Local Government Energy Audit Report

Wastewater Treatment Plant

December 11, 2024

Prepared for:
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Disclaimer

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

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

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

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

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

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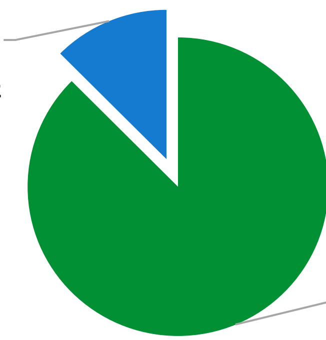
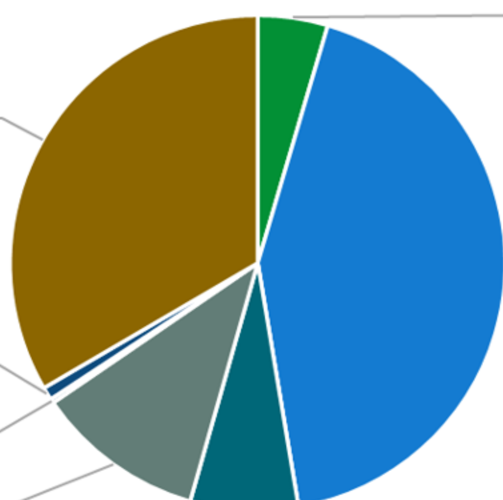
1 Executive Summary

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

BUILDING PERFORMANCE REPORT

Annual Energy Utilities	Costs: $517,976 Electricity: 4,666,461 kWh Natural Gas: 48,456 Therms Methane: 10,559 MMBtu Water: Not Quantified	 Note: Methane is generated on-site at no cost.
ENERGY STAR® Benchmarking Score	33 *(1-100 scale)*	This facility performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.



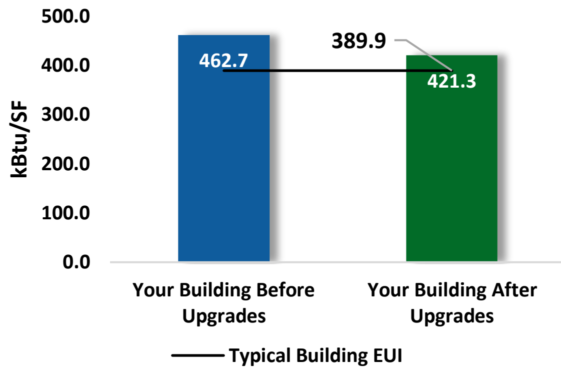
Energy Use by System

POTENTIAL IMPROVEMENTS

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

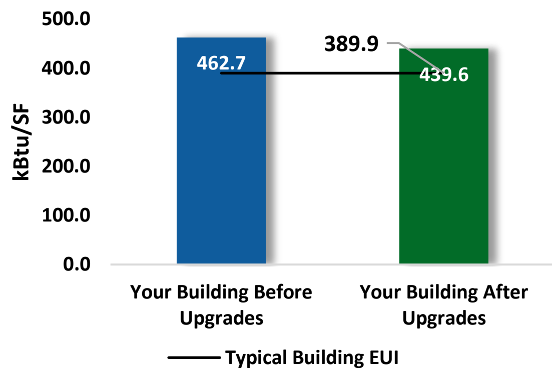
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$672,050
Potential Rebates & Incentives[1]	$20,320
Annual Cost Savings	$74,511
Annual Energy Savings	Electricity: 718,695 kWh Natural Gas: 3,521 Therms
Greenhouse Gas Emission Savings	382 Tons
Simple Payback	8.7 Years
Site Energy Savings (All Utilities)	9%



Scenario 2: Cost Effective Package[2]

Installation Cost	$194,350
Potential Rebates & Incentives	$13,220
Annual Cost Savings	$44,645
Annual Energy Savings	Electricity: 461,019 kWh Natural Gas: -99 Therms
Greenhouse Gas Emission Savings	232 Tons
Simple Payback	4.1 Years
Site Energy Savings (all utilities)	5%



On-site Generation Potential

Photovoltaic	Medium
Combined Heat and Power	High

[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			**35,590**	**6.6**	**-7**	**$3,364**	**$11,830**	**$1,700**	**$10,130**	**3.0**	**35,030**
ECM 1	Install LED Fixtures	Yes	2,133	0.0	0	$207	$1,600	$200	$1,400	6.8	2,148
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	4,057	1.1	-1	$383	$2,460	$300	$2,160	5.6	3,984
ECM 3	Retrofit Fixtures with LED Lamps	Yes	29,400	5.5	-6	$2,775	$7,770	$1,200	$6,570	2.4	28,897
Lighting Control Measures			**14,207**	**3.4**	**-3**	**$1,339**	**$12,730**	**$2,010**	**$10,720**	**8.0**	**13,952**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	12,887	3.3	-3	$1,215	$11,610	$1,380	$10,230	8.4	12,656
ECM 5	Install High/Low Lighting Controls	Yes	1,320	0.1	0	$124	$1,120	$630	$490	3.9	1,296
Motor Upgrades			**32,033**	**8.4**	**0**	**$3,111**	**$68,000**	**$0**	**$68,000**	**21.9**	**32,257**
ECM 6	Premium Efficiency Motors	No	32,033	8.4	0	$3,111	$68,000	$0	$68,000	21.9	32,257
Variable Frequency Drive (VFD) Measures			**433,223**	**51.2**	**0**	**$42,078**	**$202,100**	**$13,600**	**$188,500**	**4.5**	**436,252**
ECM 7	Install VFDs on Constant Volume (CV) Fans	No	15,753	4.9	0	$1,530	$19,300	$2,200	$17,100	11.2	15,863
ECM 8	Install VFDs on Heating Water Pumps	No	11,168	1.7	0	$1,085	$13,400	$2,000	$11,400	10.5	11,246
ECM 9	Install VFDs on Process Pumps	Yes	388,333	40.3	0	$37,718	$159,100	$7,400	$151,700	4.0	391,048
ECM 10	Install VFDs on Process Blowers	Yes	17,970	4.5	0	$1,745	$10,300	$2,000	$8,300	4.8	18,095
Unitary HVAC Measures			**4,252**	**2.3**	**0**	**$413**	**$17,100**	**$900**	**$16,200**	**39.2**	**4,281**
ECM 11	Install High Efficiency Air Conditioning Units	No	4,252	2.3	0	$413	$17,100	$900	$16,200	39.2	4,281
HVAC System Improvements			**828**	**0.0**	**0**	**$80**	**$140**	**$20**	**$120**	**1.5**	**834**
ECM 12	Install Pipe Insulation	Yes	828	0.0	0	$80	$140	$20	$120	1.5	834
Domestic Water Heating Upgrade			**4,092**	**0.0**	**0**	**$397**	**$250**	**$90**	**$160**	**0.4**	**4,121**
ECM 13	Install Low-Flow DHW Devices	Yes	4,092	0.0	0	$397	$250	$90	$160	0.4	4,121
Custom Measures			**194,471**	**0.0**	**362**	**$23,727**	**$359,900**	**$2,000**	**$357,900**	**15.1**	**238,218**
ECM 14	Installation of an Energy Management System	No	15,170	0.0	362	$6,310	$68,700	$0	$68,700	10.9	57,663
ECM 15	Replace Electric Water Heater with Heat Pump Water Heater	No	10,921	0.0	0	$1,062	$10,800	$0	$10,800	10.2	10,997
ECM 16	Install Automated Dissolved Oxygen Aeration Control	No	161,290	0.0	0	$15,666	$267,000	$0	$267,000	17.0	162,418
ECM 17	Install Air Compressors with VFDs	No	7,090	0.0	0	$689	$13,400	$2,000	$11,400	16.6	7,140
TOTALS (COST EFFECTIVE MEASURES)			**461,019**	**54.7**	**-10**	**$44,645**	**$194,350**	**$13,220**	**$181,130**	**4.1**	**463,079**
TOTALS (ALL MEASURES)			**718,695**	**72.0**	**352**	**$74,511**	**$672,050**	**$20,320**	**$651,730**	**8.7**	**764,944**

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

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

All Evaluated Energy Improvements[3]

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

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

1.1 Planning Your Project

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

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

Pick Your Installation Approach

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

Options from Your Utility Company

Prescriptive and Custom Rebates

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

Direct Install

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

Engineered Solutions

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

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

Options from New Jersey's Clean Energy Program

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

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

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

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

Successor Solar Incentive Program (SuSI)

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

Ongoing Electric Savings with Demand Response

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

Large Energy User Program (LEUP)

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

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

2 Existing Conditions

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

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

2.1 Site Overview

On June 25, 2024, TRC performed an energy audit at Wastewater Treatment Plant located in Manalapan, New Jersey. TRC met with facility staff to review the facility operations and help focus our investigation on specific energy-using systems.

The Western Monmouth WWTP is a wastewater treatment facility originally constructed in 1974 with subsequent additions. It consists of 12 buildings that occupy 67,699 square feet, including the Old Administration Building (Old Admin), Facilities Management Building (FMB), Grit Building, Digester Building, Pump Station Electrical Control Building, Pump Station, Plant Maintenance Garage, U.V. Disinfection, Filter Building, Nitrification Building, Plant Maintenance Storage Building, and Collections Vehicle Garage. Exterior areas include the clarifiers, solar farm, and various connecting infrastructure. Typical spaces include process areas, administration and offices, workshops and crew areas, and electrical and mechanical spaces. Energy use is primarily dedicated to the wastewater treatment process.

Most areas are illuminated by LED lamps or fixtures; some areas use fluorescent lamps. Some administrative buildings and process building offices are cooled by package rooftop units, split air conditioners, or heat pumps. There are two dual-fuel boilers that support heating in the FMB and for heating the sludge in the Digester Building. The solar farm provides on-site energy generation. Two generators are used for emergency purposes.

Western Monmouth Utility Authority

2.2 Building Occupancy

Most buildings are occupied Monday through Friday during regular business hours, year-round. They are occupied intermittently on weekends as needed for maintenance and operations. Process buildings are occupied only as needed during these hours. The wastewater treatment process operates continuously.

Building Name	Weekday/Weekend	Operating Schedule
Old Administration Building	Weekday	7:00 AM-3:00 PM
	Weekend	No
Facilities Management Building	Weekday	7:00 AM-5:00 PM
	Weekend	No
Grit Building	Weekday	Occupied: 7:00 AM-3:00 PM Operates Continuously
	Weekend	Occupied: Limited Operates Continuously
Digester Building	Weekday	Occupied: 7:00 AM-3:00 PM Operates Continuously
	Weekend	Occupied: Limited Operates Continuously
Pump Station Electrical Control Building	Weekday	Occupied: 7:00 AM-3:00 PM Operates Continuously
	Weekend	Occupied: Limited Operates Continuously
Pump Station	Weekday	Occupied: 7:00 AM-3:00 PM Operates Continuously
	Weekend	Occupied: Limited Operates Continuously
Plant Maintenance Garage	Weekday	7:00 AM-3:00 PM
	Weekend	Limited
U.V. Disinfection	Weekday	Occupied: 7:00 AM-3:00 PM Operates Continuously
	Weekend	Occupied: Limited Operates Continuously
Filter Building	Weekday	Occupied: 7:00 AM-3:00 PM Operates Continuously
	Weekend	Occupied: Limited Operates Continuously
Nitrification Building	Weekday	Occupied: 7:00 AM-3:00 PM Operates Continuously
	Weekend	Occupied: Limited Operates Continuously

Building Occupancy Schedule

2.3 Building Envelope

The Old Administration Building walls consist of concrete masonry units (CMUs), with a brick veneer and gypsum drywall interior finish. Wood trusses support a pitched roof with a wood deck covered with asphalt shingles. The roof encloses a conditioned space below a drop ceiling.

Most windows are double paned with aluminum frames. Glass-to-frame seals are in fair condition. Weather seals on operable windows are also in fair condition, showing little evidence of excessive wear. Exterior doors are made from glass and metal with aluminum frames. Exterior doors are in fair condition with undamaged door seals. Degraded window and door seals increase drafts and outside air infiltration.

Building Envelope: Old Admin Building

Building Envelope: Old Admin Building

Building Door: Old Admin Building

Building Envelope: Old Admin Building

The Facility Management Building (FMB) walls consist of CMUs over structural steel with brick veneer and painted CMU interior finish. The flat roof is supported by steel trusses and formed of a metal deck with EPDM covering. The roof encloses a plenum area with conditioned space below a drop ceiling.

Most windows are double paned with aluminum frames. Glass-to-frame seals are in fair condition. Weather seals on the operable windows are also in fair condition, showing little evidence of excessive wear. Exterior doors are made from a mix of metal and fiberglass reinforced polymer (FRP) composite material with aluminum frames. Exterior doors are in fair condition with undamaged door seals.

Building Envelope: FMB

Building Envelope: FMB

Building Roof: FMB

Building Roof: FMB

The Grit Building walls consist of poured concrete with brick veneer and painted CMU interior finish. The flat roof is supported by steel trusses and formed of a metal deck.

There are no windows in the building. Exterior doors are made from metal with aluminum frames. Exterior doors are in fair condition with undamaged door seals. Overall, the building envelope is in fair condition; most of it was renovated in the last decade.

Building Envelope: Grit Building

The Digester Building walls are of made of brick over structural steel. The flat roof is supported by steel trusses.

There are no windows in the building. Exterior doors are made from metal with aluminum frames. Exterior doors are in fair condition with undamaged door seals. Facility staff are planning to renovate this building, including the structure and envelope.

Building Envelope: Digester Building

Building Door: Digester Building

The Pump Station Control walls are of made of brick over structural steel with painted CMU interior finish. Wood trusses support a pitched roof with a wood deck covered with asphalt shingles. The roof encloses a conditioned space below a drop ceiling.

There are no windows in the building. Exterior doors are made from metal with aluminum frames. Exterior doors are in fair condition with undamaged door seals.

Building Envelope: Pump Station Control

Building Door: Pump Station Control

The Pump Station walls consist of CMUs over structural steel with brick veneer and painted CMU interior finish. The flat roof is supported by steel trusses and formed of a metal deck with EPDM covering.

There are no windows in the building. Exterior doors are made from metal with aluminum frames. Exterior doors are in fair condition with undamaged door seals. Overall, the building envelope is in fair condition; the envelope was renovated about five years ago.

Building Envelope: Pump Station

Building Roof: Pump Station

Overhead Door: Pump Station

Building Envelope: Pump Station

The Plant Maintenance Garage walls are of made of brick over structural steel. Steel trusses support a flat roof with a metal deck.

There are no windows in the building. Exterior doors are made from metal with aluminum frames. Exterior doors are in fair condition with undamaged door seals. There are four overhead steel doors with door-closing motors.

Building Envelope: Plant Maintenance Garage

Building Envelope: Plant Maintenance Garage

The U.V. Disinfection Building walls are of made of brick over structural steel. Wood trusses support a pitched roof with a wood deck covered with asphalt shingles.

Most of the windows are double paned with wood frames. Glass-to-frame seals are in fair condition. Weather seals on the operable windows are also in fair condition, showing little evidence of excessive wear. Exterior doors are made from steel with aluminum frames. Exterior doors are in fair condition with undamaged door seals.

Building Envelope: U.V. Disinfection

Building Envelope: U.V. Disinfection

Building Window: U.V. Disinfection

Building Door: U.V. Disinfection

The Filter Building walls consist of CMUs over structural steel, with brick veneer and painted CMU interior finish. The flat roof is supported by steel trusses and formed of a metal deck. The roof encloses a conditioned space below a drop ceiling.

Most windows are double paned with aluminum frames. Glass-to-frame seals are in fair condition. Weather seals on the operable windows are also in fair condition, showing little evidence of excessive wear. Exterior doors are made from a mix of metal and fiberglass reinforced polymer (FRP) composite material with aluminum frames. Exterior doors are in fair condition with undamaged door seals.

Building Envelope: Filter Building

Building Roof: Filter Building

The Nitrification Building walls consist of CMUs over structural steel, with a brick veneer and painted CMU interior finish. The flat roof is supported by steel trusses and formed of a metal deck with gravel pebble finish. The roof encloses a conditioned space below a drop ceiling.

Exterior doors are made from a mix of metal and fiberglass reinforced polymer (FRP) composite material with aluminum frames. Exterior doors are in fair condition with undamaged door seals.

Building Envelope: Nitrification Building

Building Roof: Nitrification Building

Building Door: Nitrification Building

Building Envelope: Nitrification Building

The Plant Maintenance Storage Building walls are constructed of steel framing set on a poured concrete foundation with ribbed metal panel siding. Steel trusses support a pitched roof with a standing seam metal roofing system.

There are no windows in the building. Exterior doors are made from a mix of metal and fiberglass reinforced polymer (FRP) composite material with aluminum frames. Exterior doors are in fair condition with undamaged door seals. There are two overhead steel doors. Exterior doors are in fair condition with undamaged door seals.

Building Envelope: Plant Storage

Building Envelope: Plant Storage

The Collection Vehicle Garage building walls are constructed of steel framing set on a poured concrete foundation with ribbed metal panel siding. Steel trusses support a pitched roof with a standing seam metal roofing system.

There are no windows in the building. Exterior doors are made from a mix of metal and FRP composite material with aluminum frames. There are seven overhead steel doors. Exterior doors are in fair condition with undamaged door seals.

Building Envelope: Collection Vehicle Garage

Building Envelope: Collection Vehicle Garage

2.4 Lighting Systems

Interior lighting is primarily comprised of a mix of linear fluorescent lamps and LED fixtures. Linear T8 and T5 fluorescent lamps typically use electronic ballasts while T12 lamps use less efficient magnetic ballasts. Some of the linear fixtures have been converted to operate LED lube lamps. All exit signs are LED. Most fixtures are in fair condition, and interior lighting levels were generally sufficient.

Many fixtures located in process areas are rated for hazardous environments, making them more costly to replace or retrofit than standard fixtures.

Old Admin Building: The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. Fixture types include 2-lamp or 4-lamp, 4-foot-long recessed fixtures with U-bend and linear tube lamps.

There are a few LED 2-foot x 2-foot and 2-foot x 4-foot fixtures in the office area. Some incandescent and LED screw based “corn” lamps, along with LED ceiling-mounted fixtures, are present in areas that include the janitorial closet, storage room, mechanical room, and restrooms. Most lighting fixtures are controlled manually by wall switches.

T8 U-Bend Fluorescent: Old Admin Building

LED 2-foot Xx2-foot Fixture: Old Admin Building

LED "Corn" Bulb: Old Admin Building

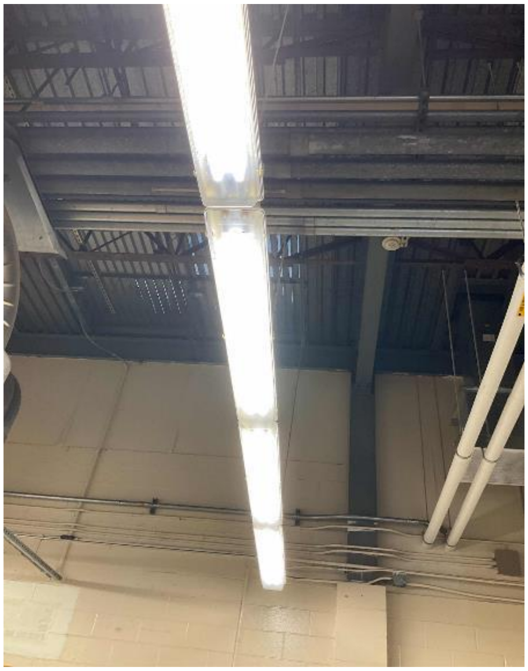
Typical Incandescent Lamp: Old Admin Building

Facility Management Building: The primary interior lighting system uses LED fixtures, mainly 2-foot x 2-foot and 2-foot x 4-foot recessed fixtures, in areas including the boiler room, corridor, restrooms, offices, dining area, conference room, and electrical control room. There are also several 32-Watt linear fluorescent T8 lamps, with fixture types including 1-lamp, 2-lamp, or 3-lamp, 4-foot-long recessed and surface-mounted fixtures with linear tube lamps.

Some of the linear fixtures have been converted to operate LED tube lamps in the attic, electrical control panel room, mechanical room, office operations, restrooms, stairs, and storage closet. There are a few compact fluorescent lamps (CFL), incandescent, and LED general-purpose lamps in the basement, boiler room, offices, restrooms, and storage areas.

Light fixtures in a few restrooms and offices are controlled by occupancy sensors while most are controlled manually by wall switches.

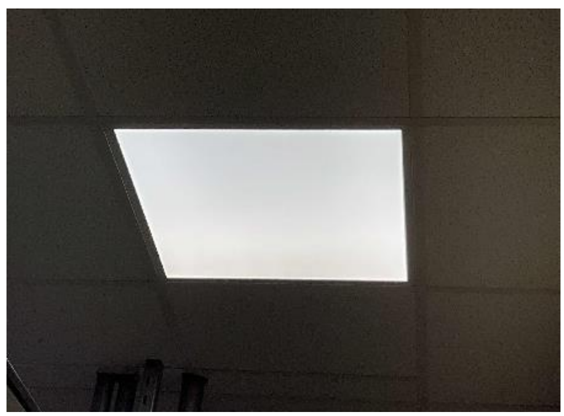
Grit Building: In the mechanical space of the building, most of the lighting consists of LED linear strip fixtures, primarily controlled by occupancy sensors.



LED Linear Tubes: FMB

T8 Linear Fluorescent: FMB

CFL Lamp Fixture: FMB



LED 2-foot X 2-foot Fixture: FMB

Digester Building: The primary interior lighting system uses LED linear strip fixtures. Fixture types include 2-lamp, 4-foot-long surface-mounted fixtures. Additionally, there are some incandescent and LED general-purpose lamps in areas that include the stairs, mechanical room, and basement.

Most lighting fixtures are controlled manually by wall switches.

Typical LED Lamp: Digester Building

Incandescent Lamp: Digester Building

LED Linear Strip: Digester Building

LED Linear Strip: Digester Building

The Pump Station Control is illuminated by LED linear strip fixtures. Fixture types include 2-lamp, 4-foot-long pendant fixtures. Most lighting fixtures are controlled manually by wall switches.

LED Linear Strip: Pump Station Control

LED Linear Strip: Pump Station Control

Pump Station: The primary interior lighting system includes LED linear strip fixtures in the basement and main pump rooms. Most of the linear fixtures have been converted to operate LED tube lamps, illuminating the stairs and pump room while a 32-Watt linear fluorescent T8 lamp illuminates a restroom. Fixture types include 2-lamp, 4-foot-long surface-mounted and pendant fixtures

There are LED 2-foot x 2-foot fixtures in the corridor and restroom. Additionally, there are large quantity of incandescent lamps in the main room of the building. Fixtures are controlled manually by a mix of wall switches and occupancy sensors.

LED Linear Strip: Pump Station

LED 2-foot X 2-foot Fixture: Pump Station

Incandescent Lamp: Pump Station Basement

Incandescent Lamp: Pump Station Basement

Plant Maintenance Garage: The primary interior lighting system is comprised of LED tube lamps with a few T5 fixtures. Fixture types include 3-lamp or 4-lamp, 4-foot-long surface-mounted and pendant fixtures with linear tube lamps. Most fixtures are controlled manually by wall switches.

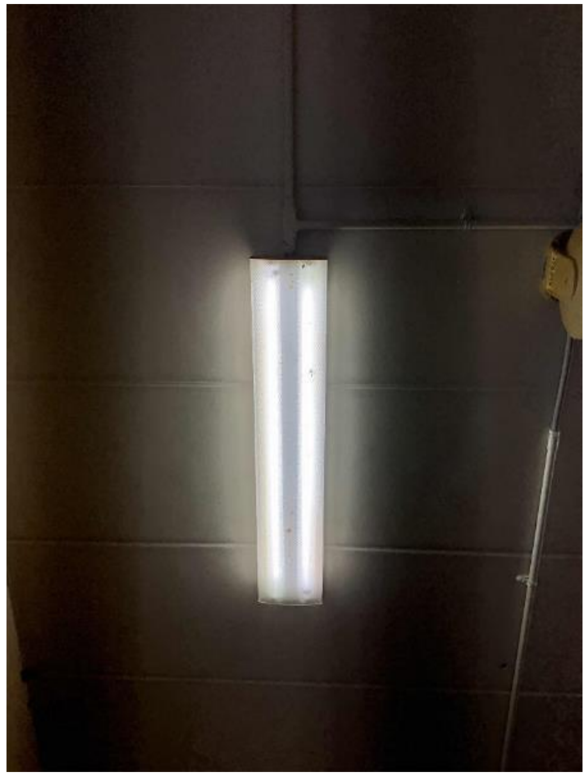
Linear T5 Lamps: Plant Maintenance Garage

LED Linear Tube: Plant Maintenance Garage

U.V. Disinfection: The primary interior lighting system uses LED tube lamps, with a few 32-Watt linear fluorescent T8 lamps for the storage building. Fixture types include 2-lamp, 4-foot or 8-foot-long surface-mounted fixtures with linear tube lamps. Light fixtures are controlled manually by wall switches.

This building also contains process lamps used for UV disinfection. Wastewater is disinfected using a UV disinfection system to ensure pathogens are rendered inactive before discharging into the environment. UV light destroys the genetic material of microorganisms, preventing reproduction. The plant has four banks of UV lights, each with seven rows of eight bulbs, designed to handle the full plant load. On average, two banks operate to manage the typical daily flow of 7-8 MGD.

LED Linear Tube – U.V. Disinfection



T8 Linear Fluorescent – U.V. Disinfection

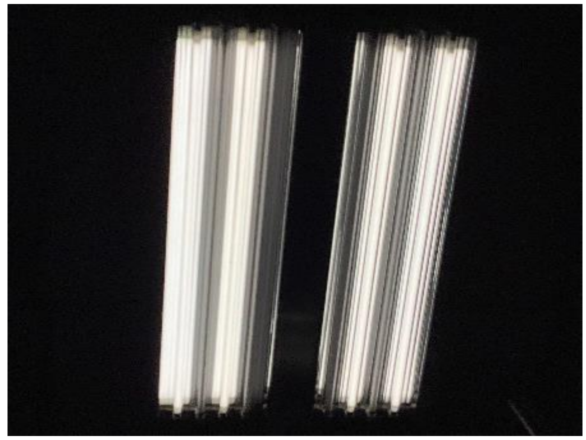
U.V. Bank 1B – U.V. Disinfection

U.V. Bank Control: Pump Station Basement

Filter Building: The primary lighting system includes LED 2-foot x 2-foot and 2-foot x 4-foot fixtures in areas including corridors, mechanical rooms, offices, restrooms, and the U.V. service room. Several T5 fixtures illuminate the mechanical rooms, and some linear fixtures have been converted to operate LED tube lamps. Fixture types include 2-lamp or 4-lamp, 4-foot-long surface-mounted fixtures with linear tube lamps.

Additionally, LED "corn" lamps illuminate the storage room. Fixtures are controlled manually by wall switches.

LED 2-foot x 2-foot Fixture: Filter Building



T5 Linear Fluorescent – Filter Building

LED Linear Tube: Filter Building

LED "Corn" Bulb: Filter Building

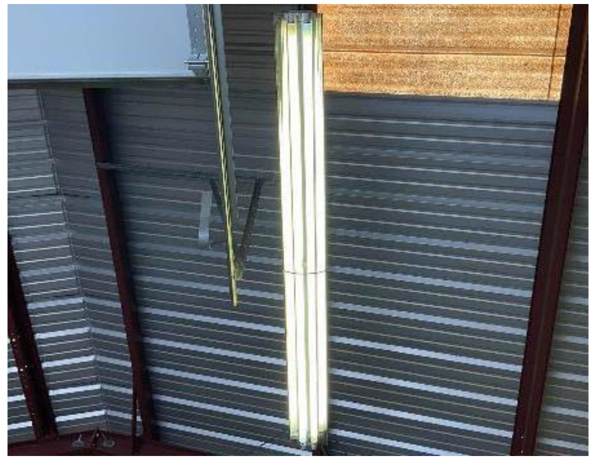
Nitrification Building: The interior lighting system uses a mix of LED tube lamps and LED strip fixtures, with a few T5 fixtures. Fixture types include 2-lamp, 4-foot-long surface-mounted fixtures with linear tube lamps. Additionally, several LED 2-foot x 2-foot and 2-foot x 4-foot recessed fixtures illuminate the corridors, offices, and restrooms. Most lighting fixtures are controlled by occupancy sensors.

LED 2-foot x 4-foot Fixture: Nitrification Building

LED Linear Tube: Nitrification Building

Plant Maintenance Storage: The primary interior lighting system uses linear fluorescent T12 lamps. Fixture types include 2-lamp, 8-foot-long pendant fixtures with linear tube lamps. Light fixtures are controlled by wall switches.

T12 Linear Fluorescent: Plant Storage



T12 Linear Fluorescent: Plant Storage

Collection Vehicle Garage: The lighting system uses a mix of LED high bay fixtures and LED linear tube and strip fixtures for the main garage area and other interior areas. Fixture types include 2-lamp, 4-foot-long surface-mounted and pendant fixtures with linear tube lamps. Light fixtures are controlled manually by wall switches.

LED Linear Tube: Collection Vehicle Garage

LED High Bay Fixture: Collection Vehicle Garage

Exterior building fixtures include wall packs and canopy lights with a mix of high-intensity discharge (HID), CFL, and LED lamps.

Site lighting is significant, with pole-mounted LED “corn” bulb fixtures illuminating roadways and parking lots throughout the facility. Exterior light fixtures are controlled by a photocell.

Exterior Incandescent Lamp: Old Admin Building

Exterior LED Wall Pack: FMB

Exterior CFL Can Fixture

Exterior LED Wall Pack: Grit Building

Exterior LED Wall Pack: Digestor Building

Exterior HID Wall Pack: Pump Station Control

Exterior Roadway Pole Fixture- LED Corn Bulb

Exterior LED Wall Pack: Plant Maintenance Garage

Exterior LED Wall Pack: U.V. Disinfection

Exterior LED Canopy Fixture: Nitrification Building

2.5 Air Handling Systems

Old Admin Building: Various areas, including offices and spaces served by a few air handlers, each equipped with a supply fan motor and electric resistance duct heaters (with 6 kW and 4 kW capacities), use split air conditioning (AC) units for cooling. The Carrier air handlers have 0.5 hp supply fans operating at a constant speed with standard efficiency. These units have cooling capacities of either 2.5 tons or 3 tons. Of these, three Carrier units are operating beyond their useful life and are considered for replacement in this report, while the Thermal Zone unit remains within its useful life.

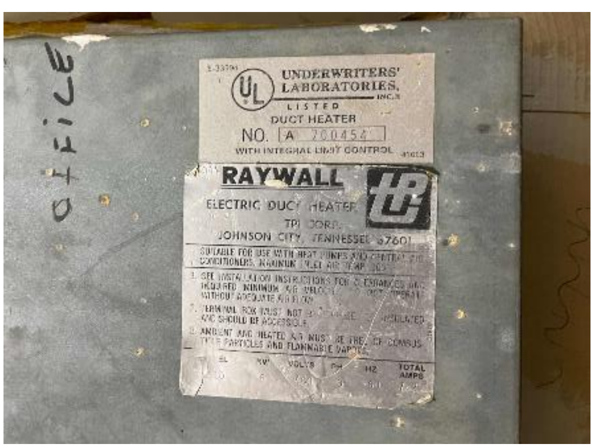
All units are in fair condition, with standard efficiency, and are controlled locally by thermostats or remotes specific to each space. The office and server room are served by a multi-indoor Mitsubishi heat pump with a maximum cooling capacity of 28,400 Btu and heating capacity of 27,400 Btu. This unit has an energy efficiency rating (EER) of 10.6 and a heating seasonal performance factor (HSPF) of 13.5. It is in fair operating condition and controlled by a remote thermostat within the space.

Split Air-Source Heat Pump: Old Admin Building

Split Condensing Unit: Old Admin Building

Wall- Mounted Indoor Unit: Old Admin Building

Remote Control: Old Admin Building



Electric Duct Heater: Old Admin Building

Air Handling Unit: Old Admin Building

Facility Management Building: The FMB is mainly served by three packaged rooftop units of varying sizes: 3-ton, 5-ton, and 15-ton units. The Trane units are equipped with gas-fired burners rated at 48 MBh and 64 MBh, while the Aaon unit receives hot water from the boiler. More details on the heating system are provided in Section 2.6. These units, manufactured in 2015, are in fair condition and include economizers, all controlled locally by thermostats. The Aaon unit has a 5 hp supply fan and a 2 hp return fan, while the Trane units have supply fans of 5 hp and 2 hp, respectively. These fans are not equipped with VFDs and operate at constant speed, with standard efficiency motors that are in fair condition.

Location	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Manufacturer	Model
Roof - FMB	1	Package Unit	15.00		Aaon	RN-015-3-0EA-09-000
Roof - FMB	1	Package Unit	5.00	64.00	Trane	YHC060F4RYA0
Roof - FMB	1	Package Unit	3.00	48.00	Trane	YHC036E4RXA1JH

A Trane air handling unit equipped with a 0.5 hp supply fan motor, hot water heating coil, and refrigerant cooling coil is located in the attic. The refrigerant coil is tied to a split outdoor condensing unit with a 2-ton capacity. The supply fan operates at constant speed, equipped with a standard efficiency motor. This unit is in fair operating condition and is controlled by a local thermostat.

Additionally, the building utilizes an Ingersoll Rand multi-indoor heat pump for cooling and heating select spaces. The unit has a cooling capacity of 38,000 Btu and a heating capacity of 42,000 Btu. Manufactured in 2015, it is in fair condition and has standard efficiency, controlled locally by a thermostat.

Several areas, including corridors, restrooms, and stairways, are heated by electric resistance heaters, each with an estimated capacity of 3 kW. These heaters are of standard efficiency and controlled by manual dial thermostats near the units. The mechanical and boiler rooms also feature a few hot water unit heaters, supplied with hot water from the boiler system, as detailed in Section 2.6. The unit heaters are in fair operating condition.

Split Condensing Unit: FMB

Ceiling Cassette Indoor Unit: FMB

Air Handling Unit: FMB

Electric Resistance Heater: FMB Corridor

Hot Water Unit Heater: FMB Boiler Room

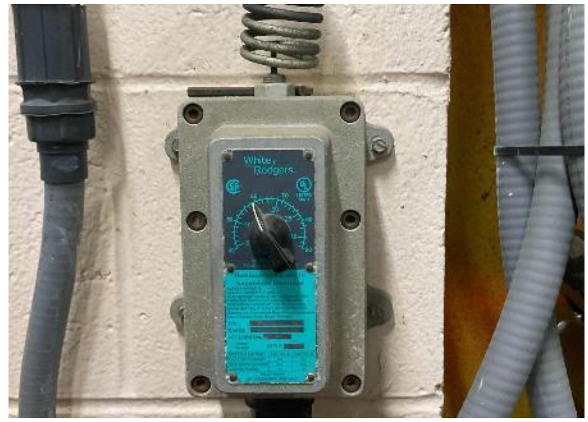
Manual Dial Thermostat: FMB Restroom

Rooftop Package Unit: FMB

Rooftop Package Unit: FMB

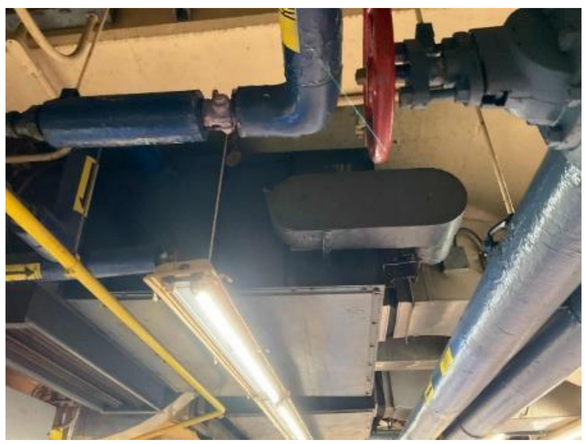
Grit Building: The mechanical space is heated by two electric resistance heaters. These TPI Corporation heaters have a 15-kW input rating and are controlled by manual dial thermostats located in the space.

Electric Resistance Heater: Grit Building



Manual Dial Thermostat: Grit Building

The Digester Building has two air handling units serving various parts of the building. These units are equipped with supply fans and hot water heating coils. The supply fan motors are 1 hp each, constant speed, and standard efficiency.



Air Handling Unit: Digester Building

The Pump Station Control Building is cooled using a Mitsubishi split system air conditioning unit with a 1.5-ton capacity and an indoor wall-mounted blower unit. This unit is controlled by a programmable thermostat located next to the indoor air handling unit, which was set to 68°F during the audit. Manufactured in 2016, the unit is in fair operating condition and has an EER of 9.9.

Wall-Mounted Indoor Unit: Pump Station Control

Thermostat: Pump Station Control

Condensing Unit: Pump Station Control

Some areas of the Pump Station Building are served by an Aaon rooftop package unit. This unit has a 26-ton cooling capacity and an 864 MBh gas-fired burner heating capacity. It has a 5 hp constant speed supply fan motor of standard efficiency, which is in fair condition. This unit was manufactured in 2016 and is in fair operating condition. It is equipped with an economizer that is in fair condition and is locally controlled using a thermostat in the building.

Several areas, including corridors, main pump room, stairs, and storage room, are heated by electric resistance heaters. These range in capacity from 3 kW to 5 kW and are in good condition. The equipment is controlled by manual dial thermostats.

Electric Resistance Heater: Pump Station

Manual Dial Thermostat: Pump Station

Rooftop Package Unit: Pump Station

The Plant Maintenance Garage is heated by a Reznor gas-fired furnace, estimated to be 500 MBh. The unit is in fair condition and is controlled locally by a thermostat in the building.

Gas Fired Furnace: Plant Maintenance Garage

The UV Disinfection Building and adjacent storage building are heated by electric resistance heaters, estimated to have a 5-kW rating. These heaters are in fair condition and are controlled by manual dial thermostats located in the space.

Electric Resistance Heater: U.V. Disinfection

Filter Building: Three air handling units serve various parts of the building. These units are equipped with supply fans and hot water heating coils. Two units have 1.5 hp constant-speed, standard-efficiency supply fans, while the Luxaire unit has a 0.25 hp blower fan with the same specifications.

The Luxaire air handling unit is connected to a split outdoor condensing unit on the rooftop with a 3-ton cooling capacity. Manufactured in 2020, this unit is in fair condition and is controlled locally by a thermostat.

Several areas, including the corridor, mechanical room, and UV service room, are heated by electric resistance heaters. The corridor is heated by a 10 kW Dayton suspended unit, the mechanical room has two, 16 kW Dayton heaters, and the UV service room has one, 10 kW Qmark heater. These heaters are in fair condition and controlled by manual dial thermostats.

Electric Resistance Heater: Filter Building

Electric Resistance Heater: Filter Building

Split Condensing Unit: Filter Building

Indoor Air Handler: Filter Building

Air Handling Unit: Filter Building

Nitrification Building: The office space is partly cooled by a 4-ton Allied split system unit, manufactured in 2017. It is in fair condition and controlled locally by a thermostat. A 4-ton Trane rooftop package unit, manufactured in 2021, serves the office and other areas. This unit is equipped with an economizer and a 1 hp supply fan. It is controlled by a local thermostat. Both units have constant speed fans and standard efficiency motors.

Several areas such as the blowing room, pump room, and garage are heated by electric resistance heaters with capacities ranging from 3 kW to 5 kW. These units are in good condition and controlled by manual dial thermostats. They are equipped with fractional hp supply fans.

Electric Resistance Heater: Nitrification Building

Electric Resistance Heater: Nitrification Building

Split Condensing Unit: Nitrification Building

Rooftop Package Unit: Nitrification Building

The Collection Vehicle Garage is heated by two gas fired infrared heaters, each with an estimated heating capacity of 500 MBh. This equipment is within its useful life and is in fair condition. The units are controlled by a thermostat located in the space. Infrared heating is generally a recommended approach for providing heat to people working in large open areas.

Refer to Appendix A for detailed information about each unit

Infrared Heaters: Collection Vehicle Garage

Exhaust Fan

Most buildings are served by exhaust fans, which are either rooftop or wall mounted. They vary in size, ranging from fractional horsepower to 3 hp. Fan motors are generally of standard efficiency and are in fair condition. Most of them operate during the building's occupied hours and are controlled locally. Many are operating beyond their useful life, and those fan motors are evaluated for replacement in this report.

Exhaust Fan: FMB

Exhaust Fan: FMB

Exhaust Fan: Grit Building

Exhaust Fan: Digester Building

Exhaust Fan: Pump Station

Exhaust Fan: Pump Stations

Exhaust Fan: U.V. Disinfection

Exhaust Fan: Filter Building

Exhaust Fan: Nitrification Building

Exhaust Fan: Collection Vechicle Garage

2.6 Heating Hot Water Systems

Two Weil-McLain hot water boilers, with output capacities of 2,656 MBh and 2,957 MBh, are in the FMB. They serve the building heating load of several buildings and provide process heating for the sludge. The burners are fully modulating, with nominal efficiencies of 81.80% and 81.96%, respectively.

Both boilers are dual fuel, using natural gas and methane, with the methane produced from the sludge at the plant. Fuel selection is set to automatic via the Industrial Combustion burner associated with each boiler.

Sludge is heated in wastewater treatment plants to enhance anaerobic digestion, promote faster breakdown of organic matter, reduce pathogens, and increase biogas production. This process also reduces the volume of sludge for disposal or reuse. In spring and summer, methane production is typically higher due to warmer temperatures and an increased organic load in the wastewater. The digestion process slows in winter, leading to higher natural gas consumption. This is compounded by the additional building heating load on the boilers.

The boilers operate in a lead-lag control scheme, and both are required under high load conditions. Installed in 2015, they are in fair condition.

The hydronic distribution system is a two-pipe, heating-only system. The boilers are configured in a constant-flow primary distribution, with two, 7.5 hp constant-speed hot water pumps operating under a lead-lag control scheme, and fractional hp booster pumps in nearby buildings. The boilers provide hot water to unit heaters, air handlers, and heat exchangers located in the Old Administration Building, Digester Building, and FMB. As per the boiler operation log, the supply water setpoint is typically between 175°F and 180°F.

A Lochinvar hot water boiler with an 842 MBh output capacity serves the heating load for the Filter Building. The burner is fully modulating, with a nominal efficiency of 85%. Manufactured in 2014, the boiler is in fair operating condition. It provides hot water to the air handling unit located in the building. The boiler pipes are well insulated, and the insulation is in fair condition.

Hydronic Boiler: FMB

Hydronic Boiler: FMB

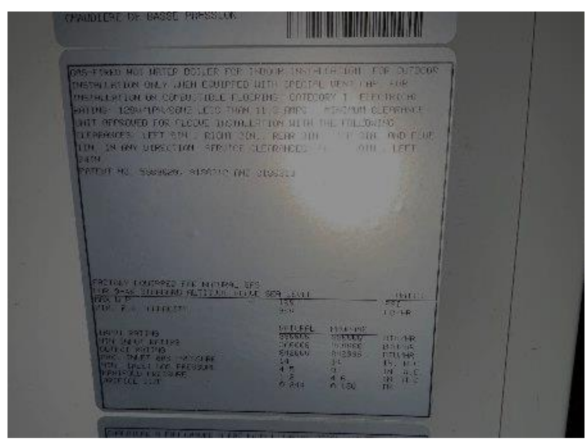
Boiler Feed Water Pump: FMB

Boiler Heating Hot Water Pump: FMB

Heat Exchanger: Old Admin Building

Heat Exchanger: Digester Building

Hydronic Boiler: Filter Building



Hydronic Boiler Nameplate: Filter Building

2.7 Domestic Hot Water

Hot water is primarily produced using Bradford White electric storage tank water heaters in buildings including the Old Admin, FMB, Digester Building, Pump Station, Plant Maintenance Garage, Filter Building, and Nitrification Building. These units range from 19 gallons to 119 gallons in capacity, with electric input ratings of 4.5 kW except for the 119-gallon tank heater in the FMB, which has a heating capacity of 36 kW. The tanks are of standard efficiency and are in fair operating condition.

A fractional horsepower circulation pump recirculates the hot water for the FMB building. The domestic hot water pipes are well insulated throughout most of the system, and the insulation is in fair condition. An exception is in the Old Admin building where the pipes are not insulated. Insulation is evaluated for the Old Admin building in this report.

Electric Storage Water Heater: Old Admin Building

Electric Storage Water Heater: FMB

DHW Circulation Pump: FMB

Electric Storage Water Heater: Pump Station

Electric Storage Water Heater: Filter Building

Electric Storage Water Heater: Nitrification Building

Electric Storage Water Heater: Plant Maintenance Garage

2.8 Plug Load and Vending Machines

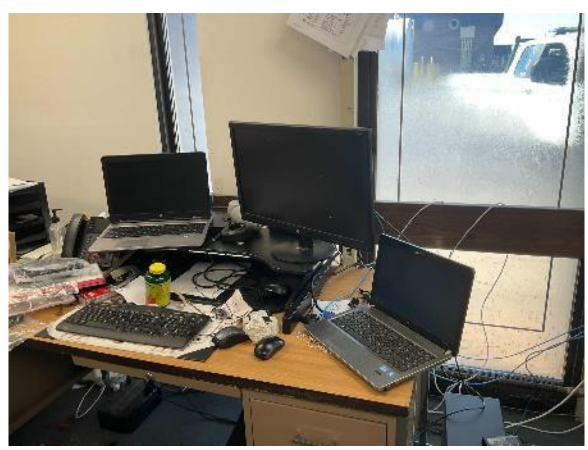
The location is doing a great job managing the electrical plug loads. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

There are 21 computer workstations throughout the facility. Plug loads include general cafe and office equipment, such as copiers/printers, televisions, laptops, color printers, fans, toaster ovens, coffee machines, and water coolers. Additionally, there is a clothes washer and dryer in the Plant Maintenance Garage, and there is server equipment in the Old Admin Building and FMB.

There are several residential-style refrigerators throughout all the buildings that are used to store food. These vary in condition and efficiency. There are also various garage tools, including a drill press, bench grinder, table saw, and electric charger located in the Plant Maintenance Garage and the Nitrification Building.

In the UV Building and Nitrification Building, there are a few dehumidifiers of various sizes serving these areas. The Plant Maintenance Garage houses a 5 hp air compressor with a storage tank to serve the tools there. This system is also equipped with a Hydrovane refrigerant dryer. During the audit, the pressure was set at 90 PSI, and no leaks were observed. The compressor is of standard efficiency and is in fair operating condition.

Printer: Old Admin Building



Typical Laptop and Desktop: Old Admin Building

Typical Plug loads: FMB

Residential-style Refrigerator: FMB

Drill Press: Plant Maintenance Garage

Air Compressor: Plant Maintenance Garage

Dehumidifier: U.V. Building

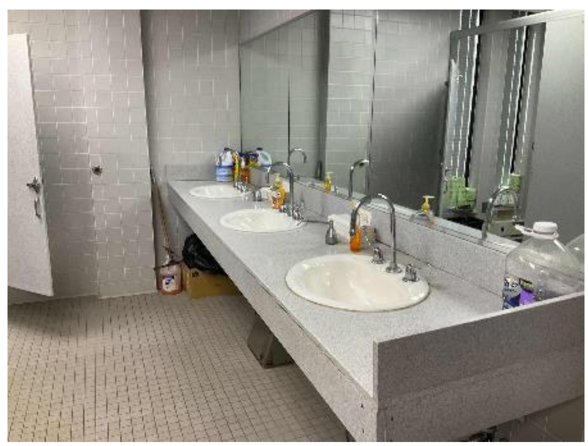
Dehumidifier: Nitrification Building

2.9 Water-Using Systems

Water is provided by municipal water supply company. Water is mainly used for drinking, cleaning, building conditioning, heating the sludge, and sanitary fixtures. Water leaks were not observed.

EPA WaterSense® has set maximum flow rates for sanitary fixtures. They are: 1.28 gallons per flush (gpf) for toilets, 0.5 gpf for urinals, 1.5 gallons per minute (gpm) for lavatory faucets, and 2.0 gpm for showerheads. There are several restrooms with toilets, urinals, and sinks spread across all the buildings. Faucet flow rates are 1.5 gpm or higher.

Typical Restroom Faucet: Old Admin Building



Typical Restroom Faucet: FMB

Typical Restroom Faucet: FMB

Typical Kitchen Faucet: FMB

Typical Restroom Faucet: Filter Building

Typical Restroom Faucet: Nitrification Building

2.10 Wastewater Treatment Equipment

The wastewater treatment process is completed in several stages. Some stages are very energy intensive, while others use relatively small amounts of energy. In an aerobic process such as used at this site, energy is primarily consumed by electric powered motors which consume over 80% of the electricity used on site.

For this discussion, process is grouped with individual buildings and motors associated with that facility. Operation of some of the motors is reviewed in this section; refer to the motor inventory tab in Appendix A for a detailed list of motors and motor operating assumptions.

The biggest challenge in efficient wastewater treatment plant operation is matching the energy use with the process flow. Plants generally operate efficiently at their design flow rate, but often operate below that design flow rate, due to diurnal and seasonal variations. Plants may also be designed with additional capacity for expected future load. If for example, a piece of equipment is only equipped with a single-speed motor, it may not be able to turn down in capacity or energy use, resulting in poor efficiency except when operating at peak design flow.

In general, operational efficiency can be improved as follows:

- Ensure each piece of equipment can operate in a part-load capacity. For some equipment this may mean installing a variable speed drive, or even replacing the equipment to obtain an optimal operating profile; while for others, the ability to start and stop the equipment to match the flow may be sufficient.
- Ensure that there is a way to measure the process flow, and the corresponding equipment needs. For pumps, this may be a fluid level or a pressure sensor. For aeration, it may be measuring the dissolved oxygen (DO) levels in the process. Whatever the system, identify the suitable process variables that can be measured and that directly relates to equipment operations.
- Ensure that adequate controls are in place to monitor the measured variable and adjust equipment operation up or down in response to the measured variable.

Grit Building

The initial removal of heavy, inorganic solids like sand, gravel, and small rocks from the wastewater begins at the Grit Building. The process starts with screening larger debris such as sticks and plastics. Then, the water flows into a grit chamber where the velocity is reduced, allowing the heavier particles to settle by gravity. These particles, often consisting of sand and grit, form a layer at the bottom of the chamber. The settled grit is periodically removed and disposed of, typically in landfills. This grit removal process is important because it prevents damage to pumps and other equipment, improving the efficiency and longevity of the treatment plant.

For filtering the sand and grit, there are two, 7.5 hp pumps that assist in the filtration and dumping process. Additionally, there are two aerator blowers, each 7.5 hp, which help keep the grit suspended for better separation, allowing heavier particles to settle for efficient removal. Blowers in grit buildings are used to introduce air into the grit chamber, creating a rolling motion that helps settle heavier particles like grit while keeping lighter organic materials suspended. They also aid in odor control, prevent clogging, and improve energy efficiency in the grit removal process, making them more suitable for low-pressure, high-volume aeration. There are two, 0.5 hp grit screw pumps at the building exterior that discharge the sand and grit. All these pumps operate at a constant speed and are mostly operated continuously during the treatment process, controlled by an on/off application panel in the building.

Grit and Screen Blowers

Exterior Grit Pumps

Grit Separation Pump

Control Panel: Grit Building

Digester Building

In the Digester Building, organic sludge undergoes anaerobic digestion, where bacteria break down the sludge in an oxygen-free environment. During the digestion process, hot water from the boiler room is supplied via a heat exchanger to maintain the optimal temperature for anaerobic bacteria activity. This process stabilizes the sludge, reduces its volume, and produces biogas (mainly methane). Additionally, digestion reduces pathogens in the sludge, making it safer for disposal or further use, such as in land applications.

On the exterior part of the building, there are two motors used primarily for sludge mixing, one rated at 10 hp and the other at 30 hp. These constant-speed motors are designed to keep the sludge in motion within the tank or digester, preventing settling and promoting uniform treatment by stirring the sludge. In the basement mechanical area there are two sludge pumps, each rated at 5 hp, operating at constant speed. Sludge pumps in the digester transfer raw sludge into the digester, recirculate it for uniform treatment, and move digested sludge to disposal units.

There are also two water pumps, each rated at 7.5 hp and operating at constant speed. Some of the pump motors are operating beyond their useful life and have been evaluated for replacement. Others have been considered for variable speed drive control. These pumps and motors are of standard efficiency, are in fair operating condition, and operate year-round.

Sludge Mixer: Digester Building

Process Water Pumps

Sludge Pumps: Digester Building

Sludge Piping

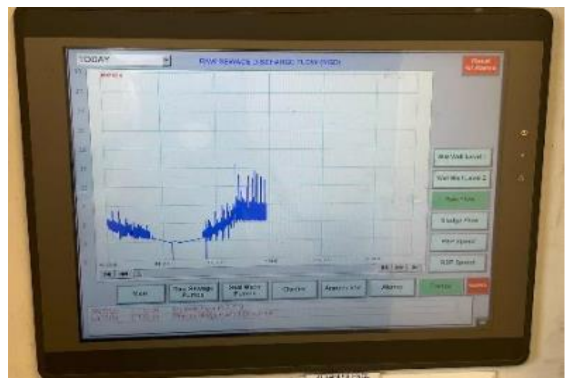
Pump Station Control

The Pump Station Control facility mainly houses the electric panels, drives, and the SCADA system for the operation of the entire plant. The building is not generally occupied, usually visited once a day for logbook checks.

Raw Sewage Pump: Control System

Raw Sewage Pump and Primary Sludge Pump: Control System

Clarifier: Control System



Raw Sewage Discharge (MGD)

Pump Station

The Pump Station includes all the major sludge pumps, including four, 150 hp primary sludge pumps. These pumps are equipped with VFDs, and their drives are located in the Pump Station Control Building.

There are also four smaller raw sludge pumps: two, 15 hp and two, 3 hp. The 15 hp raw sludge pumps have VFDs, and operation data from the plant SCADA system indicates that the flow set point for these pumps is 3,000 GPH, ensuring the appropriate volume of sludge is transferred for further treatment or processing. The graph on the following page indicates sludge transfer information as provided by the SCADA.

The pumps are of standard efficiency and are in fair operating condition. All of these pumps are crucial for transporting sludge to the appropriate treatment stages, ensuring efficient treatment and stabilization of wastewater solids.

Year	Month	Raw Sludge Total Hours	GPH	Total Gallons
2023	January	260.3	3000	780,900
	February	239.5	3000	718,500
	March	283.9	3000	851,700

Year	Month	Raw Sludge Total Hours	GPH	Total Gallons
	April	308.6	3000	925,800
	May	332.5	3000	997,500
	June	306.9	3000	920,700
	July	285	3000	855,000
	August	227.8	3000	683,400
	September	211.2	3000	633,600
	October	238	3000	714,000
	November	219.1	3000	657,300
	December	224.2	3000	672,600

Debris Collection Motor (Bar Screen)

Primary Sludge Pump: Pump Station

Raw Sludge Pump

Raw Sludge Pump

Sealed Water Portable Water Pumps

Raw Sludge Pump

Clarifiers

Primary clarifiers are the first stage of solid-liquid separation. Wastewater flows into the primary clarifiers, where heavier solids (sludge) settle at the bottom. The collected sludge (primary sludge) is then sent to the digester for further processing. The primary clarifiers are equipped with several small-sized and medium-sized motors used for sludge transfer and for moving the screens within the clarifiers.

After biological treatment, the water flows into secondary clarifiers. The process in the secondary clarifiers also involves small-sized and medium-sized motors used for sludge transfer and for moving the screens, similar to the operation of the primary clarifiers. These motors are of standard efficiency and are in fair operating condition. However, during the audit, it was noted that most of these motors were vibrating. Many are old and operating beyond their useful life.

Primary Clarifier 3

Secondary Clarifier 1

Primary Clarifier 1

Primary Clarifier 2

Filter Building

The Filter Building contains major equipment primarily used for advanced filtration processes. There are four filter influent pumps, each rated at 125 hp and equipped with VFDs. The main purpose of these pumps is to maintain a consistent flow of influent to the filters, ensuring efficient filtration. There are two, 150 hp backwash pumps, which operate at constant speed and incorporate a soft-start mechanism to gradually ramp up the speed of the pump motor during startup. The backwash process is essential to remove accumulated solids and debris from the filter media, restoring the filter's efficiency.

There are two service water pumps, each rated at 20 hp and equipped with VFDs. There are also two constant speed 15 hp surface wash pumps.

There are also two large 7.5 hp air compressors, with refrigerant dryers and air storage tanks. During the audit, the compressors were set to 140 psi, and they are primarily used to provide air for tools and for the Rotex control valves used in the filtration process. These valves provide precise control over the direction of flow, switching between different modes of operation to ensure the system runs efficiently. The compressors are nearing the end of their useful life and are evaluated for replacement with VFD equipped air compressors in this report. We also suggest that the facility explore opportunities to lower the set pressure required for the control valves and review the sequencing of the compressors for better energy efficient operation.

Air Compressor

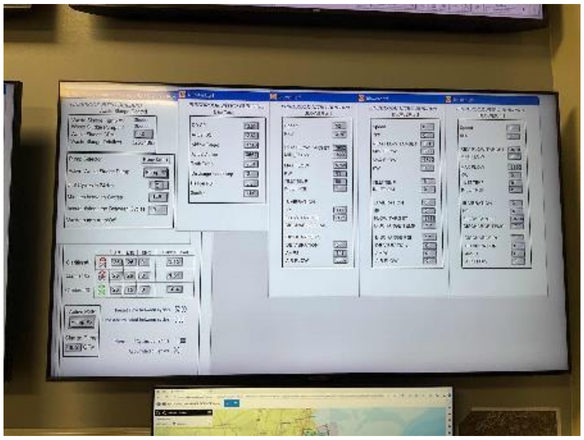
Filter Influent Pumps

Backwash Pump

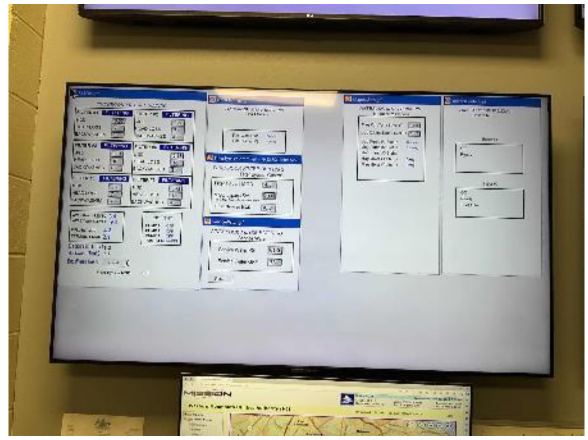
Service Water Pumps

Surface Wash Pumps

Water Pumps



SCADA System



SCADA System

Nitrification Building

The Nitrification Building houses part of the biological nitrogen removal process in activated sludge treatment. Nitrification is the first step in removing nitrogen compounds from wastewater. During secondary treatment at a wastewater treatment plant, aerobic microorganisms consume and break down any remaining organic impurities in the sludge. Since these microorganisms require oxygen, it is blown into the aeration tanks to ensure oxygen is not the limiting factor in the process. Over-aeration increases energy usage from the blowers, which is typically the most energy-intensive part of the treatment process. Therefore, improving the aeration process is critical for reducing energy consumption.

The Nitrification Building contains five aeration blowers, each rated at 200 hp, making them major energy consumers. These blowers are not equipped with VFD controls. Outside the nitrification building and in the pump room, there are two, 15 hp pumps and other smaller pumps and motors used for adding magnesium to the water and magnesium hydroxide slurry for pH control.

Additionally, there are three sludge return pumps, each rated at 50 hp and equipped with VFDs. Pumps 2 and 3 operate in a lead-lag configuration, with Pump 1 serving as a backup. The sludge return pumps recycle a portion of the settled sludge from the clarifier back into the aeration process, a step referred to as return activated sludge (RAS). This is essential for maintaining the right concentration of microorganisms for continued treatment.

Overall, pumps and motors are of standard efficiency and in fair operating condition. However, some motors and pumps are operating beyond their useful life and are evaluated for replacement in this report.

Aeration Blower 1: Control Panel

Sludge Return Pump-2

Aeration Blowers

Process Pump: Magnesium Hydroxide Slurry

Pump Room: Magnesium Hydroxide Slurry

VFD: Sludge Return Pump

2.11 On-Site Generation

The Western Monmouth Wastewater Facility has a 696-kW photovoltaic (PV) array, which provides approximately 20% of the electricity used. The electricity produced by the solar plant is distributed over 12 months, as described in Section 3.1.

The facility also has two emergency generators that, in the event of a power outage, serve the entire facility and critical services, including lighting, heating (boiler), and pumps. These generators are used only for emergency purposes.

Solar PV Plant: Panel

Solar Farm (Google Earth)

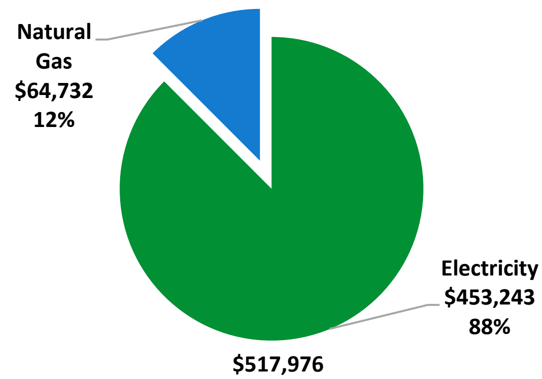
Solar PV Plant: Panel

Emergency Generator 910 kW

3 Energy and Water Use and Costs

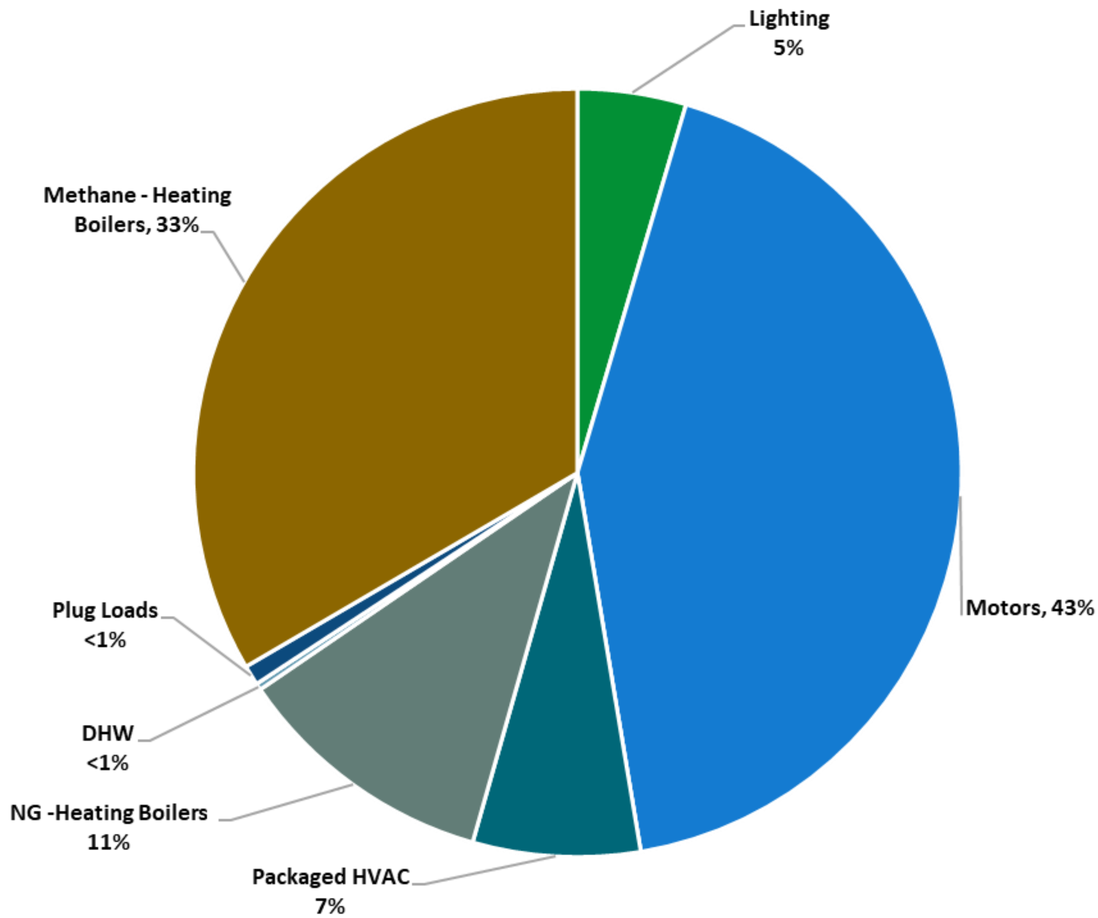
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	4,666,461 kWh	$453,243
Natural Gas	48,456 Therms	$64,732
Total		**$517,976**



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

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

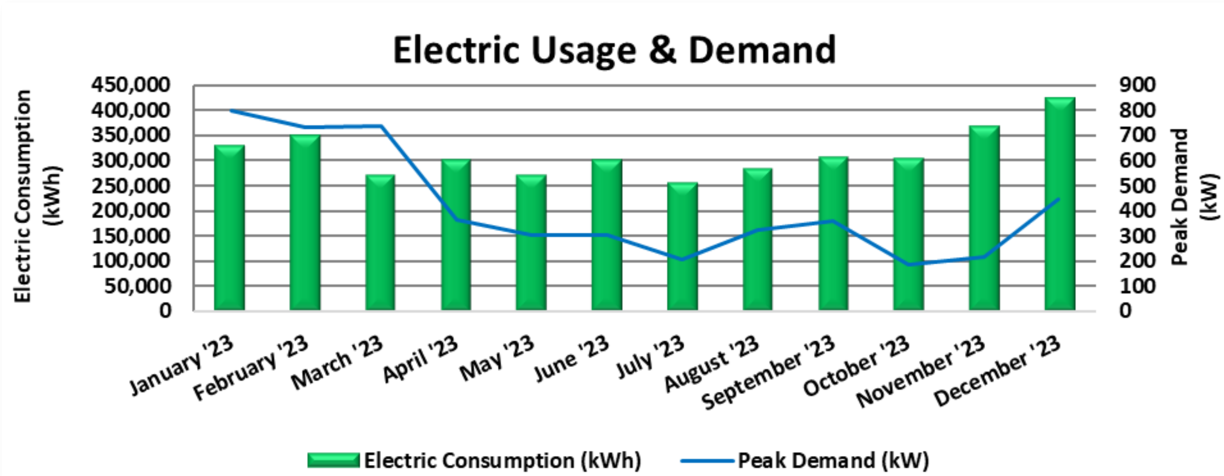


Energy Balance by System

3.1 Electricity

Most electricity used by the complex is purchased off the grid. Additional electricity is generated on-site by the solar farm. The average electric cost over the past 12 months was $0.097/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.

The following graph indicates the grid purchased electricity total, delivered by JCP&L under rate class General Service Secondary Time of Day 3 Phase_ JC_GST_01D.

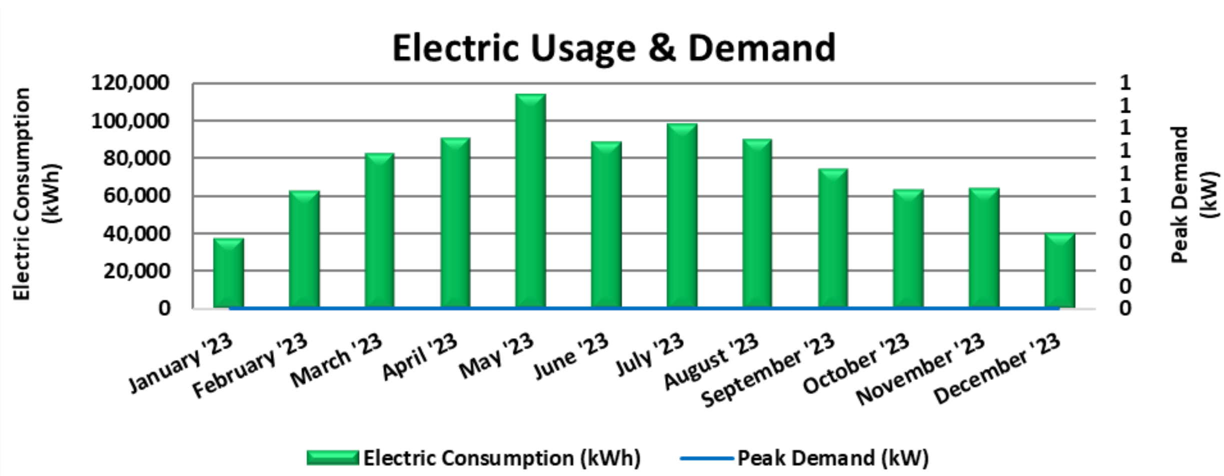


Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
2/9/23	29	329,443	798	$5,287	$33,698
3/13/23	32	348,536	731	$5,321	$35,370
4/11/23	29	271,324	736	$5,180	$28,556
5/10/23	29	301,185	364	$6,107	$32,061
6/9/23	30	271,130	301	$5,504	$28,862
7/12/23	33	300,127	301	$5,794	$31,654
8/10/23	29	255,888	207	$5,615	$27,661
9/12/23	33	283,807	325	$5,812	$30,264
10/11/23	29	305,320	360	$5,921	$39,157
11/9/23	29	304,477	187	$5,218	$37,955
12/11/23	32	366,575	214	$5,531	$44,938
1/11/24	31	423,912	446	$6,979	$53,018
Totals	**365**	**3,761,724**	**798**	**$68,269**	**$423,193**
Annual	**365**	**3,761,724**	**798**	**$68,269**	**$423,193**

Electric Usage

- Peak demand of 798 kW occurred in January '23.
- Average demand over the past 12 months was 414 kW.
- The average electric cost over the past 12 months for this meter was $0.112/kWh.

The following graph illustrates total of on-site produced electricity.



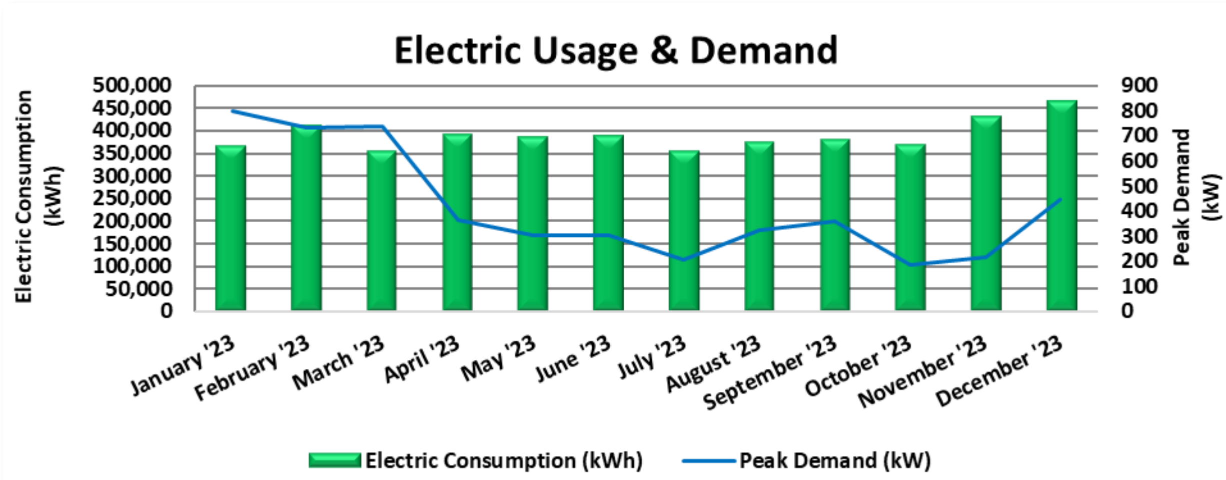
Electric Billing Data			
Period Ending	Days in Period	Electric Usage (kWh)	Total Electric Cost
2/9/23	29	37,352	$1,216
3/13/23	32	62,879	$2,047
4/11/23	29	82,020	$2,671
5/10/23	29	90,344	$3,016
6/9/23	30	113,769	$3,798
7/12/23	33	88,676	$2,960
8/10/23	29	98,236	$3,279
9/12/23	33	89,905	$3,001
10/11/23	29	73,849	$2,465
11/9/23	29	63,479	$2,119
12/11/23	32	63,918	$2,134
1/11/24	31	40,310	$1,346
Totals	**365**	**904,737**	**$30,051**
Annual	**365**	**904,737**	**$30,051**

Electric Usage: On-site Generation Solar

Notes:

- On-site generation is through a PPA, and all of the electricity generated on-site is used on-site.
- Demand (kW) information is not available for generated electricity.
- The average electric cost over the past 12 months for generated solar was $0.033/kWh.

The following graph illustrates the total electricity consumption, including both grid purchases and onsite generation.



Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
2/9/23	29	366,795	798	$5,287	$34,914
3/13/23	32	411,415	731	$5,321	$37,417
4/11/23	29	353,344	736	$5,180	$31,226
5/10/23	29	391,529	364	$6,107	$35,077
6/9/23	30	384,899	301	$5,504	$32,660
7/12/23	33	388,803	301	$5,794	$34,614
8/10/23	29	354,124	207	$5,615	$30,940
9/12/23	33	373,712	325	$5,812	$33,265
10/11/23	29	379,169	360	$5,921	$41,622
11/9/23	29	367,956	187	$5,218	$40,074
12/11/23	32	430,493	214	$5,531	$47,071
1/11/24	31	464,222	446	$6,979	$54,363
Totals	**365**	**4,666,461**	**798**	**$68,269**	**$453,243**
Annual	**365**	**4,666,461**	**798**	**$68,269**	**$453,243**

Electric Usage: Grid and On-site Generation Solar

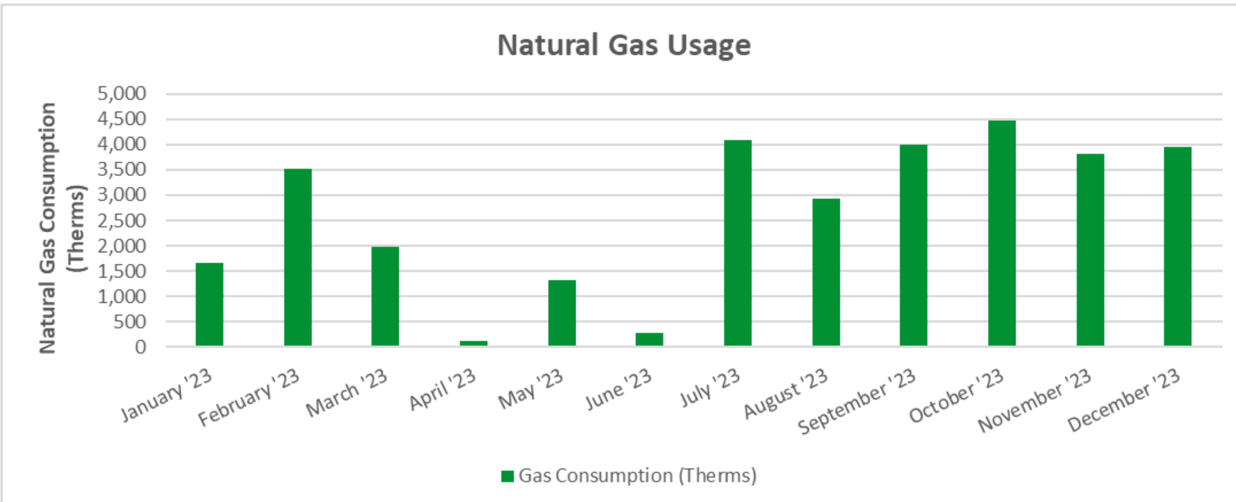
- The average electric cost over the past 12 months was $0.097/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

The site is served by six natural gas meters. The meter serving Old Admin Building did not log any usage. Below are the graphs depicting usage at the five meters.

NJ Natural Gas delivers natural gas under rate class Monthly 007SNN4G, with natural gas supply provided by Indra, a third-party supplier. The overall average gas cost for the past 12 months is $1.34/therm, which is the blended rate used in this analysis.

Facility Management Building



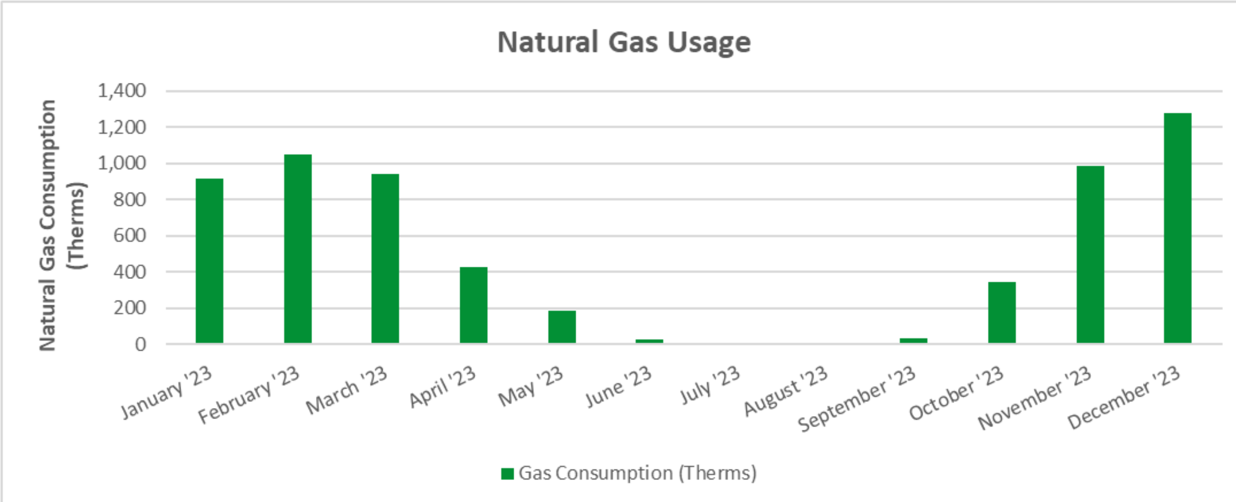
Facilities Management Building			
Gas Billing Data for Wastewater Treatment Plant			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
2/2/23	29	1,669	$2,150
3/3/23	29	3,517	$4,008
4/3/23	31	1,968	$2,451
5/4/23	31	119	$591
6/2/23	29	1,321	$1,804
7/5/23	33	273	$746
8/4/23	30	4,087	$4,598
9/1/23	28	2,941	$3,441
10/3/23	32	3,999	$4,521
11/1/23	29	4,463	$5,104
12/1/23	30	3,809	$4,425
1/5/24	35	3,949	$4,570
Totals	**366**	**32,116**	**$38,408**
Annual	**365**	**32,028**	**$38,303**

Natural Gas Usage FMB Building

Notes:

- The average gas cost for the past 12 months for this meter is $1.20/therm.

Pump Station Building



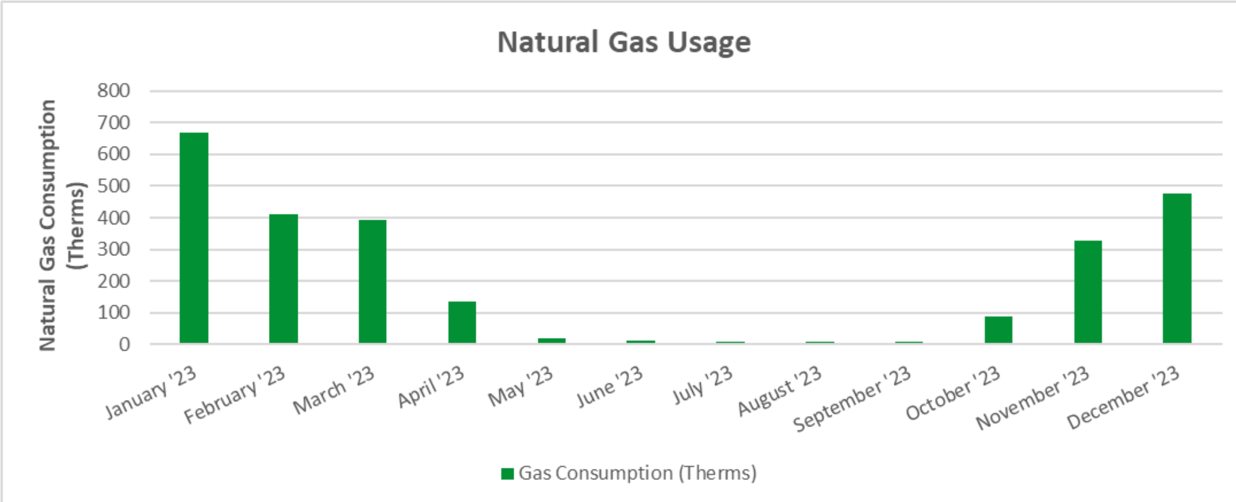
WMUA - Pump Station Gas Billing Data for Wastewater Treatment Plant			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
2/2/23	29	914	$1,295
3/3/23	29	1,050	$1,431
4/3/23	31	938	$1,319
5/4/23	31	427	$805
6/2/23	29	186	$563
7/5/23	33	25	$401
8/4/23	30	0	$375
9/1/23	28	2	$377
10/3/23	32	34	$294
11/1/23	29	346	$618
12/1/23	30	983	$1,279
1/5/24	35	1,279	$1,587
Totals	**366**	**6,184**	**$10,344**
Annual	**365**	**6,167**	**$10,316**

Natural Gas Usage Pump Station Building

Notes:

- The average gas cost for the past 12 months for this meter is $1.67/therm.

Plant Maintenance Garage



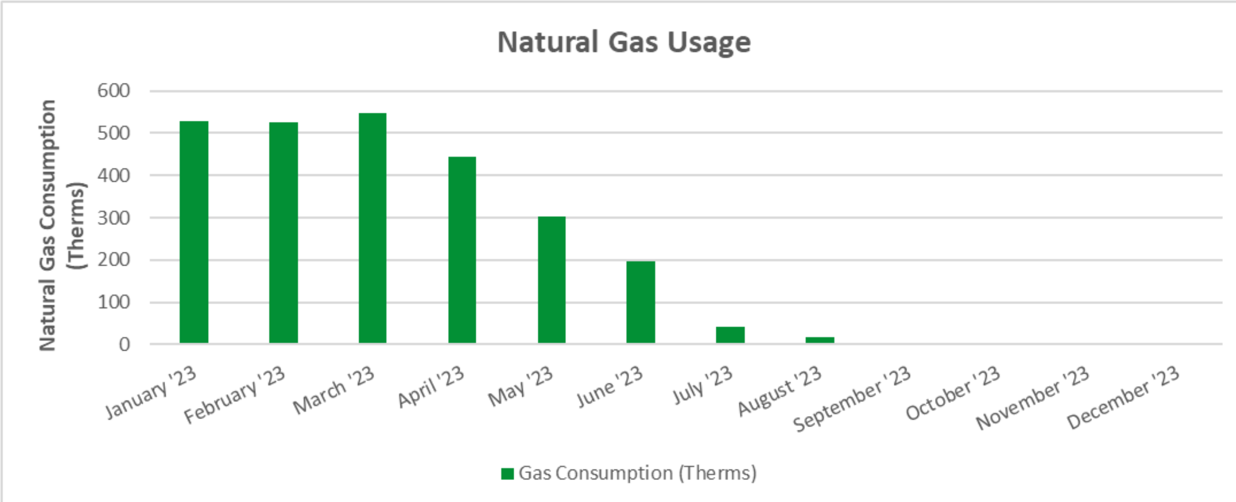
WMUA - Plant Maintenance Garage			
Gas Billing Data for Wastewater Treatment Plant			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
2/2/23	29	670	$849
3/3/23	29	412	$539
4/3/23	31	393	$515
5/4/23	31	136	$206
6/2/23	29	20	$66
7/5/23	33	11	$55
8/4/23	30	9	$52
9/1/23	28	7	$51
10/3/23	32	7	$51
11/1/23	29	87	$152
12/1/23	30	329	$456
1/5/24	35	478	$644
Totals	**366**	**2,558**	**$3,635**
Annual	**365**	**2,551**	**$3,625**

Natural Gas Usage Plant Maintenance Garage

Notes:

- The average gas cost for the past 12 months for this meter is $1.42/therm.

Filter Building



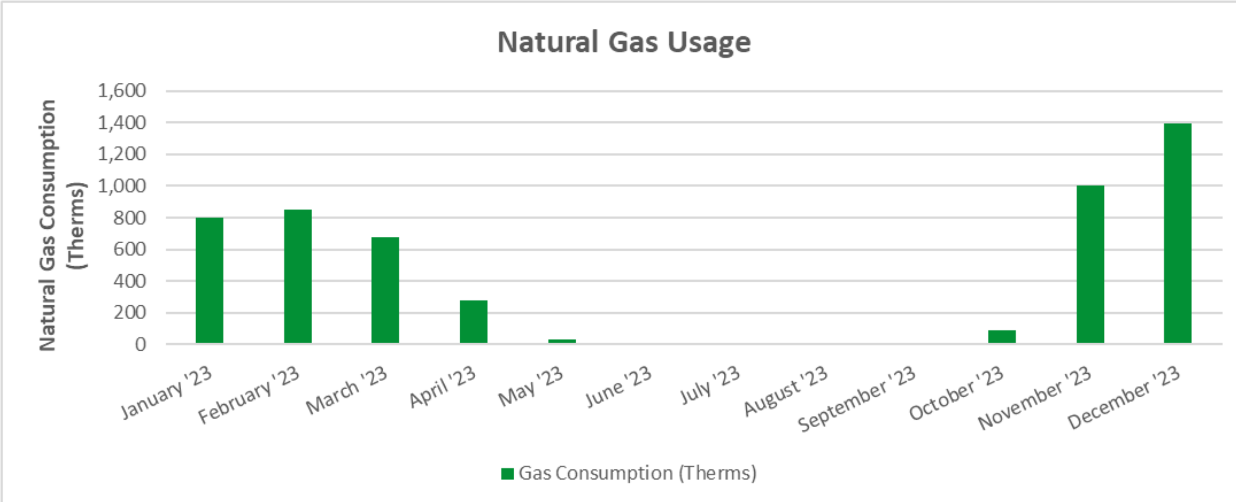
WMUA - Filter Building			
Gas Billing Data for Wastewater Treatment Plant			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
2/2/23	29	527	$677
3/3/23	29	526	$675
4/3/23	31	548	$702
5/4/23	31	443	$575
6/2/23	29	304	$409
7/5/23	33	198	$281
8/4/23	30	42	$93
9/1/23	28	18	$64
10/3/23	32	0	$42
11/1/23	29	0	$42
12/1/23	30	2	$44
1/5/24	35	0	$42
Totals	**366**	**2,608**	**$3,647**
Annual	**365**	**2,600**	**$3,637**

Natural Gas Usage Filter Building

Notes:

- The average gas cost for the past 12 months for this meter is $1.40/therm.

Collections Vehicle Garage



WMUA - Collections Vehicle Garage			
Gas Billing Data for Wastewater Treatment Plant			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
2/2/23	29	797	$1,065
3/3/23	29	851	$1,119
4/3/23	31	676	$943
5/4/23	31	281	$546
6/2/23	29	34	$297
7/5/23	33	0	$263
8/4/23	30	0	$263
9/1/23	28	0	$263
10/3/23	32	0	$259
11/1/23	29	86	$349
12/1/23	30	1,006	$1,304
1/5/24	35	1,391	$1,703
Totals	**366**	**5,123**	**$8,371**
Annual	**365**	**5,109**	**$8,348**

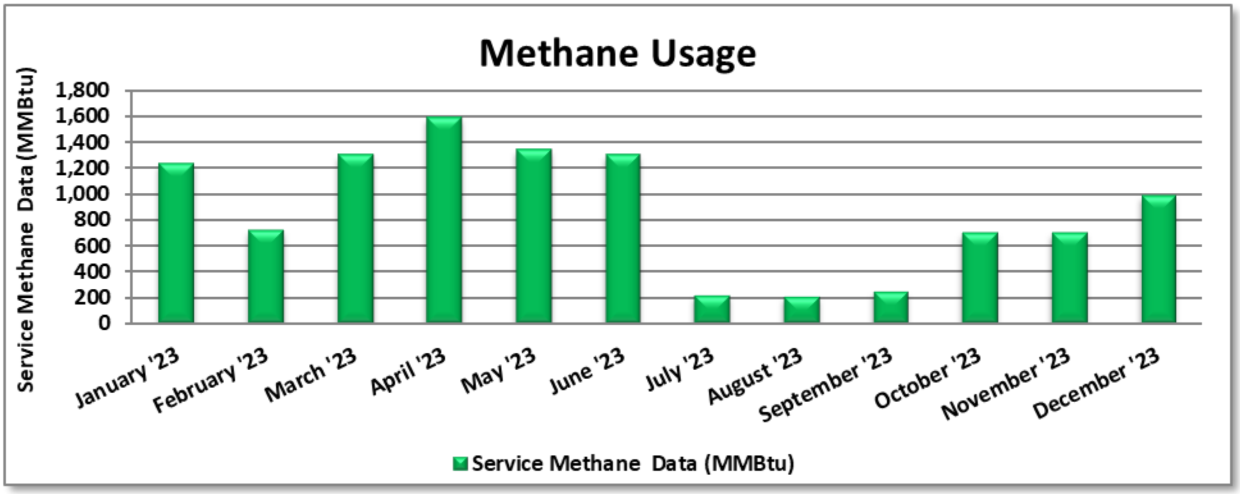
Natural Gas Usage Collections Vehicle Garage

Notes:

- The average gas cost for the past 12 months for this meter is $1.63/therm.

3.3 Methane

Methane is generated on-site through the anaerobic digestion process.



Notes:

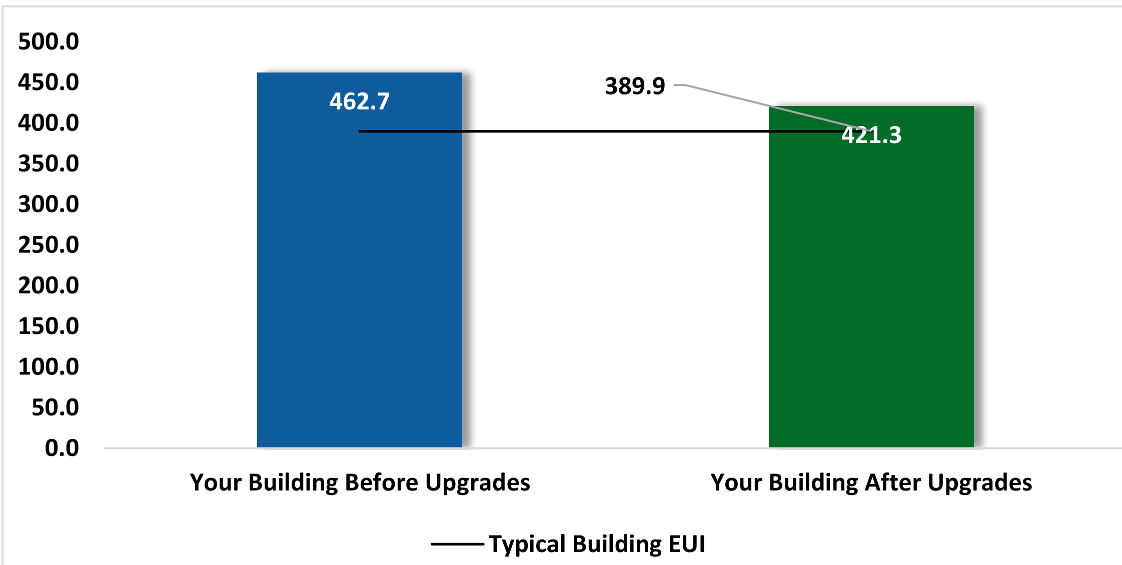
- Facility staff provided historical methane gas production data for review, including both service and waste methane.
- Methane is used only for the dual fuel boilers.
- The report, including the information included in the graph above, considers only the service methane gas, leaving the waste methane gas unaccounted for.

3.4 Benchmarking

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

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

Benchmarking Score	33



Energy Use Intensity Comparison[4]

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

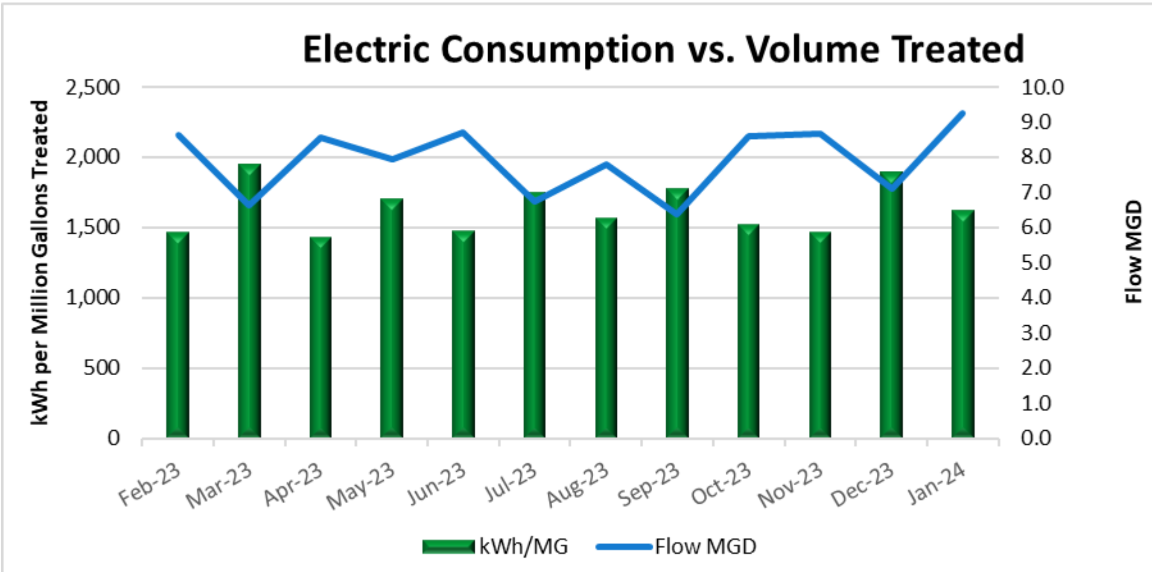
Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. Several factors can cause a building to vary from typical energy usage. Local weather conditions,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

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).

Wastewater treatment plant energy use is typically dominated by electricity use with most of the electricity accounted for by pumps, blowers, and fans. Plant electricity use varies for many reasons

[4] Based on all evaluated ECMs

including type of treatment, process volume, equipment efficiency, energy management practices, and climate. In the case of wastewater treatment plants, the score applies to treatment facilities that process more than 0.6 MGD. The score looks at energy performance while controlling for operating parameters such as influent flow, BOD levels, load factor, application of trickle filters and nutrient removal, and weather.



WWTP: kWh vs MGD

The data highlights variations in energy efficiency (kWh/MG) relative to flow (MGD) over the months, with higher flows not always resulting in lower energy use. For example, March, with a low flow of 6.6 MGD, has the highest energy consumption per million gallons, while higher flow months like June and January are more energy efficient. Higher kWh/MG during these times suggests that pumps may not be operating at optimal efficiency, possibly due to being oversized for reduced loads. Implementing variable-speed drives or improving pump controls could help adjust operations to match flow more closely, reducing energy consumption. Regular maintenance and equipment optimization could further enhance energy efficiency, particularly during periods of fluctuating or lower flows.

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

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

Tracking your Energy Performance

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

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

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

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

3.5 Understanding Your Utility Bills

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

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

Why Utility Bills Vary

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

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

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

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

4 Energy Conservation Measures

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

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

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

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

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**35,590**	**6.6**	**-7**	**$3,364**	**$11,830**	**$1,700**	**$10,130**	**3.0**	**35,030**
ECM 1	Install LED Fixtures	Yes	2,133	0.0	0	$207	$1,600	$200	$1,400	6.8	2,148
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	4,057	1.1	-1	$383	$2,460	$300	$2,160	5.6	3,984
ECM 3	Retrofit Fixtures with LED Lamps	Yes	29,400	5.5	-6	$2,775	$7,770	$1,200	$6,570	2.4	28,897
Lighting Control Measures			**14,207**	**3.4**	**-3**	**$1,339**	**$12,730**	**$2,010**	**$10,720**	**8.0**	**13,952**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	12,887	3.3	-3	$1,215	$11,610	$1,380	$10,230	8.4	12,656
ECM 5	Install High/Low Lighting Controls	Yes	1,320	0.1	0	$124	$1,120	$630	$490	3.9	1,296
Motor Upgrades			**32,033**	**8.4**	**0**	**$3,111**	**$68,000**	**$0**	**$68,000**	**21.9**	**32,257**
ECM 6	Premium Efficiency Motors	No	32,033	8.4	0	$3,111	$68,000	$0	$68,000	21.9	32,257
Variable Frequency Drive (VFD) Measures			**433,223**	**51.2**	**0**	**$42,078**	**$202,100**	**$13,600**	**$188,500**	**4.5**	**436,252**
ECM 7	Install VFDs on Constant Volume (CV) Fans	No	15,753	4.9	0	$1,530	$19,300	$2,200	$17,100	11.2	15,863
ECM 8	Install VFDs on Heating Water Pumps	No	11,168	1.7	0	$1,085	$13,400	$2,000	$11,400	10.5	11,246
ECM 9	Install VFDs on Process Pumps	Yes	388,333	40.3	0	$37,718	$159,100	$7,400	$151,700	4.0	391,048
ECM 10	Install VFDs on Process Blowers	Yes	17,970	4.5	0	$1,745	$10,300	$2,000	$8,300	4.8	18,095
Unitary HVAC Measures			**4,252**	**2.3**	**0**	**$413**	**$17,100**	**$900**	**$16,200**	**39.2**	**4,281**
ECM 11	Install High Efficiency Air Conditioning Units	No	4,252	2.3	0	$413	$17,100	$900	$16,200	39.2	4,281
HVAC System Improvements			**828**	**0.0**	**0**	**$80**	**$140**	**$20**	**$120**	**1.5**	**834**
ECM 12	Install Pipe Insulation	Yes	828	0.0	0	$80	$140	$20	$120	1.5	834
Domestic Water Heating Upgrade			**4,092**	**0.0**	**0**	**$397**	**$250**	**$90**	**$160**	**0.4**	**4,121**
ECM 13	Install Low-Flow DHW Devices	Yes	4,092	0.0	0	$397	$250	$90	$160	0.4	4,121
Custom Measures			**194,471**	**0.0**	**362**	**$23,727**	**$359,900**	**$2,000**	**$357,900**	**15.1**	**238,218**
ECM 14	Installation of an Energy Management System	No	15,170	0.0	362	$6,310	$68,700	$0	$68,700	10.9	57,663
ECM 15	Replace Electric Water Heater with Heat Pump Water Heater	No	10,921	0.0	0	$1,062	$10,800	$0	$10,800	10.2	10,997
ECM 16	Install Automated Dissolved Oxygen Aeration Control	No	161,290	0.0	0	$15,666	$267,000	$0	$267,000	17.0	162,418
ECM 17	Install Air Compressors with VFDs	No	7,090	0.0	0	$689	$13,400	$2,000	$11,400	16.6	7,140
TOTALS			**718,695**	**72.0**	**352**	**$74,511**	**$672,050**	**$20,320**	**$651,730**	**8.7**	**764,944**

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

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

All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**35,590**	**6.6**	**-7**	**$3,364**	**$11,830**	**$1,700**	**$10,130**	**3.0**	**35,030**
ECM 1	Install LED Fixtures	2,133	0.0	0	$207	$1,600	$200	$1,400	6.8	2,148
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	4,057	1.1	-1	$383	$2,460	$300	$2,160	5.6	3,984
ECM 3	Retrofit Fixtures with LED Lamps	29,400	5.5	-6	$2,775	$7,770	$1,200	$6,570	2.4	28,897
Lighting Control Measures		**14,207**	**3.4**	**-3**	**$1,339**	**$12,730**	**$2,010**	**$10,720**	**8.0**	**13,952**
ECM 4	Install Occupancy Sensor Lighting Controls	12,887	3.3	-3	$1,215	$11,610	$1,380	$10,230	8.4	12,656
ECM 5	Install High/Low Lighting Controls	1,320	0.1	0	$124	$1,120	$630	$490	3.9	1,296
Variable Frequency Drive (VFD) Measures		**406,302**	**44.7**	**0**	**$39,463**	**$169,400**	**$9,400**	**$160,000**	**4.1**	**409,143**
ECM 9	Install VFDs on Process Pumps	388,333	40.3	0	$37,718	$159,100	$7,400	$151,700	4.0	391,048
ECM 10	Install VFDs on Process Blowers	17,970	4.5	0	$1,745	$10,300	$2,000	$8,300	4.8	18,095
HVAC System Improvements		**828**	**0.0**	**0**	**$80**	**$140**	**$20**	**$120**	**1.5**	**834**
ECM 12	Install Pipe Insulation	828	0.0	0	$80	$140	$20	$120	1.5	834
Domestic Water Heating Upgrade		**4,092**	**0.0**	**0**	**$397**	**$250**	**$90**	**$160**	**0.4**	**4,121**
ECM 13	Install Low-Flow DHW Devices	4,092	0.0	0	$397	$250	$90	$160	0.4	4,121
TOTALS		**461,019**	**54.7**	**-10**	**$44,645**	**$194,350**	**$13,220**	**$181,130**	**4.1**	**463,079**

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

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

Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**35,590**	**6.6**	**-7**	**$3,364**	**$11,830**	**$1,700**	**$10,130**	**3.0**	**35,030**
ECM 1	Install LED Fixtures	2,133	0.0	0	$207	$1,600	$200	$1,400	6.8	2,148
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	4,057	1.1	-1	$383	$2,460	$300	$2,160	5.6	3,984
ECM 3	Retrofit Fixtures with LED Lamps	29,400	5.5	-6	$2,775	$7,770	$1,200	$6,570	2.4	28,897

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. Note that many fixtures located in the process areas of this facility are rated for hazardous environments, making them more costly to replace or retrofit than standard fixtures. Site specific costs should be added to the estimates used in this analysis accordingly.

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: exterior fixtures: Digester Building, Pump Station Control, and UV Disinfection

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: Plant Maintenance Storage Building

ECM 3: Retrofit Fixtures with LED Lamps

Replace fluorescent, or 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 and T5 tubes; CFLs: FMB (basement, electrical control panel, offices, restrooms, and storage room,) and Collection Vehicle Garage (exterior fixture); and incandescent lamps: Old Admin (exterior fixtures, janitorial closet, storage room), FMB (boiler room), Digester (stairs), Pump Station Control (exterior fixtures) and Pump Station (pump room)

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		**14,207**	**3.4**	**-3**	**$1,339**	**$12,730**	**$2,010**	**$10,720**	**8.0**	**13,952**
ECM 4	Install Occupancy Sensor Lighting Controls	12,887	3.3	-3	$1,215	$11,610	$1,380	$10,230	8.4	12,656
ECM 5	Install High/Low Lighting Controls	1,320	0.1	0	$124	$1,120	$630	$490	3.9	1,296

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: Old Admin (offices and storage room), FMB (attic area, boiler room, conference room, offices, mechanical area, restroom and storage), Pump Station (basement, main pump room, restroom and storage), U.V. Disinfection (Storage building and main UV building), Filter Building (offices, restrooms, and storage room), Plant Maintenance Storage (warehouse), and Collection Vehicle Garage.

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: hallways and stairwells

4.3 Motors

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Motor Upgrades		**32,033**	**8.4**	**0**	**$3,111**	**$68,000**	**$0**	**$68,000**	**21.9**	**32,257**
ECM 6	Premium Efficiency Motors	32,033	8.4	0	$3,111	$68,000	$0	$68,000	21.9	32,257

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.

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.*

Affected Motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Boiler room Facilities Management Building	Feed Water	2	Process Pump	1.0	
Exterior Grit Building	Exhaust Fan	1	Exhaust Fan	0.5	Exhaust Fan
Exterior Grit Building	Grit Pumps	2	Process Pump	0.5	Dump Sand and Grits
Mechanical Area Grit Building	Aerator Pump	2	Process Blower	7.5	
Mechanical-Digestor	Air Handling Unit	2	Supply Fan	1.0	
Exterior Backside Digestor	Exhaust Fan	4	Exhaust Fan	1.0	Exhaust Fan
Mechanical Basement Digestor	Sludge pumps	1	Process Pump	5.0	
Mechanical Basement Digestor	Sludge pumps	1	Process Pump	5.0	
Mechanical Basement Digestor	Water pumps	1	Process Pump	7.5	
Exterior Pump Station	Rooftop Package Unit	1	Supply Fan	5.0	
Exterior Pump Station	Fresh Air Fan	1	Supply Fan	3.0	
Basement pump Pump Station	Other	1	Other	15.0	
Exterior Roof Filter Building	Exhaust Fan 1 - 4	4	Exhaust Fan	0.3	Exhaust Fan
Exterior Roof Filter Building	Exhaust Fan -9	1	Exhaust Fan	0.3	Exhaust Fan
Exterior Roof Filter Building	Exhaust Fan- 10	1	Exhaust Fan	0.3	Exhaust Fan
Exterior Roof Filter Building	Exhaust Fan- 5	1	Exhaust Fan	0.3	Exhaust Fan
Exterior Roof Filter Building	Exhaust Fan- 7	1	Exhaust Fan	0.3	Exhaust Fan
Exterior Roof Filter Building	Exhaust Fan- 12	1	Exhaust Fan	0.3	Exhaust Fan
Exterior Roof Filter Building	Exhaust Fan- 13	1	Exhaust Fan	0.3	Exhaust Fan
Exterior Roof Filter Building	Exhaust Fan- 06	1	Exhaust Fan	0.3	Exhaust Fan

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Exterior Roof Filter Building	Exhaust Fan- 8	1	Exhaust Fan	0.3	Exhaust Fan
Mechanical Room Filter Building	Exhaust Fan	1	Exhaust Fan	0.3	Exhaust Fan
Mechanical Room Filter Building	Backwash Pump - 2	1	Process Pump	150.0	
Mechanical Room Filter Building	Surface Wash Pump	2	Process Pump	15.0	
Exterior Rooftop Nitrification Building	Exhaust Fan- 3	1	Exhaust Fan	0.3	Exhaust Fan
Exterior Rooftop Nitrification Building	Exhaust Fan- 5	1	Exhaust Fan	0.3	Exhaust Fan
Blowing room Nitrification Building	Aeration Blower 3	1	Process Blower	200.0	Aeration Blower
Exterior Ground Nitrification Building	Magnesium Hydroxide Slurry Mixture	1	Process Pump	15.0	Mixtutre
Pump Room Nitrification Building	Waste Sludge Pump	1	Process Pump	2.0	
Collection Vechicle Garage	Exhaust Fan	3	Exhaust Fan	0.3	Exhaust Fan

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		**433,223**	**51.2**	**0**	**$42,078**	**$202,100**	**$13,600**	**$188,500**	**4.5**	**436,252**
ECM 7	Install VFDs on Constant Volume (CV) Fans	15,753	4.9	0	$1,530	$19,300	$2,200	$17,100	11.2	15,863
ECM 8	Install VFDs on Heating Water Pumps	11,168	1.7	0	$1,085	$13,400	$2,000	$11,400	10.5	11,246
ECM 9	Install VFDs on Process Pumps	388,333	40.3	0	$37,718	$159,100	$7,400	$151,700	4.0	391,048
ECM 10	Install VFDs on Process Blowers	17,970	4.5	0	$1,745	$10,300	$2,000	$8,300	4.8	18,095

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

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

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

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

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

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

Affected Air Handlers: FMB: Aaon RTU supply fan; Pump Station: RTU supply fan, exhaust fan, and fresh air fan

ECM 8: Install VFDs on Heating Water Pumps

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

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

Affected Pumps: FMB: boiler hot water pumps

ECM 9: Install VFDs on Process Pumps

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

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

Affected Pumps:

Location	Area(s)/System(s) Served	Motor Quantity	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model
Exterior Ground Digestor	Sludge Mixer	1	10.00	91.7%	No	Weg	
Exterior Ground Digestor	Sludge Mixer	1	30.00	91.0%	No	Weg	
Mechanical Room Filter Building	Backwash Pump - 2	1	150.00	90.0%	No	General Electric	5K6277XH1A
Mechanical Room Filter Building	Backwash Pump - 1	1	150.00	93.0%	No	Emerson	CL03

Location	Area(s)/System(s) Served	Motor Quantity	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model
Mechanical Room Filter Building	Surface Wash Pump	2	15.00	89.0%	No	General Electric	5K6227XH5A
Exterior Ground Nitrification Building	Magnesium Hydroxide Slurry Mixture	1	15.00	88.0%	No	Westinghouse	TBFC
Exterior Ground Nitrification Building	Magnesium Hydroxide Slurry Mixture	1	15.00	91.7%	No	Weg	01512ST30E28-W22

ECM 10: Install VFDs on Process Blowers

Install VFDs to control process blowers. In most cases sensors will be required to trigger adjustments to blower speed. 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.

Affected Pumps: Grit Building: aerator pump

4.5 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**4,252**	**2.3**	**0**	**$413**	**$17,100**	**$900**	**$16,200**	**39.2**	**4,281**
ECM 11	Install High Efficiency Air Conditioning Units	4,252	2.3	0	$413	$17,100	$900	$16,200	39.2	4,281

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

ECM 11: Install High Efficiency Air Conditioning Units

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

Affected Units:

Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Manufacturer	Model
Exterior Old Admin	Old Admin Building Cooling	1	Split-System	3.00	Carrier	38CKC036630
Exterior Old Admin	Old Admin Building Cooling	1	Split-System	3.00	Carrier	38CKC036610
Exterior Old Admin	Old Admin Building Cooling	1	Split-System	2.50	Carrier	38CKC030500

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		**828**	**0.0**	**0**	**$80**	**$140**	**$20**	**$120**	**1.5**	**834**
ECM 12	Install Pipe Insulation	828	0.0	0	$80	$140	$20	$120	1.5	834

ECM 12: Install Pipe Insulation

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

Affected Systems: Old Admin: 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		**4,092**	**0.0**	**0**	**$397**	**$250**	**$90**	**$160**	**0.4**	**4,121**
ECM 13	Install Low-Flow DHW Devices	4,092	0.0	0	$397	$250	$90	$160	0.4	4,121

ECM 13: Install Low-Flow DHW Devices

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

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

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

4.8 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**194,471**	**0.0**	**362**	**$23,727**	**$359,900**	**$2,000**	**$357,900**	**15.1**	**238,218**
ECM 14	Installation of an Energy Management System	15,170	0.0	362	$6,310	$68,700	$0	$68,700	10.9	57,663
ECM 15	Replace Electric Water Heater with Heat Pump Water Heater	10,921	0.0	0	$1,062	$10,800	$0	$10,800	10.2	10,997
ECM 16	Install Automated Dissolved Oxygen Aeration Control	161,290	0.0	0	$15,666	$267,000	$0	$267,000	17.0	162,418
ECM 17	Install Air Compressors with VFDs	7,090	0.0	0	$689	$13,400	$2,000	$11,400	16.6	7,140

ECM 14: Installation of an Energy Management System

Most larger facilities have some type of building automation system (BAS), which provides for centralized, remote control and monitoring of HVAC equipment, and sometimes lighting or other building systems. A BAS utilizes a system of temperature and pressure sensors that obtain feedback about field conditions and provide signals to control systems that adjust HVAC system operation for optimal functioning. Thirty years ago, most control systems were pneumatic systems driven by compressed air, with pneumatic thermostats and air driven actuators for valves and dampers. Pneumatic controls have largely been replaced by direct digital control (DDC) systems, but many pneumatic systems remain. Contemporary DDC systems afford tighter controls and enhanced monitoring and trending capabilities as compared to the older systems.

Often smaller facilities are not equipped with central controls. For many small sites, it has been less costly to install distributed local controls, such as programmable thermostats and timeclocks, rather than centralized DDC. Local controls do a reasonably good job of scheduling equipment and maintaining operating conditions by relying on controls integral to HVAC units, such as logic for compressor staging, to manage the equipment operating algorithms.

Even for smaller sites, inefficiencies arise when temperature sensors and thermostat schedules are not maintained, when there are separate systems for heating and cooling, and especially when equipment is added, or the facility is reconfigured or repurposed.

Based on our survey, it appears that the installation of a BAS at your site (FMB) could increase the efficiency of your building HVAC system operation.

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

It is recommended that an HVAC engineer or contractor who specializes in BAS be contacted for a detailed evaluation and implementation costs. For the purposes of this report, the potential energy savings and measure costs were estimated based on industry standards and previous project experience. Further analysis should be conducted for the feasibility of this measure. This is not an investment grade analysis nor should be used as a basis for design and construction.

A high-level evaluation of potential savings and costs is provided for demonstration purposes only. It is a screening evaluation for the potential in installing a BAS. Based on industry standards and previous project experience, the potential energy savings may be up to 20% of existing HVAC energy use. We estimate the cost for installing a BAS is approximately $2.00 per square foot. Actual savings and costs will need to be outlined by the specific contractor engaged to implement the system. For the purposes of this report, we have conservatively estimated savings to be 7.4% of the HVAC energy consumption baseline.

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

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

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

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

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

HPWH operate most effectively when the temperature difference between the incoming and outgoing water is high. Generally, this means that cold make-up water should be piped to the bottom of the tank and return water should be piped to the top of the tank to maintain stratification within the storage tank.

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

Water should be drawn from the bottom of the tank to be heated. If there is a DHW recirculation pump, it should only be operated during high hot water demand periods.

Affected Units: electric hot water tank storage heater: FMB, Pump Station, and Nitrification Building

ECM 16: Install Automated Dissolved Oxygen Aeration Control

In a wastewater treatment plant, aeration provides oxygen to bacteria in the wastewater so that the bacteria can break down the organic matter in the wastewater. Wastewater is aerated either by bubbling air through it, or by mixing it so that oxygen is transferred through contact with the atmosphere. The two most common types of aeration systems are diffused aeration and mechanical surface aeration. Control of the aeration process is critical to efficient operation of wastewater treatment plants as both over- and under-aeration have detrimental effects. The energy used for aeration ranges from 25 to as much as 60 percent of total plant energy use.

The oxygen demand for aeration varies based on the amount of organic material in the wastewater. The oxygen transfer efficiency of the aeration basin also varies in response to changing air and water temperature and other wastewater characteristics such as concentrations of solids and surfactants. The ratio of peak to minimum oxygen demand can be as great as 2:1. As a result, the amount of air that is required to maintain proper aeration in the aeration basin varies considerably throughout the year and during the day.

Typically, the dissolved oxygen (DO) level in an aeration basin is measured by the plant operators a few times a day and adjustments are made to the aeration system to maintain the desired DO level. This approach will generally not capture the full variation in DO levels, as a result, a safety factor is often applied to the DO setpoint so that the DO level does not drop below that required to maintain proper aeration. The DO concentration needed to maintain stable biological activity is site-specific but usually ranges from 1.0 to 2.0 milligrams per liter (mg/L) for activated sludge systems.

Automated DO control systems use real-time DO concentration readings from DO probes located within the aeration basins as inputs to a process controller. The process controller provides control output signals to the aeration system. The system responds by adjusting the aeration process (e.g., mechanical mixer or blower speed) to deliver the proper amount of air needed to maintain the target DO concentration. A simple control system might use one DO probe and one target DO concentration for all aeration basins. A more complex control strategy involves individual DO probes and air header control valves for each basin and/or stages within each basin. Systems that target DO concentrations for individual basins or stages can yield greater energy savings than simple controls. In developing the costs for this measure, it was assumed that one DO sensor would be used for each aeration basin. The cost estimate also includes installing VFDs to control the speed of the aeration equipment. This measure reduces the energy use of the aeration system by continuously adjusting the airflow provided by the aeration system to maintain the required DO level.

The facility staff expressed interest in adding a smaller aerator blower. This addition would allow for more effective load cycling by alternating between aerators when installed in conjunction with a fully modulating VFD and controls. The overall load profile of the aeration system could be reduced with this modification.

Affected Units: aeration blowers 1, 2, 3, 4, and 5 (Nitrification Building)

ECM 17: Install Air Compressors with VFDs

We evaluated replacing the two 7.5 hp air compressors in the Filter Building with variable-speed drive (VSD) air compressors. The compressors are primarily used to provide air for tools, and for the Rotex control valves used in the filtration process. The system air pressure was noted as set to 140 psi. The compressors are nearing the end of their useful life

VSD air compressors use a variable-speed motor to adjust output based on the load, making them more efficient than fixed-speed compressors. Traditional compressors regulate output by restricting inlet air, which leads to higher energy use and peak demand.

With a VSD, the compressor operates more efficiently at partial loads by adjusting speed to match air demand, rather than using mechanical unloading. Energy savings come from lowering compressor speed and power when the load decreases. The amount of energy saved depends on how much time the system operates at reduced load and the increased efficiency of the new compressor.

Whether or not facility staff decide to replace the compressors at this time, we suggest that opportunities to lower the system pressure from 140 psi by evaluating pressure requirements for the control valves and tools. We also recommend a review of compressor sequencing.

Affected Units: air compressors (Filter Building).

4.9 Measures for Future Consideration

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

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

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

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

Electric Sub Metering

Electricity use varies in different facilities, and plant operators need to perform their own investigations and analyses to understand how their facilities consume energy. Facility staff expressed interest in sub metering key, which are currently served by a master meter. Utility bills indicate how much energy a facility uses across the entire facility, but submetering provides more detailed data on the energy consumption of specific systems and even on individual pieces of equipment, depending on how extensively meters are installed. Electric submeters alone do not save energy, but they are a useful tool under the right circumstances. Electric sub-meters can provide facility staff with real-time energy use data for specific buildings, systems or equipment, information that enhances the potential for greater energy management activities. Revenue grade submeters are a tool that allow operators to better understand how and where electricity is used at the facility. Better resolution of system energy use can lead to operational changes or even equipment modifications or replacement, which often result in reduced energy use, which often result in reduced energy use.

Upgrade to a Heat Pump System

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

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

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

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

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

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

Replace Smooth V-Belts with Notched or Synchronous Belts

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

In general, there are two styles of grooved V-belts: notched and synchronous. The U.S. Department of Energy (DOE) compares these two types as follows:[6]

Characteristic	Notched V-Belts	Synchronous Belts
Description	A notched belt has grooves or notches that run perpendicular to the belt's length, which reduces the bending resistance of the belt.	They are also called cogged, timing, positive-drive, or high-torque drive belts, and are "toothed".
Pulleys/Sprockets	Can use the same pulleys as cross-section standard V-belts	Require the installation of mating grooved sprockets.

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

Characteristic	Notched V-Belts	Synchronous Belts
Typical Efficiency	Run cooler, last longer, and are about 2% more efficient than standard V-belts.	Operate with a consistent efficiency of 98% and maintain their efficiency over a wide load range.
Constraints	Have a sharp reduction in efficiency at high torque due to increased slippage.	Noisier than V-belts, less suited for use on shock-loaded applications, and transfer more vibration due to their stiffness.
Other Benefits	Lower cost than synchronous belts, overall.	Require minimal maintenance and re-tensioning. Operate in wet and oily environments, and run slip-free

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

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

High Speed Insulated Overhead Doors

Energy efficient overhead doors are an important consideration when improving the building envelope of the Pump Station, Plant Maintenance Garage, Nitrification Building, Plant Maintenance Storage Building, and Collection Vehicle Garage Building. The heat loss when overhead doors are open is responsible for a significant portion of the facility's heating energy consumption. We recommend replacing overhead doors with high-speed insulated overhead doors. This measure will permit overhead doors to open and close more than twice as quickly as the existing case, significantly reducing heat loss in the garage area. The insulation will further mitigate heat loss when the doors are closed.

As part of the installation, the overhead door frames should be properly sealed with weather stripping and sealing materials to ensure the mitigation of air infiltration. Building envelopes that limit air infiltration play a key role in optimizing heating and cooling efficiency, controlling moisture, and providing occupant comfort. Overhead door replacement may be an expensive upgrade, especially as it may involve structural or architectural elements.

Overall savings will also vary depending on the type of heating system present. Since infrared heaters tend to radiate heat directly to occupants or objects, they contribute less to overall heat loss than forced air systems do. Areas with forced air heat are the better candidates for this measure.

Flow Based Ultraviolet Disinfection System

The Long Term 2 Enhanced Surface Water Treatment Rule[7] mandates that public water systems (PWSs) monitor UV reactors to ensure they are operating within validated conditions for the required UV dose. PWSs must track flow rate, lamp status, UV intensity (via sensors), and other state-required parameters.

[7] https://www.epa.gov/system/files/documents/2022-10/ultraviolet-disinfection-guidance-manual-2006.pdf

UV absorbance should be measured if it's part of the dose-monitoring strategy, and UV sensors need to be calibrated per state-approved protocols.

UV disinfection works by damaging the nucleic acids of microorganisms, preventing them from replicating. Unlike chemical disinfectants, UV intensity (measured in watts per square meter) determines the effectiveness of the process. UV dose is calculated as the product of intensity and exposure time, but UV lamps degrade over time, reducing output and effectiveness.

When designing a UV disinfection facility, key considerations include the overall disinfection strategy, target pathogens, and required UV dose. Factors like sleeve fouling, lamp aging, and UV sensor window fouling can affect performance, so proper maintenance and calibration are essential. The flow rate measurement method should align with plant variability and state requirements, typically with a dedicated flow meter for each UV reactor.

The plant uses four banks of UV lights, each with 7 rows of 8 bulbs, designed to handle the full plant load. On average, two banks operate to manage the typical daily flow of 7-8 MGD.

UV disinfection can account for large portion of a wastewater plant's operational budget. Consider a flow pacing system control that adjusts UV output based on flow rate, optimizing energy use by turning banks on and off automatically.

Optimizing the system through sensing, control, and automation - such as using dose-pacing to adjust lamp output based on real-time data, can significantly reduce costs by lowering energy consumption while maintaining disinfection efficiency.

4.10 Wastewater Process Energy Considerations

"Electricity constitutes between 25 and 40 percent of a typical wastewater treatment plant's (WWTP's) operating budget,"[8] and process motors and blowers often consume 75% or more of the energy used in plant operations. Regardless of your plant's size and treatment processes there are fundamental ways to approach operations, controls, retrofits, and planned upgrades to ensure reliable operations that match energy use to your production requirements.

Energy Management

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

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

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

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

Baseline Measurements

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

Best Practices

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

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

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

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

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

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

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

Third Party Resources

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

EPA ENERGY STAR Portfolio Manager

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

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

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

EPA Energy Assessment Tool

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

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

DOE Energy Performance Indicator (EnPI) Tool

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

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

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

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

DOE Wastewater Energy Management Toolkit (SWIFt)

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

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

5 Energy Efficient Best Practices

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

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

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

Energy Tracking with ENERGY STAR Portfolio Manager

You've heard it before—you cannot manage what you do not measure. ENERGY STAR Portfolio Manager is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[10]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Weatherization

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

Doors and Windows

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

Window Treatments/Coverings

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

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

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.

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 Short Cycling Reduction

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

Motor Maintenance

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

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°F-10°F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced by increasing the facility's occupied setpoint temperature. In general, during the cooling season, thermostats should be set as high as possible without sacrificing occupant comfort.

Economizer Maintenance

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

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

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

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

Ductwork Maintenance

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

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

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

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

Boiler Maintenance

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

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.

Label HVAC Equipment

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

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

Optimize HVAC Equipment Schedules

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

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

Water Heater Maintenance

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

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

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

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.
- Reduce pressure setting to minimum needed for air operated equipment.
- Turn off compressor if not routinely needed.
- Use low pressure blower air rather than high pressure compressed air.

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

Procurement Strategies

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

6 WATER BEST PRACTICES

Getting Started

The commercial and institutional sector is the second largest consumer of publicly supplied water in the United States, accounting for 17% of the withdrawals from public water supplies[11]. In New Jersey, excluding water used for power generation, approximately 80% of total water use was attributed to potable supply during the period of 2009 to 2018. Water withdrawals for potable supply have not changed noticeably during the period from 1990 to 2018[12].

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

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

For more information regarding water conservation or additional details regarding the practices shown below go to the EPA's WaterSense website[13] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[14] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Water Metering and Submetering

Tracking a facility's total water use, as well as specific end uses, is a key component of a facility's water-efficiency efforts. Accurately measuring water use can help facility managers identify areas for targeted reductions and track progress from water-efficiency upgrades. If possible, install meters to measure all water conveyed to the facility, regardless of the source. Each source should be metered separately. Consider developing a metering plan and installing separate submeters to measure specific end uses. There are many types and sizes of meters intended for different uses. Installing the correct type and size of meter are critical to accurate water measurement. Sub-metering applications may include:

- Individual tenant spaces
- Cooling tower make-up and blowdown water supply
- Water lines serving other HVAC systems including water circulating loops
- Make up water supply for steam boiler plants with a capacity of 500,000 Btu/hr. or greater
- Systems or equipment that use single pass cooling water
- Irrigation systems

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

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

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

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

- Roof spray systems (for irrigating vegetated roofs or thermal conditioning)
- Ornamental water features
- Indoor and outdoor pools and spas
- Industrial water using processes

Leak Detection and Repair

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

Toilets and Urinals

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

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

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

Faucets and Showerheads

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

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

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

7 On-Site Generation

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

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

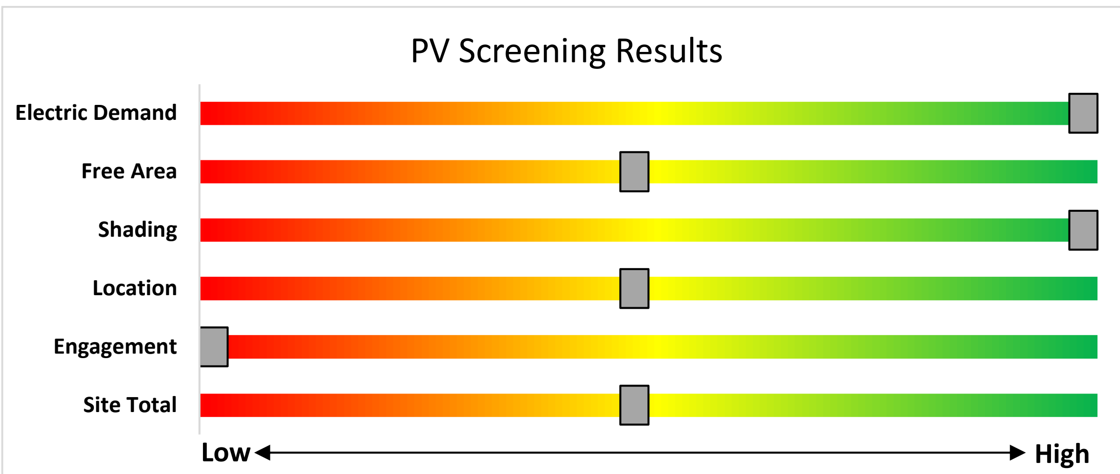
7.1 Solar Photovoltaic

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

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

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the medium potential. A PV array located on the ground 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	Medium	
System Potential	54	kW DC STC
Electric Generation	64,334	kWh/yr
Displaced Cost	$6,250	/yr
Installed Cost	$154,400	

Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

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

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

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

7.2 Combined Heat and Power

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

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

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

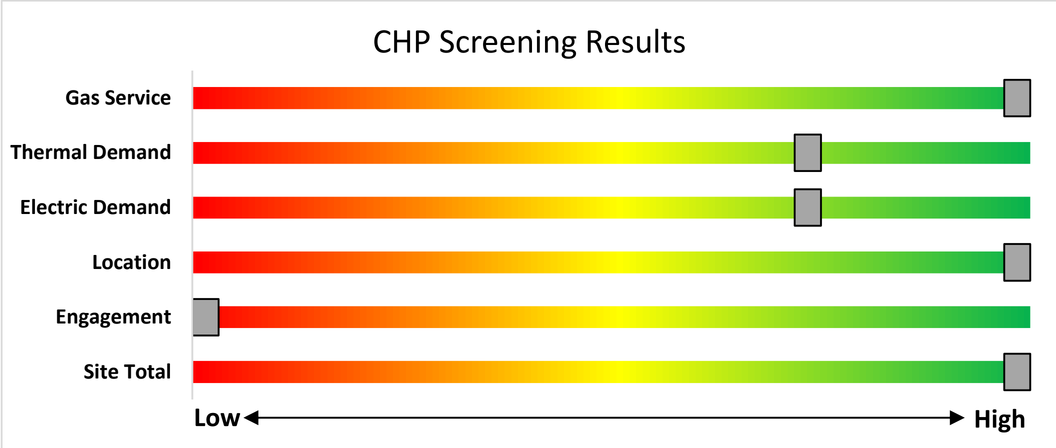
A preliminary screening based on heating and electrical demand, siting, and interconnection shows that the facility has high potential for installing a cost-effective CHP system.

The magnitude, type, and duration of the thermal demand, the coincident electric load, and the ease of interconnection contribute to the potential for CHP at the site. Based on the amount of hot water used throughout the year and the concurrent electric demand a Microturbine may be feasible. If you are interested in pursuing CHP, we recommend performing a detailed feasibility study, which will provide a thorough understanding of the costs and savings associated with this technology.

CHP has been successfully implemented across various sectors, including WWTPs. At WWTPs, CHP can take several forms, such as biogas-fueled systems using anaerobic digester gas, natural gas systems, heat recovery from sludge incinerators, or engine-driven systems that generate both heat and mechanical power. Biogas can fuel engines, microturbines, or fuel cells to generate electricity and heat, helping to offset a WWTP's power demand and provide thermal energy for heating the digester or facility.

Although CHP can be a beneficial use of biogas, each WWTP must evaluate its technical, economic, and environmental needs to determine the best approach. Challenges to CHP development include regulatory fees, interconnection issues, environmental permitting, staff training, gas pretreatment, and lack of adequate biosolid supply.

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.



Potential	High	
System Type	Microturbine	
System Potential	190	kW
Electric Generation	1,521,094	kWh/yr
Thermal Generation	7,878,696	MBtu/yr
Displaced Cost	$34,792	/yr
Installed Cost	$600,000	

Combined Heat and Power Screening

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

8 ELECTRIC VEHICLES

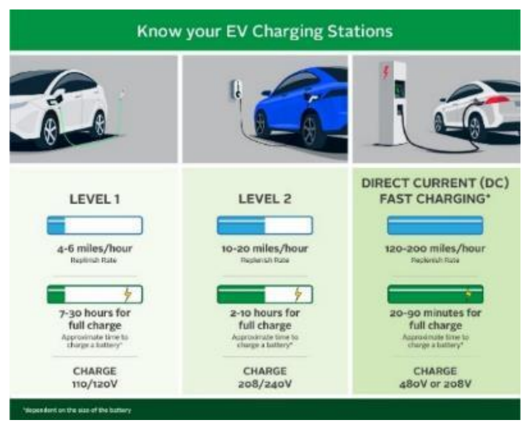
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes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

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

8.1 EV Charging

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

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



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

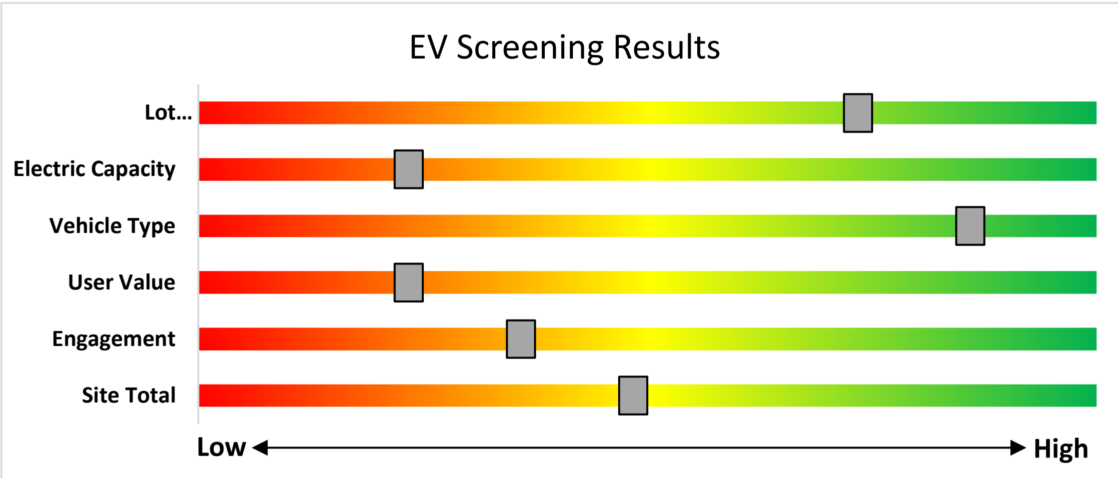
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

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

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

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

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



EV Charger Screening

Electric Vehicle Programs Available

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

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

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

9 Project Funding and Incentives

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

NJBPU and NJCEP Administered Programs

New Jersey's cleanenergy program™

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

*State facilities are also eligible for utility programs

Utility Administered Programs

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

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

9.1 New Jersey's Clean Energy Program

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

Large Energy Users

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

Incentives

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

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

How to Participate

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

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

Combined Heat and Power

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

Incentives[15]

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

[15]

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

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

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

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

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

How to Participate

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

Successor Solar Incentive Program (SuSI)

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

Administratively Determined Incentive (ADI) Program

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

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

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

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

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

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

Competitive Solar Incentive (CSI) Program

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

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

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

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

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

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

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

Energy Savings Improvement Program

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

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

How to Participate

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

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

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

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

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

Demand Response (DR) Energy Aggregator

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

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

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

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

The first step toward participation in a DR program is to contact a curtailment service provider. A list of these providers is available on the website of the independent system operator, PJM, and it includes contact information for each company, as well as the states where they have active business[16]. PJM also posts training materials for program members interested in specific rules and requirements regarding DR activity along with a variety of other DR program information[17].

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

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

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

9.2 Utility Energy Efficiency Programs

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

Prescriptive and Custom

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

Equipment Examples

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

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

Direct Install

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

Incentives

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

How to Participate

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

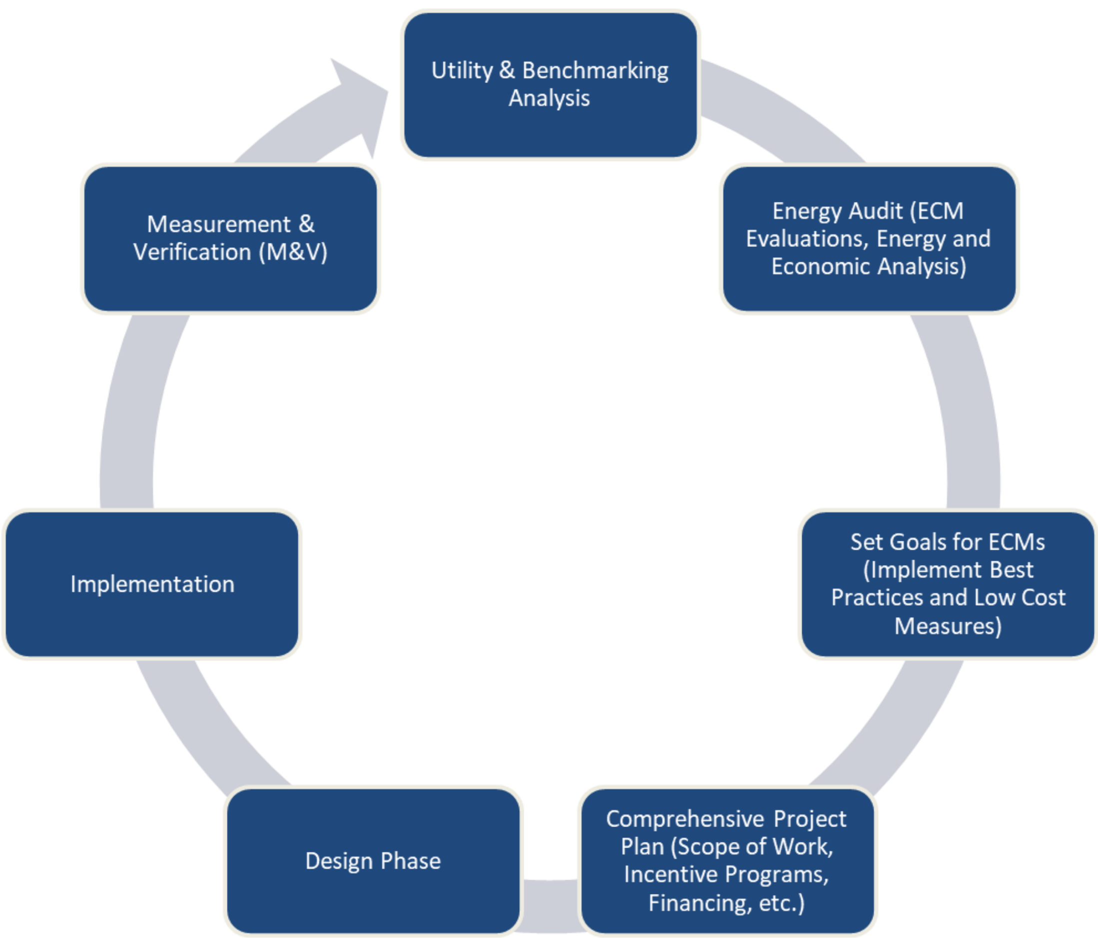
Engineered Solutions

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

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

10 Project Development

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



Project Development Cycle

11 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

11.1 Retail Electric Supply Options

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

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

A list of licensed third-party electric suppliers is available at the NJBPU website[18].

11.2 Retail Natural Gas Supply Options

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

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

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

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

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

[19] 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
Exterior Old Admin	2	Incandescent: (1) 60W A19 Screw-In Lamp	Photocell		60	4,380	3	Relamp	No	2	LED Lamps: A19 Lamps	Photocell	9	4,380	0.0	447	0	$43	$50	$0	1.2
Janitorial Closet Old Admin	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,912	3	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,912	0.0	160	0	$15	$30	$0	2.0
Main area Old Admin	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,912	3	Relamp	No	3	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,912	0.1	274	0	$26	$270	$30	9.3
Mechanical Room Old Admin	1	LED Lamps: Corn Bulb	Wall Switch	S	15	4,368		None	No	1	LED Lamps: Corn Bulb	Wall Switch	15	4,368	0.0	0	0	$0	$0	$0	0.0
Office - 1 Old Admin	4	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	28	3,120	4	None	Yes	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	2,153	0.0	117	0	$11	$150	$20	11.8
Office - 2 Closet Old Admin	4	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	28	3,120	4	None	Yes	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	2,153	0.0	117	0	$11	$150	$20	11.8
Office - 3 Server Old Admin	4	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	3,120	4	None	Yes	4	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	2,153	0.0	167	0	$16	$150	$20	8.2
Old Vault room Old Admin	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,912	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,009	0.1	264	0	$25	$250	$40	8.4
Restroom - Unisex Old Admin	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,080	3	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,080	0.0	36	0	$3	$40	$10	8.9
Restroom - Unisex Old Admin	1	LED Lamps: Corn Bulb	Wall Switch	S	15	2,080		None	No	1	LED Lamps: Corn Bulb	Wall Switch	15	2,080	0.0	0	0	$0	$0	$0	0.0
Storage Room Old Admin	8	Incandescent: (1) 150W A19 Screw-In Lamp	Wall Switch	S	150	2,912	3, 4	Relamp	Yes	8	LED Lamps: A19 Lamps	Occupancy Sensor	23	2,009	0.9	3,375	-1	$318	$530	$50	1.5
Storage Room Old Admin	2	LED - Fixtures: Ceiling Mount	Wall Switch	S	14	2,912	4	None	Yes	2	LED - Fixtures: Ceiling Mount	Occupancy Sensor	14	2,009	0.0	27	0	$3	$0	$0	0.0
Storage Room Old Admin	36	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,912	3, 4	Relamp	Yes	36	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,009	1.3	4,754	-1	$448	$2,810	$470	5.2
Storage Room Old Admin	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,912	3, 4	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,009	0.2	698	0	$66	$270	$60	3.2
Attic AreaFacility Management	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
Attic Area- Facility Management	24	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch		32	2,912	3, 4	Relamp	Yes	24	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	2,009	0.5	1,660	0	$157	$1,270	$190	6.9
Attic Area- Facility Management	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch		29	2,912	4	None	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,009	0.1	226	0	$21	$0	$0	0.0
Basement- Facility Management	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,912	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,009	0.2	792	0	$75	$630	$100	7.1
Basement- Facility Management	1	Compact Fluorescent: (1) 42W Spiral Plug-In Lamp	Wall Switch	S	42	2,912	3	Relamp	No	1	LED Lamps: LED Lamps	Wall Switch	30	2,912	0.0	38	0	$4	$30	$0	8.4
Boiler room- Facility Management	2	Incandescent: (1) 150W A19 Screw-In Lamp	Wall Switch	S	150	2,912	3, 4	Relamp	Yes	2	LED Lamps: A19 Lamps	Occupancy Sensor	23	2,009	0.2	844	0	$80	$50	$0	0.6
Boiler room- Facility Management	2	LED Lamps: (1) 30W A19 Screw-In Lamp	Wall Switch	S	30	2,912	4	None	Yes	2	LED Lamps: (1) 30W A19 Screw-In Lamp	Occupancy Sensor	30	2,009	0.0	58	0	$6	$0	$0	0.0
Boiler room- Facility Management	1	LED - Fixtures: Downlight Pendant	Wall Switch	S	35	2,912		None	No	1	LED - Fixtures: Downlight Pendant	Wall Switch	35	2,912	0.0	0	0	$0	$0	$0	0.0
Boiler room- Facility Management	10	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	40	2,009	4	None	Yes	10	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	1,386	0.1	269	0	$25	$330	$40	11.4
Conference Room- Facility Management	3	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	28	2,912	4	None	Yes	3	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	2,009	0.0	82	0	$8	$330	$40	37.6
Corridor- Facility Management	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	2,912		None	No	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	40	2,912	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Dining Area- Facility Management	4	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	2,912	4	None	Yes	4	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	2,009	0.0	156	0	$15	$330	$40	19.7
Dining Area- Facility Management	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	28	2,009	4	None	Yes	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	1,386	0.0	38	0	$4	$0	$0	0.0
Electrical Control- Facility Management	4	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	40	2,009	4	None	Yes	4	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	1,386	0.0	108	0	$10	$330	$40	28.6
Electrical Control- Facility Management	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	2,009		None	No	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,009	0.0	0	0	$0	$0	$0	0.0
Electrical Control- Facility Management	4	Compact Fluorescent: (2) 22W Spiral Plug-In Lamps	Photocell		44	4,380	3	Relamp	No	4	LED Lamps: LED Lamps	Photocell	31	4,380	0.0	228	0	$22	$150	$10	6.3
Exterior- Facility Management	7	LED - Fixtures: Wall Pack	Photocell		75	4,380		None	No	7	LED - Fixtures: Wall Pack	Photocell	75	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior- Facility Management	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
Mechanical Room- Facility Management	15	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,368	4	None	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,014	0.1	636	0	$60	$330	$40	4.8
Mechanical Room- Facility Management	3	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	4,368	4	None	Yes	3	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	3,014	0.0	175	0	$17	$330	$40	17.5
Office - COO- Facility Management	1	Compact Fluorescent: (2) 22W Spiral Plug-In Lamps	Occupancy Sensor	S	44	3,120	3	Relamp	No	1	LED Lamps: LED Lamps	Occupancy Sensor	31	3,120	0.0	44	0	$4	$40	$0	9.7
Office - Engineer- Facility Management	2	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	40	3,120	4	None	Yes	2	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	2,153	0.0	84	0	$8	$0	$0	0.0
Office - Engineer- Facility Management	4	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	3,120	4	None	Yes	4	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	2,153	0.0	167	0	$16	$330	$40	18.4
Office - Maintenance- Facility Management	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	3,120	4	None	Yes	2	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	2,153	0.0	84	0	$8	$150	$20	16.5
Office - Manager Assets- Facility Management	1	Compact Fluorescent: (2) 22W Spiral Plug-In Lamps	Wall Switch	S	44	3,120	3	Relamp	No	1	LED Lamps: LED Lamps	Wall Switch	31	3,120	0.0	44	0	$4	$40	$0	9.7
Office - Open Plane- Facility Management	15	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	28	3,120	4	None	Yes	15	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	2,153	0.1	439	0	$41	$330	$40	7.0
Office - Open Plane- Facility Management	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	3,120	4	None	Yes	2	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	2,153	0.0	84	0	$8	$0	$0	0.0
Office - Operations- Facility Management	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	3,120		None	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,120	0.0	0	0	$0	$0	$0	0.0
Restroom - Female- Facility Management	1	Compact Fluorescent: (2) 22W Spiral Plug-In Lamps	Wall Switch	S	44	2,080	3	Relamp	No	1	LED Lamps: LED Lamps	Wall Switch	31	2,080	0.0	29	0	$3	$40	$0	14.5
Restroom - Female- Facility Management	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	74	0	$7	$50	$10	5.7
Restroom - Female- Facility Management	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,080	3	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,080	0.0	111	0	$10	$60	$20	3.8
Restroom - Female- Facility Management	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	28	2,080		None	No	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	2,080	0.0	0	0	$0	$0	$0	0.0
Restroom - Male- Facility Management	2	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	40	2,080		None	No	2	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	2,080	0.0	0	0	$0	$0	$0	0.0
Restroom - Male- Facility Management	8	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	2,080	4	None	Yes	8	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	1,435	0.1	223	0	$21	$330	$40	13.8
Restroom - Male- Facility Management	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,080	4	None	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.0	121	0	$11	$330	$40	25.4
Stairs- Facility Management	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch		29	8,760	5	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	6,044	0.0	340	0	$32	$280	$140	4.4

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Stairs 2- Facility Management	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch		93	8,760	3	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	8,760	0.0	468	0	$44	$60	$20	0.9
Storage- Facility Management	1	Compact Fluorescent: (1) 22W Spiral Plug-In Lamp	Wall Switch	S	22	500	3	Relamp	No	1	LED Lamps: LED Lamps	Wall Switch	16	500	0.0	3	0	$0	$30	$0	98.2
Storage closet- Facility Management	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500	4	None	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.0	29	0	$3	$330	$40	105.6
Storage Clothes- Facility Management	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	500	4	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	345	0.0	15	0	$1	$150	$20	94.7
Storage Safety- Facility Management	2	LED - Fixtures: Wall Pack	Photocell		75	4,380		None	No	2	LED - Fixtures: Wall Pack	Photocell	75	4,380	0.0	0	0	$0	$0	$0	0.0
Mechanical Area - Grit	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
Mechanical Area - Grit	11	LED - Fixtures: Linear Strip	Occupancy Sensor	S	28	4,368		None	No	11	LED - Fixtures: Linear Strip	Occupancy Sensor	28	4,368	0.0	0	0	$0	$0	$0	0.0
Exterior Backside Digestor	1	Metal Halide: (1) 150W Lamp	Photocell		190	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	45	4,380	0.0	635	0	$62	$440	$50	6.3
Exterior Ground Digestor	1	LED - Fixtures: Wall Pack	Photocell		60	4,380		None	No	1	LED - Fixtures: Wall Pack	Photocell	60	4,380	0.0	0	0	$0	$0	$0	0.0
Mechanical Basement Digestor	9	LED Lamps: (1) 30W A19 Screw-In Lamp	Wall Switch	S	30	4,368		None	No	9	LED Lamps: (1) 30W A19 Screw-In Lamp	Wall Switch	30	4,368	0.0	0	0	$0	$0	$0	0.0
Mechanical Room Digestor	13	LED - Fixtures: Linear Strip	Wall Switch	S	12	4,368		None	No	13	LED - Fixtures: Linear Strip	Wall Switch	12	4,368	0.0	0	0	$0	$0	$0	0.0
Mechanical Room Digestor	7	LED - Fixtures: Linear Strip	Wall Switch	S	24	4,368		None	No	7	LED - Fixtures: Linear Strip	Wall Switch	24	4,368	0.0	0	0	$0	$0	$0	0.0
Stairs Digestor	2	Incandescent: (1) 150W A19 Screw-In Lamp	Wall Switch		150	8,760	3, 5	Relamp	Yes	2	LED Lamps: A19 Lamps	High/Low Control	23	6,044	0.2	2,538	-1	$239	$330	$70	1.1
Stairs Digestor	1	LED Lamps: (1) 30W A19 Screw-In Lamp	Wall Switch		30	8,760	5	None	Yes	1	LED Lamps: (1) 30W A19 Screw-In Lamp	High/Low Control	30	6,044	0.0	88	0	$8	$0	$0	0.0
Stairs 2 Digestor	3	LED Lamps: (1) 30W A19 Screw-In Lamp	Wall Switch		30	8,760		None	No	3	LED Lamps: (1) 30W A19 Screw-In Lamp	Wall Switch	30	8,760	0.0	0	0	$0	$0	$0	0.0
Exterior Pump Station Control	1	Incandescent: (1) 60W A19 Screw-In Lamp	Photocell		60	4,380	3	Relamp	No	1	LED Lamps: A19 Lamps	Photocell	9	4,380	0.0	223	0	$22	$30	$0	1.4
Exterior Pump Station Control	2	Metal Halide: (1) 150W Lamp	Photocell		190	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	45	4,380	0.0	1,270	0	$123	$880	$100	6.3
Hallway Pump Station Control	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
Hallway Pump Station Control	2	LED - Fixtures: Linear Strip	Occupancy Sensor	S	24	8,760		None	No	2	LED - Fixtures: Linear Strip	Occupancy Sensor	24	8,760	0.0	0	0	$0	$0	$0	0.0
Mechanical Pump Station Control	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
Mechanical Pump Station Control	18	LED - Fixtures: Linear Strip	Wall Switch	S	24	4,368		None	No	18	LED - Fixtures: Linear Strip	Wall Switch	24	4,368	0.0	0	0	$0	$0	$0	0.0
Exterior Plant Pump Station	1	LED Lamps: (1) 200W Corn Bulb Screw-In Lamp	Photocell		200	4,380		None	No	1	LED Lamps: (1) 200W Corn Bulb Screw-In Lamp	Photocell	200	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Plant Pump Station	8	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell		180	4,380		None	No	8	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell	180	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Plant Pump Station	16	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell		200	4,380		None	No	16	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell	200	4,380	0.0	0	0	$0	$0	$0	0.0
Basement pump Pump Station	11	LED - Fixtures: Linear Strip	Wall Switch	S	24	8,760	4	None	Yes	11	LED - Fixtures: Linear Strip	Occupancy Sensor	24	6,044	0.1	774	0	$73	$330	$40	4.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Corridor Pump Station	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 Pump Station	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	28	8,760		None	No	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	8,760	0.0	0	0	$0	$0	$0	0.0
Exterior Pump Station	5	LED - Fixtures: Wall Pack	Photocell		60	4,380		None	No	5	LED - Fixtures: Wall Pack	Photocell	60	4,380	0.0	0	0	$0	$0	$0	0.0
Garage Storage Pump Station	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Garage Storage Pump Station	10	LED - Fixtures: Linear Strip	Occupancy Sensor	S	24	800		None	No	10	LED - Fixtures: Linear Strip	Occupancy Sensor	24	800	0.0	0	0	$0	$0	$0	0.0
Main Room Pump Station	18	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	8,760	3, 4	Relamp	Yes	18	LED Lamps: A19 Lamps	Occupancy Sensor	9	6,044	0.9	9,160	-2	$864	$1,120	$90	1.2
Pump Room Pump Station	11	LED - Fixtures: Linear Strip	Occupancy Sensor	S	24	8,760		None	No	11	LED - Fixtures: Linear Strip	Occupancy Sensor	24	8,760	0.0	0	0	$0	$0	$0	0.0
Pump Room Pump Station	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Pump Room Pump Station	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	8,760		None	No	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	8,760	0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex Pump Station	2	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	28	2,080	4	None	Yes	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	1,435	0.0	39	0	$4	$330	$40	78.9
Restroom - Unisex Pump Station	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,080	3	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,080	0.0	111	0	$10	$60	$20	3.8
Stairs Pump Station	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch		29	8,760	5	None	Yes	6	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	6,044	0.0	510	0	$48	$280	$210	1.5
Storage Room Pump Station	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500	4	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.0	19	0	$2	$330	$40	158.4
Exterior- Plant Maintenance	6	LED - Fixtures: Wall Pack	Photocell		65	4,380		None	No	6	LED - Fixtures: Wall Pack	Photocell	65	4,380	0.0	0	0	$0	$0	$0	0.0
Garage - Plant Maintenance	35	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	4,368	4	None	Yes	35	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	3,014	0.6	2,969	-1	$280	$990	$110	3.1
Garage - Plant Maintenance	4	Linear Fluorescent - T5: 4' T5 (28W) - 3L	Wall Switch	S	90	4,368	3, 4	Relamp	Yes	4	LED - Linear Tubes: (3) 4' T5 (14.5W) Lamps	Occupancy Sensor	45	3,014	0.2	1,112	0	$105	$400	$60	3.2
Exterior UV Disinfection	2	LED - Fixtures: Wall Pack	Photocell		65	4,380		None	No	2	LED - Fixtures: Wall Pack	Photocell	65	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior UV Disinfection	1	Metal Halide: (1) 75W Lamp	Photocell		75	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	23	4,380	0.0	228	0	$22	$280	$50	10.4
Storage Building UV Disinfection	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	500	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.1	91	0	$9	$350	$60	33.9
UV building	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
UV building	9	LED - Linear Tubes: (2) 8' Lamps	Wall Switch	S	72	2,912	4	None	Yes	9	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	2,009	0.2	632	0	$60	$330	$40	4.9
Corridor Filter Building	6	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	28	4,380	5	None	Yes	6	LED - Fixtures: Ambient 2x2 Fixture	High/Low Control	28	3,022	0.0	246	0	$23	$280	$210	3.0
Exterior Ground Filter Building	1	LED - Fixtures: Wall Pack	Photocell		60	4,380		None	No	1	LED - Fixtures: Wall Pack	Photocell	60	4,380	0.0	0	0	$0	$0	$0	0.0
Mechanical Room Filter Building	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
Mechanical Room Filter Building	1	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	4,368		None	No	1	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	40	4,368	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room Filter Building	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,368		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,368	0.0	0	0	$0	$0	$0	0.0
Mechanical Room Filter Building	16	Linear Fluorescent - T5: 4' T5 (28W) - 4L	Wall Switch	S	120	4,368	3	Relamp	No	16	LED - Linear Tubes: (4) 4' T5 (14.5W) Lamps	Wall Switch	60	4,368	0.8	4,529	-1	$427	$2,220	$320	4.4
Office Filter Building	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Office Filter Building	4	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	3,120	4	None	Yes	4	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	2,153	0.0	167	0	$16	$330	$40	18.4
Restroom - Male Filter Building	3	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	28	2,080	4	None	Yes	3	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	1,435	0.0	58	0	$6	$330	$40	52.6
Storage Room Filter Building	8	LED Lamps: (1) 35W Corn Bulb Screw-In Lamp	Wall Switch	S	35	500	4	None	Yes	8	LED Lamps: (1) 35W Corn Bulb Screw-In Lamp	Occupancy Sensor	35	345	0.1	47	0	$4	$330	$40	65.6
Storage Room Filter Building	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	500	4	None	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.0	5	0	$0	$0	$0	0.0
UV service room Filter Building	4	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	2,912		None	No	4	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	40	2,912	0.0	0	0	$0	$0	$0	0.0
Blowing room Nitrification Building	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	2,009		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,009	0.0	0	0	$0	$0	$0	0.0
Corridor Nitrification Building	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 Nitrification Building	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	40	4,380		None	No	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	40	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Ground Nitrification Building	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Photocell		13	4,380		None	No	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Photocell	13	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Ground Nitrification Building	2	LED - Fixtures: Wall Pack	Photocell		35	4,380		None	No	2	LED - Fixtures: Wall Pack	Photocell	35	4,380	0.0	0	0	$0	$0	$0	0.0
Garage Nitrification Building	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Garage Nitrification Building	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,368		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,368	0.0	0	0	$0	$0	$0	0.0
Office Nitrification Building	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Office Nitrification Building	8	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	40	3,120		None	No	8	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	40	3,120	0.0	0	0	$0	$0	$0	0.0
Office Nitrification Building	1	Linear Fluorescent - T5: 2' T5 (14W) - 2L	Wall Switch	S	34	3,120	3	Relamp	No	1	LED - Linear Tubes: (2) 2' T5 (8W) Lamps	Wall Switch	17	3,120	0.0	57	0	$5	$60	$10	9.3
Pump Room Nitrification Building	10	LED - Fixtures: Linear Strip	Wall Switch	S	24	8,760		None	No	10	LED - Fixtures: Linear Strip	Wall Switch	24	8,760	0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex Nitrification Building	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	28	2,080		None	No	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	2,080	0.0	0	0	$0	$0	$0	0.0
Restroom - Women Nitrification Building	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	28	2,080		None	No	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	28	2,080	0.0	0	0	$0	$0	$0	0.0
Exterior Plant Storage	2	LED - Fixtures: Wall Pack	Photocell		60	4,380		None	No	2	LED - Fixtures: Wall Pack	Photocell	60	4,380	0.0	0	0	$0	$0	$0	0.0
Warehouse Plant Storage	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
Warehouse Plant Storage	15	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	S	158	2,912	2, 4	Relamp & Reballast	Yes	15	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	2,009	1.4	5,110	-1	$482	$2,790	$340	5.1
Collection Vechicle Garage	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,368		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,368	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Exterior Plant	6	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell		360	4,380		None	No	6	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell	360	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Plant	4	LED Lamps: Corn Bulbs- Pole Mounted	Photocell		400	4,380		None	No	4	LED Lamps: Corn Bulbs- Pole Mounted	Photocell	400	4,380	0.0	0	0	$0	$0	$0	0.0
UV Building	224	LED - Linear Tubes: Ultraviolet Lamps	Other		260	4,380		None	No	224	LED - Linear Tubes: Ultraviolet Lamps	Other	260	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Collection Vechicle Garage	2	Compact Fluorescent: (1) 42W Spiral Plug-In Lamp	Photocell		42	4,380	3	Relamp	No	2	LED Lamps: LED Lamp	Photocell	30	4,380	0.0	105	0	$10	$50	$0	4.9
Exterior Collection Vechicle Garage	4	LED - Fixtures: Wall Pack	Photocell		60	4,380		None	No	4	LED - Fixtures: Wall Pack	Photocell	60	4,380	0.0	0	0	$0	$0	$0	0.0
Collection Vechicle Garage	8	LED - Fixtures: High-Bay	Wall Switch	S	100	2,912	4	None	Yes	8	LED - Fixtures: High-Bay	Occupancy Sensor	100	2,009	0.2	780	0	$74	$330	$40	3.9
Collection Vechicle Garage	8	LED - Fixtures: Linear Strip	Wall Switch	S	24	2,912	4	None	Yes	8	LED - Fixtures: Linear Strip	Occupancy Sensor	24	2,009	0.1	187	0	$18	$0	$0	0.0
Restroom Collection Vechicle Garage	1	LED - Fixtures: Linear Strip	Wall Switch	S	24	2,912		None	No	1	LED - Fixtures: Linear Strip	Wall Switch	24	2,912	0.0	0	0	$0	$0	$0	0.0

Motor Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	Proposed Conditions: ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Energy Impact & Financial Analysis: 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 Old Admin	Exhaust Fan	1	Exhaust Fan	0.33	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Old Admin	Heating Hot Water Pump	2	Heating Hot Water Pump	0.25	55.0%	No			W	1,784		No	55.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room Old Admin	Heating Hot Water Pump	1	Heating Hot Water Pump	0.04	55.0%	No			W	1,784		No	55.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room Old Admin	Heating Hot Water Pump	1	Heating Hot Water Pump	0.25	65.0%	No			W	1,784		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Kitchen Old Admin	Kitchen Hood Exhaust Fan	1	Kitchen Hood Exhaust Fan	0.08	65.0%	No			W	2,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room Old Admin	Air Handling Unit	1	Supply Fan	0.50	68.0%	No	Carrier		W	2,745		No	68.0%	No		0.0	0	0	$0	$0	$0	0.0
Kitchen Old Admin	Air Handling Unit	1	Supply Fan	0.50	68.0%	No	Carrier		W	2,745		No	68.0%	No		0.0	0	0	$0	$0	$0	0.0
Office - 1- Old Admin	Wall Mounted Unit	1	Supply Fan	0.25	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Office - 3 Server - Old Admin	Wall Mounted Unit	1	Supply Fan	0.25	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Clothes Storage- FMB	Domestic Water Recirculator Pump	1	DHW Circulation Pump	0.17	65.0%	No	AO Smith		W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof Facilities Management Building	Exhaust Fan	1	Exhaust Fan	1.00	75.0%	No	Cook		W	2,745		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof Facilities Management Building	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No	Cook	90 ACRUH 90R17DHEC	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof Facilities Management Building	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No	Cook	101 ACRUH 101R17DEC	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof Facilities Management Building	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No	Cook	101 ACRUH 101R17DEC	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof Facilities Management Building	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No	Cook	90 ACRUH 90R17DHEC	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof Facilities Management Building	Exhaust Fan	2	Exhaust Fan	0.25	65.0%	No	Cook		W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler room Facilities Management Building	Heating Hot Water Pump	1	Heating Hot Water Pump	7.50	91.0%	No	Baldor		W	2,204	8	No	91.0%	Yes	1	0.7	5,082	0	$494	$6,700	$1,000	11.5
Boiler room Facilities Management Building	Heating Hot Water Pump	1	Heating Hot Water Pump	7.50	85.0%	No			B	2,204	8	No	91.0%	Yes	1	0.9	6,086	0	$591	$6,700	$1,000	9.6
Boiler room Facilities Management Building	Feed Water	2	Process Pump	1.00	75.0%	No			B	1,000	6	Yes	82.5%	No		0.1	136	0	$13	$1,900	$0	144.2
Boiler room - FMB	Unit Heater	1	Supply Fan	0.25	65.0%	No			W	700		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Corridor - FMB	Unit Heater	1	Supply Fan	0.25	65.0%	No			W	700		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room - FMB	Unit Heater	1	Supply Fan	0.25	65.0%	No			W	700		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof - FMB	Rooftop Package Unit - 2	1	Supply Fan	5.00	85.0%	No	Trane	YHC060F4RYA0	W	2,745	7	No	89.5%	Yes	1	1.5	4,926	0	$478	$5,600	$900	9.8
Roof - FMB	Rooftop Package Unit	1	Return Fan	2.00	79.0%	No	Aaon	RN-015-3-0EA-09-000	W	2,745		No	79.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior- FMB	Split Unit	1	Supply Fan	0.75	75.0%	No	Ingersoll Rand	4TVH0036B100NBB	W	2,745		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof - FMB	Rooftop Package Unit-3	1	Supply Fan	1.00	78.0%	No	Trane	YHC036E4RXA1JH	W	2,745		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room - FMB	Hot Water Boiler	2	Combustion Air Fan	0.75	75.0%	No			W	2,500		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Area - FMB	Air Handling Unit	1	Supply Fan	0.50	68.0%	No	Trane	BCHC024G2J0A1L02	W	2,745		No	68.0%	No		0.0	0	0	$0	$0	$0	0.0
Dining Area - FMB	Ceiling Cassette Unit	1	Supply Fan	0.25	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Area- Grit Building	Exhaust Fan	1	Exhaust Fan	0.50	68.0%	No			W	2,745		No	68.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Area- Grit Building	Unit Heater	1	Supply Fan	0.25	65.0%	No	TPI Corporation	P3P5115CA1N	W	700		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Area- Grit Building	Unit Heater	1	Supply Fan	0.25	65.0%	No	TPI Corporation	P3P5115CA1N	W	700		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Grit Building	Exhaust Fan	1	Exhaust Fan	0.50	68.0%	No			B	2,745	6	Yes	78.2%	No		0.0	147	0	$14	$500	$0	34.9
Mechanical Area Grit Building	Exhaust Fan	1	Exhaust Fan	0.50	68.0%	No			W	2,745		No	68.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Area Grit Building	Exhaust Fan	1	Exhaust Fan	0.50	68.0%	No			W	2,745		No	68.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Grit Building	Grit Pumps	2	Process Pump	0.50	72.0%	No	Reliance	05F100W666C1	B	2,912	6	Yes	78.2%	No		0.0	179	0	$17	$1,300	$0	74.6
Mechanical Area Grit Building	Aerator Pump	2	Process Blower	7.50	85.0%	No			B	3,640	6, 10	Yes	91.0%	Yes	2	4.9	20,103	0	$1,953	$13,100	$2,000	5.7
Mechanical Area Grit Building	Grit Pumps	2	Process Pump	7.50	91.7%	No	Baldor	N09J371X327	W	2,912		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical- Digestor	Air Handling Unit	2	Supply Fan	1.00	78.0%	No	AO Smith		W	2,745	6	Yes	85.5%	No		0.1	345	0	$34	$1,200	$0	35.8
Exterior Backside Digestor	Exhaust Fan	4	Exhaust Fan	1.00	78.0%	No			B	2,745	6	Yes	85.5%	No		0.2	691	0	$67	$2,500	$0	37.3

		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 Digestor	Exhaust Fan	2	Exhaust Fan	0.25	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Ground Digestor	Methane Dump	1	Process Blower	0.75	75.0%	No			B	5,000		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Ground Digestor	Sludge Mixer	1	Process Pump	10.00	91.7%	No	Weg		W	2,184	9	No	91.7%	Yes	1	1.0	6,663	0	$647	$7,500	$1,100	9.9
Exterior Ground Digestor	Sludge Mixer	1	Process Pump	30.00	91.0%	No	Weg		W	2,184	9	No	91.7%	Yes	1	3.0	20,419	0	$1,983	$16,000	$1,500	7.3
Mechanical Basement Digestor	Sludge pumps	1	Process Pump	5.00	85.0%	No	Reliance Electric		B	2,059	6	Yes	89.5%	No		0.1	341	0	$33	$1,600	$0	48.4
Mechanical Basement Digestor	Sludge pumps	1	Process Pump	5.00	85.0%	No	US Electrical		B	2,059	6	Yes	89.5%	No		0.1	341	0	$33	$1,600	$0	48.4
Mechanical Basement Digestor	Water pumps	1	Process Pump	7.50	91.7%	No	Westinghouse		W	2,543		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Basement Digestor	Water pumps	1	Process Pump	7.50	88.0%	No	Marathon		B	2,543	6	Yes	91.0%	No		0.1	400	0	$39	$2,000	$0	51.5
Pump Station Control	Wall Mounted Unit	1	Supply Fan	0.25	65.0%	No	Mitsuibishi Electric		W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Station Control	Air Handling Unit	1	Supply Fan	1.00	78.0%	No			W	2,745		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Station Control	Exhaust Fan	1	Exhaust Fan	1.00	78.0%	No			W	2,745		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Primary Clarifier 3	Primary Clarifier 3 Valve	1	Other	0.20	65.0%	No			B	1,092		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Final Clarifier 1	Final Clarifier Motor 1	1	Other	1.00	77.0%	No	Baldor	VM8003	B	1,092		No	77.0%	No		0.0	0	0	$0	$0	$0	0.0
Final Clarifier 2	Final Clarifier Motor 2	1	Other	1.00	77.0%	No	Lesson	C6T17FC2E	B	1,092		No	77.0%	No		0.0	0	0	$0	$0	$0	0.0
Final Clarifier 3	Final Clarifier Motor 3	1	Other	1.00	77.0%	No	Baldor	VM8003	B	1,092		No	77.0%	No		0.0	0	0	$0	$0	$0	0.0
Final Clarifier 4	Final Clarifier Motor 4	1	Other	0.75	75.0%	No	Baldor		B	1,092		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Primary Clarifier 1	Primary Clarifier 1	1	Other	0.50	70.0%	No	US Motor	E180	B	1,092		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Primary Clarifier 1	Primary Clarifier 1 Valve	1	Other	0.33	65.0%	No	Flowserve		W	1,092		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Primary Clarifier 2	Primary Clarifier 2	1	Other	0.50	70.0%	No	Syncrogear Motor		B	1,092		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Primary Clarifier 2	Primary Clarifier 2 Valve	1	Other	0.33	65.0%	No	Flowserve		W	1,092		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Primary number 3	Primary Clarifier 3	1	Other	1.00	78.0%	No	Emerson	6134	B	1,092		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Secondary Clarifier 1	Secondary Clarifier 1	1	Other	0.50	70.0%	No	Syncrogear Motor		B	1,092		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Secondary Clarifier 2	Secondary Clarifier 2	1	Other	0.50	70.0%	No	Syncrogear Motor		B	1,092		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Pump Station	Rooftop Package Unit	1	Supply Fan	5.00	85.0%	No	Aaon	RN-026-3A-0000	W	2,745	6, 7	Yes	89.5%	Yes	1	1.5	4,926	0	$478	$5,600	$900	9.8
Main Room Pump Station	Exhaust Fans	1	Exhaust Fan	0.50	70.0%	No			W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Pump Station	Exhaust Fan	1	Exhaust Fan	3.00	80.0%	No			B	2,745	7	No	89.5%	Yes	1	1.0	3,430	0	$333	$5,100	$200	14.7
Exterior Pump Station	Fresh Air Fan	1	Supply Fan	3.00	80.0%	No			B	2,745	6, 7	Yes	89.5%	Yes	1	1.0	3,430	0	$333	$5,000	$200	14.4
Exterior Pump Station	Exhaust Fan	1	Exhaust Fan	2.00	79.0%	No			W	2,745		No	79.0%	No		0.0	0	0	$0	$0	$0	0.0
Basement pump Pump Station	Other	1	Other	15.00	90.0%	No	Imperial Electric		W	100	6	Yes	93.0%	No		0.2	30	0	$3	$2,300	$0	787.2
Garage Storage Pump Station	Garage door	1	Other	0.50	70.0%	No	AO Smith		W	100		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Basement pump Pump Station	Sealed water Portable water	2	Process Pump	1.00	77.0%	No	Bluffton		W	2,000		No	77.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Room Pump Station	Bar screen-Debris Collection	2	Other	5.00	85.0%	No			W	728		No	85.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Pump Station	Primary Sludge Pumps	4	Process Pump	150.00	95.8%	Yes	Nidec	8P150V3CCR-P	W	2,800		No	95.8%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Pump Station	Raw Sludge	2	Process Pump	3.00	89.5%	No	Baldor Reliance	C38003819	W	2,000		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Pump Station	Raw Sludge	2	Process Pump	15.00	92.4%	Yes	Toshiba	0154SDSR42A-P	W	1,591		No	92.4%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Pump Station	Exhaust Fan	2	Exhaust Fan	0.50	75.0%	No	Cook	150 ACE 150 C5B	W	2,745		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Pump Station	Exhaust Fan	2	Exhaust Fan	0.25	68.0%	No	Cook	100 ACE 100 C3B	W	2,745		No	68.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Pump Station	Exhaust Fan	1	Exhaust Fan	1.00	78.0%	No	Cook		W	2,745		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Plant Maintenance Garage	Air Compressor	1	Air Compressor	5.00	89.5%	No	Weg	00518OT3E184T-S	W	1,200		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Exterior- Plant Maintenance Garage	Exhaust Fan	1	Exhaust Fan	0.20	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Plant Maintenance Garage	Garage door	4	Other	0.25	65.0%	No			W	100		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior- Plant Maintenance Garage	Exhaust Fan	1	Exhaust Fan	0.33	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage Building- UV	Unit Heater	1	Supply Fan	0.25	65.0%	No	Dayton		W	700		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage Building- UV	Unit Heater	1	Supply Fan	0.25	65.0%	No			W	700		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
UV building	Unit Heater	1	Supply Fan	0.25	65.0%	No	Dayton		W	700		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage Building-UV	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
UV building	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
UV building	Lift Motors	1	Other	1.00	77.0%	No	Marathon	JVE 56T17F5323J	W	100		No	77.0%	No		0.0	0	0	$0	$0	$0	0.0
UV building	Lift Motors	1	Other	0.25	65.0%	No	Columbus McKinnon		W	100		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
UV building	Screening Gate Motor	1	Other	0.25	65.0%	No	Orbinox		W	1,456		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Filter Building	Air Handling Unit	1	Supply Fan	1.50	75.0%	No	Kolbach		W	2,745		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical - Filter Building	Air Handling Unit	1	Supply Fan	0.25	65.0%	No	Luxaire		W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room Filter Building	Air Compressor	2	Air Compressor	7.50	85.5%	No			W	5,200		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room Filter Building	Air Compressor	1	Air Compressor	3.00	80.0%	No	Emerson	T63BXCBZ1216	W	500		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage Room Filter Building	Air Compressor	1	Air Compressor	0.75	75.0%	No	GE Motor	5KC49RN0340AX	W	400		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Roof Filter Building	Exhaust Fan 1 - 4	4	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.1	361	0	$35	$1,900	$0	54.3
Exterior Roof Filter Building	Exhaust Fan -9	1	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1
Exterior Roof Filter Building	Exhaust Fan- 10	1	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1
Exterior Roof Filter Building	Exhaust Fan- 5	1	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1
Exterior Roof Filter Building	Exhaust Fan- 7	1	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1

		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
Exterior Roof Filter Building	Exhaust Fan- 12	1	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1
Exterior Roof Filter Building	Exhaust Fan- 13	1	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1
Exterior Roof Filter Building	Exhaust Fan- 06	1	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1
Exterior Roof Filter Building	Exhaust Fan- 8	1	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1
Mechanical Room Filter Building	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No			B	2,745	6	Yes	69.5%	No		0.0	38	0	$4	$500	$0	134.6
Mechanical Room Filter Building	Backwash Pump - 2	1	Process Pump	150.00	90.0%	No	General Electric	5K6277XH1A	B	3,500	6, 9	Yes	95.8%	Yes	1	18.2	180,971	0	$17,577	$58,000	$0	3.3
Mechanical Room Filter Building	Backwash Pump - 1	1	Process Pump	150.00	93.0%	No	Emerson	CL03	W	3,500	9	No	95.8%	Yes	1	16.2	166,232	0	$16,146	$59,300	$0	3.7
Mechanical Room Filter Building	Filter Influent	4	Process Pump	125.00	94.3%	Yes	General Electric	5KS405DP6018	W	2,500		No	94.3%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room Filter Building	Service Water Pump	2	Process Pump	20.00	91.0%	Yes	Weg	02036ET3E256HP-W22	W	1,696		No	91.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room Filter Building	Surface Wash Pump	2	Process Pump	15.00	89.0%	No	General Electric	5K6227XH5A	B	1,696	6, 9	Yes	91.0%	Yes	2	3.2	16,621	0	$1,614	$19,800	$2,400	10.8
Mechanical Room Filter Building	Water pumps	2	Process Pump	0.25	65.0%	No	US Motor	S55JXDYE-2681	W	1,373		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room Filter Building	Air Handling Unit	1	Supply Fan	1.50	80.0%	No			W	2,745		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0
Unit Heaters Nitrification Building	Unit Heaters	3	Supply Fan	0.25	65.0%	No			W	700		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
RTU Nitrification Building	Rooftop Package Unit	1	Supply Fan	1.00	78.0%	No	Trane	TSC048G4R0A25	W	2,745		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop Nitrification Building	Exhaust Fan- 3	1	Exhaust Fan	0.33	65.0%	No	Penn Ventilator	LB-24	B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1
Exterior Rooftop Nitrification Building	Exhaust Fan- 5	1	Exhaust Fan	0.33	65.0%	No	Penn Ventilator	RB 30	B	2,745	6	Yes	73.4%	No		0.0	90	0	$9	$500	$0	57.1
Exterior Rooftop Nitrification Building	Exhaust Fan-1	1	Exhaust Fan	1.00	78.0%	No	Pennbarry	FX18B-HS	W	2,745		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop Nitrification Building	Exhaust Fan-Bathrooms	1	Exhaust Fan	0.17	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop Nitrification Building	Exhaust Fan-4	1	Exhaust Fan	0.33	65.0%	No	Penn Ventilator	RB 45	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Blowing room Nitrification Building	Wall Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Blowing room Nitrification Building	Garage doors	1	Other	0.50	75.0%	No	A.O. Smith		W	100		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Garage Nitrification Building	Garage door	1	Other	0.50	75.0%	No	A.O. Smith		W	100		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Nitrification Building	Garage Door	1	Other	0.50	75.0%	No	A.O. Smith		W	100		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Blowing room Nitrification Building	Aeration Blower 1	1	Process Blower	200.00	95.4%	No	Baldor	EM2562T-4	W	2,200		No	95.4%	No		0.0	0	0	$0	$0	$0	0.0
Blowing room Nitrification Building	Aeration Blower 2	1	Process Blower	200.00	95.4%	No	Baldor	EM2562T-4	W	2,200		No	95.4%	No		0.0	0	0	$0	$0	$0	0.0
Blowing room Nitrification Building	Aeration Blower 3	1	Process Blower	200.00	93.0%	No	US Electrical		B	2,200	6	Yes	95.0%	No		1.9	5,573	0	$541	$14,500	$0	26.8
Blowing room Nitrification Building	Aeration Blower 4	1	Process Blower	200.00	95.0%	No	US Electrical		W	2,000		No	95.0%	No		0.0	0	0	$0	$0	$0	0.0
Blowing room Nitrification Building	Aeration Blower 5	1	Process Blower	200.00	95.0%	No	US Electrical		W	500		No	95.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Ground Nitrification Building	Magnesium Hydroxide Slurry Mixture	1	Process Pump	15.00	88.0%	No	Westinghouse	TBFC	B	1,696	6, 9	Yes	91.7%	Yes	1	1.7	8,672	0	$842	$11,200	$1,200	11.9
Exterior Ground Nitrification Building	Magnesium Hydroxide Slurry Mixture	1	Process Pump	15.00	91.7%	No	Weg	01512ST30E28-W22	W	1,696	9	No	91.7%	Yes	1	1.4	7,759	0	$754	$11,400	$1,200	13.5
Pump Room Nitrification Building	Waste Sludge Pump	1	Process Pump	2.00	80.0%	No			B	1,373	6	Yes	88.5%	No		0.1	184	0	$18	$900	$0	50.3
Pump Room Nitrification Building	Waste Sludge Pump	1	Process Pump	2.00	80.0%	No	Weg	00212T3ER184TC	W	1,373		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Nitrification Building	Magnesium Hydroxide Slurry Mixture	2	Process Pump	2.00	85.0%	No	Leeson		W	1,373		No	85.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Nitrification Building	Magnesium Hydroxide Slurry Mixture	1	Process Pump	2.00	86.5%	No	Weg	00216ET3E56CFL-S	W	1,373		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Nitrification Building	Service Water Pumps	2	Process Pump	1.50	80.0%	No	Marathon	EVA 56T34D5561B	W	1,373		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Nitrification Building	Sludge Return -1	1	Process Pump	50.00	90.0%	Yes	Weg	Z05007ES30081909	W	53		No	90.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Nitrification Building	Sludge Return -2	1	Process Pump	50.00	90.0%	Yes	Weg	Z05007ES30081909	W	3,465		No	90.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room Nitrification Building	Sludge Return -3	1	Process Pump	50.00	90.0%	Yes	Weg	Z05007ES30081909	W	3,571		No	90.0%	No		0.0	0	0	$0	$0	$0	0.0
Collection Vechicle Garage	Air Compressor	1	Air Compressor	1.60	75.0%	No	DeWALT		W	400		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Collection Vechicle Garage	Air Compressor	1	Air Compressor	5.00	80.0%	No	Black Max		W	400		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Collection Vechicle Garage	Exhaust Fan	3	Exhaust Fan	0.33	65.0%	No			B	2,745	6	Yes	73.4%	No		0.1	270	0	$26	$1,400	$0	53.3
Roof - FMB	Rooftop Package Unit	1	Supply Fan	5.00	85.0%	No	Aaon	RN-015-3-0EA-09-000	W	2,745		No	85.0%	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
Exterior Old Admin	Old Admin Building Cooling	1	Split-System	3.00		9.28		Carrier	38CKC036630	B	11	Yes	1	Split-System	3.00		16.00		0.8	1,501	0	$146	$6,000	$300	39.1
Exterior Old Admin	Old Admin Building Cooling	1	Split-System	3.00		9.28		Carrier	38CKC036610	B	11	Yes	1	Split-System	3.00		16.00		0.8	1,501	0	$146	$6,000	$300	39.1
Exterior Old Admin	Old Admin Building Cooling	1	Split-System	2.50		9.28		Carrier	38CKC030500	B	11	Yes	1	Split-System	2.50		16.00		0.7	1,251	0	$121	$5,100	$300	39.5
Exterior Old Admin	Old Admin Building Cooling	1	Split-System	3.00		11.50		Thermal Zone	TZAA-336-CA757	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Old Admin	Old Admin Building Cooling	1	Split-System Air-Source HP	2.37	28.60	10.60	13.4905660377358 HSPF	Mitsuibishi	MXZ-3C30NA2	W		No							0.0	0	0	$0	$0	$0	0.0
Mechanical Room Old Admin	Unit Heater	1	Unit Heater		20.47		1 COP	Raywall		W		No							0.0	0	0	$0	$0	$0	0.0
Corridor - FMB	Unit Heater	1	Unit Heater		10.24		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Restroom - Female - FMB	Unit Heater	1	Unit Heater		10.24		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Stairs - FMB	Unit Heater	1	Unit Heater		10.24		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Stairs 2 - FMB	Unit Heater	1	Unit Heater		10.24		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Roof - FMB	Rooftop Package Unit	1	Package Unit	15.00		10.60		Aaon	RN-015-3-0EA-09-000	W		No							0.0	0	0	$0	$0	$0	0.0
Roof - FMB	Rooftop Package Unit 2	1	Package Unit	5.00	64.00	13.00	0.8 AFUE	Trane	YHC060F4RYA0	W		No							0.0	0	0	$0	$0	$0	0.0
Roof - FMB	Rooftop Package Unit-3	1	Package Unit	3.00	48.00	13.00	0.8 AFUE	Trane	YHC036E4RXA1JH	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior- FMB	Split Unit	1	Split-System Air-Source HP	3.17	42.00	12.00	8.5 HSPF	Ingersoll Rand	4TVH0036B100NBB	W		No							0.0	0	0	$0	$0	$0	0.0
Attic Area - FMB	Air Handling Unit	1	Split-System	2.00		10.00		Trane		W		No							0.0	0	0	$0	$0	$0	0.0
Restroom - Male - FMB	Unit Heater	2	Unit Heater		10.24		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Mechanical Area- Grit Building	Unit Heater	1	Unit Heater		51.18		1 COP	TPI Corporation	P3P5115CA1N	W		No							0.0	0	0	$0	$0	$0	0.0
Mechanical Area- Grit Building	Unit Heater	1	Unit Heater		51.18		1 COP	TPI Corporation	P3P5115CA1N	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Pump Station Control	Pump Station Control	1	Split-System	1.50		9.90		Mitsuibishi	PUY-A18NKA7	W		No							0.0	0	0	$0	$0	$0	0.0
Corridor Pump Station	Corridor Pump Station Heating	1	Unit Heater		10.24		1 COP			W		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
Main Room Pump Station	Main Room Pump Station Heating	1	Unit Heater		17.06		1 COP	Marley		W		No							0.0	0	0	$0	$0	$0	0.0
Stairs Pump Station	Stairs Pump Station Heating	1	Unit Heater		10.24		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Storage Room Pump Station	Storage Room Pump Station Heating	1	Unit Heater		10.24		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Pump Station	Rooftop Package Unit	1	Package Unit	26.00	864.00	12.00	0.8 AFUE	Aaon	RN-026-3A-0000	W		No							0.0	0	0	$0	$0	$0	0.0
Maintenace Garage	Unit Heater	1	Unit Heater		500.00		0.8 AFUE	Reznor		W		No							0.0	0	0	$0	$0	$0	0.0
Storage Building- UV	Unit Heater	1	Unit Heater		17.06		1 COP	Dayton		W		No							0.0	0	0	$0	$0	$0	0.0
Storage Building- UV	Unit Heater	1	Unit Heater		17.06		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
UV building	Unit Heater	1	Unit Heater		17.06		1 COP	Dayton		W		No							0.0	0	0	$0	$0	$0	0.0
Corridor Filter Building	Unit Heater	1	Unit Heater		34.12		1 COP	Dayton	3UF87	W		No							0.0	0	0	$0	$0	$0	0.0
Mechanical Room Filter Building	Unit Heater	2	Unit Heater		54.59		1 COP	Dayton	9UF90	W		No							0.0	0	0	$0	$0	$0	0.0
UV service room Filter Building	Unit Heater	1	Unit Heater		34.12		1 COP	Qmark	MUH104	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Roof Filter Building	Mechanical Room Cooling	1	Split-System	3.00		12.00		Luxaire	TF4B3621SA	W		No							0.0	0	0	$0	$0	$0	0.0
Blowing room Nitrification Building	Unit Heater	1	Unit Heater		10.24		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Garage Nitrification Building	Unit Heater	1	Unit Heater		10.24		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Pump Room Nitrification Building	Unit Heater	1	Unit Heater		17.06		1 COP	Dayton		W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop Nitrification Building	Rooftop Package Unit	1	Package Unit	4.00		12.00		Trane	TSC048G4R0A25	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop Nitrification Building	Office- Nitrification Building	1	Split-System	4.00		11.00		Allied	TSA048S4N44Y	W		No							0.0	0	0	$0	$0	$0	0.0
Collection Vechicle Garage	Garage Area- Infared Heating	2	Infrared Heater		500.00		0.8 AFUE			W		No							0.0	0	0	$0	$0	$0	0.0
Mechanical Room Old Admin	Unit Heater	1	Unit Heater		13.65		1 COP	Raywall		W		No							0.0	0	0	$0	$0	$0	0.0

Space Heating Boiler Inventory & Recommendations

		Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis						
Location	**Area(s)/System(s) Served**	System Quantity	System Type	Output Capacity per Unit (MBh)	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room - FMB	Building Heating and Sludge Heating	1	Non-Condensing Hot Water Boiler	2,656	Weil- McLain	1094	W		No						0.0	0	0	$0	$0	$0	0.0
Boiler Room - FMB	Building Heating and Sludge Heating	1	Non-Condensing Hot Water Boiler	2,957	Weil- McLain	1194	W		No						0.0	0	0	$0	$0	$0	0.0
Filter Building	Building Heating System	1	Non-Condensing Hot Water Boiler	842	Lochinvar	CHN0992	W		No						0.0	0	0	$0	$0	$0	0.0

Pipe Insulation Recommendations

		Recommendation Inputs			Energy Impact & Financial Analysis						
n	**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
d Admin	Hot Water System	12	10	0.75	0.0	828	0	$80	$140	$20	1.5

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Janitorial- Old Admin	Hot Water System	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White	RE340S6-1NCWW	W		No						0.0	0	0	$0	$0	$0	0.0
Clothes Storage- FMB	Hot Water System	1	Storage Tank Water Heater (> 50 Gal)	Bradford White	MII120363SF70	W		No						0.0	0	0	$0	$0	$0	0.0
Mechanical- Digestor	Hot Water System	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White	RE340S6-1NCWW	W		No						0.0	0	0	$0	$0	$0	0.0
Restroom Pump Station	Hot Water System	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White	M250S6DS-1NCWW	W		No						0.0	0	0	$0	$0	$0	0.0
Maintenance Garage	Hot Water System	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White	RE120L6-1NCWW	W		No						0.0	0	0	$0	$0	$0	0.0
UV Service Room- Filter Building	Hot Water System	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White	M240S6DS-1NCWW	W		No						0.0	0	0	$0	$0	$0	0.0
Garage- Nitrfication Building	Hot Water System	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White	RE340S6-1NCWW	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
Old Admin Building	13	2	Faucet Aerator (Lavatory)	2.20	0.50	0.0	111	0	$11	$20	$10	0.9
Restrooms - FMB	13	11	Faucet Aerator (Lavatory)	2.20	0.50	0.0	1,835	0	$178	$90	$40	0.3
Kitchen- FMB	13	2	Faucet Aerator (Lavatory)	1.50	0.50	0.0	196	0	$19	$20	$10	0.5
Restroom Pump Station	13	1	Faucet Aerator (Lavatory)	2.20	0.50	0.0	167	0	$16	$10	$0	0.6
Maintenance Garage	13	1	Faucet Aerator (Lavatory)	2.50	0.50	0.0	196	0	$19	$10	$0	0.5
UV building	13	1	Faucet Aerator (Lavatory)	2.20	0.50	0.0	167	0	$16	$10	$0	0.6
Restroom- Filter Building	13	3	Faucet Aerator (Lavatory)	1.80	0.50	0.0	383	0	$37	$30	$10	0.5
UV Room- Filter Building	13	1	Faucet Aerator (Lavatory)	2.00	0.50	0.0	147	0	$14	$10	$0	0.7
Nitrfication Building	13	5	Faucet Aerator (Lavatory)	2.20	0.50	0.0	834	0	$81	$40	$20	0.2
Collection Vechicle Garage	13	1	Faucet Aerator (Lavatory)	2.20	0.50	0.0	56	0	$5	$10	$0	1.9

Plug Load Inventory

Location	Existing Conditions					
	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Office - 3 Server Old Admin	2	Desktop	150	No		
Storage Room Old Admin	1	Fan (Large)	200	No		
Office - 3 Server Old Admin	2	Laptop	45	No		
Office - 3 Server Old Admin	1	Server Equipments	1,500	No		
Storage Room Old Admin	1	Printer (Medium/Small)	200	No		
Dining Area - FMB	3	Coffee Machine	900	No		
Facility Management Building	11	Desktop	150	No		
Offices- FMB	4	Laptop	45	No		
Dining Area - FMB	3	Microwave	1,000	No		
Office - Open Plane - FMB	1	Printer/Copier (Large)	600	No		
Dining Area - FMB	3	Refrigerator (Residential)	218	No		
Facility Management Building	7	Television	190	No		
Dining Area - FMB	3	Toaster Oven	1,200	No		
Conference Room - FMB	1	Color Printer	120	No		
Conference Room - FMB	1	Color Printer	120	No	HP	Design Jet T2530
Electrical Control - FMB	1	Server Equipments	1,500	No		
Plant Maintenance Garage	1	Refrigerant Dryer	34	No	Hydrovane	VNC35A2C1N1F
Plant Maintenance Garage	1	Clothes Dryer	5,000	No		
Plant Maintenance Garage	1	Clothes Washer	900	No		
Plant Maintenance Garage	1	Coffee Machine	900	No		
Plant Maintenance Garage	2	Desktop	150	No		
Plant Maintenance Garage	1	Fan (Large)	200	No		
Plant Maintenance Garage	1	Microwave	1,000	No		
Plant Maintenance Garage	1	Drill Press	1,118	No	Rockwell	70-6X0
Plant Maintenance Garage	1	Bench Grinder	745	No	Sears	
Plant Maintenance Garage	1	Garage Equipment	7,500	No		
Plant Maintenance Garage	1	Printer (Medium/Small)	200	No		
Plant Maintenance Garage	1	Water Fountain	150	No		
Plant Maintenance Garage	1	Bench Grinder	745	No		
UV building	1	Dehumidifier	644	No	Dayton	5EAJ8
UV building	1	Dehumidifier	644	No	Dayton	5EAJ8
UV building	1	Dehumidifier	1,288	No	Dri-Eaz	F411
Office Filter Building	1	Coffee Machine	900	No		
UV service room Filter Building	2	Coffee Machine	900	No		

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Office Filter Building	1	Microwave	1,000	No		
UV service room Filter Building	1	Microwave	1,000	No		
Office Filter Building	1	Printer (Medium/Small)	200	No		
Office Filter Building	1	Refrigerator (Mini)	153	No		
UV service room Filter Building	2	Refrigerator (Residential)	218	No		
Office Filter Building	2	Television	190	No		
Office Filter Building	5	Television	190	No		
UV service room Filter Building	1	Toaster Oven	1,200	No		
UV service room Filter Building	1	Water Cooler	92	No		
Mechanical Room Filter Building	1	Refrigerant Dryer	1,200	No	Parker	SPE025-A11516016TIU
Mechanical Room Filter Building	1	Refrigerant Dryer	1,200	No	Parker	SPE025-A11516016TIU
Pump Room Nitrification Building	1	Dehumidifier	120	No	Bry Air	A-9-BE
Office Nitrification Building	2	Desktop	150	No		
Garage Nitrification Building	1	Garage Equipment- Table Saw	1,600	No		
Garage Nitrification Building	1	Electric Charger	1,440	No	Ford	
Office Nitrification Building	1	Precision Oven	1,680	No	Thermo	658
Office Nitrification Building	1	Isotemp Oven	3,360	No	Fisher Scientific	6901
Office Nitrification Building	1	Steam Scrubber	2,000	No	Labconco	
Office Nitrification Building	1	Electric Furnace	1,298	No	Hoskins	FD202C
Office Nitrification Building	1	Printer (Medium/Small)	200	No		
Office Nitrification Building	1	Refrigerator (Residential)	218	No		
Collection Vechicle Garage	1	Desktop	150	No		
Collection Vechicle Garage	2	Fan (Ceiling)	120	No		
Collection Vechicle Garage	1	Fan (Portable)	100	No		
Collection Vechicle Garage	1	Printer (Medium/Small)	200	No		
Collection Vechicle Garage	1	Refrigerator (Residential)	218	No		
Office Nitrification Building	1	Refrigerator (Residential)	218	No	Frigidaire	FFU20F9GW5

Miscellaneous Fuel Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Input Capacity per Unit (MBh)	ENERGY STAR Qualified?	Manufacturer	Model
Boiler Room - FMB	1	Non-Condensing Hot Water Boiler	2,656.0	No	Weil- McLain	1,094.0
Boiler Room - FMB	1	Non-Condensing Hot Water Boiler	2,957.0	No	Weil- McLain	1194

Custom (High Level) Measure Analysis

Installation of an Energy Management System

Building Square Footage	29,521	Fuel Utility Rate	$13.359 MMBtu
Percent of Conditioned Area Impacted	100%	Blended Electric Utility Rate	$0.097 kWh

Existing Conditions						Proposed Conditions					Energy Impact & Financial Analysis										
Description	Area(s)/System(s) Served	Remaining Useful Life	Total HVAC Motor Usage kWh	Total HVAC Electric Usage kWh	Total HVAC Fuel Usage MMBtu	Description	% Savings HVAC Motor Usage kWh	% Savings HVAC Electric Usage kWh	% Savings HVAC Fuel Usage MMBtu	Estimated Cost per Sqft	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Base Incentives	Enhanced Incentives	Total Incentives	Total Net Cost	Payback w/o Incentives in Years	Simple Payback w/ Incentives in Years
Limited/No HVAC Controls	HVAC Equipment & Systems	15	3,792,694	189,620	4,827	Installation of an Energy Management System	0.15%	5%	7.5%	$2.00	0.00	15,170	362	$6,310	$68,700	$0	$0	$0	$68,700	10.89	10.89

Electric Tank Water Heater to HPWH

Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis										
Description	Area(s)/System(s) Served	SF of Area Served	Fuel Type	Input Capacity per Unit (kW)	Tank Capacity per Unit (Gal)	Description	COP	Tank Capacity per Unit (Gal)	Estimated Unit Cost	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Base Incentives	Enhanced Incentives	Total Incentives	Total Net Cost	Payback w/o Incentives in Years	Payback w/ Incentives in Years
Storage Tank Water Heater (>50 Gal)	DHW Hot Water- FMB	20,000	Electric	36.0	119	Heat Pump Water Heater	2.5	119	$4,544.73	0.00	8,089	0	$786	$5,400	$0	$0	$0	$5,400	6.87	6.87
Storage Tank Water Heater (≤50 Gal)	DHW Hot Water- Pump Station	3,500	Electric	4.5	50	Heat Pump Water Heater	2.5	50	$2,383.17	0.00	1,416	0	$138	$2,900	$0	$0	$0	$2,900	21.01	21.01
Storage Tank Water Heater (≤50 Gal)	DHW Hot Water- Nitrification Building	3,500	Electric	4.5	40	Heat Pump Water Heater	2.5	40	$2,091.00	0.00	1,416	0	$138	$2,500	$0	$0	$0	$2,500	18.12	18.12

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]

Western Monmouth Utilities Authority (WMUA) 1 Utility Road Campus

Primary Property Type: Wastewater Treatment Plant
Gross Floor Area (ft²): 67,699
Built: 1974

For Year Ending: December 31, 2023
Date Generated: September 11, 2024

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Western Monmouth Utilities Authority (WMUA 1 Utility Road Campus) 1 Utility Road Manalapan, New Jersey 07726	Western Monmouth Utilities Authority (WMUA) 103 Pension Road Manalapan, NJ 07726 (732) 446-3900	Stephen Bagadinski 103 Pension Road Manalapan, NJ 07726 (732) 446-3900 sbagadinski@wmua.manalapan.nj.us

Property ID: 34923442

Energy Consumption and Energy Use Intensity (EUI)

Site EUI	Annual Energy by Fuel		Annual Emissions	
462.7 kBtu/ft²	Natural Gas (kBtu)	4,823,184 (15%)	Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	N/A
	Other: (kBtu)	10,654,848 (34%)		
	Electric - Grid (kBtu)	12,752,809 (41%)		
	Electric - Solar (kBtu)	3,096,351 (10%)		
Source EUI	**National Median Comparison**		**Green Power**	
805.4 kBtu/ft²	National Median Site EUI (kBtu/ft²)	389.9	Green Power – Onsite (kWh)	0
	National Median Source EUI (kBtu/ft²)	678.6	Green Power – Offsite (kWh)	0
	% Diff from National Median Source EUI	19%	Percent of RECs Retained	0

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

____ ________

,
(____)____-______

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Professional Engineer or Registered Architect Stamp (if applicable)

Appendix C: Glossary

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

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

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