Local Government Energy Audit:
Energy Audit Report

Water Treatment Plant

Willingboro Municipal Utilities Authority

Meribrook Circle
Willingboro, NJ 08046

November 28, 2017

Final Report by:
TRC Energy Services

Disclaimer

The intent of this energy analysis report is to identify energy savings opportunities and recommend upgrades to the facility's energy using equipment and systems. Approximate savings are included in this report to help make decisions about reducing energy use at the facility. This report, however, is not intended to serve as a detailed engineering design document. Further design and analysis may be necessary in order to implement some of the measures recommended in this report.

The energy conservation measures and estimates of energy savings have been reviewed for technical accuracy. However, estimates of final energy savings are not guaranteed, because final savings may depend on behavioral factors and other uncontrollable variables. TRC Energy Services and New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy savings vary.

Estimated installation costs are based on TRC's experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from *RS Means*. The owner of the facility is encouraged to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Since actual installed costs can vary widely for certain measures and conditions, TRC and NJBPU do not guarantee installed cost estimates and shall in no event be held liable should actual installed costs vary from estimates.

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

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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 the Water Treatment Plant.

The goal of a LGEA is to provide you with information on how your facility uses energy, identify energy conservation measures (ECMs) that can reduce your energy use, and put you in a position to implement the ECMs. The LGEA also sets you on the path to receive financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing the ECMs.

This study was conducted by TRC Energy Services, as part of a comprehensive effort to assist Willingboro Municipal Utilities Authority (WMUA) in controlling energy costs and protecting our environment by offering a full spectrum of energy management options.

1.1 Facility Summary

The Meribrook Water Treatment Plant is located on Meribrook Circle and includes an 8,500 square foot building, aerators, settling basins, and an in-ground storage tank. A thorough description of the facility and our observations are located in Section 2, "Facility Information and Existing Conditions".

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC Energy Services recommends five (5) measures which together represent an opportunity for Meribrook Water Treatment Plant to reduce its annual energy costs by roughly $14,569 and its annual greenhouse gas emissions by 119,733 lbs CO_2e. We estimate that the measures would likely pay for themselves in about 3.1 years. A breakdown of current energy usage and costs and an estimate of energy costs after the proposed upgrades are shown in Figure 1 and Figure 2, respectively. These measures represent an opportunity to reduce Meribrook Water Treatment Plant's annual energy use by 8.5%.

Figure 1 – Previous 12 Month Utility Costs

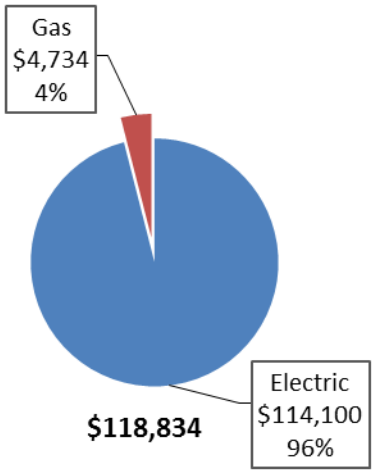
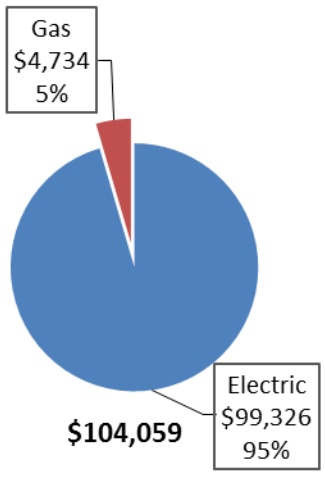


Figure 2 – Potential Post-Implementation Costs



A detailed description of Meribrook Water Treatment Plant's existing energy use can be found in Section 3, "Site Energy Use and Costs".

The evaluated measures have been listed and grouped into major categories as shown in Figure 3. Brief descriptions of the categories can be found below and descriptions of the individual opportunities can be found in Section 4, "Energy Conservation Measures".

Figure 3 – Summary of Energy Reduction Opportunities

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**68,601**	**6.8**	**$8,405.77**	**$7,961.66**	**$565.00**	**$7,396.66**	**0.88**	**69,080**
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	26,273	2.2	$3,219.34	$3,195.00	$565.00	$2,630.00	0.82	26,457
ECM 2	Retrofit Fixtures with LED Lamps	Yes	40,427	4.5	$4,953.55	$3,476.00	$0.00	$3,476.00	0.70	40,709
ECM 3	Install LED Exit Signs	Yes	1,901	0.2	$232.88	$1,290.66	$0.00	$1,290.66	5.54	1,914
Lighting Control Measures			**9,160**	**0.5**	**$1,122.41**	**$2,278.00**	**$335.00**	**$1,943.00**	**1.73**	**9,224**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	9,160	0.5	$1,122.41	$2,278.00	$335.00	$1,943.00	1.73	9,224
Motor Upgrades			**41,140**	**12.1**	**$5,041.00**	**$36,256.69**	**$0.00**	**$36,256.69**	**7.19**	**41,428**
ECM 5	Premium Efficiency Motors	Yes	41,140	12.1	$5,041.00	$36,256.69	$0.00	$36,256.69	7.19	41,428
TOTALS			**118,901**	**19.4**	**$14,569.18**	**$46,496.35**	**$900.00**	**$45,596.35**	**3.13**	**119,733**

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

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

Lighting Upgrades generally involve the replacement of existing lighting components such as lamps and ballasts (or the entire fixture) with higher efficiency lighting components. These measure save energy by reducing the power used by the lighting components due to improved electrical efficiency.

Lighting Controls measures generally involve the installation of automated controls to turn off lights or reduce light output when conditions allow. Automated control reduces reliance on occupant behavior for adjusting lights. These measures save energy by reducing the amount of time lights are on.

Motor Upgrades generally involve replacing old standard efficiency motors with motors of the current efficiency standard (EISA 2007). Motors will be replaced with the same size motors. This measure saves energy by reducing the power used by the motors due to improved electrical efficiency.

Energy Efficient Practices

TRC Energy Services also identified four (4) low (or no) cost energy efficient practices. The energy performance of most facilities can be significantly improved by employing certain behavioral and operational adjustments, as well as performing better routine maintenance on building systems. These practices can extend equipment lifetime, improve occupant comfort, provide better health and safety, as well as reduce annual energy and O&M costs. Potential opportunities identified at Meribrook Water Treatment Plant include:

- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Perform Routine Motor Maintenance
- Perform Proper Boiler Maintenance

For details on these Energy Efficient Practices, please refer to Section 5.

On-Site Generation Measures

TRC Energy Services evaluated the potential for installing additional onsite power generation at Meribrook Water Treatment Plant. The site already has an existing 270-kW solar PV array. Based on the configuration of the site and its electric and thermal loads, there appears to be a low potential for cost-effective installation of additional solar PV or combined heat and power self-generation measures.

For details on our evaluation and the self-generation potential, please refer to Section 6.

1.3 Implementation Planning

To realize the energy savings from the ECMs listed in this report, a project implementation plan must be developed. Available capital must be considered and decisions need to be made whether it is best to pursue individual ECMs separately, groups of ECMs, or a comprehensive approach where all ECMs are implemented together, possibly in conjunction with other facility upgrades or improvements.

Rebates, incentives, and financing are available from NJCEP, as well as other sources, to help reduce the costs associated with the implementation of energy efficiency projects. Prior to implementing any measure, please review the relevant incentive program guidelines before proceeding. This is important because in most cases you will need to submit applications for the incentives prior to purchasing materials or commencing with installation.

The ECMs outlined in this report may qualify under the following program(s):

- SmartStart (SS)

For facilities wanting to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the SmartStart program. To participate in this program you may utilize internal resources, or an outside firm or contractor, to do the final design of the ECM(s) and do the installation. Program pre-approval is required for some SS incentives, so only after receiving pre-approval should you proceed with ECM installation. The incentive estimates listed above in Figure 3 are based on the SS program. More details on this program and others are available in Section 8.

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the Energy Savings Improvement Program (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. An LGEA report (or other approved energy audit) is required for participation in ESIP. Please refer to Section 8.2 for additional information on the ESIP Program.

The Demand Response Energy Aggregator is a program (non-NJCEP) designed to reduce consumer electric load when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak demand. Demand Response (DR) service providers (a.k.a. Curtailment Service Providers) are registered with PJM, the independent system operator (ISO) for mid-Atlantic state region that is charged with maintaining electric grid reliability locally. By enabling grid operators to call upon Curtailment Service Providers and energy consumers to reduce electric usage 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 DR programs. Program participation is voluntary and participants will receive payments whether or not their facility is called upon to curtail their load. Please see Section 7 for additional information on this program.

Additional information on relevant incentive programs is located in Section 8. You may also check the following website for more details: www.njcleanenergy.com/ci

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 4 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Andrew Weber	Executive Director	Andrew@wmua.info	609-877-2900 x 15
James J. Mackie, PE	Director of Operations & Maintenance	jmackie@wmua.info	609-877-2900 x 105
TRC Energy Services			
Moussa Traore	Auditor	MTraore@trcsolutions.com	(732) 855-0033

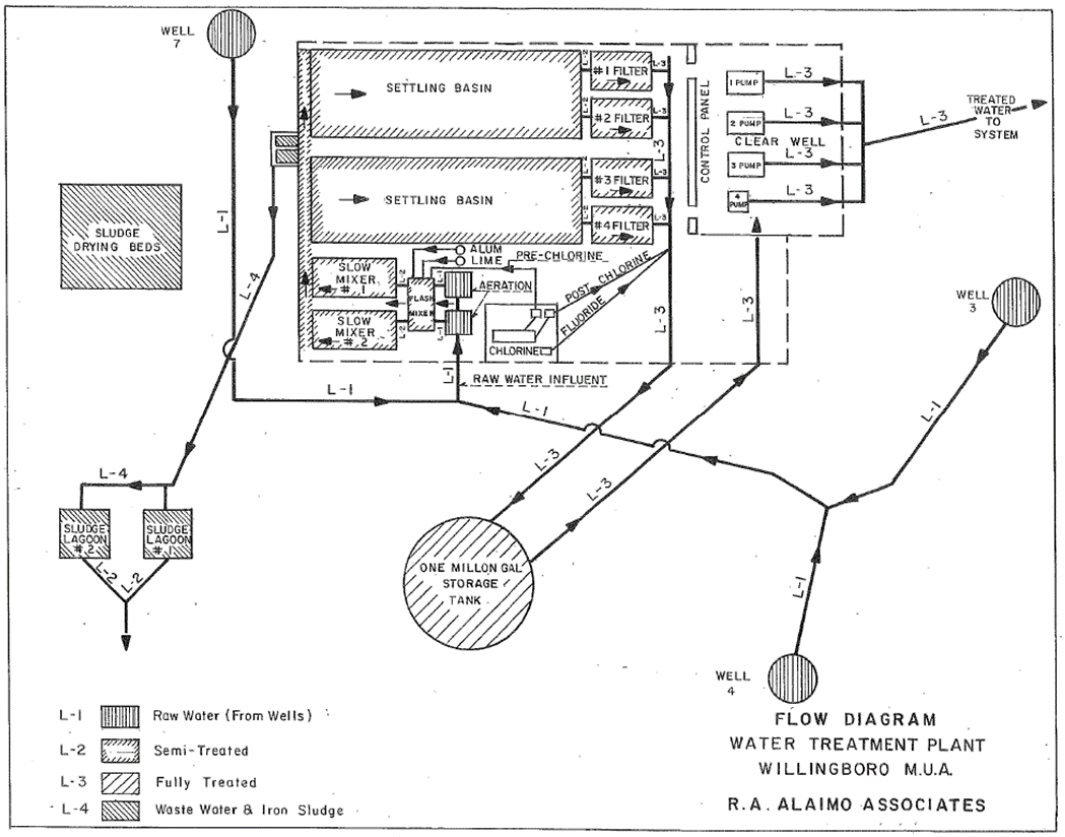
2.2 General Site Information

On August 4, 2016, TRC Energy Services performed an onsite inspection of the Meribrook Water Treatment Plant. TRC Energy Services' team met with the facility's Director of Operations and Maintenance, Jim Mackie, to review the facility operations and focus the investigation on specific energy-using systems.

The Willingboro Municipal Utilities Authority (WMUA) Main Water Treatment Plant is located on Meribrook Circle in Willingboro, NJ. The facility was constructed in 1961 and consists of an 8,500 SF building and a couple of small pump house structures onsite. The main building houses the high service pumping equipment, gravity sand filtration system, controls for the plant, a laboratory, offices, a lunchroom, as well as a locker room. In addition the facility has the following:

- Two aerators
- Two settling basins
- One 1-million gallon in-ground water storage tank
- 400,000 gallon backwash receiving lagoon

The plant is designed to treat up to 6 million gallons of water per day (MGD). It treats 4 to 5 MGD during the summer months and about 3 MGD during the rest of the year.



2.3 Building Occupancy

The building is continuously staffed. During the day, there are usually about 10 staff people and only one or two staff overnight.

2.4 Building Envelope

The building is constructed of CMU block with brick veneer. Doors and windows appeared to be in fair condition. No excessive air infiltration was noted.

2.5 On-Site Generation

The site has 1,188 solar panel modules rated for 230 W per module (273 kW dc solar photovoltaic system) to convert solar energy to electricity at the plant site.

In January 2016 Richard A. Alaimo Associates provided an evaluation of lost revenue from under performance of the solar system at the Water Treatment plant. Their analysis primarily focused on the difference between actual solar output and the potential solar output as calculated by PV Watts. They concluded that the lost revenue (at $0.20/kWh) ranged from $61,900 to $89,100. Comparing actual solar system output to PV Watts predicted output may or may not be relevant.

The table below summarizes the Water Treatment plant monthly solar array output. The 2012 and 2013 data are from the Alaimo Associates study. The 2015 and 2016 data are from the Deck Monitoring website. This data indicates that the total solar array production is noticeably lower than when the array was first installed. Compared to the average output for 2012-2013 the 2015 output is down 36% and the 2016 output is down 19%. This is particularly significant since some of the most noticeable shortfalls in 2016 occurred from July through September. **It is recommended that the solar system at the Water Treatment plant be recommissioned.**

Month	2012 kWh	2013 kWh	2015 kWh	2016 kWh
January	18,306	15,502	7,802	15,835
February	23,959	18,323	12,402	17,939
March	32,713	28,998	13,041	33,494
April	40,009	40,375	15,457	37,449
May	34,603	39,658	725	31,881
June	40,126	37,078	589	38,403
July	38,699	36,876	40,196	25,680
August	36,950	33,545	41,483	11,964
September	32,211	36,149	32,966	8,906
October	20,010	38,543	27,516	26,121
November	13,190	6,148	17,228	19,122
December	11,228	13,107	10,991	12,507
Total	342,004	344,302	220,396	279,301

2.6 Energy-Using Systems

Lighting System

Interior lighting is primarily provided by fluorescent fixtures with 4 foot T8 and T12 lamps. There are also fixtures with high intensity discharge lamps (HID) in the pump and filter rooms. The fixtures generally use metal halide lamps. All of the interior fixtures are controlled by manual switches.

Please refer to Appendix A: Equipment Inventory & Recommendations for an inventory of your equipment.

Heating, Ventilating, and Air Conditioning

Space heating is provided by unit heaters located throughout the building. Hot water for the unit heaters is supplied by a 500,000 Btu/hr boiler. The office areas also have window air conditioners.

Please refer to Appendix A: Equipment Inventory & Recommendations for an inventory of your equipment.

Domestic Hot Water

Domestic hot water for the building is provided by a 40 gallon natural gas fired water heater.

Please refer to Appendix A: Equipment Inventory & Recommendations for an inventory of your equipment.

Process Systems

The primary process loads at this facility are the high duty pumps. There are three (3) 250 hp pumps and one (1) 125-HP pump. The 250 hp pumps have variable frequency drives that are controlled based on well level. These pumps account for over 75% of the operating electric load at the facility.

Please refer to Appendix A: Equipment Inventory & Recommendations for an inventory of your equipment.

3 SITE ENERGY USE AND COSTS

Utility data for Electricity and Natural Gas was analyzed to identify opportunities for savings. In addition, data for Electricity and Natural Gas was evaluated to determine the annual energy performance metrics for the building in energy cost/ft^2 and energy use/ft^2. These energy use indices are indicative of the relative energy effectiveness of this building. There are a number of factors that could cause the energy use of this building to vary from the "typical" energy use for other facilities identified as: Water/Wastewater Treatment/Pumping. Specific local climate conditions, daily occupancy hours of the facility, seasonal fluctuations in occupancy, daily operating hours of energy use systems, and the behavior of the occupants with regard to operating systems that impact energy use such as turning off appliances and leaving windows open. Please refer to the Benchmarking section within Section 0 for additional information.

3.1 Total Cost of Energy

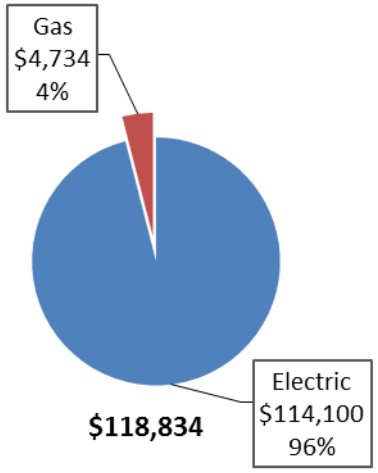
The following energy consumption and cost data is based on the last 12 month period of utility usage data that was provided for each utility. The annual consumption and cost was developed from this information.

Figure 5 - Utility Summary

Utility Summary for Water Treatment Plant		
Fuel	**Usage**	**Cost**
Electricity	1,237,079 kWh	$114,100
Natural Gas	5,772 Therms	$4,734
Total		**$118,834**

The current utility cost for this site is $118,834 as shown in the chart below.

Figure 6 - Energy Cost Breakdown



3.2 Electricity Usage

The site purchases electricity from Consolidated Edison Solutions and electric delivery is provided by PSE&G. Electricity is also generated on site using PV panels. The average electric cost (combined for commodity, transmission and distribution) for the past 12 months is $0.123/kWh, which is the blended rate used throughout the analyses in this report. PSE&G's rate schedule includes charges for energy, annual demand, and summer demand. The monthly electricity consumption and peak demand is represented graphically in the chart below. Approximately one quarter of the total electricity use is generated on-site.

Figure 7 - Graph of 12 Months Electric Usage & Demand

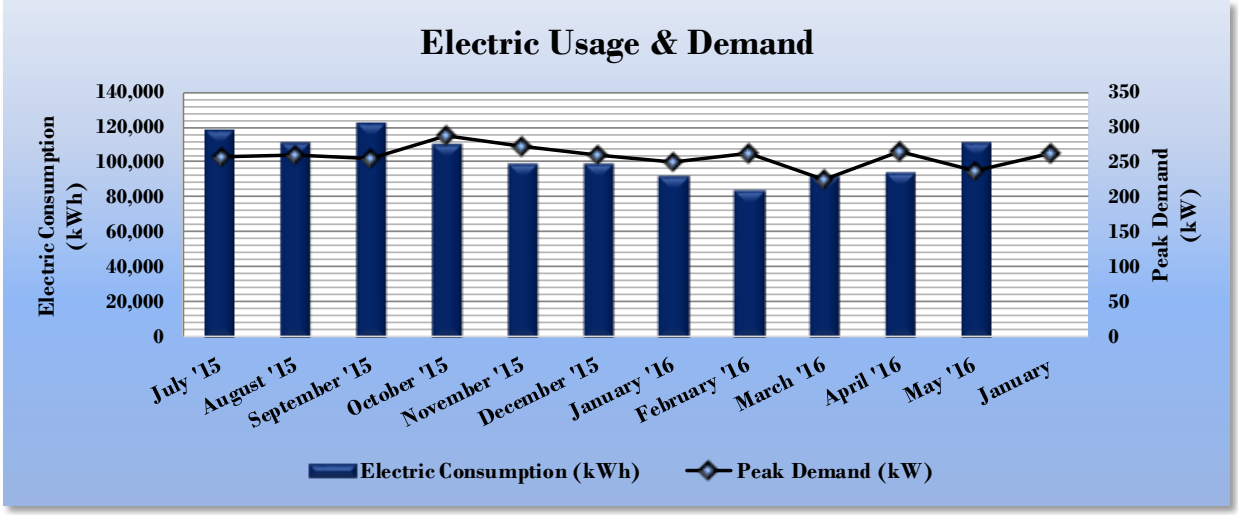


Figure 8 - Table of 12 Months Electric Usage & Demand

Electric Billing Data for Water Treatment Plant				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
6/23/15	32	112,629	258	$15,180
7/23/15	30	118,185	260	$11,329
8/21/15	29	110,926	255	$10,162
9/22/15	32	121,702	287	$12,233
10/21/15	29	109,833	273	$9,693
11/19/15	29	98,475	259	$9,508
12/22/15	33	98,973	251	$9,753
1/23/16	32	92,042	263	$8,380
2/23/16	31	83,517	224	$7,114
3/23/16	29	92,239	266	$6,615
4/22/16	30	94,298	237	$6,299
5/23/16	31	111,039	264	$8,461
Totals	**367**	**1,243,858**	**287.3**	**$114,726**
Annual	**365**	**1,237,079**	**287.3**	**$114,100**

3.3 Natural Gas Usage

Natural Gas is provided by PSE&G. The average gas cost for the past 12 months is $0.820/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is represented graphically in the chart below.

Figure 9 - Graph of 12 Months Natural Gas Usage

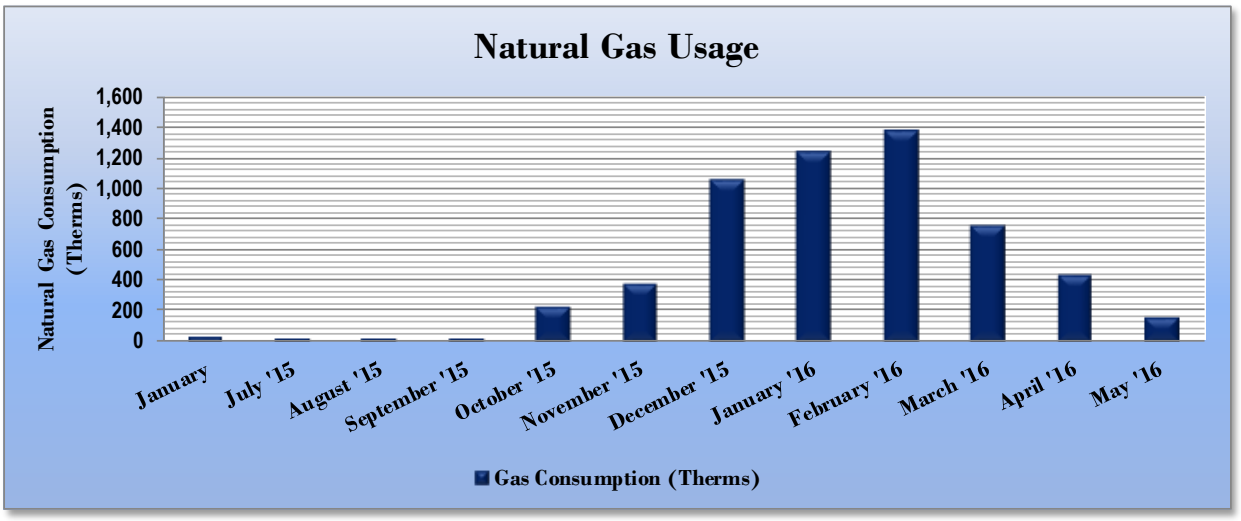


Figure 10 - Table of 12 Months Natural Gas Usage

Gas Billing Data for Water Treatment Plant			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
6/23/15	32	32	$36
7/23/15	30	29	$34
8/21/15	29	29	$34
9/21/15	31	30	$35
10/21/15	30	238	$190
11/19/15	29	379	$313
12/22/15	33	1,061	$878
1/22/16	31	1,249	$1,045
2/23/16	32	1,387	$1,135
3/23/16	29	765	$601
4/22/16	30	440	$326
5/23/16	31	165	$132
Totals	**367**	**5,804**	**$4,760**
Annual	**365**	**5,772**	**$4,734**

3.4 Benchmarking

This facility was benchmarked through Portfolio Manager, an online tool created and managed by the United State Environmental Protection Agency (EPA) through the ENERGY STAR® program. Portfolio Manager analyzes your facility's consumption data, cost information, and operational use details and compares its performance against a yearly baseline, national medians, or similar facilities in your portfolio. Metrics used in this comparison are the energy use intensity (EUI) and ENERGY STAR® Score.

Energy use intensity is a measure of a facility's energy consumption per a standard metric. For water treatment facilities the EUI is kBtu/gal-day. Comparing the EUI of a facility with the national median EUI for that facility type illustrates whether that facility uses more energy than similar facilities or if that facility performs better than the median. EUI is presented in both site energy and source energy. Site energy is the amount of fuel and electricity consumed by a facility as reflected in utility bills. Source energy is the raw fuel consumed to generate the energy consumed at the site, factoring in energy production and distribution losses.

Figure 11 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Water Treatment Plant	National Median Building Type: Water Treatment
Source Energy Use Intensity (kBtu/gal-day	3.73	6.61
Site Energy Use Intensity (kBtu/gal-day)	1.29	2.27

By implementing all recommended measures covered in this reporting, the Project's estimated post-implementation EUI improves as shown in the Table below:

Figure 12 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Water Treatment Plant	National Median Building Type: Water Treatment
Source Energy Use Intensity (kBtu/gal-day	3.39	6.61
Site Energy Use Intensity (kBtu/gal-day)	1.18	2.27

Many buildings can also receive a 1 – 100 ENERGY STAR® score. This score compares your building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75 percent of all similar buildings nationwide — and may be eligible for ENERGY STAR® certification. Although this facility has been benchmarked, the building type does not currently qualify to receive a score. Per ENERGY STAR®, more than 50% of the gross floor area must be made up of at least one property type that is eligible for receiving a score.

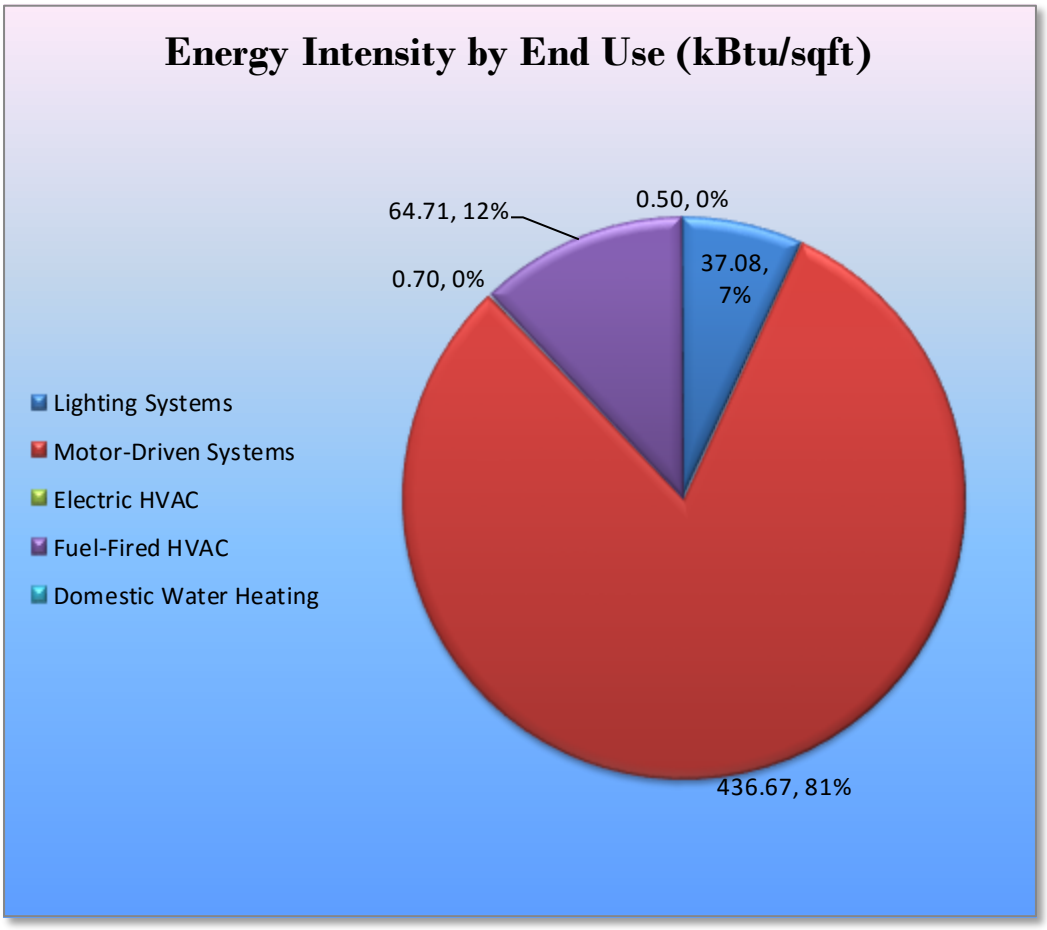
The Portfolio Manager, Statement of Energy Performance can be found in Appendix B: EPA Statement of Energy Performance.

A Portfolio Manager account has been created online for your facility and you will be provided with the login information for the account. We encourage you to update your utility information in Portfolio Manager regularly, so that you can keep track of your building's performance. 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

3.5 Energy End-Use Breakdown

In order to provide a complete overview of energy consumption across systems, an energy balance was performed at this facility. An energy balance utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems and determine their proportional contribution to overall facility energy usage. This visual representation of energy end uses highlights systems that may benefit most from energy efficiency projects.

Figure 13 - Energy Balance (% and kBtu/SF)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy projects, help prioritize specific measures for implementation, and set Water Treatment Plant on the path to receive financial incentives. For this audit report, most measures have received only a preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is considered sufficient to make "Go/No-Go" decisions and to prioritize energy projects. Savings are based on the New Jersey Board of Public Utilities New Jersey Clean Energy Program Protocols to Measure Resource Savings dated June 29, 2016. Further analysis or investigation may be required to calculate more accurate savings to support any custom SmartStart, Pay for Performance, or Large Energy Users incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJ prescriptive SmartStart program. Depending on your implementation strategy, the project may be eligible for more lucrative incentives through other programs as identified in Section 8.

The following sections describe the evaluated measures.

4.1 Recommended ECMs

The measures below have been evaluated by the auditor and are recommended for implementation at the facility.

Figure 14 – Summary of Recommended ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**68,601**	**6.8**	**$8,405.77**	**$7,961.66**	**$565.00**	**$7,396.66**	**0.88**	**69,080**
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ECM 3	Install LED Exit Signs	Yes	1,901	0.2	$232.88	$1,290.66	$0.00	$1,290.66	5.54	1,914
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** - Simple Payback Period is based on net measure costs (i.e. after incentives).

4.1.1 Lighting Upgrades

Recommended lighting upgrades are summarized in Figure 15 below.

Figure 15 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**68,601**	**6.8**	**$8,405.77**	**$7,961.66**	**$565.00**	**$7,396.66**	**0.88**	**69,080**
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ECM 3	Install LED Exit Signs	1,901	0.2	$232.88	$1,290.66	$0.00	$1,290.66	5.54	1,914

ECM 1: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	26,273	2.2	0.0	$3,219.34	$3,195.00	$565.00	$2,630.00	0.82	26,457
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.00	0

Measure Description

We recommend replacing linear fluorescent lamps, ballasts, and reflectors with LED tube lamps, reflectors, and drivers specifically designed for existing linear fluorescent fixtures. The retrofit uses the existing fixture housing but replaces the rest of the components with an efficient source and reflectors designed for LEDs. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output and efficiently projects the light into the space.

Maintenance savings are anticipated since LEDs have rated lifetimes which are more than twice that of a fluorescent tubes. Maintenance savings may be partially offset by the higher material costs associated with LED sources.

During retrofit planning and design, we recommend a holistic approach that considers both the technology of the lighting sources and how they are controlled.

Please refer to Appendix A: Equipment Inventory & Recommendations for a detailed list of the locations and light fixtures affected by this measure.

ECM 2: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	26,583	2.2	0.0	$3,257.28	$1,628.00	$0.00	$1,628.00	0.50	26,769
Exterior	13,843	2.3	0.0	$1,696.27	$1,848.00	$0.00	$1,848.00	1.09	13,940

Measure Description

This measure evaluates replacing high intensity discharge (HID) screw-in lamps with LED lamps. Screw-in LED lamps can be used as a direct replacement for most other screw-in lamps. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output.

Please refer to Appendix A: Equipment Inventory & Recommendations for a detailed list of the locations and light fixtures affected by this measure.

ECM 3: Install LED Exit Signs

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	1,901	0.2	0.0	$232.88	$1,290.66	$0.00	$1,290.66	5.54	1,914
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.00	0

Measure Description

This measure evaluates replacing existing exit signs with LEDs. LEDs require virtually no maintenance and LED exit signs have a life expectancy of at least 20 years. Many manufacturers can provide retrofit kits that meet fire and safety code requirements. Retrofit kits are less expensive and simpler to install than replacement signs, however, new fixtures would have a longer useful life and are therefore recommended.

A reduction in maintenance costs will be realized with the proposed retrofit because lamps will not have to be replaced as frequently.

Please refer to Appendix A: Equipment Inventory & Recommendations for a detailed list of the locations and light fixtures affected by this measure.

4.1.2 Lighting Control Measures

Recommended lighting control measures are summarized in Figure 16 below.

Figure 16 – Summary of Lighting Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**9,160**	**0.5**	**0.0**	**$1,122.41**	**$2,278.00**	**$335.00**	**$1,943.00**	**1.73**	**9,224**
ECM 4	Install Occupancy Sensor Lighting Controls	9,160	0.5	0.0	$1,122.41	$2,278.00	$335.00	$1,943.00	1.73	9,224

ECM 4: Install Occupancy Sensor Lighting Controls

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
9,160	0.5	0.0	$1,122.41	$2,278.00	$335.00	$1,943.00	1.73	9,224

Measure Description

We recommend installing occupancy sensors to control light fixtures throughout the facility. Occupancy sensors are not recommended for areas with HID fixtures, due to the long restart time for HID fixtures, unless the recommended LED retrofit for those fixtures is implemented. For process areas extra care should be taken when locating the sensors to make sure that the lights turn on as personnel pass through any entrance to the area.

Sensors detect occupancy using ultrasonic and/or infrared wave technologies. Lighting systems are enabled when an occupant is detected. Fixtures are automatically turned off after an area has been vacant for a preset period. Occupants will also be able to manually turn off fixtures. Energy savings result from only operating lighting systems when they are required.

Occupancy sensors may be mounted on the wall at existing switch locations, mounted on the ceiling, or in remote locations. Ceiling-mounted or remote-mounted sensors require the use of low voltage switching relays or a wireless signal to the switch. In general, use wall switch replacement sensors for single occupant offices and other small rooms. Install ceiling-mounted or remote mounted sensors in locations without local switching, in situations where the existing wall switches are not in the line-of-sight of the main work area, and in large spaces. We recommend a holistic design approach that considers both the technology of the lighting sources and how they are controlled.

Please refer to Appendix A: Equipment Inventory & Recommendations for a detailed list of the locations and light fixtures affected by this measure.

4.1.3 Motor Upgrades

ECM 5: Premium Efficiency Motors

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
41,140	12.1	0.0	$5,041.00	$36,256.69	$0.00	$36,256.69	7.19	41,428

Measure Description

We recommend replacing standard efficiency motors with IHP 2014 efficiency motors. The evaluation assumes existing motors will be replaced with the same size motors. It is important that the speed of each new motor match the speed of the motor it replaces as closely as possible. The base case motor efficiencies are obtained from nameplate information. Proposed case premium motor efficiencies are obtained from the New Jersey's Clean Energy Program Protocols to Measure Resource Savings (2016). Savings are based on the difference between baseline and proposed efficiencies and the annual operating hours.

Please refer to Appendix A: Equipment Inventory & Recommendations for more information about the equipment affected by this measure.

5 ENERGY EFFICIENT PRACTICES

In addition to the quantifiable savings estimated in Section 4, a facility's energy performance can also be improved through application of low or no-cost efficiency strategies. By employing certain behavioral and operational adjustments as well as performing routine maintenance on building systems, equipment lifetime can be extended; occupant comfort, health and safety can be improved; and annual energy, operation, and maintenance costs can be reduced. The recommendations below are provided as a framework for developing a whole building maintenance plan that is customized to your facility. Consult with qualified equipment specialists for details on proper maintenance and system operation.

Perform Proper Lighting Maintenance

In order to sustain optimal lighting levels, lighting fixtures should undergo routine maintenance. Light levels decrease over time due to lamp aging, lamp and ballast failure, and buildup of dirt and dust on lamps, fixtures and reflective surfaces. Together, these factors can reduce total illumination by 20% - 60% or more, while operating fixtures continue drawing full power. To limit this reduction, lamps, reflectors and diffusers should be thoroughly cleaned of dirt, dust, oil, and smoke film buildup approximately every 6 – 12 months.

Develop a Lighting Maintenance Schedule

In addition to routine fixture cleaning, development of a maintenance schedule can both ensure maintenance is performed regularly and can reduce the overall cost of fixture re-lamping and re-ballasting. By re-lamping and re-ballasting fixtures in groups, lighting levels are better maintained and the number of site visits by a lighting technician or contractor can be minimized, decreasing the overall cost of maintenance.

Perform Routine Motor Maintenance

Motors consist of many moving parts whose collective degradation can contribute to a significant loss of motor efficiency. In order to prevent damage to motor components, routine maintenance should be performed. This maintenance consists of 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.

Perform Proper Boiler Maintenance

Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to retain proper functionality and efficiency of the heating system. Fuel burning equipment should undergo yearly tune-ups to ensure they are operating as safely and efficiently as possible from a combustion standpoint. A tune-up should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is operating safely. Buildup of dirt, dust, or deposits on the internal surfaces of a boiler can greatly affect its heat transfer efficiency. These deposits can accumulate on the water side or fire side of the boiler. Boilers should be cleaned regularly according to the manufacturer's instructions to remove this build up in order to sustain efficiency and equipment life.

6 SELF-GENERATION MEASURES

Self-generation measures include both renewable (e.g., solar, wind) and non-renewable (e.g., microturbines) on-site technologies that generate power to meet all or a portion of the electric energy needs of a facility, often repurposing any waste heat where applicable. Also referred to as distributed generation, these systems contribute to Greenhouse Gas (GHG) emission reductions, demand reductions and reduced customer electricity purchases, resulting in the electric system reliability through improved transmission and distribution system utilization.

The State of New Jersey's Energy Master Plan (EMP) encourages new distributed generation of all forms and specifically focuses on expanding use of combined heat and power (CHP) by reducing financial, regulatory and technical barriers and identifying opportunities for new entries. The EMP also outlines a goal of 70% of the State's electrical needs to be met by renewable sources by 2050.

Preliminary screenings were performed to determine the potential that a generation project could provide a cost-effective solution for your facility. Before making a decision to implement, a feasibility study should be conducted that would take a detailed look at existing energy profiles, siting, interconnection, and the costs associated with the generation project including interconnection costs, departing load charges, and any additional special facilities charges.

6.1 Photovoltaic

Sunlight can be converted into electricity using photovoltaics (PV) modules. Modules are racked together into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is interconnected to the facility's electrical distribution system. The amount of unobstructed area available determines how large of a solar array can be installed. The size of the array combined with the orientation, tilt, and shading elements determines the energy produced.

The Water Treatment Plant has an existing PV array that provides approximately one quarter of the total electricity used on site (see Section 2.5).

Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the SREC Registration Program prior to the start of construction in order to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing.

For more information on solar PV technology and commercial solar markets in New Jersey, or to find a qualified solar installer, who can provide a more detailed assessment of the specific costs and benefits of solar development of the site, please visit the following links below:

- **Basic Info on Solar PV in NJ**: http://www.njcleanenergy.com/whysolar
- **NJ Solar Market FAQs**: http://www.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

6.2 Combined Heat and Power

In non-industrial settings, combined heat and power (CHP) is the on-site generation of electricity and recovery of heat which is put to beneficial use. Common prime movers in CHP applications include reciprocating engines, microturbines, fuel cells, and (at large facilities) gas turbines. Electricity is typically interconnected to the sites local distribution system. Heat is recovered from the exhaust stream and the ancillary cooling system and interconnected to the existing hot water (or steam) distribution system.

CHP systems are typically used to produce a portion of the electricity needed by a facility, with the balance of electric needs satisfied by purchase from the grid. The heat is used to supplement (or supplant) existing boilers for the purpose of space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for the purpose of space cooling. The key criteria used for screening, however, is the amount of time the system operates at full load and the facility's ability to use the recovered heat. Facilities with continuous use 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 a **Low** potential for installing a cost-effective CHP system.

Low and infrequent thermal load is the most significant factor contributing to the low potential for CHP at the site. In our opinion, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation.

For a list of qualified firms in NJ specializing in commercial CHP cost assessment and installation, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/

7 DEMAND RESPONSE

Demand Response (DR) is a program designed to reduce consumer electric load when electric wholesale prices are high or when the reliability of the electric grid is threatened due to peak demand. DR service providers (a.k.a. Curtailment Service Providers) are registered with PJM, the independent system operator (ISO) for mid-Atlantic state region that is charged with maintaining electric grid reliability locally.

By enabling grid operators to call upon Curtailment Service Providers and energy consumers to reduce electric usage 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 DR programs. Program participation is voluntary and participants will receive payments whether or not their facility is called upon to curtail their load.

Typically an electric customer needs to 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 a greater capability to quickly curtail their demand during peak hours will receive higher payments. Customers with back-up generators onsite 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 a DR program often find it to be a valuable source of revenue for their facility(ies) because the payments can significantly offset annual utility costs.

Participating customers can often quickly reduce their peak load through simple measures, such as temporarily raising temperature set points 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 event cycle. DR program participants often have to install smart meters and may need to also sub-meter larger energy-using equipment, such as chillers, in order 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 demand response 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 PJM's website and it includes contact information for each company, as well as the states where they have active business (www.pjm.com/markets-and-operations/demand-response/csps.aspx). PJM also posts training materials that are developed for program members interested in specific rules and requirements regarding DR activity (www.pjm.com/training/trainingmaterial.aspx), along with a variety of other program information.

Curtailment Service Providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding the program rules and requirements for metering and controls, a facility's ability to temporarily reduce electric load, as well as the payments involved in participating in the program. Also, these providers usually offer multiple options for DR to larger facilities and may also install controls or remote monitoring equipment to help ensure compliance of all terms and conditions of a DR contract.

8 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and others, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey's 1999 Electricity Restructuring Law which requires all customers of investor-owned electric and gas utilities to pay this charge on their monthly energy bills. As a contributor to the fund you were able to participate in the LGEA program and are also eligible to utilize the equipment incentive programs. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 17 for a list of the eligible programs identified for each recommended ECM.

Figure 17 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	x			
ECM 2	Retrofit Fixtures with LED Lamps	x			
ECM 3	Install LED Exit Signs	x			
ECM 4	Install Occupancy Sensor Lighting Controls	x			
ECM 5	Premium Efficiency Motors		x		

SmartStart (SS) is generally well suited for implementation of individual or small sets of measures, with the flexibility to install projects at your own pace using in-house staff or a preferred contractor. Direct Install (DI) caters to small to mid-size facilities to bundle measures and simplify participation, but requires the use of pre-approved contractors. The Pay for Performance (P4P) program is a "whole-building" energy improvement program designed for larger facilities and requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants. The Large Energy Users Program (LEUP) is available to New Jersey's largest energy users giving them flexibility to install as little or as many measures, in a single facility or several facilities, with incentives capped based on the entity's annual energy consumption; applicants can use in-house staff or preferred contractor.

Generally, the incentive values provided throughout the report assume the SS program is utilized because it provides a consistent comparison of available incentives.

Brief descriptions of all relevant alternative financing and incentive programs are located in the sections below. You may also check the following website for further information, including most current program availability, requirements, and incentive levels: www.njcleanenergy.com/ci

8.1 SmartStart

Overview

The SmartStart (SS) program offers incentives for installing *prescriptive* and *custom* energy efficiency measures at your facility. Routinely the program adds, removes or modifies incentives from year to year for various energy efficiency equipment based on market trends and new technologies.

Equipment with Prescriptive Incentives Currently Available:

Electric Chillers
Electric Unitary HVAC

Gas Cooling
Gas Heating
Gas Water Heating
Ground Source Heat Pumps
Lighting
Lighting Controls
Refrigeration Doors
Refrigeration Controls
Refrigerator/Freezer Motors
Food Service Equipment
Variable Frequency Drives

Most equipment sizes and types are served by this program. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades.

Incentives

The SS prescriptive incentive program provides fixed incentives for specific energy efficiency measures, whereas the SS custom program provides incentives for new and innovative technologies, or process improvements not defined through one of the prescriptive incentives listed above.

Although your facility is an existing building, and only the prescriptive incentives have been applied in the calculations, the SS custom measure path is recommended for ECM 5 (Premium Efficiency Motors). These incentives are calculated utilizing a number of factors, including project cost, energy savings and comparison to existing conditions or a defined standard. To qualify, the proposed measure(s) must be at least 2% more efficient than current energy code or recognized industry standard, and save at least 75,000 kWh or 1,500 therms annually.

SS custom measure incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings, capped at 50% of the total installed incremental project cost, or a project cost buy down to a one year payback (whichever is less). Program incentives in the SS program (inclusive of prescriptive and custom) are capped at $500,000 per electric account and $500,000 per natural gas account, per fiscal year.

How to Participate

To participate in the SS prescriptive program you will need to submit an application for the specific equipment installed or to be installed. Many applications are designed as rebates, although others require application approval prior to installation. Applicants may work with a contractor of their choosing and can also utilize internal personnel, which provides added flexibility to the program. Using internal personnel also helps improve the economics of the ECM by reducing the labor cost that is included in the tables in this report. Please note that SS custom application requirements are different from the prescriptive applications and will most likely require additional effort to complete.

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

8.2 Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) is an alternate method for New Jersey's government agencies to finance the implementation of energy conservation measures. An ESIP is a type of "performance contract", whereby school districts, counties, municipalities, housing authorities and other

public and state entities enter in to contracts to help finance building energy upgrades. This is done in a manner that ensures that annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive in year one, and every year thereafter. 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 can be leveraged to help further reduce the total project cost of eligible measures.

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 utilized for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

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

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

Please note that ESIP is a program delivered directly by the NJBPU and is not an NJCEP incentive program. As mentioned above, you may utilize the incentive programs to help further reduce costs when compiling the ESP. You should refer to the ESIP guidelines at the link above for further information and guidance on next steps.

8.3 Demand Response Energy Aggregator

The first step toward participation in a Demand Response (DR) program is to contact a Curtailment Service Provider. A list of these providers is available on PJM's website and it includes contact information for each company, as well as the states where they have active business (www.pjm.com/markets-and-operations/demand-response/csps.aspx). PJM also posts training materials that are developed for program members interested in specific rules and requirements regarding DR activity (www.pjm.com/training/trainingmaterial.aspx), along with a variety of other program information.

Curtailment Service Providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding the program rules and requirements for metering and controls, a facility's ability to temporarily reduce electric load, as well as the payments involved in participating in the program. Also, these providers usually offer multiple options for DR to larger facilities and may also install controls or remote monitoring equipment to help ensure compliance of all terms and conditions of a DR contract.

See Section 7 for additional information.

9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

9.1 Retail Electric Supply Options

In 1999, New Jersey State Legislature passed the Electric Discount & Energy Competition Act (EDECA) to restructure the electric power industry in New Jersey. This law deregulated the retail electric markets, allowing all consumers to shop for service from competitive electric suppliers. The intent was to create a more competitive market for electric power supply in New Jersey. As a result, utilities were allowed to charge Cost of Service and customers were given the ability to choose a third party (i.e. non-utility) energy supplier.

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

If your facility is not purchasing electricity from a third party supplier, consider shopping for a reduced rate from third party electric suppliers. If your facility is purchasing electricity from a third party supplier, review and compare prices at the end of the current contract or every couple years.

A list of third party electric suppliers, who are licensed by the state to provide service in New Jersey, can be found online at: **www.state.nj.us/bpu/commercial/shopping.html**.

9.2 Retail Natural Gas Supply Options

The natural gas market in New Jersey has also been deregulated. Most customers that remain with the utility for natural gas service pay rates that are market-based and that fluctuate on a monthly basis. The utility provides basic gas supply service (BGSS) to customers who choose not to buy from a Third Party Supplier for natural gas commodity.

A customer's decision about whether to buy natural gas from a retail supplier is typically dependent upon whether a customer seeks 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 is not purchasing natural gas from a third party supplier, consider shopping for a reduced rate from third party natural gas suppliers. If your facility is purchasing natural gas from a third party supplier, review and compare prices at the end of the current contract or every couple years.

A list of third party natural gas suppliers, who are licensed by the state to provide service in New Jersey, can be found online at: **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	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Pump Room	6	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	8,736	LED Retrofit	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,115	0.33	4,010	0.0	$491.34	$450.00	$35.00	0.84
Pump Room	4	Metal Halide: (1) 175W Lamp	Wall Switch	215	8,760	LED Retrofit	No	4	LED Screw-In Lamps: MH screw-in replacement	Wall Switch	45	8,760	0.55	6,731	0.0	$824.78	$504.00	$0.00	0.61
Pump Room	2	Exit Signs: Fluorescent	None	22	8,760	LED Retrofit	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.03	317	0.0	$38.81	$215.11	$0.00	5.54
Filter Room	5	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	8,736	LED Retrofit	No	5	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	8,736	0.41	4,936	0.0	$604.80	$300.00	$0.00	0.50
Filter Room	8	Metal Halide: (1) 70W Lamp	Wall Switch	95	8,736	LED Retrofit	No	8	LED Screw-In Lamps: MH screw-in replacement	Wall Switch	18	8,736	0.50	6,081	0.0	$745.11	$368.00	$0.00	0.49
Filter Room	1	Exit Signs: Fluorescent	None	22	8,760	LED Retrofit	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	158	0.0	$19.41	$107.56	$0.00	5.54
Filter Room - Sludge	5	Metal Halide: (1) 250W Lamp	Wall Switch	295	8,736	LED Retrofit	Yes	5	LED Screw-In Lamps: MH screw-in replacement	Occupancy Sensor	45	6,115	1.07	13,006	0.0	$1,593.64	$900.00	$35.00	0.54
Filter Room - Sludge	1	Metal Halide: (1) 150W Lamp	Wall Switch	190	8,736	LED Retrofit	No	1	LED Screw-In Lamps: MH screw-in replacement	Wall Switch	45	8,736	0.12	1,431	0.0	$175.39	$126.00	$0.00	0.72
Poles	3	Metal Halide: (1) 250W Lamp	Daylight Dimming	295	4,380	LED Retrofit	No	3	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	0.61	3,712	0.0	$454.84	$378.00	$0.00	0.83
Poles	1	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Daylight Dimming	83	4,380	None	No	1	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Daylight Dimming	83	4,380	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump House	1	Metal Halide: (1) 150W Lamp	Daylight Dimming	190	4,380	LED Retrofit	No	1	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	0.12	718	0.0	$87.94	$126.00	$0.00	1.43
Pump House	2	Metal Halide: (1) 250W Lamp	Daylight Dimming	295	4,380	LED Retrofit	No	2	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	0.41	2,475	0.0	$303.23	$252.00	$0.00	0.83
Pump House	4	Metal Halide: (1) 400W Lamp	Daylight Dimming	458	4,380	LED Retrofit	No	4	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	146	4,380	1.02	6,177	0.0	$756.86	$1,000.00	$0.00	1.32
Pump House	6	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Daylight Dimming	83	4,380	None	No	6	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Daylight Dimming	83	4,380	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Chlorine Room	2	LED Screw-In Lamps: A9	Wall Switch	7	8,736	None	No	2	LED Screw-In Lamps: A9	Wall Switch	7	8,736	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Front Door	2	Metal Halide: (1) 70W Lamp	Daylight Dimming	95	4,380	LED Retrofit	No	2	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	18	4,380	0.13	762	0.0	$93.39	$92.00	$0.00	0.99
Hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,736	LED Retrofit	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.05	652	0.0	$79.83	$60.00	$20.00	0.50
Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,736	LED Retrofit	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,650	0.10	1,477	0.0	$181.02	$206.00	$50.00	0.86
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	8,736	LED Retrofit	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	3,650	0.02	256	0.0	$31.38	$131.00	$25.00	3.38
Break Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,736	LED Retrofit	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,650	0.14	1,970	0.0	$241.36	$236.00	$60.00	0.73
Chemical Room	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,736	LED Retrofit	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,115	0.27	3,293	0.0	$403.52	$510.00	$115.00	0.98
Chemical Room	2	Compact Fluorescent: Spot Lights	Wall Switch	23	8,736	None	No	2	Compact Fluorescent: Spot Lights	Wall Switch	23	8,736	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	1	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	8,736	LED Retrofit	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	8,736	0.08	987	0.0	$120.96	$60.00	$0.00	0.50
Lab	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,736	LED Retrofit	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,115	0.10	1,235	0.0	$151.32	$206.00	$50.00	1.03
Lab	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	8,736	LED Retrofit	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	6,115	0.02	216	0.0	$26.43	$15.00	$5.00	0.38

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Lavatory	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	8,736	LED Retrofit	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,460	0.12	2,059	0.0	$252.34	$356.00	$60.00	1.17
Lavatory	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	8,736	LED Retrofit	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,460	0.02	292	0.0	$35.78	$131.00	$25.00	2.96
Locker Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,736	LED Retrofit	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,460	0.03	564	0.0	$69.13	$300.00	$45.00	3.69
Repair Shop	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	8,736	LED Retrofit	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	3,650	0.24	3,545	0.0	$434.33	$596.00	$100.00	1.14
Meter Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,736	LED Retrofit	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.03	326	0.0	$39.92	$30.00	$10.00	0.50
Misc	9	Exit Signs: Fluorescent	None	22	8,760	LED Retrofit	No	9	LED Exit Signs: 2 W Lamp	None	6	8,760	0.12	1,425	0.0	$174.66	$968.00	$0.00	5.54
Pump House	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,736	LED Retrofit	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,115	0.03	412	0.0	$50.44	$146.00	$30.00	2.30
Office	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	8,736	LED Retrofit	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	3,650	0.48	7,089	0.0	$868.65	$1,230.00	$195.00	1.19
Chemical Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	8,736	LED Retrofit	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	6,115	0.12	1,449	0.0	$177.57	$240.00	$40.00	1.13

Motor Inventory & Recommendations

		Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Annual Operating Hours	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
1st Floor Pump Room	High Dty Pump #1	1	Water Supply Pump	250.0	91.0%	Yes	2,400	Yes	95.8%	No		7.60	24,645	0.0	$3,019.77	$16,889.80	$0.00	5.59
1st Floor Pump Room	High Dty Pump #2	1	Water Supply Pump	250.0	93.0%	Yes	2,400	Yes	95.8%	No		4.34	14,067	0.0	$1,723.65	$16,889.80	$0.00	9.80
1st Floor Pump Room	High Dty Pump #3	1	Water Supply Pump	250.0	96.2%	Yes	2,400	No	96.2%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
1st Floor Pump Room	High Dty Pump #4	1	Water Supply Pump	125.0	92.0%	No	100	No	92.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
1st Floor Pump Room	Back Wash Pump	1	Process Pump	100.0	90.0%	No	400	No	90.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
2nd Floor Filter Room	Sludge Collection	2	Other	0.8	80.0%	No	8,760	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
2nd Floor Filter Room	Slow Mixer	2	Other	5.0	87.5%	No	8,760	Yes	89.5%	No		0.14	1,669	0.0	$204.50	$1,600.74	$0.00	7.83
2nd Floor Filter Room	Flash Mixer	1	Other	3.0	86.5%	No	8,760	Yes	89.5%	No		0.06	760	0.0	$93.09	$876.36	$0.00	9.41
2nd Floor Filter Room	Aerator	2	Other	3.0	86.5%	No	7,300	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump House	Transfer Pump	1	Other	10.0	89.5%	No	2,738	No	89.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Chlorine Room	Chlorine Pump	4	Process Pump	0.5	80.0%	No	2,190	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Chlorine Room	Exhaust Fan	2	Exhaust Fan	0.3	80.0%	No	4,380	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Chemical Room	Lime Pump	2	Process Pump	0.8	80.0%	No	4,380	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Chemical Room	Armer Pump	2	Process Pump	0.3	80.0%	No	4,380	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Electric HVAC Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	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 (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
various	offices	3	Window AC	0.42		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Building	1	Non-Condensing Hot Water Boiler	400.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Building	1	Storage Tank Water Heater (≤ 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Appendix B: EPA Statement of Energy Performance

ENERGY STAR® Statement of Energy Performance

LEARN MORE AT energystar.gov

N/A

ENERGY STAR® Score[1]

Willingboro MUA Main Water Treatment Plant

Primary Property Type: Drinking Water Treatment & Distribution
Gross Floor Area (ft²): 8,500
Built: 1961

For Year Ending: April 30, 2016
Date Generated: March 13, 2017

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
Willingboro MUA Main Water Treatment Plant 55 Meribrook Circle Willingboro Township, New Jersey 08046	_____ (___)___-_____	___ _____ (___)___-_____ _____

Property ID: 5735691

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
564.1 kBtu/ft²

Source EUI
1,383.4 kBtu/ft²

Annual Energy by Fuel	
Electric - Solar (kBtu)	970,589 (20%)
Natural Gas (kBtu)	582,875 (12%)
Electric - Grid (kBtu)	3,240,968 (68%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	1,169.5
National Median Source EUI (kBtu/ft²)	2,868.4
% Diff from National Median Source EUI	-52%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	514

Signature & Stamp of Verifying Professional

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

Signature: _____ Date: _____

Licensed Professional

___ _____
(___)___-_____
_____

Professional Engineer Stamp (if applicable)