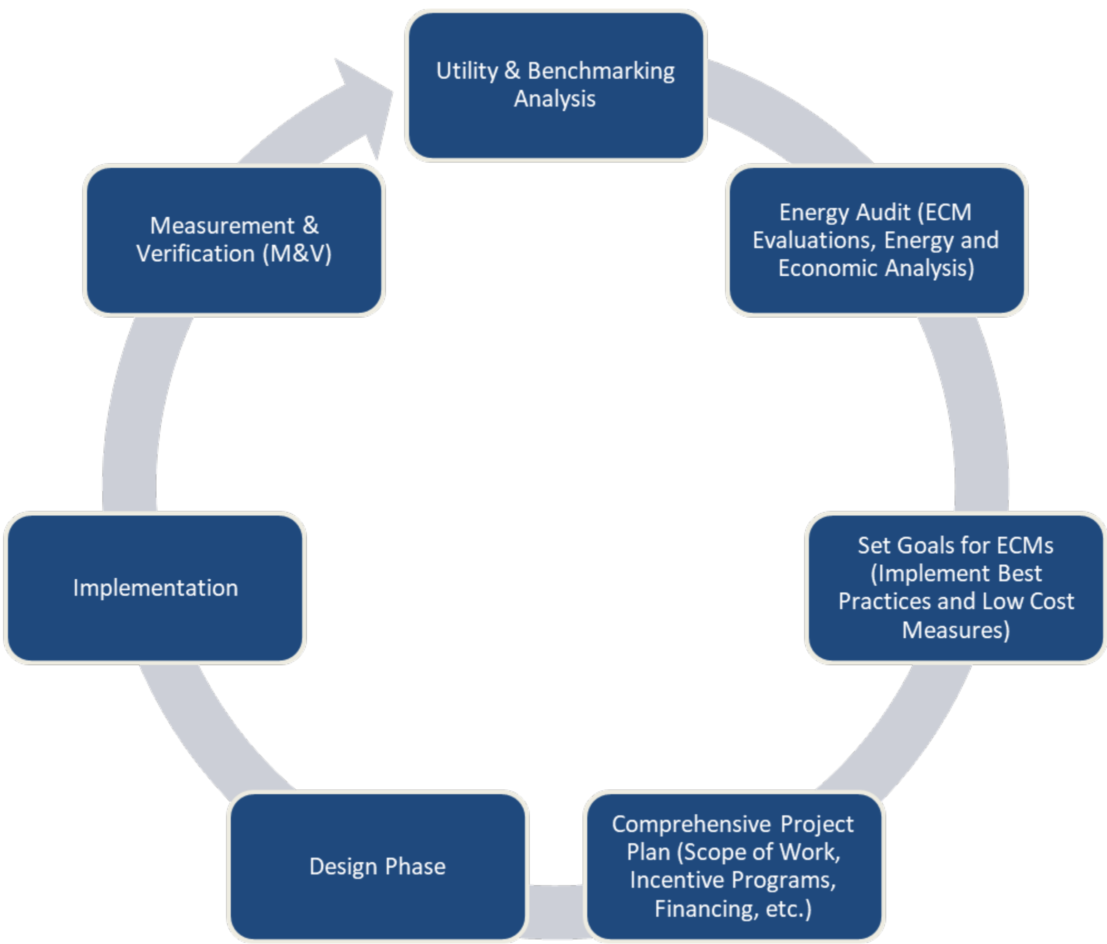


Figure 10 – Project Development Cycle

10 Energy Purchasing and Procurement Strategies

10.1 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[9].

10.2 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[10].

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	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 Offices - Corridor 3 waiting room	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor - waiting room	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	3, 5	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,435	0.1	262	0	$27	$335	$135	7.3
Laboratory sand filter Room	9	High-Pressure Sodium: (1) 400W Lamp	Wall Switch	S	465	3,640	1, 4	Fixture Replacement	Yes	9	LED - Fixtures: High-Bay	Occupancy Sensor	120	2,512	2.3	12,521	-3	$1,310	$6,412	$765	4.3
Laboratory sand filter Room	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	5,824	4	None	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.0	52	0	$5	$0	$0	0.0
Laboratory sand filter Room	18	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	5,824	2, 4	Relamp & Reballast	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.8	7,128	-2	$746	$1,778	$250	2.0
Laboratory 4 UV Room	2	High-Pressure Sodium: (1) 150W Lamp	Wall Switch	S	188	3,640	1	Fixture Replacement	No	2	LED - Fixtures: High-Bay	Wall Switch	45	3,640	0.2	1,041	0	$109	$1,094	$100	9.1
Laboratory 4 UV Room	2	High-Pressure Sodium: (1) 400W Lamp	Wall Switch	S	465	3,640	1	Fixture Replacement	No	2	LED - Fixtures: High-Bay	Wall Switch	120	3,640	0.5	2,512	-1	$263	$985	$100	3.4
Lobby 1 elevator	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,600	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,600	0.0	86	0	$9	$37	$10	3.0
Office - superintendent	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,808	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,808	0.1	239	0	$25	$146	$40	4.2
Office - superintendent 2	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,808	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,808	0.1	239	0	$25	$146	$40	4.2
Office - Enclosed 2 control room	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,808	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,808	0.1	239	0	$25	$146	$40	4.2
Office - Enclosed 2 control room	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	1,808	3	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,808	0.0	52	0	$5	$72	$10	11.4
Office - Enclosed 4 receptionist	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,808	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,808	0.1	239	0	$25	$146	$40	4.2
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
Stairs 1	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,600	3, 5	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,794	0.1	328	0	$34	$335	$135	5.8
Stairs 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
Stairs 2	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,600	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,794	0.1	437	0	$46	$371	$180	4.2
Conference 1	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	1,808	3	Relamp	No	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,808	0.3	716	0	$75	$438	$120	4.2
Corridor 1	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	3, 5	Relamp	Yes	11	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,435	0.3	961	0	$101	$852	$495	3.5
Dining Area 1	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,808	3	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,808	0.1	358	0	$37	$219	$60	4.2
Electrical Room 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,206	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,206	0.0	40	0	$4	$37	$10	6.4
Elevator Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,040	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,040	0.0	34	0	$4	$37	$10	7.4
File Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	2,340	3	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,340	0.1	309	0	$32	$146	$40	3.3
Laboratory Day Lab	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,340	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,615	0.2	590	0	$62	$489	$95	6.4
Laboratory - Main Lab	2	Compact Fluorescent: (1) 23W Spiral Plug-In Lamp	Wall Switch	S	23	2,340	3, 4	Relamp	Yes	2	LED Lamps: LED Lamp	Occupancy Sensor	17	1,615	0.0	53	0	$6	$166	$30	24.6

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Laboratory - Main Lab	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,340	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,340	0.0	77	0	$8	$37	$10	3.3
Restroom - Female	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,507	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,507	0.0	99	0	$10	$73	$20	5.1
Restroom - Female	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,507	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,507	0.0	50	0	$5	$37	$10	5.1
Restroom - Male	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,080	3, 4	Relamp	Yes	2	LED Lamps: A19 Lamps	Occupancy Sensor	9	1,435	0.1	224	0	$23	$150	$2	6.3
Restroom - Male	1	LED Lamps: 6W LED Lamps	Occupancy Sensor	S	6	1,507		None	No	1	LED Lamps: 6W LED Lamps	Occupancy Sensor	6	1,507	0.0	0	0	$0	$0	$0	0.0
Restroom - Male	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,507	3	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,507	0.1	149	0	$16	$110	$30	5.1
Restroom - Male	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	1,507	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,507	0.0	50	0	$5	$37	$10	5.1
Exterior Wall Pack	1	High-Pressure Sodium: (1) 150W Lamp	Photocell		188	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	45	4,380	0.0	626	0	$67	$346	$50	4.4
Exterior Wall Pack	3	High-Pressure Sodium: (1) 150W Lamp	Wall Switch		188	2,184	1	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	45	2,184	0.0	937	0	$100	$1,037	$150	8.9
Exterior Wall Pack	1	High-Pressure Sodium: (1) 400W Lamp	Wall Switch		465	2,184	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	120	2,184	0.0	753	0	$80	$555	$50	6.3
Alum Building																					
Exterior Tank Pole Light	6	High-Pressure Sodium: (1) 100W Lamp	Wall Switch		138	1,092	1	Fixture Replacement	No	6	LED - Fixtures: High-Bay	Wall Switch	30	1,092	0.0	708	0	$75	$3,466	$300	42.0
Exterior Wall Pack	2	High-Pressure Sodium: (1) 150W Lamp	Wall Switch		188	2,184	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	45	2,184	0.0	625	0	$66	$692	$100	8.9
Laboratory 1	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,080	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	123	0	$13	$69	$10	4.6
Laboratory 1	10	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,080	2, 4	Relamp & Reballast	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.4	1,414	0	$148	$958	$135	5.6
Control Building																					
Blower Room	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,640	3, 4	Relamp	Yes	11	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,512	0.3	1,681	0	$176	$672	$145	3.0
Electrical Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	897	0.1	218	0	$23	$416	$75	14.9
Exterior Tank Pole Light	18	High-Pressure Sodium: (1) 150W Lamp	Wall Switch		188	1,092	1	Fixture Replacement	No	18	LED - Fixtures: High-Bay	Wall Switch	45	1,092	0.0	2,811	0	$299	$9,843	$900	29.9
Exterior Wall Pack	1	LED - Fixtures: Flood Fixture	Photocell		45	4,380		None	No	1	LED - Fixtures: Flood Fixture	Photocell	45	4,380	0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex 1	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	1,820	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,820	0.0	107	0	$11	$69	$10	5.2
Stairs 1	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	1,300	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,300	0.0	77	0	$8	$69	$10	7.3
Stairs 2	3	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	1,300	2, 5	Relamp & Reballast	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	897	0.1	265	0	$28	$431	$135	10.7
Water control center	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.1	349	0	$37	$416	$75	9.3
Workshop 2	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,080	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	123	0	$13	$69	$10	4.6

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Large Garage																					
Corridor 1	3	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	2,210	2, 5	Relamp & Reballast	Yes	3	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	1,525	0.3	902	0	$94	$580	$165	4.4
Exterior Wall Pack	3	High-Pressure Sodium: (1) 400W Lamp	Wall Switch		465	2,184	1	Fixture Replacement	No	3	LED - Fixtures: High-Bay	Wall Switch	120	2,184	0.0	2,260	0	$241	$1,477	$150	5.5
Exterior Wall Pack	1	LED - Fixtures: Flood Fixture	Wall Switch		9	2,184		None	No	1	LED - Fixtures: Flood Fixture	Wall Switch	9	2,184	0.0	0	0	$0	$0	$0	0.0
Exterior Flag Light	1	LED - Fixtures: Flood Fixture	Photocell		13	4,380		None	No	1	LED - Fixtures: Flood Fixture	Photocell	13	4,380	0.0	0	0	$0	$0	$0	0.0
Garage	6	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,340	2, 4	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,615	0.3	955	0	$100	$683	$95	5.9
Garage	8	Linear Fluorescent - T8: 8' T8 (59W) - 2L	Wall Switch	S	110	2,340	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	1,615	0.3	1,129	0	$118	$978	$195	6.6
Office - Enclosed	4	Linear Fluorescent - T12: 4' T12 (40W) - 3L	Wall Switch	S	127	2,340	2, 4	Relamp & Reballast	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,615	0.3	908	0	$95	$660	$95	6.0
Restroom - Unisex	1	Incandescent: (1) 150W A19 Screw-In Lamp	Wall Switch	S	150	1,690	3	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	23	1,690	0.1	215	0	$22	$17	$1	0.7
Restroom - Unisex	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	1,690		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,690	0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex	1	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	70	1,690		None	No	1	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	70	1,690	0.0	0	0	$0	$0	$0	0.0
Storage	2	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	1,040	2, 4	Relamp & Reballast	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	718	0.2	283	0	$30	$353	$40	10.6
Raw Pump Building																					
Exterior Wall Pack	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell		9	4,380		None	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	9	4,380	0.0	0	0	$0	$0	$0	0.0
Workshop	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	978	0	$102	$416	$75	3.3
Sludge & Blower Building																					
Exterior Tank Pole Light	18	High-Pressure Sodium: (1) 150W Lamp	Wall Switch		188	1,092	1	Fixture Replacement	No	18	LED - Fixtures: High-Bay	Wall Switch	45	1,092	0.0	2,811	0	$299	$9,843	$900	29.9
Exterior Wall Pack	1	High-Pressure Sodium: (1) 150W Lamp	Wall Switch		188	2,184	1	Fixture Replacement	No	1	LED - Fixtures: High-Bay	Wall Switch	45	2,184	0.0	312	0	$33	$547	$50	15.0
Mechanical Room 1	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,470	2, 4	Relamp & Reballast	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.2	840	0	$88	$614	$85	6.0
Mechanical Room 2	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,470	2, 4	Relamp & Reballast	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,704	0.2	840	0	$88	$614	$85	6.0
Stairs 1	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,470	3, 5	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,704	0.1	311	0	$33	$335	$135	6.1
Smalll Storage																					
Exterior Wall Sconce	1	Incandescent: 100W A Lamp	Wall Switch		100	1,040	3	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	15	1,040	0.0	88	0	$9	$17	$1	1.7
Garage	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	1,560	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,560	0.0	92	0	$10	$69	$10	6.1
Thickener & Generator Building																					

	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
Exterior Wall Pack	4	Metal Halide: (1) 250W Lamp	Wall Switch		295	2,184	1	Fixture Replacement	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	75	2,184	0.0	1,922	0	$205	$1,883	$200	8.2
Laboratory 2 chemical room	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	2,600	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,600	0.0	153	0	$16	$69	$10	3.7
Locker Room 1	3	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	1,820	2, 4	Relamp & Reballast	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,256	0.1	371	0	$39	$476	$65	10.6
Mechanical 1 sludge pump Room	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	4,368	2	Relamp & Reballast	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,368	0.2	1,289	0	$135	$344	$50	2.2
Polymer Control Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,368	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,368	0.0	288	0	$30	$73	$20	1.8
Polymer Room	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,368	3	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,368	0.1	721	0	$75	$183	$50	1.8
Laboratory 1	16	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	4,368	2, 4	Relamp & Reballast	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,014	0.7	4,752	-1	$497	$1,640	$230	2.8
Stairs 1	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,368	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,014	0.1	550	0	$58	$335	$135	3.5

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
Main Offices																						
Roof	RTU - 2nd Floor Offices	1	Supply Fan	3.0	86.5%	No			W	1,790	7	No	89.5%	Yes	1	0.9	1,841	0	$196	$3,884	$200	18.8
Roof	RTU - 2nd Floor Offices	1	Exhaust Fan	0.3	0.3%	No			W	1,790		No	0.3%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU - 2nd Floor Offices	1	Supply Fan	2.0	84.0%	No			W	1,790	7	No	86.5%	Yes	1	0.6	1,254	0	$133	$3,261	$100	23.7
Roof	RTU - 2nd Floor Offices	1	Exhaust Fan	0.3	0.3%	No			W	1,790		No	0.3%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-7 - Filtration - UV Room	1	Supply Fan	15.0	92.4%	No			N	1,790		No	92.4%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-7 - Filtration - UV Room	1	Exhaust Fan	0.3	65.0%	No			N	1,790		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-8 - Filtration - UV Room	1	Supply Fan	15.0	92.4%	No			N	1,790		No	92.4%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-8 - Filtration - UV Room	1	Exhaust Fan	0.3	65.0%	No			N	1,790		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-1 & 2 - Restroom & Electrical Room	2	Exhaust Fan	0.1	65.0%	No			N	2,180		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-5 & 6 - Mens/Womens Restroom & Elevator Room	2	Exhaust Fan	0.5	70.0%	No			N	2,180		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-7 - Laboratory	1	Exhaust Fan	0.8	70.0%	No			N	2,180		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-13 - UV Room	1	Exhaust Fan	0.3	65.0%	No			N	2,180		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Elevator Room	Passenger Elevator	1	Other	20.0	80.0%	No			N	520		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0
UV Room	Water Wash Pump #1,2	2	Process Pump	25.0	91.7%	No			B	1,971	6	Yes	93.6%	No		0.5	1,221	0	$130	$6,937	$0	53.4
Alum Building (Chemical Feed Bld)																						
Roof	RTU-6 - Chemical Feed Building	1	Supply Fan	5.0	89.5%	No			N	1,790		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Exterior	Clarifier Tank Motor	3	Other	0.8	72.0%	No			W	8,760		No	72.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior	Clarifier Effluent Pumps (P1 & P2)	2	Process Pump	75.0	94.1%	Yes			W	2,920		No	94.1%	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
Garage	Compressed Air System	1	Air Compressor	5.0	86.0%	No			W	1,092		No	86.0%	No		0.0	0	0	$0	$0	$0	0.0
Raw Pump Building																						
Exterior Underground	Grinder Pump	1	Process Pump	20.0	89.5%	No			W	1,820		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Workshop	Workshop - Raw Pump #1,2,2	3	Process Pump	40.0	91.0%	Yes			B	2,920	6	Yes	94.1%	No		1.8	7,097	0	$755	$12,621	$0	16.7
Sludge & Blower Building																						
Roof	EF-4 - Electrical Control Room	1	Exhaust Fan	0.3	65.0%	No			N	2,180		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-8 - Polymer Tank Room	1	Exhaust Fan	0.8	70.0%	No			N	2,180		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-RTU-4 - Belt Thickner Room	1	Exhaust Fan	3.0	84.0%	No			N	2,180		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-4 - Belt Thickner Room	1	Supply Fan	5.0	89.5%	No			N	1,790		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Mechanical Room	1	Supply Fan	0.2	65.0%	No			W	1,235		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-11 - Blower Room	1	Exhaust Fan	1.5	84.0%	No			N	2,180		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Anarobic Tanks	Mixing Pumps	4	Process Pump	8.3	84.0%	No			W	2,912		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Belt Room	SCUM Storage Tank Pump #1	1	Process Pump	3.0	84.0%	No			B	832	6	Yes	89.5%	No		0.1	102	0	$11	$805	$0	74.0
Belt Room	SCUM Storage Tank Pump #2	1	Process Pump	3.0	89.5%	No			N	832		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Belt Room	Belt Thickener Feed Pump #1	1	Process Pump	20.0	90.2%	Yes			B	104	6	Yes	93.0%	No		0.3	39	0	$4	$2,516	$0	608.7
Belt Room	Belt Thickener Feed Pump #2	1	Process Pump	20.0	90.2%	No			B	6,570	6	Yes	93.0%	No		0.3	2,454	0	$261	$2,516	$0	9.6
Belt Room	Sump Pumps	2	Other	0.5	70.0%	No			W	546		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Belt Room	Sludge Storage Blower Pump #1,2	2	Process Blower	30.0	91.0%	Yes			B	2,920	6	Yes	93.6%	No		0.8	2,992	0	$318	$6,877	$0	21.6
Thickener & Generator Building																						
Laboratory	Serve Laboratory Equipment	2	Air Compressor	1.0	85.5%	No			W	1,040		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	**Area(s)/System(s) Served**	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	Sewer Pumps	2	Process Pump	3.0	81.5%	No			B	728	6	Yes	89.5%	No		0.3	268	0	$29	$1,610	$0	56.4
Sludge Pump Room	Thickened Sludge Pumps	2	Process Pump	15.0	91.7%	No			B	3,640	6	Yes	92.4%	No		0.1	505	0	$54	$3,783	$0	70.4
Sludge Pump Room	Backup Thickened Sludge Pump	1	Process Pump	10.0	91.7%	No			W	104		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Laboratory	Thickener Drive #1 & 2	2	Process Pump	3.0	81.5%	No			B	832	6	Yes	89.5%	No		0.3	306	0	$33	$1,610	$0	49.4
Laboratory	Scrubber Exhaust Fans #1 & 2	2	Exhaust Fan	3.0	84.0%	No			B	4,380	6	Yes	89.5%	No		0.2	1,076	0	$114	$1,610	$0	14.1
Laboratory	Scrubber Recirculation Pumps #1 & 2	2	Process Pump	5.0	84.0%	No			B	4,380	6	Yes	89.5%	No		0.3	1,793	0	$191	$1,842	$0	9.7
Polymer Room	Polymer Mixing Pump	1	Process Pump	1.5	75.5%	No			B	2,912	6	Yes	86.5%	No		0.1	412	0	$44	$758	$0	17.3
Polymer Room	Polymer Pumps #1 & 2	2	Process Pump	1.0	85.5%	Yes			W	2,912		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Polymer Room	Polymer System	1	Process Pump	0.5	72.0%	No			W	2,912		No	72.0%	No		0.0	0	0	$0	$0	$0	0.0
Laboratory Room	Laboratory Room	1	Supply Fan	0.3	65.0%	No			W	1,470		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Polymer Control Room	Polymer Control Room	1	Supply Fan	0.3	65.0%	No			W	1,470		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Polymer Control Room	Polymer Control Room	1	Supply Fan	1.5	84.0%	No			W	1,470		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Locker Room	Locker Room	1	Supply Fan	0.3	65.0%	No			W	1,470		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 Offices																									
Corridor 3rd Floor Waiting Room	Corridor 3rd Floor Waiting Room	1	Electric Resistance Heat		13.65		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
1st Floor Eelevator Lobby	1st Floor Eelevator Lobby	1	Electric Resistance Heat		13.65		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Stairs	Stairs	2	Electric Resistance Heat		20.48		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Restroom - Male	Restroom - Male	1	Electric Resistance Heat		20.48		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Roof	2nd Floor Offices	1	Package Unit	10.00	192.00	12.00	0.8 AFUE	Lennox	LGH120H4BH2G	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	2nd Floor Offices	1	Package Unit	7.50	192.00	12.50	0.8 AFUE	Lennox	LGH092H4BH1G	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	RTU-7 - Filtration - UV Room	1	Forced Air Furnace		1,000.00		0.8 AFUE	Reznor	PCDH-100	N		No							0.0	0	0	$0	$0	$0	0.0
Roof	RTU-8 - Filtration Room	1	Forced Air Furnace		1,000.00		0.8 AFUE	Reznor	PCDH-100	N		No							0.0	0	0	$0	$0	$0	0.0
Alum Blg (Chemical Feed Blg)																									
Roof	RTU-6 - Chemical Feed Building	1	Forced Air Furnace		640.00		0.8 AFUE	Reznor	RPBL-800	N		No							0.0	0	0	$0	$0	$0	0.0
Alum Blg (Chemical Feed Blg)	Alum Blg (Chemical Feed Blg)	2	Electric Resistance Heat		34.13		1 COP			N		No							0.0	0	0	$0	$0	$0	0.0
Control Building																									
Stairs	Stairs	2	Electric Resistance Heat		17.07		1 COP			N		No							0.0	0	0	$0	$0	$0	0.0
Roof	RRU-3 - Mechanical Equipment Room	1	Forced Air Furnace		320.00		0.8 AFUE	Reznor	RPBL-400	N		No							0.0	0	0	$0	$0	$0	0.0
Blower Room	Blower Room	1	Unit Heater		160.00		0.8 AFUE	Reznor	B200-2-E	N		No							0.0	0	0	$0	$0	$0	0.0
Electrical Room	Electrical Room	1	Unit Heater		60.00		0.8 AFUE	Reznor	B75--2-E	N		No							0.0	0	0	$0	$0	$0	0.0
Control Room	Control Room	1	Unit Heater		160.00		0.8 AFUE	Reznor	B200-2-E	N		No							0.0	0	0	$0	$0	$0	0.0
Large Garage																									
Storage	Storage	1	Electric Resistance Heat		17.07		1 COP			N		No							0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/ EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Corridor	Corridor	1	Unit Heater		60.00		0.8 AFUE	Nodine		B	8	Yes	1	Unit Heater		60.00		0.83 29.2210344827586	0.0	0	2	$12	$1,753	$0	145.4
Garage	Garage	2	Unit Heater		80.00		0.8 AFUE	Nodine		B	9	Yes	2	Infrared Heater		80.00		0.93 29.4206968253968	0.0	0	16	$124	$10,631	$1,000	77.5
Office	Office	1	Window AC	1.00		10.90				N		No							0.0	0	0	$0	$0	$0	0.0
Sludge & Blower Building																									
Roof	RTU-4 - Belt Thickener Pump Room	1	Forced Air Furnace		640.00		0.8 AFUE	Reznor	RPBL-800	N		No							0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Mechanical Room	1	Unit Heater		20.00		0.8 AFUE	Reznor	B-25-E	B	8	Yes	1	Unit Heater		20.00		0.83 29.2210344827586	0.0	0	1	$4	$584	$0	145.4
Roof	RTU-5 - Pump Room	1	Forced Air Furnace		180.00		0.8 AFUE	Reznor	RPB-225	N		No							0.0	0	0	$0	$0	$0	0.0
Thickener & Generator Building																									
Laboratory Room	Laboratory Room	1	Unit Heater		49.80		0.83 AFUE	Reznor	UDAP-60	W		No							0.0	0	0	$0	$0	$0	0.0
Polymer Control Room	Polymer Control Room	1	Unit Heater		60.00		0.8 AFUE	Reznor	B75--2-E	B	8	Yes	1	Unit Heater		60.00		0.83 29.2210344827586	0.0	0	2	$12	$1,753	$0	145.4
Polymer Control Room	Polymer Control Room	1	Unit Heater		32.00		0.8 AFUE	Reznor	B400-2-E	B	8	Yes	1	Unit Heater		32.00		0.83 29.2210344827586	0.0	0	1	$6	$935	$0	145.4
Locker Room	Locker Room	1	Unit Heater		49.80		83 AFUE	Reznor	UDAP-60	W		No							0.0	0	0	$0	$0	$0	0.0

Pipe Insulation Recommandations

		Recommendation Inputs			Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Main Ofc Electrical	Building DHW	10	2	1.00	0.0	0	1	$7	$12	$4	1.1

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 Office - Electrical Room	Domestic Hot Water System	1	Storage Tank Water Heater (≤ 50 Gal)	Rheem	42V50-65F	W		No						0.0	0	0	$0	$0	$0	0.0
Large Garage	Large Garage	1	Storage Tank Water Heater (≤ 50 Gal)	Rheem	22V40F1	W		No						0.0	0	0	$0	$0	$0	0.0
Control Building	Domestic Hot Water System	1	Tankless Water Heater			W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommendation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Main Offices	11	3	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	1	$11	$22	$12	0.9
Large Garage	11	1	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	0	$4	$7	$4	0.9

Plug Load Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Main Offices	1	Coffee Machine	600	No		
Main Offices	8	Desktop	120	No		
Main Offices	2	Fan (Large)	125	No		
Main Offices	2	Microwave	1,000	No		
Main Offices	1	Paper Shredder	240	No		
Main Offices	5	Printer (Medium/Small)	225	No		
Main Offices	10	Refrigerator (Mini)	200	No		
Main Offices	1	Refrigerator (Residential)	300	No		
Main Offices	1	Television	224	No		
Main Offices	2	Toaster	800	No		
Main Offices	1	Water Fountain	192	No		
Main Offices - UV Room	56	UV Lamps	256	No	Trojan UV3000	UV3000-PDC
Sand Filter Room	4	Butterfly Repellent Lamps	34	No		
Main Offices - Dining Room	2	Fish Tanks	100	No		
Main Offices - Laboratory	3	Lab Equipment	1,730	No		
Main Offices - Laboratory	4	Lab Refrigerator	650	No		
Large Garage	2	Desktop	120	No		
Large Garage	1	Fan (Large)	125	No		
Large Garage	1	Microwave	1,000	No		
Large Garage	1	Printer (Medium/Small)	225	No		
Large Garage	1	Refrigerator (Residential)	300	No		
Large Garage	1	Washing Machine	1,200	No		

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Dining Room	1	Non-Refrigerated	N/A	No	0.0	0	0	$0	$0	$0	0.0

Miscellaneous Fuel Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Input Capacity per Unit (MBh)	ENERGY STAR Qualified?	Manufacturer	Model
Large Garage	1	Dryer	48.0	No	Whirlpool	WGD4800XQ0

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]

Butterworth Sewer Treatment Plant (Campus)

Primary Property Type: Wastewater Treatment Plant
Gross Floor Area (ft²): 36,750
Built: 1975

For Year Ending: June 30, 2020
Date Generated: September 15, 2021

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Butterworth Sewer Treatment Plant (Campus) 48 Lake Valley Road Morris Township, New Jersey 07960	TwpofMorris 50 Woodland Avenue PO Box 7603 Convent Station, NJ 07961 973-326-7360	Timothy Quinn 50 Woodland Avenue PO Box 7603 Convent Station, NJ 07961 973-326-7360 tquinn@morristwp.com

Property ID: 15174814

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
294.9 kBtu/ft²

Source EUI
653.9 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	7,229,680 (67%)
Natural Gas (kBtu)	3,608,643 (33%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	183.1
National Median Source EUI (kBtu/ft²)	406
% Diff from National Median Source EUI	61%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	863

Signature & Stamp of Verifying Professional

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

LP Signature: ____________________Date: __________

Licensed Professional

____ ________
,
(___)____-______
____

Professional Engineer or Registered Architect Stamp
(if applicable)

Appendix C: Glossary

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

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

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR Portfolio Manager.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC	*Solar renewable energy credit*: a credit you can earn from the state for energy produced from a photovoltaic array.
TREC	*Transition Incentive Renewable Energy Certificate:* a factorized renewable energy certificate you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of $1/8^{th}$ of an inch.
Temperature Setpoint	The temperature at which a temperature regulating device (thermostat, for example) has been set.
therm	100,000 Btu. Typically used as a measure of natural gas consumption.
tons	A unit of cooling capacity equal to 12,000 Btu/hr.
Turnkey	Provision of a complete product or service that is ready for immediate use.
VAV	*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.