Willingboro Municipal Utilities Authority

Energy Savings Plan – Revision 2

April 16, 2020

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1.0 Executive Summary

In July 2018, Schneider Electric was selected by the Willingboro Municipal Utilities Authority as their Energy Services Company. Since that time, Schneider Electric has performed an Investment Grade Audit (IGA) to develop the Authority's Energy Savings Improvement Program (ESIP). We are pleased to provide the following Energy Savings Plan (ESP) as the result of the IGA process.

We have spent significant time visiting the facilities, evaluating systems and procedures, speaking with staff, creating preliminary engineering drawings, analyzing utility information, and creating process and energy models. We would like to thank the administration, staff and members of the Authority for providing their time, assistance, and input.

ESIP Core Team Members

Andrew Weber, WMUA Executive Director
Diallyo Diggs, WMUA Finance Director
Emmanuel Stuppard, WMUA Director of Operations
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Additional Project Contributors

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Current State

The following trends were taken into consideration to develop a successful ESIP program for the WMUA.

- Various process related equipment at the Pollution Control Plant has failed or has reached the end of useful life.
- Large horsepower pumps at the Pollution Control Plant and within the Water Department are running at constant speed. Some of this equipment has older, less efficient motors.
- Lighting in most facilities has not been upgraded to LED.

Project Goals

Our proposed ESIP will allow the WMUA to:

- Replace the aging digester boiler and heat exchanger at the Pollution Control Plant and provide another source of heat for the digesters in the form of a CHP unit
- Maximize energy savings throughout plant operations through ESIP efficiencies.
- Reduce maintenance and operational costs through increased process efficiencies to make plant staff more effective.
- Minimize risk and exposure to volatile energy prices by reducing the amount of energy needed each year.
- Increase opportunities for new revenues.

Defunct CHP Equipment

The microturbine at the Pollution Control Plant no longer functions. As a result, digester gas is often flared.

Capital Needs & Savings Opportunities

The following Energy Savings Plan highlights opportunities to reduce energy & operational costs. The largest savings opportunities are from implementation of a CHP unit, designed to burn waste gas from the Pollution Control Plant and from the installation of VFDs on process and well water pumps.

Please see the following table listing the energy conservation measures included at each facility.

	Energy Conservation Measure	WMUA Administrative Office	Water Treatment Plant	Pollution Control Plant	Well Pumps, Water Tanks, Pump Stations								
					Well 1 - Sylvan Lane	Well 5A - Baldwin Lane	Well 6 - Medallion Lane	Well 9 - Middlebury Lane	Well 10 - Barnwell Drive	Windsor Park Pump Station	Beechnut Pump Station	Tweedstone Pump Station	Lake Drive Pump Station
	Process Improvements												
1	Pump VFDs			○	○	○		○	○				
2	Premium Efficient Motors			○									
3	Digester Boiler Replacement			○									
	Cogeneration/On-Site Generation												
4	Replace existing microturbine with new CHP unit			○									
	Lighting Upgrades												
5	Lighting Retrofits	○	○	○	○	○	○			○	○	○	○
6	Lighting Occupancy Sensor Controls		○	○									
	Building Automation & Efficiency												
7	BAS - Programmable Thermostat	○											
8	Building Envelope Improvements		○	○	○	○	○			○			
	Electrical System Efficiency												
9	Secondary Transformer Replacement		○	○	○		○						
10	Plug Load Energy Management	○	○	○									

2.0 Financial Analysis

2.1 Scope Summary

The intent of this project is to maximize energy savings opportunities, replace aging and failed equipment, and minimize the risk of increasing energy costs by reducing the amount of energy needed to operate the facilities. We believe that the following energy conservation measures are the best solution to maximizing savings and meeting the Authority's needs.

Proposed Energy Savings Plan			Hard Costs, $	Annual Energy Savings, $	Rebate, Smart Start and CHP, $	Rebate, PJM EE, $
ECM	Facility	**Process Improvements**				
1	PCP	Pump VFDs	$ 160,038	$ 65,888	$ 29,000	
1	Well 1	Pump VFDs	$ 56,272	$ 5,068	$ 5,000	
1	Well 5a	Pump VFDs	$ 46,929	$ 4,382	$ 5,000	
1	Well 9	Pump VFDs	$ 69,480	$ 6,394	$ 5,000	
1	Well 10	Pump VFDs	$ 69,480	$ 6,447	$ 5,000	
2	PCP	Premium Efficient Motors	$ 21,484	$ 1,450		
3	PCP	Digester Boiler/HX Replacement	$ 713,500	$ 13		
		Rebate Application & Processing	$ 5,500			
		Cogeneration/On-Site Generation				
4	PCP	Replace Existing microturbine with new CHP	$ 1,853,968	$ 119,160	$ 416,000	
		Rebate Application & Processing	$ 120,000			
		Lighting Upgrades				
5	Admin	Lighting Retrofits	$ 5,814	$ 278	$ 560	
5	WTP	Lighting Retrofits	$ 41,959	$ 2,289	$ 3,224	
5	PCP	Lighting Retrofits	$ 150,827	$ 7,802	$ 11,694	$ 5,500
5	Wellls	Lighting Retrofits - Water Wells	$ 17,903	$ 181	$ 2,360	
5	Pump Stations	Lighting Retrofits	$ 23,094	$ 277	$ 1,710	
6	WTP	Lighting Occupancy Sensor Controls	$ 5,699	$ 220	$ 320	
6	PCP	Lighting Occupancy Sensor Controls	$ 14,719	$ 953	$ 1,200	
		Rebate Application & Processing	$ 2,200			
		Building Automation & Efficiency				
7	Admin	BAS - Programmable Thermostats	$ 1,065	$ 988		
8	WTP	Building Envelope Improvements	$ 6,503	$ 804		
8	PCP	Building Envelope Improvements	$ 31,233	$ 4,358		
8	Well 1	Building Envelope Improvements	$ 3,210	$ 111		
8	Well 5a	Building Envelope Improvements	$ 5,900	$ 833		
8	Well 6	Building Envelope Improvements	$ 2,184	$ 456		
8	Windsor Park Pump Station	Building Envelope Improvements	$ 2,359	$ 333		
		Electrical System Efficiency				
9	WTP	Secondary Transformer Replacement	$ 14,794	$ 581	$ 922	
9	PCP	Secondary Transformer Replacement	$ 48,660	$ 1,592	$ 3,749	
9	Well 1	Secondary Transformer Replacement	$ 7,450	$ 150	$ 317	
9	Well 6	Secondary Transformer Replacement	$ 9,094	$ 579	$ 910	
10	Admin	Plug Load Energy Management	$ 322	$ 208		
10	WTP	Plug Load Energy Management	$ 646	$ 89		
10	PCP	Plug Load Energy Management	$ 1,371	$ 56		
		Rebate Application & Processing	$ 400			
		Project Summary:	$ 3,514,060	$ 231,940	$ 491,966	$ 5,500

2.2 Financial Summary

The following represents the total, turn-key cost of the Energy Savings Improvement Program based on the scope of work listed on the prior page and Form V from Schneider Electric's RFP Response. The ESIP program with Schneider Electric is a firm fixed price contract, without risk of change orders. Schneider Electric will serve as the primary contractor, responsible for the execution of all scopes of work under the ESIP program.

Category	Cost	% of Hard Costs
Estimated Value of Hard Costs (2):	$ 3,514,060	
Project Service Fees		
Investment Grade Energy Audit	$ 87,851	2.50%
Design Engineering Fees	$ 193,273	5.50%
Construction Management & Project Administration	$ 175,703	5.00%
System Commissioning	$ 96,637	2.75%
Equipment Initial Training Fees	$ 35,141	1.00%
ESCO Overhead	$ 316,265	9.00%
ESCO Profit	$ 210,844	6.00%
ESCO Termination Fee	$ -	0.00%
Project Service Fees Sub Total	$ 588,605	16.75%
TOTAL PROJECT COSTS:	$ 4,629,774	31.75%

This program may be funded through a combination of ESIP financing (lease purchase or energy savings obligations) over 20 years, rebates and incentives. There are several remaining variables that may alter the scope of this project, including final scope selection, financing term, interest rate, and incentives and rebates.

2.3 Cash Flow Analysis

ESCO Name: Schneider Electric

Note: Respondents must use the following assumptions in all financial calculations:
(a) The cost of all types of energy should be assumed to inflate **at 2.4% natural gas, 2.2% electric per year**

1. Term of Agreement: 20 years
2. Construction Period (2) (months): 18 months
3. Cash Flow Analysis Format:

Project Cost ($ 4,629,774

Interest Rate to Be Used for Proposal Purposes: 2.500%

Year	Annual Electric Savings (Net)	Annual Natural Gas Savings (Net)	Additional O&M Costs - CHP	Plug Load Control & Well Pp VFD - Equip Rpl at End of Life	Annual O&M Savings (Lighting & Boiler)	Energy Rebates/PJM Incentives	Total Annual Savings	Annual Project Costs	Annual Service Fees	Annual WMUA Costs	Net Cash-Flow to WMUA	Cumulative Cash Flow
Installation	$ 62,235	$ -					$ 62,235				$ -	$ -
1	$ 241,695	$ 6,830	$ (15,000)		$ 6,008	$ 149,215	$ 388,748	$ 445,183		$ 445,183	$ 5,800	$ 5,800
2	$ 247,012	$ 6,994	$ (15,300)		$ 6,008	$ 346,168	$ 590,882	$ 585,082		$ 585,082	$ 5,800	$ 11,600
3	$ 252,447	$ 7,162	$ (15,606)		$ 6,008	$ 1,500	$ 251,510	$ 245,710		$ 245,710	$ 5,800	$ 17,400
4	$ 258,000	$ 7,334	$ (80,000)		$ 6,008	$ 1,000	$ 192,342	$ 186,542		$ 186,542	$ 5,800	$ 23,200
5	$ 263,676	$ 7,510	$ (15,918)		$ 6,008		$ 261,276	$ 255,476		$ 255,476	$ 5,800	$ 29,000
6	$ 269,477	$ 7,690	$ (16,236)				$ 260,931	$ 255,131		$ 255,131	$ 5,800	$ 34,800
7	$ 275,406	$ 7,874	$ (16,561)				$ 266,719	$ 260,919		$ 260,919	$ 5,800	$ 40,600
8	$ 281,465	$ 8,063	$ (83,232)				$ 206,296	$ 200,496		$ 200,496	$ 5,800	$ 46,400
9	$ 287,657	$ 8,257	$ (16,892)				$ 279,021	$ 273,221		$ 273,221	$ 5,800	$ 52,200
10	$ 293,985	$ 8,455	$ (17,230)	$ (1,200)			$ 284,010	$ 278,210		$ 278,210	$ 5,800	$ 58,000
11	$ 300,453	$ 8,658	$ (17,575)	$ (50,000)			$ 241,536	$ 235,736		$ 235,736	$ 5,800	$ 63,800
12	$ 307,063	$ 8,866	$ (86,595)				$ 229,334	$ 223,534		$ 223,534	$ 5,800	$ 69,600
13	$ 313,818	$ 9,079	$ (17,926)				$ 304,971	$ 299,171		$ 299,171	$ 5,800	$ 75,400
14	$ 320,722	$ 9,297	$ (18,285)				$ 311,734	$ 305,934		$ 305,934	$ 5,800	$ 81,200
15	$ 327,778	$ 9,520	$ (18,651)				$ 318,647	$ 312,847		$ 312,847	$ 5,800	$ 87,000
16	$ 334,989	$ 9,748	$ (90,093)				$ 254,645	$ 248,845		$ 248,845	$ 5,800	$ 92,800
17	$ 342,359	$ 9,982	$ (19,024)				$ 333,318	$ 327,518		$ 327,518	$ 5,800	$ 98,600
18	$ 349,891	$ 10,222	$ (19,404)				$ 340,709	$ 334,909		$ 334,909	$ 5,800	$ 104,400
19	$ 357,589	$ 10,467	$ (19,792)				$ 348,263	$ 342,463		$ 342,463	$ 5,800	$ 110,200
20	$ 365,456	$ 10,718	$ (93,733)				$ 282,441	$ 275,566		$ 275,566	$ 6,875	$ 117,075
Totals	$ 6,053,175	$ 172,724	$ (693,054)	$ (51,200)	$ 30,040	$ 497,882	$ 5,947,333	$ 5,892,493		$ 5,892,493	$ 117,075	

NOTES:
(1) Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"
(2) No payments are made by Board during the construction period.
(3) This figure should equal the value indicated on the ESCO's PROPOSED "FORM V". DO NOT include in the Financed Project Cost
(4) Rebates are not included in financed amount due to uncertainty of Smart Start Program.

2.4 Incentives, Rebates, and Curtailment Services

A variety of incentive and rebate programs were evaluated during the development of the Project. Based upon the scope of this project, the following rebates were calculated:

Year	CHP	Smart Start	PJM EE	TOTAL
1	$416,000	$76,382	$1,500	$493,882
2			$1,500	$1,500
3			$1,500	$1,500
4			$1,000	$1,000
TOTAL	$416,000	$76,382	$5,500	$497,882

NJ Clean Energy Program – Combined Heat and Power:

One of the goals of the State of New Jersey is to enhance energy efficiency through on-site power generation with recovery and productive use of waste heat, and to reduce existing and new demands to the electric power grid. The

Board of Public Utilities seeks to accomplish this goal by providing generous financial incentives for Combined Heat & Power (CHP) installations. Additional incentives for this technology are available for this project due to the intent to use waste digester gas, a renewable fuel source, as the primary fuel for the CHP unit.

NJ Clean Energy Program – Smart Start

The Smart Start Program provides prescriptive rebates for specific equipment changes, such as lighting upgrades, or installation of variable frequency drives (VFDs).

PJM Energy Efficiency Program (PJM EE):

The Energy Efficiency program is designed to provide financial benefit to the consumer for permanent reductions in electrical load. Examples of energy efficiency projects include upgrading to more efficient lighting, or replacing HVAC systems with more efficient ones, or other ECMs that reduce electrical load.

The WMUA will see permanent reductions in peak kW, primarily from lighting upgrades, but also from the installation of secondary transformers and high efficiency motors. After the installation of this Project, Schneider Electric will work to ensure that these incentives are secured on behalf of the WMUA.

PJM Capacity Market Program (Demand Response):

The capacity market program stems from the need for utilities to balance electric supply with electric demand on the grid. Because there is a finite amount of generating capacity, demand response was created to allow consumers to shed demand when needed by PJM. Consumers must work with Curtailment Service Providers (CSPs) to shed electrical load when needed by PJM, in order to generate revenue. The load-shaving can be done through a variety of measures including energy efficiency, on-site generation, or manual shutdown.

While there may be an opportunity for WMUA to participate due to the installation of additional on-site generation, in the form of the CHP unit, the operation of this unit is based on the process needs and operation of the Pollution Control Plant and cannot necessarily be used for load curtailment when needed by PJM. Also, it is important to note that the WMUA offers critical services to the community in the form of potable water supply and sewer services and therefore, demand response, in the form of load curtailment, is not a recommended option for the Authority.

3.0 Energy Conservation Measures

3.1 Existing Facility Descriptions

PCP - Pollution Control Plant

Located at 72 Ironside Court, Willingboro NJ, this facility, built in the late 1950s, is the only wastewater treatment plant that is owned and operated by the WMUA. The treatment process includes headworks that consists of a comminutor type pump and a bar screen to remove large, inorganic debris. Two large raw sewage pumps draw influent from a wet well into a set of primary settling tanks through to primary trickling filters and into a second wet well. Sludge is pulled off the primary settling tanks via two sludge feed pumps and sent to the anaerobic digesters. Two large recirculating pumps pull liquid from the secondary wet well into a set of secondary trickling filters and then on to the secondary settling tanks. Liquid from the secondary settling tanks is disinfected with chlorine and is further treated to remove excess chlorine before it leaves the plant via an outfall to Rancocas Creek, a contributing stream to the nearby Delaware River.

Two transfer pumps pull sludge out of the anaerobic digesters to the belt filter press which acts to remove water from the sludge. The resultant solid material generated from the dewatering process is hauled offsite to the local landfill.

Another biproduct of the digestion process is waste biogas. Currently this biogas is used to fuel the digester boiler that provides a heat source for the digesters and the digester building heat or it is burned or ‘flared’ to atmosphere. Natural gas is used as a secondary fuel source for the digester boiler when sufficient quantity of biogas is not available to meet the heat demand of the digestion process and the building heating requirement. A now defunct microturbine, once used to generate both electricity for the facility and heat for the digesters, also burned the waste biogas, but has been non-functional for several years.

There are several buildings on site including the Digester Building, the Pump and Control Building, a Maintenance Garage, an Electrical Building, the Belt Filter Press Building and a Chemical Building. Natural gas fired unit heaters provide heat for the Pump and Control Building, the Maintenance Garage and the Belt Filter Press Building. Electric unit heaters are used in the Electrical Building and the Chemical Building. A testing laboratory is located on the back side of the Pump and Control building. This lab is heated by a packaged roof top unit. The lab and offices in the Pump and Control Building use packaged through-wall units for cooling.

A 500 kW natural gas fired emergency generator is located near the Electrical Building and provides standby power for the facility in the event of a utility outage. A 750 kW solar PV field, constructed in 2010, provides a portion of the electrical energy used at the facility.

Site lighting at the plant consists mainly of pole mounted HID fixtures. Building mounted HID fixtures also provide some exterior lighting at the facility. Lighting in the buildings consists of HID and linear fluorescent fixtures.

Refer to the LGEA for this facility for a plant flow diagram and a list of the motor inventory and HVAC equipment. A lighting inventory is also provided in the LGEA but a more accurate, up to date inventory, conducted as part of the energy audit performed by Schneider Electric, is provided in Appendix 7.5.

WTP – Main Water Treatment Plant

This facility, located at 55 Meribrook Circle, was also constructed in the late 1950s. It provides treated potable water for the community of Willingboro as well as the nearby community of Mount Laurel. Water wells 9, 10 and 11 provide ground water supply to this facility. The water treatment process includes two aerators, chemical mixing tanks, settling basins and a series of sand filters. Clear water is stored in a large, million-gallon storage tank located on site. Three large high duty pumps pull water from the storage tank into a clear well and then out to the treated/potable water distribution system.

This facility has a 500 kW diesel-fired emergency generator located near the main building which provides standby power in the event of a utility outage. A 250 kW solar PV field, constructed in 2010, provides a portion of the electrical energy used at the facility.

A small natural gas fired boiler provides heating for the building. Several window air-conditioning units provide cooling for the office and the main control room.

Site lighting at the plant consists mainly of pole mounted HID fixtures. Building mounted HID fixtures also provide some exterior lighting at the facility. Lighting in the buildings consists of HID, linear fluorescent fixtures and LED fixtures.

Refer to the LGEA for a list of the motor inventory and HVAC equipment. A lighting inventory is also provided in the LGEA but a more accurate, up to date inventory, conducted as part of the energy audit performed by Schneider Electric, is provided in Appendix 7.5.

Water Wells and Tanks

As noted above, Water wells 9, 10 and 11 provide untreated ground water supply to the Main Water Treatment Plant. These wells are located throughout the community of Willingboro and consist of submersible well pumps, piping and electrical power supply and control equipment. Wells 9 and 10 have 100 hp motors with no VFDs installed. Well 11 has a 200 hp motor with VFD. There are no buildings at these well locations.

Well 1 includes a water well pump and a small water treatment plant consisting of chemical feed processes. The well pump, which is driven by a 150 hp motor, the chemical feed systems and electrical equipment are housed in a building. Interior building lighting includes fixtures with screw-in fluorescent lamps. Site lighting consists of pole mounted HID fixtures. A 250 kW diesel fuel fired standby generator is located at this site to provide power in the event of a utility outage.

Well 5a consists of a water well pump, a radium treatment system and chemical feed processes including chlorine, fluoride and lime injection systems. The well pump is driven by a 125 hp motor. There are three buildings on site. One building, constructed in 2017, houses the radium treatment system. A second building houses some chemical feed systems, the plant controls and electrical equipment and the third building serves as chemical storage and houses the chorine feed system. A ductless mini-split system provides heating and cooling for the control/electrical building. Electric unit heaters provide heating for the other two buildings. All lighting at this facility is LED, with the exception of one exterior pole mounted fixture which contains a high pressure sodium lamp. A 350 kW natural gas fired standby generator is located at this site to provide power in the event of a utility outage.

Well 6 consists of a water well pump and a small water treatment plant that includes water filtration and chemical treatment systems. In addition to the filtration system, water treatment equipment includes an aeration system, a chlorination system and a clear well for treated water storage. There is one building on site that houses the well pump, the chemical feed systems, plant controls and the electrical equipment serving the plant. Lighting at this facility consists of linear fluorescent industrial style fixtures and some surface mounted fixtures with compact fluorescent lamps. LED flood lights exist on the exterior of the building. A 350 kW natural gas fired standby generator is located at this site to provide power in the event of a utility outage.

Two elevated water storage tanks are located Holyoke Lane and Edge Lane. These tanks are used to store treated water from the Main Water Treatment Plant. There are no buildings located at these sites that are owned or operated by WMUA. There are some facilities that are owned and operated by cell service providers who rent space from the WMUA at these locations. There is no interior or exterior lighting at these sites that is owned or operated by the WMUA.

Refer to the LGEA for a list of the motor inventory and HVAC equipment for the water wells. A lighting inventory is also provided in the LGEA but a more accurate, up to date inventory, conducted as part of the energy audit performed by Schneider Electric, is provided in Appendix 7.5.

Sewage Lift Stations

There are four sewage lift stations located throughout the community of Willingboro. Windsor Park Pump Station consists of two submersible pumps that pull raw sewage from a wet well and into the collection system that feeds the Pollution Control Plant. This lift station has a building that houses the pumps, the controls and electrical equipment. Lighting at this facility consists of some linear fluorescent vapor tight fixtures and HID fixtures. A 150 kW natural gas fired standby generator is located at this site to provide power in the event of a utility outage.

The other three sewer lift stations, located on Lake Drive, Beechnut Lane and Tweedstone Lane also have submersible pumps that pull raw sewage from wet wells into the collection system that feeds the Pollution Control Plant. Equipment at these three lift stations is located outdoors and there are no buildings on site. Each pump station has a standby generator to provide power for the pumps in the event of a utility outage. Site lighting at these facilities consists of exterior pole mounted HID fixtures.

Administrative Building

The Administrative Building for the WMUA is located at 433 John F Kennedy Way in Willingboro. This facility, approximately 3600 sf in size, consists of offices for WMUA staff. Additionally, the WMUA's water/sewer customers can pay bills in person at the service window located in the public portion of the building. The building is heated by a natural gas fired hot water boiler feeding a perimeter radiant heating system. Three split system DX air conditioning units provide cooling to the facility. These units are controlled by stand alone non-programmable thermostats. Interior lighting for this facility consists mostly of LED fixtures. There are a small number of linear T8 and T12 fluorescent fixtures remaining. Exterior fixtures include LED and HID flood lamps and fixtures with screw-in compact fluorescent lamps.

Refer to the LGEA for a list of the HVAC equipment. A lighting inventory is also provided in the LGEA but a more accurate, up to date inventory, conducted as part of the energy audit performed by Schneider Electric, is provided in Appendix 7.5.

3.2 ECM Descriptions

Process Improvements

Pump VFDs

Overview

Fixed speed pumps supply almost full horsepower and consume nearly maximum energy at all times during operation, regardless of demand. Reducing the speed of a pump motor when reduced flow requirements are permissible can save dramatic amounts of energy by providing only the amount of water needed to the system at any given time. Due to the cubic relationship between pump speed and power, even a 20% reduction in speed can equate to a 50% reduction in the power consumed by a pump motor.

VFDs allow the flow from each pump to be varied to match the actual loads while saving energy. Variable speed pumping is implemented with the installation of VFDs on the pump motors, flow, pressure or level transducers in the system, and the necessary wiring and programming. In some cases, existing valves may be removed or modified and new controls may be required to regulate the pump speed according to plant process or system requirements.

Well pumps are assumed to operate such that the VFD limits peak electrical demand, driving energy demand (kW) savings at 80% speed. Pumps at the PCP will be controlled based on required flow.

Scope

The following equipment will receive VFDs and new inverter duty rated motors:

Facility	Application	Quantity	Motor Size
Pollution Control Plant	Recirculation Pumps	2	200 HP
Well 1 - Sylvan Lane	Well Pump	1	150 HP
Well 5a – Baldwin Lane	Well Pump	1	125 HP
Well 9 – Middlebury Lane	Well Pump	1	100 HP
Well 10 – Barnwell Drive	Well Pump	1	100 HP

Premium Efficiency Motors

Overview

Electric motors with efficiencies less than the current National Electric Manufacturers Association's (NEMA) premium efficiency standards are considered opportunities for economical replacement based on motor size and number of run hours per year. Premium efficiency motors typically save between two to eight percent of the power consumed by standard efficiency motors, depending on the motor's horsepower, load factor, and operating speed.

Premium efficiency electric motors save energy by reducing the energy losses associated with converting electrical energy to kinetic energy. This efficiency gain is accomplished by using higher quality and thinner steel laminations in the motor stator, using more copper in the windings, tightening machining tolerances, reducing the fan cooling losses, and minimizing the air gaps between the rotor and stator.

Scope

The following equipment will receive new premium efficient motors:

Facility	Application	Quantity	Motor Size
Pollution Control Plant	Utility Water Pumps	3	15 HP

Digester Boiler Replacement

Overview

The existing digester boiler and combined heat exchanger is at the end of useful life and has increasing maintenance costs. The installation of a new boiler and heat exchanger to replace the current equipment will improve reduce maintenance costs and improve system reliability.

Scope

The new equipment will consist of a new 1.5 MBTU high-efficiency boiler, a 1.0 MBTU/hour sludge heat exchanger, 6-inch diameter sludge recirculation pipes and two (2) sludge recirculation pumps. The new boiler will be dual-fuel fired and therefore able to operate on natural gas or digester gas produced onsite. The boiler is sized to ensure the digesters are sufficiently heated to optimize the anaerobic digestion process thereby improving sludge stabilization, maximizing volatile solids destruction and increasing biogas production. Like the existing equipment, the dual-fuel fired nature will allow the facility the flexibility to utilize on-site digester gas when possible. A boiler schematic is provided in Appendix 7.3

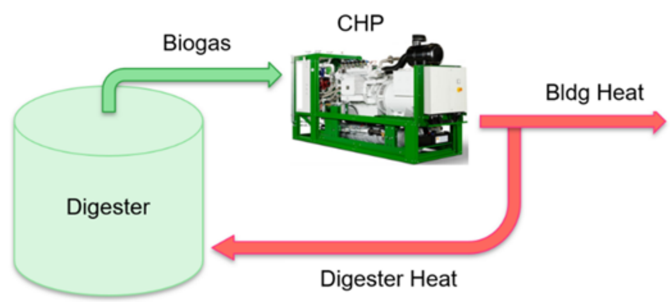
Cogeneration/On-Site Generation

Replace existing Microturbine with new CHP Unit

Overview

Localized power generation provides the opportunity to recover naturally occurring digester biogas that would otherwise be flared to the atmosphere. A combined heat and power (CHP) system generates electricity while providing useful heat to digesters and buildings. The output of the CHP engine or turbine would offset a portion of the plant's purchased electricity.

The new CHP equipment would provide the ability to burn digester gas to generate electricity while simultaneously using the waste heat for digester and building heating needs.



Combined Heat and Power Process Flow

CHP can use digester gas to efficiently and concurrently generate electricity and recover waste heat for digester and building heating needs.

Scope

The existing Microturbine is non-functional and will be replaced with a new containerized CHP unit consisting of a reciprocating engine generator, heat exchanger, exhaust silencer, piping, pumps and electrical equipment to fully integrate the unit into the plant's mechanical and electrical systems.

The intent of this ECM is to use as much of the digester gas as possible as the fuel source for the CHP unit. Though natural gas supply will be connected to the CHP unit, the intent is to only operate on purchased natural gas to ensure continuous operation of the CHP unit when there is an upset condition or other situation that leads to a loss of digester gas flow. The CHP unit will be the primary user of digester gas and the digester boiler will be designated as the secondary user of digester gas.

Based on available biogas production from the digesters and available biogas cogeneration system sizes a lean burn 2G 160 kW engine has been selected for this application. In addition to the cogeneration system, the following equipment and facilities are included:

- Removal of the existing non-functional microturbine and gas conditioning system. Microturbine will be delivered back to the WMUA and potentially repurposed as teaching tool for Township students, or as otherwise directed by WMUA.
- Removal of the existing Microturbine concrete pad and installation of a thicker pad, in the same location, to suit the heavier weight of the containerized CHP equipment.
- Installation of an active carbon filter gas conditioning system to remove free moisture, hydrogen sulfide, VOCs and siloxanes to meet the cogeneration system engine manufacturer's engine specifications for gas quality. This equipment will be provided by the CHP unit manufacturer and will be located adjacent to the containerized cogeneration equipment.
- All necessary mechanical and electrical equipment, material and connections needed to facilitate the operation of the cogeneration unit and the gas conditioning system.

Other characteristics and design features:

- This measure includes cogeneration and gas conditioning system capable of producing 160 kWe of electrical power and 170 kW (580 MBH) of heat.
- This CHP unit will be capable of electrical load following operation and potentially island-mode operation, if necessary.
- The unit will be capable of burning natural gas and blending natural gas with digester gas to ensure continuous unit operation in the case of a loss of digester gas.
- A heat exchanger and hot water circulating pump are included to capture and direct waste heat from the CHP unit to the digesters to support the anaerobic digestion process. This will supplement digester boiler operation, reducing the need to purchase natural gas for digester heating.
- The CHP container will include a space heater to prevent freezing. An engine block heater is also included. The control cabinet, located at one end of the container, will have an air conditioning unit to prevent overheating.
- The CHP container measures approximately 21 feet long by 8 feet wide by 9 feet tall.
- Metering will include a gas flow meter to measure gas to the unit, an electrical generation meter to measure electrical output and a BTU meter to measure heat recovered from the unit.
- No equipment is included to address air emissions. The selected CHP unit is expected to generate a maximum of 2.1 tons/year of NOx. This is less than the 5 ton/year limit on NOx emissions, at which point additional exhaust treatment is required. Stack testing and unit tuning should be acceptable for air permitting purposes.

The CHP specification and schematic are provided in Appendix 7.4.

Lighting Upgrades

Lighting Retrofits

Overview

A large amount of the existing lighting at the WMUA is inefficient, mostly consisting of interior High Intensity Discharge (HID), T8 fluorescent and incandescent lighting and exterior HID fixtures at most facilities. Some fixtures at the Administration building, the Main Water Treatment Plant and the Pollution Control Plant have been retrofit with LED lighting. Continuing this upgrade and replacing less efficient lighting with high-efficiency fixtures will result in significant energy savings from the difference in fixture wattage.

Example High Bay Lighting

Existing lighting systems, like this one in the Pollution Control Plant, are inefficient.

Scope

The following summarizes the scope of work associated with lighting retrofits at the various WMUA sites:

Facility	New LED Fixtures	Fixture Retrofit - Lamp & Ballast	Retrofit Kit	Replace Lamp
Administration Building	1	5	0	13
Pollution Control Plant	70	107	6	9
Water Treatment Plant	13	15	16	2
Well 1- Sylvan Lane	8	5	0	6
Well 5A – Baldwin Lane	0	0	1	0
Well 6 – Medallion Lane	0	22	0	4
Windsor Park Pump Station	4	3	0	0
Beechnut Pump Station	1	0	1	0
Tweedstone Pump Station	0	0	2	0
Lake Drive Pump Station	1	0	1	0

For exact location and lighting retrofit scope of work, refer to the detailed line by line lighting audit that is included in Appendix 7.5.

Lighting Occupancy Sensor Controls

Overview

As a result of the varying occupancy load within building spaces, many of the lighting systems operate when no occupants are present. The lack of lighting control results in additional electrical energy consumption and greater burden on space cooling systems. The opportunity to reduce lighting hours of operation while maintaining continuity of service can be achieved through automated lighting controls.

Occupancy sensors are effective in controlling lighting operation in areas with variable occupancy, such as gymnasiums, restrooms, hallways, private offices, auditoriums, large open offices, etc. Energy savings are obtained by turning lights off when occupants are not present within the space for a prolonged period.

Figure 1. Lighting Occupancy Sensor

Occupancy sensors control lighting based on the use of the space.

Scope

Occupancy sensors are included for spaces at the Pollution Control Plant and the Water Treatment Plant. Refer to Appendix 7.5 for the proposed location of these control devices.

Building Automation and Efficiency

Programmable Thermostats

Overview

Existing temperature control varies by system and includes simple on/off switches, mercury bulb type thermostats and digital thermostats. Installing programmable thermostats to control temperature settings and allow setbacks during unoccupied periods will save energy.

The microprocessor-based programmable thermostats have built-in keypad and display for programming and scheduling, and a 365-day time clock with two setback intervals per day. The thermostats have limited temporary set-point adjustment, definable in programming, and a local override button with remote override capability. This will allow occupants to adjust temperature settings for a temporary period without impacting night or unoccupied set points.

Programmable Thermostat

Microprocessor-based programmable thermostats support temperature settings and setbacks to save energy during unoccupied periods.

Scope

Programmable thermostats are proposed for the HVAC systems at the WMUA Administration Building. This includes two split system HVAC units as well as the heating system.

Building Envelope Improvements

Overview

This ECM addresses the shell of the building and how well it is keeping conditioned air in and ambient air out. Our onsite testing and analysis of energy consumption indicate there is an opportunity to improve the indoor air quality, occupant comfort, and energy use by upgrading the existing air barrier systems. A tighter Building Envelope will provide the following advantages:

- Drafts will be reduced providing greater comfort for the building occupants. A tighter building envelope will lower the possibility of “hot” or “cold” spots brought on by unconditioned air infiltrating into conditioned spaces.
- Decreased Energy Consumption - Less conditioned air will be lost through the building envelope and the Heating and Cooling equipment will operate less to maintain the set point of the conditioned space. This will decrease the energy consumed and save on energy costs.
- Improved Air Quality – Decreasing infiltration of contaminated air promotes less humidity and greater air quality. This allows for the existing systems to run at peak performance and maintain the highest level of air quality for the occupants.
- Reduced Maintenance Costs – Reducing the “runtime” will increase the operating life of the heating and cooling equipment and increase the performance of new equipment.

Scope

The following is a breakout of the Building Envelope scope by facility:

Item	Main WTP	Well 1	Well 5A – New Buildings	Well 5A – Old Building	Well 6	Windsor Park Pump Station
Door – Install Jamb Spacer, quantity		2				
Exterior Door Weatherstripping – Double Doors, quantity	3	3	5	2	1	
Exterior Door Weatherstripping – Single Doors, quantity	5	5	1	2	4	1
Install New Attic Hatch, quantity						1
Penetration Air Sealing, quantity		2				
Roof-Wall Intersection Air Sealing, Linear Feet						58

Item	PCP – Chemical Building	PCP – Digester Building	PCP – Electrical Building	PCP – Filter Building	PCP - Garage	PCP – Pump & Control Building
Caulking, Linear Feet				44	120	
Exterior Door Weatherstripping – Double Doors, quantity	1	1	3	1		2
Exterior Door Weatherstripping – Single Doors, quantity	5	3			4	1
Overhand Air Sealing, Sq Feet					32	
Roll-Up Door Weatherstripping – quantity				2		
Roof-Wall Intersection Air Sealing, Linear Feet	96			92	170	94

Electrical System Efficiency

Secondary Transformer Replacement

Overview

This measure replaces existing secondary transformers with new high efficiency transformers. With the age and condition of many of the electrical transformers, replacement with new equipment is recommended for efficiency improvement as well as reliability and safety. New transformers have lower losses across the transformer core.

Secondary transformers reduce voltage from distribution level, to building level voltage (normally from 480V to 120/208V) to maintain power in the facility. These transformers operate continuously; therefore, utilizing new, high efficiency transformers results in long term, steady energy savings.

High Efficiency Transformer

Scope

A transformer survey was performed during the investment grade audit and an inventory of existing equipment was compiled. Savings were calculated based on replacing this equipment with higher efficiency transformers. The resulting scope is as follows:

Facility - Location	Transformer ID/Tag Number	Transformer Rating, kVA	Quantity
Main WTP – Pump Room	ELP1	30	1
Main WTP – Chemical Room	ERP1	15	1
PCP - Garage	TX1	30	1
PCP – Pump & Control Building	TX2	30	1
PCP – Pump & Control Building	TX3	45	1
PCP – Digester Building	TX4	45	1
PCP – Electrical Building	TX5	30	1
PCP – Chemical Building	ERPCB	15	1
Well 1 – Pump Room	TX 2	25	1
Well 6	LP1	45	1

Plug Load Energy Management

Overview

Information Technology (IT) systems are growing with the introduction of new technologies and are becoming a foundation in the workplace and other office environments. These systems are becoming larger and more difficult to manage effectively. The potential for energy savings has grown as well with plug load devices consuming as much as 15 to 20% of the total electric baseline in some facilities.

Examples of plug loads that can be managed include:

- Workstation equipment such as computers, laptops, printers, scanners, and other peripherals.
- IT equipment such as wireless access points, servers, routers, Voice over Internet Protocol (VoIP) phones, and copiers.
- Display equipment such as projectors, televisions, and monitors.
- Presentation equipment such as projectors, smart boards, and speakers.
- Vending equipment such as snack machines, soda machines, and drink machines.
- Miscellaneous equipment such as water fountains, space heaters, stereos, and fans.

Scope

This measure involves installing simple load-based plug load controllers such as Smart Power strips or similar devices for office equipment in the following facilities:

- WMUA Administrative Building
- Water Treatment Plant office area
- Pollution Control Plant – Pump & Control Building offices
- Pollution Control Plant – Garage break area

Schneider Electric's Smart Power Strip

Schneider Electric's Smart Power Strips offer active and easy to deploy energy management strategies for load-based plug loads.

Financial

Rebates

Overview

Schneider Electric will assist the Authority in getting all applicable rebates for the project. If desired, Schneider Electric can host a public event to present a check similar to one shown to the right for Salem Community College.

Please see the section 2.4 of this report for rebates specific to this project.

Sample Large Check Event

Schneider can hold an event for the WMUA that would showcase the Authority's efforts to maximize available grants.

3.3 ECMs Evaluated but Not Included

The following ECMs were listed in the LGEA and were reviewed as part of the ESP and were not included for the project.

Facility	ECM #	ECM Name	Notes
Well Pumps, Water Tanks, and Pump Station	LGEA #5	Install Occupancy-Controlled Thermostats	ECM does not generate sufficient savings to justify cost.
Main Water Treatment Plant	LGEA #7	Install Occupancy-Controlled Thermostats	ECM does not generate sufficient savings to justify cost.
Main Water Treatment Plant	LGEA #5	Install Premium Efficient Motors	ECM does not generate sufficient savings to justify cost.
Pollution Control Plant	LGEA #5	Install Premium Efficient Motors on Macerator Pump	ECM does not generate sufficient savings to justify cost.
Pollution Control Plant	LGEA #5 & #6	Install High Efficiency Motors and VFDs on Raw Sewage Pumps	Equipment is being replaced as part of separate project to upgrade plant Headworks.
Administration Building	LGEA #5	Install Occupancy Sensor Lighting Controls	ECM does not generate sufficient savings to justify cost.

4.0 Energy Savings

4.1 Baseline Energy Use

The following information represents the energy baseline for all WMUA facilities. It was created by taking several years of utility data and utilizing the following:

- Prorating the usage into clean monthly bins
- Weather normalizing the baseline to represent a typical meteorological year

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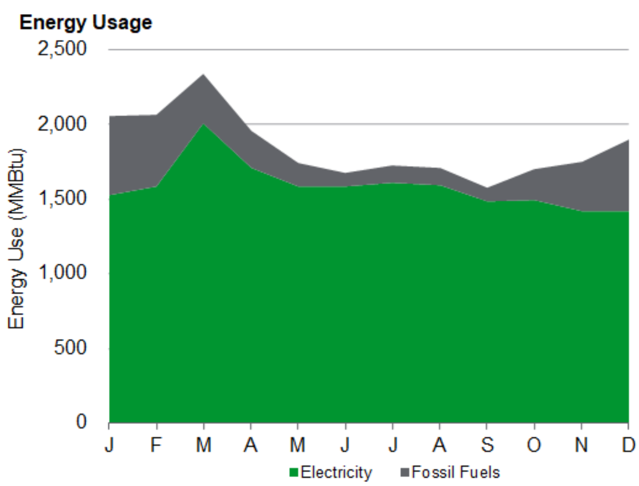
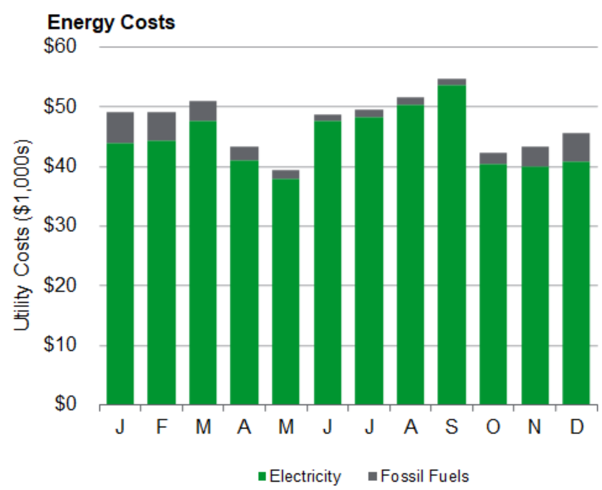
	Electricity			Fossil Fuels		Energy Total		
Month	Energy Use	Billed Demand	Cost	Energy Use	Cost	Energy Use	Billed Demand	Cost
mmm	*kWh*	*kW*	*$*	*MMBtu*	*$*	*MMBtu*	*kBtu/hr*	*$*
Jan	447,515	1,294	$43,982	530	$5,216	2,057	4,417	$49,197
Feb	463,502	1,292	$44,436	483	$4,797	2,065	4,411	$49,232
Mar	588,766	1,256	$47,662	331	$3,341	2,340	4,285	$51,004
Apr	500,583	1,238	$41,162	252	$2,100	1,961	4,225	$43,263
May	464,543	1,208	$37,917	156	$1,446	1,741	4,124	$39,363
Jun	463,842	1,200	$47,760	91	$1,019	1,674	4,095	$48,779
Jul	472,408	1,227	$48,381	111	$1,180	1,723	4,189	$49,561
Aug	468,067	1,232	$50,425	113	$1,183	1,711	4,206	$51,609
Sep	436,167	1,382	$53,709	90	$1,014	1,578	4,718	$54,723
Oct	437,337	1,412	$40,463	209	$1,825	1,701	4,820	$42,287
Nov	416,838	1,259	$39,996	332	$3,431	1,754	4,297	$43,427
Dec	415,274	1,177	$40,777	482	$4,787	1,900	4,019	$45,563
Year	**5,574,843**	**15,179**	**$536,670**	**3,179**	**$31,339**	**22,206**	**51,805**	**$568,009**





Site Name **Administrative Office**
Project square footage 19,160
Total building square footage 3,600 | Total Energy Usage Index 109.4
Percentage of Total site area 19% | Total Utility Cost Index $1.995

Fuel Type	Utility Usage	Utility Demand	Utility Cost	Percentage of Total
Fuel	*Value*	*Value*	*$*	*%*
Electricity	30,100 kWh	138 kW	$4,460	62%
Natural Gas	286 MCF	0 kBtu/hr	$2,722	38%
Total	**394 MMBtu**	**469 kbtu/hr**	**$ 7,182**	

Site Name **WMUA WTP**
Project square footage 19,160
Total building square footage 8,500 | Total Energy Usage Index 401.8
Percentage of Total site area 44% | Total Utility Cost Index $8.528

Fuel Type	Utility Usage	Utility Demand	Utility Cost	Percentage of Total
Fuel	*Value*	*Value*	*$*	*%*
Electricity	802,407 kWh	2,730 kW	$66,401	92%
Natural Gas	664 MCF	0 kBtu/hr	$6,083	8%
Total	**3,415 MMBtu**	**9,317 kbtu/hr**	**$ 72,484**	

Site Name **WMUA PCP**
Project square footage 19,160
Total building square footage 5,100 | Total Energy Usage Index 1,966.6
Percentage of Total site area 27% | Total Utility Cost Index $37.005

Fuel Type	Utility Usage	Utility Demand	Utility Cost	Percentage of Total
Fuel	*Value*	*Value*	*$*	*%*
Electricity	2,538,996 kWh	3,719 kW	$176,335	93%
Natural Gas	1,338 MCF	0 kBtu/hr	$12,389	7%
Total	**10,030 MMBtu**	**12,692 kbtu/hr**	**$ 188,724**	

Site Name **Well 1 - Sylvan Lane**
Project square footage 19,160
Site Name 1,360 | Total Energy Usage Index 1,541.4
Project square footage 7% | Total Utility Cost Index $45.850

Fuel Type	Utility Usage	Utility Demand	Utility Cost	Percentage of Total
Fuel	*Value*	*Value*	*$*	*%*
Electricity	568,687 kWh	1,488 kW	$60,736	97%
Natural Gas	152 MCF	0 kBtu/hr	$1,620	3%
Total	**2,096 MMBtu**	**5,077 kbtu/hr**	**$ 62,357**	

Site Name **Well 5A - Baldwin Lane**
Project square footage 19,160
Total building square footage 100
Percentage of Total site area 1%
Total Energy Usage Index 19,400.0
Total Utility Cost Index $696.001

Fuel Type *Fuel*	Utility Usage *Value*	Utility Demand *Value*	Utility Cost *$*	Percentage of Total *%*
Electricity	385,981 kWh	1,865 kW	$62,934	90%
Natural Gas	610 MCF	0 kBtu/hr	$6,666	10%
Total	**1,940 MMBtu**	**6,365 kbtu/hr**	**$ 69,600**	

Site Name **Well 6 - Medallion**
Project square footage 19,160
Total building square footage 100
Percentage of Total site area 1%
Total Energy Usage Index 10,067.7
Total Utility Cost Index $489.982

Fuel Type *Fuel*	Utility Usage *Value*	Utility Demand *Value*	Utility Cost *$*	Percentage of Total *%*
Electricity	290,588 kWh	2,586 kW	$48,691	99%
Natural Gas	15 MCF	0 kBtu/hr	$308	1%
Total	**1,007 MMBtu**	**8,827 kbtu/hr**	**$ 48,998**	

Site Name **Well 9 - Middlebury Lane**
Project square footage 19,160
Total building square footage 100
Percentage of Total site area 1%
Total Energy Usage Index 11,176.3
Total Utility Cost Index $473.951

Fuel Type *Fuel*	Utility Usage *Value*	Utility Demand *Value*	Utility Cost *$*	Percentage of Total *%*
Electricity	326,200 kWh	1,308 kW	$47,174	100%
Natural Gas	4 MCF	0 kBtu/hr	$221	0%
Total	**1,118 MMBtu**	**4,466 kbtu/hr**	**$ 47,395**	

Site Name **Well 10 - Barnwell**
Project square footage 19,160
Total building square footage 100
Percentage of Total site area 1%
Total Energy Usage Index 15,849.2
Total Utility Cost Index $519.360

Fuel Type *Fuel*	Utility Usage *Value*	Utility Demand *Value*	Utility Cost *$*	Percentage of Total *%*
Electricity	462,180 kWh	938 kW	$51,694	100%
Natural Gas	7 MCF	0 kBtu/hr	$242	0%
Total	**1,585 MMBtu**	**3,200 kbtu/hr**	**$ 51,936**	

Site Name	Windsor Park			
Project square footage	19,160			
Total building square footage	100	Total Energy Usage Index	3,993.0	
Percentage of Total site area	1%	Total Utility Cost Index	$111.722	

Fuel Type	Utility Usage	Utility Demand	Utility Cost	Percentage of Total
Fuel	*Value*	*Value*	*$*	*%*
Electricity	108,473 kWh	246 kW	$10,748	96%
Natural Gas	29 MCF	0 kBtu/hr	$425	4%
Total	**399 MMBtu**	**838 kbtu/hr**	**$ 11,172**	

Site Name	Beechnut			
Project square footage	19,160			
Total building square footage	100	Total Energy Usage Index	661.3	
Percentage of Total site area	1%	Total Utility Cost Index	$23.833	

Fuel Type	Utility Usage	Utility Demand	Utility Cost	Percentage of Total
Fuel	*Value*	*Value*	*$*	*%*
Electricity	18,524 kWh	46 kW	$2,173	91%
Natural Gas	3 MCF	0 kBtu/hr	$211	9%
Total	**66 MMBtu**	**156 kbtu/hr**	**$ 2,383**	

Site Name	Tweedstone			
Project square footage	19,160			
Total building square footage	100	Total Energy Usage Index	1,176.5	
Percentage of Total site area	1%	Total Utility Cost Index	$41.399	

Fuel Type	Utility Usage	Utility Demand	Utility Cost	Percentage of Total
Fuel	*Value*	*Value*	*$*	*%*
Electricity	32,147 kWh	80 kW	$3,890	94%
Natural Gas	8 MCF	0 kBtu/hr	$250	6%
Total	**118 MMBtu**	**274 kbtu/hr**	**$ 4,140**	

Site Name	Lake Drive			
Project square footage	19,160			
Total building square footage	100	Total Energy Usage Index	382.0	
Percentage of Total site area	1%	Total Utility Cost Index	$16.378	

Fuel Type	Utility Usage	Utility Demand	Utility Cost	Percentage of Total
Fuel	*Value*	*Value*	*$*	*%*
Electricity	10,560 kWh	37 kW	$1,435	88%
Natural Gas	2 MCF	0 kBtu/hr	$203	12%
Total	**38 MMBtu**	**126 kbtu/hr**	**$ 1,638**	

PSE&G is the electric and natural gas utility for all sites. The following rate tariffs are applicable to the each of the sites:

Facility	PSE&G Electric Rate Tariff	PSE&G Natural Gas Rate Tariff
Pollution Control Plant	LPLS	LVG
Main Water Treatment Plant	LPLS	GSG
Administrative Building	GLP	GSG
Well 1	GLP BGS	GSG
Well 5a	GLP BGS	LVG
Well 6	LPLS	GSG
Well 9 & Well 10	GLP	GSG
Windsor Park, Beechnut, Lake Drive and Tweedstone Pump Stations	GLP	GSG

The table below shows details for the electric rate tariff LPLS, which applies to PCP and WTP:

Utility Company	PSE&G	Tariff Name	LPLS		
Tariff Charges					
Description	Charge	Description	Charge	Description	Charge
PSEG Service	$370.81	kWh Summer Off Peak (kWh)	$0.0011190	Onpk surplus buyback $/kWh	$ -
Annual Demand (kW)	$3.7617	Societal Benefits (kWh)	$0.007874	Offpk surplus buyback $/kWh	$ -
kWh Winter Peak (kWh)	$0.0053350	Securitization. (kWh)		Supply On Peak Energy(kWh) Constelation	$0.0794
kWh Winter Off Peak (kWh)	$0.0011190	PSEG Summer kW (kW)	$8.9495	Supply Off Peak Energy(kWh) Constelation	$0.0794
kWh Summer Peak (kWh)	$0.0053350				

The table below shows details of the electric rate tariff GLP, which applies to the Admin Building, Well 9, Well 10 and the four sewer lift stations:

Utility Company	PSE&G	Tariff Name	GLP		
Tariff Charges					
Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.72	kWh Summer Off Peak (kWh)	$0.0080000	Supply Generation (kW)	
Annual Demand (kW)	$3.9274	Societal Benefits (kWh)	$0.007644	Supply Transmission (kW)	
kWh Winter Peak (kWh)	$0.0080000	Securitization. (kWh)		Supply On Peak Energy(kWh)	$0.0921
kWh Winter Off Peak (kWh)	$0.0080000	PSEG Summer kW (kW)	$9.8480	Supply Off Peak Energy(kWh)	$0.0921
kWh Summer Peak (kWh)	$0.0080000				

The table below shows details of the electric rate tariff GLP BGS, which applies to Well 1 and Well 5a:

Utility Company	PSE&G	Tariff Name	GLP BGS		
Tariff Charges					
Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.74	Transmission kW	76	Supply Transmission (kW)	$10.0165
Annual Demand (kW)	$3.9313	Societal Benefits (kWh)	$0.007758	Supply On Peak Energy(kWh) Winter	$0.0450
kWh Winter Peak (kWh)	$0.0129000	Generation kW	60	Supply Off Peak Energy(kWh) Winter	$0.0450
kWh Winter Off Peak (kWh)	$0.0129000	PSEG Summer kW (kW)	$9.8490	Supply On Peak Energy(kWh) Summer	$0.0450
kWh Summer Peak (kWh)	$0.0129000	Supply Generation (kW)	$5.1470	Supply Off Peak Energy(kWh) Summer	$0.0450

The table below shows details for the natural gas tariff LVG, which applies to PCP and Well 5a:

Utility Company	PSEG	Tariff Name	LVG
Tariff Charges			
Description	Charge	Description	Charge
Tier 1 (first 1000)	$0.0130	Monthly Service Charge	$139.84
Tier 2	$0.0158	DE Supply	$0.5283
Demand	$0.1900		
Balancing Charge	$0.1300		
Societal Benefits	$0.0486		

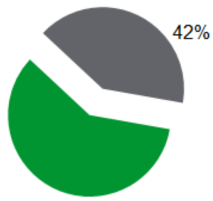
The table below shows details for the natural gas tariff GSG, which applies to WTP, the Administrative Building, Well 1, Well 6, Well 9, Well 10 and all four sewer lift stations:

Utility Company	PSEG	Tariff Name	GSG		
Tariff Charges					
Description	Charge	Description	Charge	Description	Charge
customer charge	$15.5700				
first	$0.2419				
next	$0.2429				
balancing charge	$0.0935			Societal benefits	$0.0486
				Supply charges	$0.5030

Schneider Electric uses a spreadsheet-based tariff simulation tool to model baseline energy cost according to the rate tariffs shown above and historical utility bills. Copies of these rate tariff simulations for each site and utility meter are given in Appendix 7.1

4.2 Energy Savings

The following table highlights projected energy savings from implementing the recommended ECMs.



Energy Cost Savings

Energy and Water Indices		
	Energy	Cost
	kBtu/ft2	*$/ft2*
Baseline	1159.0	$29.65
Post Project	694.0	$17.54
% Savings	**40.1%**	**40.8%**

Project Summary				
	Electricity		Fossil Fuels	Energy
	Energy	Actual	Energy	Total
Project	Use	Demand	Use	Cost
Phase	*kWh*	*kW*	*MMBtu*	*$*
Baseline	5,574,843	15,179	3,179	$568,009
Post Project	3,221,990	12,958	2,301	$336,067
Projected Savings, Units	**2,352,853**	**2,221**	**878**	**$231,941**
Projected Savings, %	**42.2%**	**14.6%**	**27.6%**	**40.8%**

Note that the information provided above regarding Electricity Actual Demand reflects the total annual baseline demand, the anticipated post project demand and estimated demand savings. The values represent the total demand for 12 months for all sites in the project. The average annual monthly baseline for all sites is 1,265 kW. The average post project monthly demand for all sites is 1,080 kW. The average monthly demand savings for all sites is 185 kW.

Name	Total	Consumption		Demand	Cost	
	Total Cost Savings $	Electricity kWh	Natural Gas MMBtu	Electricity kW	Electric $	Nat Gas $
Site: Administrative Office		**Consumption**		**Demand**	**Cost**	
Lighting Retrofits	$278	2,068	0	8	$278	$0
BAS - Programmable Thermostat	$988	3,743	65	4	$434	$554
Plug Load Energy Management	$208	1,932	0	0	$208	$0
Site: WMUA WTP						
Lighting Retrofits	$2,289	22,811	0	32	$2,289	$0
Lighting Occupancy Sensor Controls	$220	2,445	0	0	$220	$0
Building Envelope Improvements	$804	8,679	0	0	$804	$0
Secondary Transformer Replacement	$581	5,760	0	8	$581	$0
Plug Load Energy Management	$89	968	0	0	$89	$0
Site: WMUA PCP						
Pump VFD	$65,888	730,736	0	0	$65,888	$0
Premium Efficiency Motors	$1,450	14,587	0	20	$1,450	$0
Digester Boiler Replacement	$13	0	2	0	$0	$13
Replace Existing Microturbine with new CHP Unit	$119,160	1,177,720	812	1,112	$112,897	$6,263
Lighting Retrofits	$7,802	74,176	0	154	$7,802	$0
Lighting Occupancy Sensor Controls	$953	10,565	0	0	$953	$0
Building Envelope Improvements	$4,358	47,047	0	0	$4,358	$0
Secondary Transformer Replacement	$1,592	23,432	0	33	$1,592	$0
Plug Load Energy Management	$56	968	0	0	$56	$0
Site: Well 1 - Sylvan Lane						
Pump VFD	$5,068	48,838	0	258	$5,068	$0
Lighting Retrofits	$37	151	0	4	$37	$0
Building Envelope Improvements	$111	1,683	0	0	$111	$0
Secondary Transformer Replacement	$150	1,984	0	3	$150	$0
Site: Well 5A - Baldwin Lane						
Pump VFD	$4,382	42,860	0	217	$4,382	$0
Lighting Retrofits	$37	569		0	$37	$0
Building Envelope Improvements	$833	12,691		0	$833	$0
Site: Well 6 - Medallion						
Lighting Retrofits	$107	433	0	10	$107	$0
Building Envelope Improvements	$456	4,928		0	$456	$0
Secondary Transformer Replacement	$579	5,689		8	$579	$0
Site: Well 9 - Middlebury Lane						
Pump VFD	$6,394	44,936	0	173	$6,394	$0
Site: Well 10 - Barnwell						
Pump VFD	$6,447	53,545	0	174	$6,447	$0
Site: Windsor Park						
Lighting Retrofits	$253	2,686	0	4	$253	$0
Building Envelope Improvements	$333	3,983	0	0	$333	$0
Site: Beechnut						
Lighting Retrofits	$6	59	0	0	$6	$0
Site: Tweedstone						
Lighting Retrofits	$12	122	0	0	$12	$0
Site: Lake Drive						
Lighting Retrofits	$6	59	0	0	$6	$0
Total	$231,941	2,352,853	878	2,221	$ 225,111	$ 6,831

4.3 Environmental Impact

The following graphic shows the environmental impact of the project.

Environmental Benefits

	Direct	Indirect	
Total Energy (MMBtu)	3,179	19,027	-
Total Emission (Tons CO_2e)	186	3,724	-
Total Savings (Tons CO_2e)	51	1,821	-

Savings	1,872 eTons GHG	402 Cars Removed	242 Equivalent Houses

* Emissions factors are derived from EPA eGrids database and represent the Sub Region of USA

Totals include 12 Project Sites and a total of 44 ECMs

5.0 Performance Assurance Support Services (PASS)

The purpose of the Performance Assurance Support Services is to measure, verify, and provide the necessary support services to sustain savings over time. Per NJ ESIP law, the PASS Agreement must be a separate contract from the ESIP Construction Contract. This section includes a description of services that WMUA may wish to consider as part of implementing an ESIP.

5.1 Description of Services

The following is a description of services and terms that are used within this section.

Remote System Monitoring and Reporting

Activities include monitoring live conditions, reviewing and analyzing trends, recording deficiencies, as well as tuning, adjusting, and optimizing parameters. This also includes reporting operational performance of specific systems and equipment necessary to sustain energy savings and system and equipment reliability.

Remote Energy Management, Training & Technical Support

This involves live remote telephone and internet support used to provide instruction, assisted troubleshooting, and system training. This on-call service provides technical support for all installed systems and measures and helps reduce system downtime.

On-site Visits

On-site visits include a review and reporting of changes to operations (past present and future), usage, status, and conditions of building systems and equipment relative to their impact on energy performance. ECM and systems training can be provided upon request. Benefits include:

- Expert advice to aid in energy planning based on operational and future commitments
- Identifying excess energy targets and recommendations for improvement
- An increase in overall energy awareness

Resource Advisor

Resource Advisor is Schneider Electric's enterprise-level application providing secure access to data reports and summaries to drive the Authority's energy and sustainability programs. Resource Advisor combines quality assurance and data capture capabilities of utility information into one energy management solution.

5.2 Measurement & Verification (M&V) Plan

No measurement & verification (M&V) plan has been chosen for the WMUA at this point as this will depend on the final project selected for implementation. Schneider Electric will work closely with the WMUA and their staff to assess and develop an M&V plan based on the final set of ECMs that are included in an ESIP contract. The purpose of the plan will be to assist the WMUA in sustaining equipment performance, reliability and resulting savings over the long term.

5.3 Ongoing Maintenance

Under the New Jersey ESIP legislation, all maintenance contracts are required to be procured separately from the ESIP. Schneider Electric will properly commission all equipment, provide training, review manufacturer maintenance requirements, and provide an owner's manual to ensure proper maintenance of the equipment.

Additionally, the cash flow provided as part of this ESP, shown in Section 2.3, includes an estimate of the maintenance costs associated with the new CHP unit, including the associated gas treatment system. As the WMUA has no costs for CHP maintenance in their current budget, the costs are included to ensure that estimated energy savings can cover these items over the long term.

6.0 Implementation

6.1 Design & Compliance Issues

This project was developed using the proper Building Codes, Energy Codes, and Electrical Codes. Safety is of the utmost important to Schneider Electric, not only for our customers, but also for our employees and subcontractors. SE will comply with all the required safety codes and protocols to ensure a successful implementation.

6.2 Assessment of Risks

This assessment of risks is meant to provide the WMUA with an idea of the potential risks that lie within the ESIP project. By no means is this an effort to eliminate responsibility of the ESCO to provide an Energy Savings Plan that meets industry standards of engineering, energy analysis, and expertise. This is included to allow the customer to know where potential failure points could be that would result in savings not being achieved.

- The CHP unit installation requires review and approval by PSE&G for interconnection to the electrical grid. Schneider Electric has started this process by recently submitting an interconnect application to the utility company. The energy savings and construction costs associated with this ECM do not reflect any potential curtailment of operation of the CHP unit by PSE&G or costs for electrical distribution system upgrades on PSE&G's system that may be identified as part of their evaluation.

- The following projects, already in the design or construction phase, must be completed at the Pollution Control Plant to ensure the steady flow of digester gas to the CHP unit:
    - Installation of new headworks to include grit removal and bar screen
    - Replacement of non-functional digester mixers
    - Cleaning of digester to remove built-up grit or other debris as a result of having no grit removal and lack of functioning mixers
    - Replacement of digester gas piping in the digesters and from the digesters to the boiler room
    - Replacement of the sludge feed pumps

7.0 Appendices

7.1 Savings Calculations & Documentation

Energy Analysis Methodology

Many tools and approaches exist for effectively analyzing energy conservation measures. Some ECMs are best analyzed in an individual spreadsheet calculation while other more comprehensive ECMs require higher levels of computer modeling to capture the entirety of their impact on energy consumption and demand. In general, the complexity of analysis tools escalates from spreadsheet calculations to, to more sophisticated computer software-based building simulation tools such as eQuest. Aspects such as total savings potential, influence on other ECMs, influence from weather, and overall complexity are all considered when selecting the analysis approach or tool for an ECM.

For the ECMs included in this ESP, spreadsheet calculations were used to estimate energy savings. More details are provided below, as are sample calculations for various ECMs.

Savings Methodology by ECM

Pump VFDs

Recirc pump savings at the PCP was modeled based on a review of historical plant operation and process flow. The following table shows historical plant loading over the course of 16 consecutive months. Recirc pump loading directly correlates to plant loading.

From NPDES Reports	MGD	% of Desigr
Apr-17	3.90	75%
May-17	3.73	71%
Jun-17	3.17	61%
Jul-17	2.88	55%
Aug-17	3.06	59%
Sep-17	2.63	50%
Oct-17	2.55	49%
Nov-17	2.82	54%
Dec-17	2.83	54%
Jan-18	3.05	58%
Feb-18	4.51	86%
Mar-18	5.14	99%
Apr-18	4.14	79%
May-18	3.87	74%
Jun-18	4.48	86%
Jul-18	3.41	65%

There are two Recirc Pumps, one of which operates at all times, with pump operation being alternated periodically by the plant operators. Assumptions used to estimate savings from installation of VFDs and premium efficient, inverter duty rated motors on the Recirc Pumps, are shown in the table below and include the following:

- One pump is operating at all times to yield 8760 operating hours/year
- Baseline load factor is 85%
- Post Project load factor is equivalent to plant loading
- VFD installation will allow for pump speed, and thus flow, to decrease to match process flow through the plant
- Some savings is also assumed as the result of replacing the existing motors with new, premium efficient, inverter duty rated motors

						Total		2 - Recirc Pump VFDs		3 - More Efficient Motor	
Month	Days/mo	Plant Load (%) / Load Factor	Post Pump kW	Baseline Pump kWh	Post Pump kWh	kW Savings	kWh Savings	kW Savings	kWh Savings	kW Savings	kWh Savings
Aug-17	31	59%	46	99,320	20,007	2	79,313		78,074	1.7	1,239
Sep-17	30	50%	34	96,116	12,241	2	83,875		82,676	1.7	1,199
Oct-17	31	49%	32	99,320	11,565	2	87,755		86,516	1.7	1,239
Nov-17	30	54%	39	96,116	15,090	2	81,026		79,827	1.7	1,199
Dec-17	31	54%	39	99,320	15,776	2	83,544		82,305	1.7	1,239
Jan-18	31	58%	45	99,320	19,715	2	79,606		78,367	1.7	1,239
Feb-18	28	86%	100	89,708	57,895	2	31,814		30,695	1.7	1,119
Mar-18	31	99%	130	99,320	95,045	2	4,275		3,036	1.7	1,239
Apr-18	30	79%	84	96,116	48,089	2	48,027		46,828	1.7	1,199
May-18	31	74%	73	99,320	40,472	2	58,848		57,609	1.7	1,239
Jun-18	30	86%	98	96,116	60,557	2	35,559		34,360	1.7	1,199
Jul-18	31	65%	57	99,320	27,639	2	71,681	No SVGs	70,442	1.7	1,239
TOTAL	365		777	1,169,414	424,091	20	745,323		730,736	20.0	14,587

Well Pump VFDs

VFDs installed on Well pumps will be used to set well pump operation at 90%, resulting in demand and energy savings. However, the well pumps still need to pump the same quantity of water to the system so while speed and flow are reduced, total volume pumped must remain the same, thereby increasing annual run hours, as depicted in the tables below.

ECM Summary

Well	Pump HP	Efficiency	load factor	Hours	VFD New Load	Kw Savings	VFD Penalty	VFD Penalty based on hours run at a 5% efficiency penalty	GPM
Well 1 Sylvan	150	95.80%	85.00%	3800	0.9	40.65	7%	29,765	1400
Well 9 Middlebury	100	95.00%	85.00%	5230	0.9	27.10	7%	27,311	1500
Well 10 Barnwell Dr	100	94.50%	85.00%	6200	0.9	27.10	7%	32,376	1500
Well 5A Baldwin	125	94.50%	85.00%	4000	0.9	33.88	7%	26,110	1000

Existing Conditions

Well	Speed	Pump Head	GPM	MG/yr	kW draw	Annual Hrs	kWH
Well 1 Sylvan	1750	315	1414.286	322.46	99.28	3800	377,283
Well 9 Middlebury	1750	200	1485	465.99	66.75	5230	349,089
Well 10 Barnwell Dr	1750	200	1485	552.42	67.10	6200	416,023
Well 5A Baldwin	1650	300	1237.5	297	83.88	4000	335,503

Proposed Operation

Well	Speed	GPM	Pump Head	HP	kW	Run Hours	MG/yr	kWH
Well 1 Sylvan	1575	1273	255	109	78	4222	322	328,445
Well 9 Middlebury	1575	1337	162	73	52	5811	466	304,153
Well 10 Barnwell Dr	1575	1337	162	73	53	6889	553	362,478
Well 5A Baldwin	1485	1114	243	91	66	4450	297	292,643

Savings Summary

Well	kW savings	kWh Savings
Well 1 Sylvan	21.5	48,838
Well 9 Middlebury	14.4	44,936
Well 10 Barnwell Dr	14.5	53,545
Well 5A Baldwin	18.1	42,860

Premium Efficiency Motors

Schneider Electric used spreadsheet-based calculations to estimate savings from the installation of premium efficiency motors on three, constant volume, Utility Water Pumps at the PCP, as follows:

	Baseline	**Post Project**
Quantity Installed	3	3
Quantity Operating	2	2
HP	15	15
Motor Efficiency	86%	90%
Run hours/day	24	24
Run hours/year	8,760	8,760
Load Factor	85%	85%
Max kW/month	22.2	22.1
Annual Energy Use, kWhr	194,902	184,747
Annual Energy Savings, kWhr	**10,156**	

Combined Heat and Power

Savings from the new CHP unit is based on a detailed analysis of the PCP process operation including the production of digester gas, which will be used to fuel the unit. Historical data was collected from plant operating logs to create the basis for the model. In addition to that data, performance information from the specified CHP unit was used to estimate energy production and heat available for digester operation. Heat rejection from the CHP unit will offset the heat required from the digester boiler. The spreadsheet model inputs, outputs and savings calculations are shown on the following page.

Digester Boiler

Savings from replacement of the digester boiler is minimal, as the new CHP unit is expected to offset a portion of the heat currently being generated by the boiler. However, there will be savings when the CHP unit is down for maintenance. Savings is based on the improved efficiency of a new boiler compared to the existing equipment, which is beyond useful life. Savings was calculated using a spreadsheet-based model with the following assumptions:

Boiler Replacement	Digester Biogas Produced	Boiler Heating Load	Boiler Gas Usage	Existing Efficiency	Proposed Efficiency	New Boiler Gas Savings
Month	*Therms*	*Therms*	*Therms*	*%*	*%*	*Therms*
January	9,826.3	925.1	0.0	80%	90%	0.0
February	8,646.2	830.9	0.0	80%	90%	0.0
March	8,649.9	657.8	53.1	80%	90%	5.3
April	13,442.7	497.5	0.0	80%	90%	0.0
May	18,075.8	429.2	0.0	80%	90%	0.0
June	15,574.0	334.4	27.9	80%	90%	2.8
July	16,220.0	327.3	0.0	80%	90%	0.0
August	15,454.7	359.5	0.0	80%	90%	0.0
September	15,318.6	347.9	29.0	80%	90%	2.9
October	13,089.2	505.3	0.0	80%	90%	0.0
November	12,359.2	664.7	55.4	80%	90%	5.5
December	12,771.2	881.7	0.0	80%	90%	0.0
Total	159,427.7	6,761.4	165.3	80%	90%	16.5
			*Using pipeline gas when CHP is down			*Natural gas savings observed when CHP plant is down and boiler must provide all site heat **CHP scheduled for maintenance for 2 days every 3 months

LED Lighting

Schneider Electric partnered with Wrightlight Solutions to generate savings for the interior and exterior lighting retrofits. Spreadsheet-based calculations were used by Wrightlight to generate kWh and kW savings, which were reviewed by Schneider Electric. Schneider Electric used the savings generated by Wrightlight to calculate energy cost savings. This methodology applies to lighting upgrades at all facilities. Refer to Appendix 7.5 for the lighting line by line information.

Lighting Occupancy Sensor Savings

The following tables show information pertaining to savings for lighting occupancy sensor controls.

Pollution Control Plant – Occupancy Sensor Locations and existing burn hour assumptions

SPACE DATA				CURRENT SYSTEM		CONTROLS	ECM				HOURS & SAVINGS				
Building	Floor	Hours Group	Room Description	System Description	Fixture Description	Existing Controls	Description	ECM System Wattage	ECM System Lumens	ECM Quantity	Annual Hours	Existing Annual kW	Existing Annual kWh	ECM Annual kW	ECM Annual kWh
Garage	1	BRK		2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	6	5824	0.516	3005.2	**0.156**	908.544
Garage	1	BRK	Closet	100W INC	/14" SURFACE MOUNT GLASS CANOPY	Single Pole	14" Round LED Ceiling	24	1810	1	260	0.1	26	**0.024**	6.24
Pump and Control	1	COR		2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Three Way	RETRO LED TYPE B LAMP	26	3400	6	4380	0.516	2260.1	**0.156**	683.28
Digestor	1	COR		175W MH CWA	SURFACE MOUNT GLASS CANOPY	Single Pole	61W BAILD LED FIXTURE	61	8093	2	5824	0.416	2422.8	**0.122**	710.528
Garage	1	COR		2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	2	5824	0.172	1001.7	**0.052**	302.848
Garage	1	GAR	Garage	2L4' STD/EEMAG	/1X4 PENDANT CHAIN INDUSTRIAL	Three Way	RETRO LED TYPE B LAMP	26	3400	12	1040	1.032	1073.3	**0.312**	324.48
Pump and Control	1	JC		1L 42W COMPACT SI	BARE SOCKET	Single Pole	13W LED Par 38 Screw In	13	1200	1	260	0.042	10.92	**0.013**	3.38
Sludge transfer	1	JC		2L2' 17W T8/ELIG LOW	/1X2 SURFACE MOUNT PRISMATIC VANITY	Single Pole	RETRO LED TYPE B LAMP	14	1700	1	260	0.027	7.02	**0.014**	3.64
Garage	1	LRF		2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	3	5824	0.258	1502.6	**0.078**	454.272
Garage	1	LRF		4L 13W COMPACT SI	/1X3 WALL MOUNT VANITY	Single Pole	9W LED A-line Screw In	9	800	1	2524	0.052	131.25	**0.009**	22.716
Garage	1	LRF	Shower	100W INC	/1X1 SURFACE MOUNT PRISMATIC CANOPY	Single Pole	9W LED A-line Screw In	9	800	1	260	0.1	26	**0.009**	2.34
Garage	1	LRM		2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	5	5824	0.43	2504.3	**0.13**	757.12
Garage	1	LRM		4L 13W COMPACT SI	/1X3 WALL MOUNT VANITY	Single Pole	9W LED A-line Screw In	9	800	2	5824	0.104	605.7	**0.018**	104.832
Garage	1	LRM	Shower	100W INC	/1X1 SURFACE MOUNT PRISMATIC CANOPY	Single Pole	9W LED A-line Screw In	9	800	1	520	0.2	104	**0.009**	4.68
Pump and Control	1	OPO	Laboratory	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	9	2600	0.774	2012.4	**0.234**	608.4
Pump and Control	1	PRO	Superintendent	3L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	39	5100	5	1040	0.68	707.2	**0.195**	202.8
Pump and Control	1	PRO	Laboratory	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	2	2600	0.172	447.2	**0.052**	135.2
Pump and Control	1	RRF		2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	1	260	0.086	22.36	**0.026**	6.76
Pump and Control	1	RRM		2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	1	260	0.086	22.36	**0.026**	6.76
Sludge transfer	1	RRU		3L4'T8/ELIG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	2	520	0.176	91.52	**0.052**	27.04
Sludge transfer	1	RRU		2L2' 17W T8/ELIG LOW	/2X2 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	14	1700	1	520	0.027	14.04	**0.014**	7.28
Sludge transfer	1	RRU		1L2' 17W T8/ELIG	/1X2 SURFACE MOUNT PRISMATIC VANITY	Single Pole	RETRO LED TYPE B LAMP	7	850	1	520	0.017	8.84	**0.007**	3.64
Pump and Control	1	STO	Laboratory	2L4'T8/ELIG	/1X4 PENDANT CHAIN INDUSTRIAL	Single Pole	RETRO LED TYPE B LAMP	26	3400	2	260	0.12	31.2	**0.052**	13.52
Storage	1	STO	Grounds	2L4' STD/EEMAG	/1X4 STRUT / TRUSS ACRYLIC VAPOR TIGHT	Three Way	RETRO LED TYPE B LAMP	26	3400	6	1300	0.516	670.8	**0.156**	202.8
Storage	1	STO	Chemical storage	175W MH CWA	STRUT / TRUSS GLASS CANOPY	Three Way	HPLED 42 700 LS	98	11245	6	5824	1.248	7268.4	**0.588**	3424.512
Storage	1	STO	Control room	2L4' STD/EEMAG	/1X4 STRUT / TRUSS ACRYLIC VAPOR TIGHT	Three Way	RETRO LED TYPE B LAMP	26	3400	5	5824	0.43	2504.3	**0.13**	757.12
Sludge transfer	1	STO		3L4'T8/ELIG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	RETRO LED TYPE B LAMP	26	3400	2	260	0.176	45.76	**0.052**	13.52
Storage	1	STO		2L4' STD/EEMAG	/1X4 PENDANT CHAIN INDUSTRIAL	Three Way	RETRO LED TYPE B LAMP	26	3400	6	260	0.516	134.16	**0.156**	40.56
Storage	1	STO		2L4' STD/EEMAG	/1X4 PENDANT CHAIN INDUSTRIAL	Three Way	RETRO LED TYPE B LAMP	26	3400	3	260	0.258	67.08	**0.078**	20.28
Pump and Control	1	URO	Telecom	1L 13W COMPACT SI	BARE SOCKET	Single Pole	9W LED A-line Screw In	9	800	1	260	0.013	3.38	**0.009**	2.34
Pump and Control	1	URO	Mech / Elec	2L4' STD/EEMAG	/1X4 PENDANT CHAIN INDUSTRIAL	Single Pole	RETRO LED TYPE B LAMP	26	3400	4	5824	0.344	2003.5	**0.104**	605.696
Pump and Control	Basement	URO	Dry well	175W MH CWA	STRUT / TRUSS REFRACTOR LOW BAY	See comments	81W PHZ12L LED High Bay	81	11895	14	8760	2.912	25509	**1.134**	9933.84
Pump and Control	Basement	URO	Dry well	2L8'TW T8/ELIG	/1x8 PENDANT CHAIN STRIP		NEW T8 LED STRIP WITH MOTIC	46	6020	1	8760	0.055	481.8	**0.046**	402.96
Digestor	1	URO	Gas room	175W MH CWA	SURFACE MOUNT GLASS CANOPY	Single Pole	61W BAILD LED FIXTURE	61	8093	4	5824	0.832	4845.6	**0.244**	1421.056
Digestor	1	URO	Valve control	175W MH CWA	SURFACE MOUNT GLASS CANOPY	Single Pole	61W BAILD LED FIXTURE	61	8093	6	5824	1.248	7268.4	**0.366**	2131.584
Digestor	1	URO	Boiler	175W MH CWA	SURFACE MOUNT GLASS CANOPY	Single Pole	61W BAILD LED FIXTURE	61	8093	4	5824	0.832	4845.6	**0.244**	1421.056
Digestor	Basement	URO	Basement	175W MH CWA	SURFACE MOUNT GLASS CANOPY	Three Way	61W BAILD LED FIXTURE	61	8093	11	5724	2.288	13097	**0.671**	3840.804
Garage	1	URO	Mech	1L4' STD/EEMAG	/1X4 SURFACE MOUNT STRIP	Single Pole	RETRO LED TYPE B LAMP	26	3400	1	5824	0.05	291.2	**0.026**	151.424
Sludge transfer	1	URO		2L4'T8/ELIG	/1X4 PENDANT THREAD ROD PRISMATIC VAPOR TI	See comments	RETRO LED TYPE B LAMP	26	3400	15	5824	0.9	5241.6	**0.39**	2271.36
Sludge transfer	1	URO	Elec	2L4'T8/ELIG	/1X4 STRUT / TRUSS INDUSTRIAL	Single Pole	RETRO LED TYPE B LAMP	26	3400	3	1040	0.18	187.2	**0.078**	81.12

Pollution Control Plant – Occupancy Sensor Locations, post project burn hour assumptions and savings estimates

SPACE DATA				Controls Savings			
Building	Floor	Hours Group	Room Description	Control Type	Post-ECM Annual Run Hours	kWh	Savings kWh
Garage	1	BRK		Wall Sensor	3902	608.8	299.8
Garage	1	BRK	Closet	Wall Sensor	174	4.181	2.059
Pump and Control	1	COR		Wall Sensor	2935	457.8	225.4
Digestor	1	COR		Wall Sensor	3902	476.1	234.4
Garage	1	COR		Wall Sensor	3902	202.9	99.92
Garage	1	GAR	Garage	Ceiling Sensor	697	217.4	107.1
Pump and Control	1	JC		Wall Sensor	174	2.265	1.115
Sludge transfer	1	JC		Wall Sensor	174	2.439	1.201
Garage	1	LRF		Wall Sensor	3902	304.4	149.9
Garage	1	LRF		Wall Sensor	1691	15.22	7.495
Garage	1	LRF	Shower	Wall Sensor	174	1.568	0.772
Garage	1	LRM		Wall Sensor	3902	507.3	249.8
Garage	1	LRM		Wall Sensor	3902	70.24	34.59
Garage	1	LRM	Shower	Wall Sensor	348	3.136	1.544
Pump and Control	1	OPO	Laboratory	Ceiling Sensor	1742	407.7	200.7
Pump and Control	1	PRO	Superintendent	Wall Sensor	697	135.9	66.91
Pump and Control	1	PRO	Laboratory	Wall Sensor	1742	90.59	44.61
Pump and Control	1	RRF		Ceiling Sensor	174	4.53	2.23
Pump and Control	1	RRM		Ceiling Sensor	174	4.53	2.23
Sludge transfer	1	RRU		Wall Sensor	348	18.12	8.921
Sludge transfer	1	RRU		Wall Sensor	348	4.878	2.402
Sludge transfer	1	RRU		Wall Sensor	348	2.439	1.201
Pump and Control	1	STO	Laboratory	Wall Sensor	174	9.059	4.461
Storage	1	STO	Grounds	Wall Sensor	871	135.9	66.91
Storage	1	STO	Chemical storage	Wall Sensor	3902	2295	1130
Storage	1	STO	Control room	Ceiling Sensor	3902	507.3	249.8
Sludge transfer	1	STO		Wall Sensor	174	9.059	4.461
Storage	1	STO		Wall Sensor	174	27.18	13.38
Storage	1	STO		Wall Sensor	174	13.59	6.691
Pump and Control	1	URO	Telecom	Wall Sensor	174	1.568	0.772
Pump and Control	1	URO	Mech / Elec	Wall Sensor	3902	405.9	199.8
Pump and Control	Basement	URO	Dry well	Corner Sensors	5870	6656	3277
Pump and Control	Basement	URO	Dry well	Fixture sensor	5870	270	132.9
Digestor	1	URO	Gas room	Wall Sensor	3902	952.2	468.8
Digestor	1	URO	Valve control	Wall Sensor	3902	1428	703.3
Digestor	1	URO	Boiler	Wall Sensor	3902	952.2	468.8
Digestor	Basement	URO	Basement	Ceiling Sensor	3835	2574	1267
Garage	1	URO	Mech	Wall Sensor	3902	101.5	49.96
Sludge transfer	1	URO		Corner Sensors	3902	1522	749.4
Sludge transfer	1	URO	Elec	Wall Sensor	697	54.36	26.76

Main Water Treatment Plant – Occupancy Sensor Locations and existing burn hour assumptions

SPACE DATA			CURRENT SYSTEM		Controls	ECM				Hours and Savings				
Floor	Hours Group	Room Description	System Description	Fixture Description	Existing Controls	ECM Description	ECM System Wattage	ECM System Lumens	ECM Quantity	Annual Hours	Existing Annual kW	Existing Annual kWh	ECM Annual kW	ECM Annual kWh
1	STO		2L4'T8/EEMAG	/1X4 SURFACE MOUNT INDUSTRIAL	Single Pole	RETRO LED TYPE B LAMP	26	3400	1	260	0.07	18.2	0.026	6.76
1	CLO		75W INC	BARE SOCKET	Single Pole	11W LED A-Line Screw In	11	1100	1	260	0.075	19.5	0.011	2.86
1	URO	Pipe gallery	175W MH CWA	PENDANT STEM REFRACTOR LOW BAY	Single Pole	81W PHZ12L LED High Bay	81	11895	4	8760	0.832	7288.32	0.324	2838
2	URO	Filter room	2L8' EE/EEMAG	/1x8 SURFACE MOUNT ACRYLIC VAPOR TIGHT	Single Pole	LED Retrofit Kit 8'	46	6020	7	8760	0.861	7542.36	0.322	2821
	STO	Chemical room	4L4'T8/ELIG	/1X4 SURFACE MOUNT WIRE GUARD INDUSTR	Three Way	RETRO LED TYPE B LAMP	52	6800	8	8760	0.896	7848.96	0.416	3644
	WRK	Tool room	4L4'T8/EEMAG	/1X4 SURFACE MOUNT PRISMATIC WRAP	Single Pole	RETRO LED TYPE B LAMP	52	6800	2	1456	0.28	407.68	0.104	151.4
	WRK	Tool room	4L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	LED Panel	30	3800	1	1456	0.172	250.432	0.03	43.68
	WRK	Machine shop	4L4'T8/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	Single Pole	LED Panel	30	3800	1	1456	0.14	203.84	0.03	43.68
	URO	Small pump house	2L4'T8/ELIG	/1X4 SURFACE MOUNT INDUSTRIAL	Single Pole	RETRO LED TYPE B LAMP	26	3400	1	8760	0.06	525.6	0.026	227.8

Main Water Treatment Plant – Occupancy Sensor Locations, post project burn hour assumptions and savings estimates

SPACE DATA			Controls Savings			
Floor	Hours Group	Room Description	Control Type	Post-ECM Annual Run Hours	kWh	Savings kWh
1	STO		Wall Sensor	195	5.07	1.69
1	CLO		Wall Sensor	195	2.145	0.715
1	URO	Pipe gallery	Ceiling Sensor	6570	2128.68	709.56
2	URO	Filter room	Ceiling Sensor	6570	2115.54	705.18
	STO	Chemical room	Ceiling Sensor	6570	2733.12	911.04
	WRK	Tool room	Wall Sensor	1092	113.568	37.856
	WRK	Tool room	Wall Sensor	1092	32.76	10.92
	WRK	Machine shop	Wall Sensor	1092	32.76	10.92
	URO	Small pump house	Wall Sensor	6570	170.82	56.94

Programmable Thermostats

Schneider Electric used an internally developed spreadsheet tool, called Element, to estimate energy savings associated with programmable thermostats at the Administrative Building. The following shows the inputs and calibration details of the Element model used to predict savings associated with this ECM.

Baseline Calculation Inputs

Building Envelope

3,600	Building Area, sqft
Light	Building Weight
Exterior Walls	
12.00	R_wall, hr-sqft-oF/Btu
2,976	Total Exterior Wall Area, sqft
Light	Outside Surface Color
Windows	
Alum w/ Thermal Breaks	Frame Type
1/8 in. Clear Double	Glass Type
0%	Exterior Shading Percentage
250	Window Area, sqft
25%	% North Facing
40%	% East Facing
20%	% South Facing
20%	% West Facing
Roof	
14.00	R-value, hr-sqft-oF/Btu
3,440	Roof Area, sqft
Light	Outside Surface Color
3.00	Plenum Height, ft

Internal Space Loads

	Peak Load	Units	Schedule
Lighting	1.24	W / sqft	Lighting
Equipment	0.50	W / sqft	Equipment
People	30	People	People
People Activity Level		Office Work	

Outdoor Air

Infiltration	
0.250	CFM / sqft of Exterior Wall Area
12.0	Average Ceiling Height, ft
1.033	Air Change Per Hour, ACH
Ventilation	
7.5	OA Rate, CFM per person
0.06	OA Rate, CFM per sqft
441	OA CFM Total
Min Night	OA Modulation Schedule

Dehumidification

No	Does Building Dehumidify?
Fuel	Type of Reheat

Supply Fans

Const kW	0.50	Variable kW	
Schedule	Baseline	Speed Ctrl	Proportional
Availability	Enabled	Min Speed	100%

Space Set Points

	Occupied	Unoccupied	
Heating	70.0	65.0	oF
Cooling	72.0	76.0	oF
	60.0	60.0	% RH

Heating Pumps

Pump kW		Availability?	Enabled
Speed Ctrl		Min Speed	100%

Cooling Pumps

Pump kW		Availability?	Enabled
Speed Ctrl		Min Speed	100%

Fuel Distribution

Fuel 1	100%	Fuel 2	0%

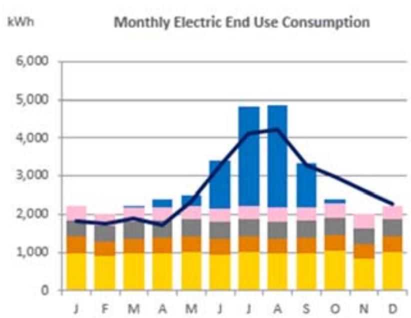
Heating and Cooling Systems

Heating	HW Blr - Condensing	System Type
	80%	Fuel Efficiency, %
	1.00	Oversize Factor
	0%	% Load Electric Heat
	100%	Electric Efficiency, %
Cooling	DX Cooling	System Type
	1.00	Cooling Efficiency, kW/ton
	1.00	Oversize Factor
	100%	% Bldg Cooled
	No	Remote Chilled Water?

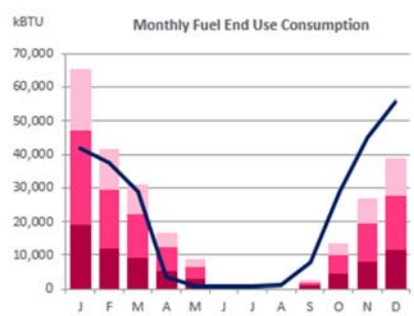
Miscellaneous Loads

Electric	Peak kW	Schedule		
exterior	2.2	Ext Lighting		
		Off		
		Off		Stand-alone
Fuel	**Peak kBtu**	**Schedule**	**Plant?**	**Efficiency**
		Off	No	100%
		Off	No	100%
		Off	No	100%

Energy Modeling Calibration



	Electric Calibration			Fuel Calibration		
	Modeled kWh	Utility kWh	Error %	Modeled kBTU	Utility kBTU	Error %
Jan	2,225	1,802	23%	65,481	42,022	56%
Feb	2,018	1,754	15%	41,558	37,596	11%
Mar	2,204	1,902	16%	30,919	28,875	7%
Apr	2,401	1,708	41%	16,705	3,457	383%
May	2,507	2,349	7%	8,684	748	1061%
Jun	3,395	3,272	4%	1,277	615	108%
Jul	4,830	4,119	17%	313	620	-49%
Aug	4,857	4,234	15%	0	1,222	-100%
Sep	3,341	3,270	2%	2,451	7,685	-68%
Oct	2,397	2,976	-19%	13,619	27,870	-51%
Nov	1,997	2,606	-23%	26,837	45,047	-40%
Dec	2,227	2,287	-3%	38,815	55,875	-31%
	34,399	32,281	6.6%	246,661	251,632	-2.0%



The following describes the calculation methodologies used within the Element tool to estimate savings for a variety of measures, including the application of programmable thermostats.

ELEMENT

The ELEMENT tool was developed to provide transparency into the end use breakdown of energy consumption for each fuel type. The simplified building inputs and schedules are used in a powerful hourly load analysis to provide quick building calibrations. Energy saving scenarios can be run quickly to see the financial impact to the overall project and generate useful graphs for visualization and reports.

Introduction

ELEMENT is Schneider Electric's proprietary Microsoft Excel based spreadsheet calculation tool used for simulating building energy consumption. Its purpose is to allow a user with prior knowledge of a facility and its energy using equipment to simulate energy consumption, compare the outputs to historical utility data of the facility, breakout the calibrated baseline into its end use components and determine the energy savings of Energy Conservation Measures (ECMs).

The tool uses a variety of Excel functions and custom generated algorithms written in Visual Basic for Applications (VBA) to quickly simulate the energy consumption of a simple to moderately complex building. Heating and cooling loads are determined on an hourly basis (8,760 hours per year) using TMY2 or TMY3 weather data and the building definitions specified by the user. Loads are generated by the user inputs and key building variables are defined and adjusted to calibrate and predict energy impacts.

Calculations

The Element tool is an hourly load and energy analysis tool used for whole building energy models. The results show end use breakdowns of energy on a monthly basis while allowing for quick calibration to utility billing data. Energy conservation measures can be easily defined and reviewed using the ECM tab to redefine variables used in the baseline model. Each new ECM run is sequential and uses the variable last defined by the previously successful run. The savings are determined by the difference in runs by either actual, percent or minimum unit method, as described previously.

The hourly outdoor air conditions and solar data are imported from the National Renewable Energy Laboratories (NREL) typical meteorological year (TMY) data set. The building calendar defines up to four typical day types that occur throughout the year. These day types are used by the hourly load percentage schedules and HVAC schedules used to define the operation of internal and external building loads, as well as the fan operation of the HVAC system. All 365 days of the year are assigned a day type as defined by the calendar and each hour of the day has an hourly load percentage for each load schedule name and on or off status for each HVAC schedule name. The occupied and unoccupied set points are also driven by the on/off status of the HVAC fan. An algorithm determines if the system is in heating or cooling mode based on the user inputs and weather data in order to determine which occupied heating or cooling set point to use.

Zone and system loads are calculated using industry standard engineering equations (ASHRAE) as listed below based on the user defined building parameters described in the baseline calculation inputs section. The total sensible system load determines if heating or cooling energy is required (negative results for heating and positive values for cooling). Calculations are repeated for each hour of the year to determine the total annual loads and energy consumption.

The following is a sampling of the variables and equations used for calculations the building loads and energy consumption and demand.

Weather and Solar Data

Outdoor Air Dry Bulb Temperature, °F
Outdoor Air Density, lbm air/ft^3
Outdoor Air Humidity Ratio, lbm water/lbm air
Solar Direct Normal Irradiance, Btu/ft^2
Solar Diffuse Horizontal Irradiance, Btu/ft^2
Sol-air Temperature, °F

- $T_{SA} = T_{OA} + (\alpha \times I_N / h_o) - (\varepsilon \times \Delta R / h_o)$
    - α = wall or roof absorptivity of solar radiation based on surface color, dimensionless
    - I_N = direct normal solar flux on wall and diffuse horizontal irradiance on roof, Btu/hr-ft^2
    - h_o = the convective heat transfer coefficient on exterior wall or roof = 3.0 Btu/h-ft^2 °F
    - ε = hemispherical emittance of exterior surface = 1.0 Btu/h-ft^2
    - ΔR = long wave radiation incident on exterior surface and blackbody radiation
        - For vertical surfaces (walls), ΔR = 0 (vertical surfaces)
        - For horizontal surfaces (roof), ΔR = 20.0 Btu/h-ft^2

Zone Loads

Sensible Zone Loads, Btu

Internal Heat Gains

- Lighting, $Q_{S\_LTG} = L_{LTG} \times A_{BLDG} / 1000 \times HLP_{LTG} \times C$
- Equipment, $Q_{S\_EQUIP} = L_{EQUIP} \times A_{BLDG} / 1000 \times HLP_{EQUIP} \times C$
- People, $Q_{S\_PEOPLE} = n_{PEOPLE} \times HGF_{S\_PEOPLE} \times HLP_{PEOPLE}$
  - A_{BLDG} = building area, ft^2
  - C = conversion factor kW to kBtu = 3412 kBtu/kWh
  - HGF_{S_PEOPLE} = heat gain factor (sensible) based on activity level, (see Table 1), Btu/h-person
  - HLP = hourly load percentage of peak load based on assigned schedule, %
  - L = peak load density, W/ft^2
  - n_{PEOPLE} = number of people, persons

Envelope Loads

- Wall, $Q_{S\_WALL} = 1/R_{WALL} \times (A_{WALL} - A_{WINDOW}) \times (T_{SA\_WALL} - T_{SP})$
- Roof, $Q_{S\_ROOF} = 1/R_{ROOF} \times (A_{ROOF}) \times (T_{SA\_ROOF} - T_{SP})$
- Window Conduction, $Q_{S\_WINDOW,C} = U_{WINDOW} \times A_{WINDOW} \times (T_{OA} - T_{SP})$
- Window Radiation, $Q_{S\_WINDOW,R} = A_{WINDOW} \times SHGC \times (1 - ES) \times I_N$
- Infiltration, $Q_{S\_INFIL} = \rho \times c_p \times q_{INF} \times A_{WALL} \times 60 \times (T_{OA} - T_{SP})$
  - ρ = density of outdoor air, lbm/ft^3
  - A_{ROOF} = roof area, ft^2
  - A_{WALL} = exterior wall area, ft^2
  - A_{WINDOW} = window area, ft^2
  - c_p = heat capacity of air = 0.24 Btu/lbm °F
  - ES = exterior shading, %
  - q_{INF} =infiltration rate per area of exterior wall, CFM/ft^2
  - R_{WALL} = R-value of roof, hr-ft^2-°F/Btu
  - R_{ROOF} = R-value of roof, hr-ft^2-°F/Btu
  - SHGC = solar heat gain coefficient based on window selection (see Table 2), dimensionless
  - T_{OA} = outdoor air dry bulb temperature, °F
  - T_{SA_ROOF} = sol-air temperature of the roof, °F
  - T_{SA_WALL} = sol-air temperature of the wall, °F
  - T_{SP} = indoor air dry bulb temperature, °F
  - U_{WINDOW} = U-value of the window based on window selection (see Table 3), Btu/h-°F-ft^2

Latent Zone Loads, Btu

Internal Heat Gains

- People, $Q_{L\_PEOPLE} = n_{PEOPLE} \times HGF_{L\_PEOPLE} \times HLP_{PEOPLE}$
  - HGF_{L_PEOPLE} = heat gain factor (latent) based on activity level (see Table 1), Btu/h-person

Envelope Loads

- Infiltration, $Q_{L\_INFIL} = \rho \times h_{fg} \times q_{INF} \times A_{WALL} \times 60 \times (\omega_{OA} - \omega_{SP})$
  - h_{fg} = latent heat of vaporization of water = 1054.8 Btu/lbm water
  - ω_{OA} = humidity ratio of outdoor air, lbm water/lbm air
  - ω_{SP} = humidity ratio of indoor space set point, lbm water/lbm air

Total Zone Loads, kBtu

- Sensible, $Q_{S\_ZONE} = (Q_{S\_LTG} + Q_{S\_EQUIP} + Q_{S\_PEOPLE} + Q_{S\_WALL} + Q_{S\_ROOF} + Q_{S\_WINDOW,C} + Q_{S\_WINDOW,R} + Q_{S\_INFIL}) / 1000$
- Latent, $Q_{L\_ZONE} = (Q_{L\_PEOPLE} + Q_{L\_INFIL}) / 1000$

- Total, $Q_{TOTAL\_ZONE} = Q_{S\_ZONE} + Q_{L\_ZONE}$

System Loads

Ventilation, CFM

- Ventilation Rate, $Q_{OA} = R_{PEOPLE} \times n_{PEOPLE} + R_{AREA} \times A_{BLDG}$
  - R_{PEOPLE} = outdoor air rate per person, CFM/person
  - R_{AREA} = outdoor air rate per floor area, CFM/ft^2

Ventilation Loads, Btu

- Ventilation Sensible, $Q_{S\_VENT} = \rho \times c_p \times 60 \times Q_{OA} \times (T_{OA} - T_{SP})$
- Ventilation Latent, $Q_{L\_VENT} = \rho \times h_{fg} \times 60 \times Q_{OA} \times (\omega_{OA} - \omega_{SP})$

Total System Loads, kBtu

- System Sensible, $Q_{S\_SYSTEM} = Q_{S\_ZONE} + (Q_{S\_VENT} / 1000)$
- System Latent, $Q_{L\_SYSTEM} = Q_{L\_ZONE} + (Q_{L\_VENT} / 1000)$
- System Total, $Q_{TOTAL\_SYSTEM} = Q_{S\_SYSTEM} + Q_{L\_SYSTEM}$

Energy Consumption

Electric, kWh

- Lighting, $E_{LTG} = L_{LTG} \times A_{BLDG} / 1000 \times HLP_{LTG}$
- Equipment, $E_{EQUIP} = L_{EQUIP} \times A_{BLDG} / 1000 \times HLP_{EQUIP}$
- Miscellaneous Electric Load 1, $E_{MISCE,1} = L_{MISCE,1} \times HLP_{MISCE,1}$ (typical of 3)
  - $L_{MISCE,1}$ = peak miscellaneous electric load 1, kW (typical of 3)
  - $HLP_{MISCE,1}$ = hourly load percentage of miscellaneous electric load 1 (typical of 3)
- Fans, $E_{FAN} = E_{C,FAN} + E_{P,FAN} + E_{V,FAN}$
  If the HVAC schedule is on or if the fan availability is enabled and there is a load on the system, then
  - Constant fan speed, $E_{C,FAN} = L_{C,FAN}$
  - Proportional fan speed, $E_{P,FAN} = L_{V,FAN} \times PL$
  - Variable fan speed, $E_{V,FAN} = L_{V,FAN} \times PL^{2.5}$
    - $L_{C,FAN}$ = constant fan load, kW
    - $L_{V,FAN}$ = variable fan load, kW
    - S_{MIN_FAN} = minimum fan speed, %
    - PL = percentage of load equal to the maximum of $(Q_{S\_SYSTEM} / Q_{HTG\_DESIGN})$, $(Q_{TOTAL\_SYSTEM} / Q_{CLG\_DESIGN})$, or (S_{MIN_FAN})
- Pumps, $E_{PUMP} = E_{C,PUMP} + E_{P,PUMP} + E_{V,PUMP}$ (typical of heating and cooling)
  If the HVAC schedule is on or if the pump availability is enabled and there is a load on the system, then
  - Constant pump speed, $E_{C,PUMP} = L_{C,PUMP}$
  - Proportional pump speed, $E_{P,PUMP} = L_{V,PUMP} \times PL$
  - Variable pump speed, $E_{V,PUMP} = L_{V,PUMP} \times PL^{2.5}$
    - $L_{C,PUMP}$ = constant pump load, kW (typical of heating and cooling)
    - $L_{V,PUMP}$ = variable pump load, kW (typical of heating and cooling)
    - S_{MIN_PUMP} = minimum pump speed, % (typical of heating and cooling)
    - PL_{HTG} = percentage of heating load equal to the maximum of $(Q_{S\_SYSTEM} / Q_{HTG\_DESIGN})$ or $S_{MIN\_PUMP,HTG}$
    - PL_{CLG} = percentage of cooling load equal to the maximum of $(Q_{TOTAL\_SYSTEM} / Q_{CLG\_DESIGN})$ or $S_{MIN\_PUMP,CLG}$

If the HVAC schedule is on or if the fan availability is enabled and there is a load on the system, then energy calculations will be done for heating or cooling depending on the polarity of the load (positive for cooling, negative for heating).

- Heating (Electric), $E_{HTG} = (-1) \times Q_{S\_SYSTEM} \times P_{HTG,E} / \eta_{HTG\_E} / 3.412$
  - $\eta_{HTG,E}$ = electric nominal heating efficiency, %
  - $P_{HTG,E}$ = percentage of load assigned to electric heat, %
  - Q_{S_SYSTEM} = hourly calculated heating load (negative values), kBtu
- Cooling, $E_{CLG} = Q_{TOTAL\_SYSTEM} / 12 \times \eta_{CLG\_PL} \times P_{CLG}$
  - Part Load Ratio, $PLR_{CLG} = Q_{TOTAL\_SYSTEM} / (Q_{CLG\_DESIGN} \times OF_{CLG})$, dimensionless
  - Energy Input Ratio, $EIR_{CLG} = a + b \times PLR_{CLG} + c \times PLR_{CLG}^2 + d \times PLR_{CLG}^3$, dimensionless
  - Cooling Part Load Efficiency, $\eta_{CLG\_PL} = \eta_{CLG} \times PLR_{CLG} / EIR_{CLG}$, kW/ton
    - a, b, c, d = cooling efficiency curve coefficients (see Table 4) based on system selection, dimensionless
    - η_{CLG} = nominal cooling efficiency, kW/ton
    - OF_{CLG} = oversize factor used to adjust calculated cooling design load, %
    - P_{CLG} = percent of building with cooling, %
    - Q_{CLG_DESIGN} = total cooling design load based on design day conditions, kBtu
    - Q_{TOTAL_SYSTEM} = hourly calculated cooling load (positive values), kBtu

Fuel, kBtu

- Miscellaneous Fuel Load 1, $F_{MISCF,1} = L_{MISCF,1} \times HLP_{MISCF,1} / \eta_{MISCF,1}$ (typical of 3)
  - $L_{MISCF,1}$ = peak miscellaneous fuel load 1, kBtu (typical of 3)
  - $HLP_{MISCF,1}$ = hourly load percentage of miscellaneous fuel load 1 (typical of 3)
  - $\eta_{MISCF,1}$ = miscellaneous fuel load 1 stand-alone efficiency, % (typical of 3)
    - Note: $\eta_{MISCF,1} = \eta_{HTG\_PL,F}$ if miscellaneous load is included on main boiler plant

The heating energy consumption of fuel is calculated and further broken down to provide more resolution into three main end use categories: Envelope, Infiltration, and Ventilation.

- Envelope, $F_{HTG\_ENV} = (-1) \times Q_{S\_ZONE} \times (1 - P_{HTG,E}) \times (1 - P_{INF}) / \eta_{HTG\_PL,F}$
- Infiltration, $F_{HTG,INF} = (-1) \times Q_{S\_ZONE} \times (1 - P_{HTG,E}) \times P_{INF} / \eta_{HTG\_PL,F}$
- Ventilation, $F_{HTG,VENT} = (-1) \times Q_{S\_VENT} \times (1 - P_{HTG,E}) / \eta_{HTG\_PL,F}$
  - Part Load Ratio, $PLR_{HTG} = Q_{S\_SYSTEM} / (Q_{HTG\_DESIGN} \times OF_{HTG})$, dimensionless
    - For miscellaneous fuel loads on the plant, Q_{S_SYSTEM} includes these loads.
  - Energy Input Ratio, $EIR_{HTG} = a + b \times PLR_{HTG} + c \times PLR_{HTG}^2$, dimensionless
  - Fuel Part Load Efficiency, $\eta_{HTG\_PL,F} = \eta_{HTG,F} \times PLR_{HTG} / EIR_{HTG}$, %
    - a, b, c = heating efficiency curve coefficients (see Table 5) based on system selection, dimensionless
    - $\eta_{HTG,F}$ = fuel nominal heating efficiency, %
    - OF_{HTG} = oversize factor used to adjust calculated heating design load, %
    - $P_{HTG,E}$ = percentage of load assigned to electric heat, %
    - Q_{HTG_DESIGN} = heating design load calculated on design day conditions, kBtu
    - Q_{S_SYSTEM} = hourly calculated heating load (negative values), kBtu
  - Zone Envelope Sensible Load, $Q_{S\_ZONE,ENV} = Q_{S\_WALL} + Q_{S\_ROOF} + Q_{S\_WINDOW,C} + Q_{S\_WINDOW,R}$
  - Percent of Zone Sensible Load attributed to infiltration, $P_{INF} = Q_{S\_ZONE,INF} / (Q_{S\_ZONE,ENV} + Q_{S\_INF})$

Energy Demand

Electric, kW

The tool determined the peak kW load of the month and displays the demand of each end use category component for that hour.

Air Sealing Improvements

Schneider Electric used typical meteorological year (TMY) weather data, draft pressure, internal space temperatures (both occupied and unoccupied), and crack size to conduct savings calculations. Schneider Electric follows ASTM E1186-03 Standard Practices for air leakage in building envelope. ASHRAE Fundamentals 16.23-48 was used to calculate the flow rate and crack method for all envelope calculations. The following table shows the crack size and resulting air flow rates.

Building/ Measure	Sum of Crack Size	Sum of Crack Length (LF)	Sum of Leakage Area (SF)	Sum of Savings (CFM)
Main Water Treatment Plant				
Door Weather Stripping				
Double Door - Sides, Top, Sweep, Center (UT)	1/10 In.	99 LF	0.8 SF	101 CFM
Single Door - Sides, Top, Sweep (UT)	1/10 In.	100 LF	0.8 SF	102 CFM
Main Water Treatment Plant Total	---	---	1.7 SF	202 CFM
Pollution Control Plant - Chemical Building				
Door Weather Stripping				
Double Door - Sides, Top, Sweep, Center (UT)	1/10 In.	33 LF	0.3 SF	34 CFM
Single Door - Sides, Top, Sweep (UT)	1/10 In.	100 LF	0.8 SF	102 CFM
Roof-Wall Intersection Air Sealing				
Seal Paint (LF)	1/10 In.	96 LF	0.8 SF	98 CFM
Pollution Control Plant - Chemical Building Total	---	---	1.9 SF	233 CFM
Pollution Control Plant - Digester Building				
Door Weather Stripping				
Double Door - Sweep, Center (UT)	1/10 In.	13 LF	0.1 SF	13 CFM
Single Door - Sides, Top, Sweep (UT)	1/10 In.	60 LF	0.5 SF	61 CFM
Pollution Control Plant - Digester Building Total	---	---	0.6 SF	74 CFM
Pollution Control Plant - Electrical Building				
Door Weather Stripping				
Double Door - Sides, Top, Sweep, Center (UT)	1/10 In.	99 LF	0.8 SF	101 CFM
Pollution Control Plant - Electrical Building Total	---	---	0.8 SF	101 CFM
Pollution Control Plant - Filter Building				
Caulking				
Exterior Seal (LF)	1/50 In.	44 LF	0.1 SF	9 CFM
Door Weather Stripping				
Double Door - Sides, Top, Sweep, Center (UT)	1/10 In.	33 LF	0.3 SF	34 CFM
Garage Door Weather Stripping				
Roll-Up Door Weather Strip - Top	1/10 In.	17 LF	0.1 SF	17 CFM
Roof-Wall Intersection Air Sealing				
Seal (LF)	1/8 In.	32 LF	0.3 SF	41 CFM
Seal Paint (LF)	1/8 In.	60 LF	0.6 SF	76 CFM
Pollution Control Plant - Filter Building Total	---	---	1.4 SF	177 CFM

⊟ Pollution Control Plant - Garage					
⊟ Caulking					
⊟ Exterior Seal (LF)	1/50	In.	120 LF	0.2 SF	24 CFM
⊟ Door Weather Stripping					
⊟ Single Door - Sides, Top, Sweep (UT)	1/10	In.	60 LF	0.5 SF	61 CFM
⊟ Single Door - Sweep (UT)	1/10	In.	3 LF	0.0 SF	3 CFM
⊟ Overhang Air Sealing					
⊟ Block, Seal (SF)	1/8	In.	8 LF	0.1 SF	10 CFM
⊟ Roof-Wall Intersection Air Sealing					
⊟ Seal Paint (LF)	1/8	In.	170 LF	1.8 SF	216 CFM
Pollution Control Plant - Garage Total	---		---	2.6 SF	315 CFM
⊟ Pollution Control Plant - Pump & Control					
⊟ Door Weather Stripping					
⊟ Double Door - Sides, Top, Sweep, Center (UT)	1/10	In.	66 LF	0.6 SF	67 CFM
⊟ Single Door - Sides, Top, Sweep (UT)	1/10	In.	20 LF	0.2 SF	20 CFM
⊟ Roof-Wall Intersection Air Sealing					
⊟ Block, Seal (LF)	1/8	In.	20 LF	0.2 SF	25 CFM
⊟ Block, Seal Exposed (LF)	1/8	In.	38 LF	0.4 SF	48 CFM
⊟ Seal (LF)	1/10	In.	36 LF	0.3 SF	37 CFM
Pollution Control Plant - Pump & Control Total	---		---	1.6 SF	198 CFM
⊟ Well 1 Building					
⊟ Door Weather Stripping					
⊟ Double Door - Sides, Top, Sweep, Center (UT)	1/10	In.	99 LF	0.8 SF	101 CFM
⊟ Install Door Jamb Spacer (UT)			---	---	---
⊟ Single Door - Sides, Top, Sweep (UT)	1/10	In.	60 LF	0.5 SF	61 CFM
	1/10	In.	40 LF	0.3 SF	41 CFM
⊟ Penetration Air Sealing					
⊟ Block, Seal (UT)	1/2	In.	4 LF	0.2 SF	20 CFM
Well 1 Building Total	---		---	1.8 SF	223 CFM
⊟ Well 5a - New Buildings					
⊟ Door Weather Stripping					
⊟ Double Door - Sides, Top, Sweep, Center (UT)	1/10	In.	165 LF	1.4 SF	168 CFM
⊟ Single Door - Sides, Top, Sweep (UT)	1/10	In.	20 LF	0.2 SF	20 CFM
Well 5a - New Buildings Total	---		---	1.5 SF	188 CFM
⊟ Well 5a - Old Building					
⊟ Door Weather Stripping					
⊟ Double Door - Sides, Top, Sweep, Center (UT)	1/10	In.	66 LF	0.6 SF	67 CFM
⊟ Single Door - Sides, Top, Sweep (UT)	1/10	In.	40 LF	0.3 SF	41 CFM
Well 5a - Old Building Total	---		---	0.9 SF	108 CFM
⊟ Well 6 Building					
⊟ Door Weather Stripping					
⊟ Double Door - Sides, Top, Sweep, Center (UT)	1/10	In.	33 LF	0.3 SF	34 CFM
⊟ Single Door - Sides, Top, Sweep (UT)	1/10	In.	80 LF	0.7 SF	81 CFM
Well 6 Building Total	---		---	0.9 SF	115 CFM
⊟ Windsor Park Pump Station					
⊟ Attic Bypass Air Sealing					
⊟ Install New Attic Hatch (UT)	1/6	In.	8 LF	0.1 SF	14 CFM
⊟ Door Weather Stripping					
⊟ Single Door - Sides, Top, Sweep (UT)	1/10	In.	20 LF	0.2 SF	20 CFM
⊟ Roof-Wall Intersection Air Sealing					
⊟ Seal (LF)	1/10	In.	58 LF	0.5 SF	59 CFM
Windsor Park Pump Station Total	---		---	0.8 SF	93 CFM

The following tables show the location of the envelope scope, the associated crack size, air leakage, and savings in both heating and cooling units.

			INFILTRATION SAVINGS			
Building	**Report Group**	**Task**	**Units**	**Crack Size**	**Units**	**LF/ Unit**
Main Water Treatment Plant	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	3	1/10	3	33.0
Main Water Treatment Plant	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	5	1/10	5	20.0
Pollution Control Plant - Garage	Roof-Wall Intersection Air Sealing	Seal Paint (LF)	170	1/8	170	1.0
Pollution Control Plant - Garage	Overhang Air Sealing	Block, Seal (SF)	32	1/8	1	8.0
Pollution Control Plant - Garage	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	3	1/10	3	20.0
Pollution Control Plant - Garage	Door Weather Stripping	Single Door - Sweep (UT)	1	1/10	1	3.0
Pollution Control Plant - Garage	Caulking	Exterior Seal (LF)	120	1/50	120	1.0
Pollution Control Plant - Filter Building	Roof-Wall Intersection Air Sealing	Seal Paint (LF)	60	1/8	60	1.0
Pollution Control Plant - Filter Building	Roof-Wall Intersection Air Sealing	Seal (LF)	32	1/8	32	1.0
Pollution Control Plant - Filter Building	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	1	1/10	1	33.0
Pollution Control Plant - Filter Building	Garage Door Weather Stripping	Roll-Up Door Weather Strip - Top	2	1/10	2	8.5
Pollution Control Plant - Filter Building	Caulking	Exterior Seal (LF)	44	1/50	44	1.0
Pollution Control Plant - Electrical Building	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	3	1/10	3	33.0
Pollution Control Plant - Pump & Control	Roof-Wall Intersection Air Sealing	Block, Seal Exposed (LF)	38	1/8	38	1.0
Pollution Control Plant - Pump & Control	Roof-Wall Intersection Air Sealing	Block, Seal (LF)	20	1/8	20	1.0
Pollution Control Plant - Pump & Control	Roof-Wall Intersection Air Sealing	Seal (LF)	36	1/10	36	1.0
Pollution Control Plant - Pump & Control	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	2	1/10	2	33.0
Pollution Control Plant - Pump & Control	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	1	1/10	1	20.0
Pollution Control Plant - Digester Building	Door Weather Stripping	Double Door - Sweep, Center (UT)	1	1/10	1	13.0
Pollution Control Plant - Digester Building	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	3	1/10	3	20.0
Pollution Control Plant - Chemical Building	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	5	1/10	5	20.0
Pollution Control Plant - Chemical Building	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	1	1/10	1	33.0
Pollution Control Plant - Chemical Building	Roof-Wall Intersection Air Sealing	Seal Paint (LF)	96	1/10	96	1.0
Well 1 Building	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	3	1/10	3	20.0
Well 1 Building	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	3	1/10	3	33.0
Well 1 Building	Penetration Air Sealing	Block, Seal (UT)	2	1/2	2	2.0
Well 1 Building	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	2	1/10	2	20.0
Well 1 Building	Door Weather Stripping	Install Door Jamb Spacer (UT)	2			
Well 5a - New Buildings	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	5	1/10	5	33.0
Well 5a - New Buildings	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	1	1/10	1	20.0
Well 5a - Old Building	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	2	1/10	2	33.0
Well 5a - Old Building	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	2	1/10	2	20.0
Well 6 Building	Door Weather Stripping	Double Door - Sides, Top, Sweep, Center (UT)	1	1/10	1	33.0
Well 6 Building	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	4	1/10	4	20.0
Windsor Park Pump Station	Door Weather Stripping	Single Door - Sides, Top, Sweep (UT)	1	1/10	1	20.0
Windsor Park Pump Station	Attic Bypass Air Sealing	Install New Attic Hatch (UT)	1	1/6	1	8.0
Windsor Park Pump Station	Roof-Wall Intersection Air Sealing	Seal (LF)	58	1/10	58	1.0

		INFILTRATION SAVINGS								TOTAL SAVINGS	
Building	Report Group	Crack Length (LF)	Leakage Area (SF)	Savings (CFM)	Infiltration Heating Savings (MMBtu)	Infiltration Heating Savings (therms)	Infiltration Cooling Savings (MMBtu)	Infiltration Cooling Savings (kWHr)	Infiltration Total Savings (MMBtu)	Total Heating Savings (MMBtu)	Total Cooling Savings (MMBtu)
Main Water Treatment Plant	Door Weather Stripping	99.0	0.8	100.7	14.7	147.4	2.0	572.9	16.7	14.7	2.0
Main Water Treatment Plant	Door Weather Stripping	100.0	0.8	101.7	14.9	148.8	2.0	578.6	16.9	14.9	2.0
Pollution Control Plant - Garage	Roof-Wall Intersection Air Sealing	170.0	1.8	216.0	31.6	316.3	4.2	1,229.6	35.8	31.6	4.2
Pollution Control Plant - Garage	Overhang Air Sealing	8.0	0.1	10.2	1.5	14.9	0.2	57.9	1.7	1.5	0.2
Pollution Control Plant - Garage	Door Weather Stripping	60.0	0.5	61.0	8.9	89.3	1.2	347.2	10.1	8.9	1.2
Pollution Control Plant - Garage	Door Weather Stripping	3.0	0.0	3.1	0.4	4.5	0.1	17.4	0.5	0.4	0.1
Pollution Control Plant - Garage	Caulking	120.0	0.2	24.4	3.6	35.7	0.5	138.9	4.0	3.6	0.5
Pollution Control Plant - Filter Building	Roof-Wall Intersection Air Sealing	60.0	0.6	76.3	11.2	111.6	1.5	0.0	12.6	11.2	1.5
Pollution Control Plant - Filter Building	Roof-Wall Intersection Air Sealing	32.0	0.3	40.7	6.0	59.5	0.8	0.0	6.7	6.0	0.8
Pollution Control Plant - Filter Building	Door Weather Stripping	33.0	0.3	33.6	4.9	49.1	0.7	0.0	5.6	4.9	0.7
Pollution Control Plant - Filter Building	Garage Door Weather Stripping	17.0	0.1	17.3	2.5	25.3	0.3	0.0	2.9	2.5	0.3
Pollution Control Plant - Filter Building	Caulking	44.0	0.1	8.9	1.3	13.1	0.2	0.0	1.5	1.3	0.2
Pollution Control Plant - Electrical Building	Door Weather Stripping	99.0	0.8	100.7	14.7	4,318.7	2.0	0.0	16.7	14.7	2.0
Pollution Control Plant - Pump & Control	Roof-Wall Intersection Air Sealing	38.0	0.4	48.3	7.1	70.7	0.9	274.9	8.0	7.1	0.9
Pollution Control Plant - Pump & Control	Roof-Wall Intersection Air Sealing	20.0	0.2	25.4	3.7	37.2	0.5	144.7	4.2	3.7	0.5
Pollution Control Plant - Pump & Control	Roof-Wall Intersection Air Sealing	36.0	0.3	36.6	5.4	53.6	0.7	208.3	6.1	5.4	0.7
Pollution Control Plant - Pump & Control	Door Weather Stripping	66.0	0.6	67.1	9.8	98.2	1.3	381.9	11.1	9.8	1.3
Pollution Control Plant - Pump & Control	Door Weather Stripping	20.0	0.2	20.3	3.0	29.8	0.4	115.7	3.4	3.0	0.4
Pollution Control Plant - Digester Building	Door Weather Stripping	13.0	0.1	13.2	1.9	19.3	0.3	0.0	2.2	1.9	0.3
Pollution Control Plant - Digester Building	Door Weather Stripping	60.0	0.5	61.0	8.9	89.3	1.2	0.0	10.1	8.9	1.2
Pollution Control Plant - Chemical Building	Door Weather Stripping	100.0	0.8	101.7	14.9	4,362.3	2.0	0.0	16.9	14.9	2.0
Pollution Control Plant - Chemical Building	Door Weather Stripping	33.0	0.3	33.6	4.9	1,439.6	0.7	0.0	5.6	4.9	0.7
Pollution Control Plant - Chemical Building	Roof-Wall Intersection Air Sealing	96.0	0.8	97.6	14.3	4,187.9	1.9	0.0	16.2	14.3	1.9
Well 1 Building	Door Weather Stripping	60.0	0.5	61.0	8.9	89.3	1.2	0.0	10.1	8.9	1.2
Well 1 Building	Door Weather Stripping	99.0	0.8	100.7	14.7	147.4	2.0	0.0	16.7	14.7	2.0
Well 1 Building	Penetration Air Sealing	4.0	0.2	20.3	3.0	29.8	0.4	0.0	3.4	3.0	0.4
Well 1 Building	Door Weather Stripping	40.0	0.3	40.7	6.0	59.5	0.8	0.0	6.7	6.0	0.8
Well 1 Building	Door Weather Stripping	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Well 5a - New Buildings	Door Weather Stripping	165.0	1.4	167.8	24.6	7,197.9	3.3	954.8	27.8	24.6	3.3
Well 5a - New Buildings	Door Weather Stripping	20.0	0.2	20.3	3.0	872.5	0.4	115.7	3.4	3.0	0.4
Well 5a - Old Building	Door Weather Stripping	66.0	0.6	67.1	9.8	2,879.1	1.3	381.9	11.1	9.8	1.3
Well 5a - Old Building	Door Weather Stripping	40.0	0.3	40.7	6.0	1,744.9	0.8	231.5	6.7	6.0	0.8
Well 6 Building	Door Weather Stripping	33.0	0.3	33.6	4.9	1,439.6	0.7	0.0	5.6	4.9	0.7
Well 6 Building	Door Weather Stripping	80.0	0.7	81.3	11.9	3,489.9	1.6	0.0	13.5	11.9	1.6
Windsor Park Pump Station	Door Weather Stripping	20.0	0.2	20.3	3.0	872.5	0.4	0.0	3.4	3.0	0.4
Windsor Park Pump Station	Attic Bypass Air Sealing	8.0	0.1	13.6	2.0	581.6	0.3	0.0	2.2	2.0	0.3
Windsor Park Pump Station	Roof-Wall Intersection Air Sealing	58.0	0.5	59.0	8.6	2,530.2	1.1	0.0	9.8	8.6	1.1

High Efficiency Transformers

Schneider Electric partnered with Powersmiths to determine savings for this measure. Spreadsheet-based calculations were used by Powersmiths to generate kWh savings, which were reviewed by Schneider Electric. This methodology is applicable to scope at the following facilities:

- Water Treatment Plant
- Pollution Control Plant
- Well 1
- Well 6

Main Water Treatment Plant

					Adjustments						Baseline Transformer Losses			Powersmiths Transformer Losses			Savings	
Location ID or Room #	Transformer Designation	Proposed Powersmiths OPAL Transformer	Baseline kVA	Replacement kVA	Bseline % Load During Normal Operating Hours	Baseline % Load Outside Operating Hours	Powersmiths % Load During Normal Operating Hours	Powersmiths % Load Outside Operating Hours	Equipment Operating hrs/ day	Equipment Operating days/yr	Baseline Transformer kW Losses (Normal Operation)	Baseline Transformer kW Losses (Outside Op. hrs)	Baseline Annual kWh Losses from Transformers	Powersmiths Transformer kW Losses (Normal Operation)	Powersmiths Transformer kW Losses (Outside Op. hrs)	Powersmiths Annual kWh Losses from Transformers	Total kW Reduction During Normal Op. Hrs. (Peak)	Total kWh Savings
Pump Rm	ELP1	E-Saver-80R	30	30	15.4%	10.0%	15.4%	10.0%	12	255	0.490	0.476	4,215	0.087	0.070	665	0.40	3,550
Chem Rm	ERP1	E-Saver-80R	15	15	11.9%	7.0%	11.9%	7.0%	12	255	0.299	0.290	2,569	0.045	0.039	359	0.25	2,210

Pollution Control Plant

					Adjustments						Baseline Transformer Losses			Powersmiths Transformer Losses			Savings	
Location ID or Room #	Transformer Designation	Proposed Powersmiths OPAL Transformer	Baseline kVA	Replacement kVA	Bseline % Load During Normal Operating Hours	Baseline % Load Outside Operating Hours	Powersmiths % Load During Normal Operating Hours	Powersmiths % Load Outside Operating Hours	Equipment Operating hrs/ day	Equipment Operating days/yr	Baseline Transformer kW Losses (Normal Operation)	Baseline Transformer kW Losses (Outside Op. hrs)	Baseline Annual kWh Losses from Transformers	Powersmiths Transformer kW Losses (Normal Operation)	Powersmiths Transformer kW Losses (Outside Op. hrs)	Powersmiths Annual kWh Losses from Transformers	Total kW Reduction During Normal Op. Hrs. (Peak)	Total kWh Savings
Garage	TX1	E-Saver-80R	30	30	15.4%	10.0%	15.4%	10.0%	12	255	0.490	0.476	4,215	0.087	0.070	665	0.40	3,550
Pump and Control	TX2	E-Saver-80R	30	30	16.0%	11.0%	16.0%	11.0%	12	255	0.430	0.416	3,683	0.090	0.072	688	0.34	2,995
Pump and Control	TX3	E-Saver-80R	45	45	24.6%	19.0%	24.6%	19.0%	12	255	0.902	0.866	7,696	0.178	0.137	1,327	0.72	6,369
Sludge Bldg	TX4	E-Saver-80R	45	45	2.8%	2.8%	2.8%	2.8%	12	255	0.664	0.664	5,820	0.079	0.079	694	0.59	5,125
Generator Bldg	TX5	E-Saver-80R	30	30	14.8%	10.0%	14.8%	10.0%	12	255	0.550	0.538	4,750	0.085	0.070	658	0.47	4,092
Chlorine Bldg	ERPCB	E-Saver-80R	15	15	11.9%	7.0%	11.9%	7.0%	12	255	0.299	0.290	2,569	0.045	0.039	359	0.25	2,210

Well 1

					Adjustments							Baseline Transformer Losses			Powersmiths Transformer Losses			Savings	
Location ID or Room #	Transformer Designation	Proposed Powersmiths OPAL Transformer	Baseline kVA	Replacement kVA	Bseline % Load During Normal Operating Hours	Baseline % Load Outside Operating Hours	Powersmiths % Load During Normal Operating Hours	Powersmiths % Load Outside Operating Hours	Equipment Operating hrs/ day	Equipment Operating days/yr	A/C System Performance (kW/ton)	Baseline Transformer kW Losses (Normal Operation)	Baseline Transformer kW Losses (Outside Op. hrs)	Baseline Annual kWh Losses from Transformers	Powersmiths Transformer kW Losses (Normal Operation)	Powersmiths Transformer kW Losses (Outside Op. hrs)	Powersmiths Annual kWh Losses from Transformers	Total kW Reduction During Normal Op. Hrs. (Peak)	Total kWh Savings
Pump Rm	TX2	E-Saver-80R	25	25	8.7%	3.0%	8.7%	3.0%	12	255	0	0.290	0.283	2,501	0.062	0.058	517	0.23	1,984

Well 6

					Adjustments						Baseline Transformer Losses			Powersmiths Transformer Losses			Savings	
Location ID or Room #	Transformer Designation	Proposed Powersmiths OPAL Transformer	Baseline kVA	Replacement kVA	Bseline % Load During Normal Operating Hours	Baseline % Load Outside Operating Hours	Powersmiths % Load During Normal Operating Hours	Powersmiths % Load Outside Operating Hours	Equipment Operating hrs/ day	Equipment Operating days/yr	Baseline Transformer kW Losses (Normal Operation)	Baseline Transformer kW Losses (Outside Op. hrs)	Baseline Annual kWh Losses from Transformers	Powersmiths Transformer kW Losses (Normal Operation)	Powersmiths Transformer kW Losses (Outside Op. hrs)	Powersmiths Annual kWh Losses from Transformers	Total kW Reduction During Normal Op. Hrs. (Peak)	Total kWh Savings
Well 6	LP1	E-Saver-80R	45	45	20.7%	15.0%	20.7%	15.0%	12	255	0.796	0.766	6,799	0.149	0.115	1,110	0.65	5,689

Plug Load Controllers

Spreadsheet-based calculations were used by Schneider Electric to generate savings for multifunction copier/printers at the following locations:

Facility	Number of Copiers	Savings, kWhrs
Administrative Building	2	1,936
Main Water Treatment Plant	1	968
Pollution Control Plant	1	968

Current State, with no control:

Full Load Run Hours	1500	Hours/year
Idling Run Hours	7260	Hours/year
Full Load Power Use	1500	kWhr/year
Idling Power Use	726	kWhr/year
Total Power Use	2226	KWhr/year

Assumptions are that full load power use is 1 kW and idling power use is 100 W only.

Future State, with plug load control:

Full Load Run Hours	800	Hours/year
Idling Run Hours	1200	Hours/year
Energy Star Mode	6760	Hours/year
Full Load Power Use	800	kWhr/year
Idling Power Use	120	kWhr/year
Energy Star Mode Power Use	338	kWhr/year
Total Power Use	1258	KWhr/year
Savings	**968**	**kWhr/year/unit**

RATE Tariff Simulations: The following tables represent the utility rate tariff simulations referenced in Section 4.1.

Pollution Control Plant – Electric meter

Meter Information	
First Bill Number to Use	10
Account Number	4200603918 E
Utility Code	E
Utility	Electricity (kWh, kW)
Number of Bills	21

Utility Company	PSE&G
Tariff Name	LPLS

Utility Company: PSE&G — Tariff Name: LPLS

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
PSEG Service	$370.81	kWh Summer Off Peak (kWh)	$0.0011190	Onpk surplus buyback $/kWh	$ -
Annual Demand (kW)	$3.7617	Societal Benefits (kWh)	$0.007874	Offpk surplus buyback $/kWh	$ -
kWh Winter Peak (kWh)	$0.0053350	Securitization. (kWh)		Supply On Peak Energy(kWh) Constelation	$0.0794
kWh Winter Off Peak (kWh)	$0.0011190	PSEG Summer kW (kW)	$8.9495	Supply Off Peak Energy(kWh) Constelation	$0.0794
kWh Summer Peak (kWh)	$0.0053350				

Utility Bill Data								Tariff Simulation													Total	Error	Error
Read Date	Total Cost	Consumption-kWh Period 1	Period 2	Period 3	Demand-kW Period 1	Period 2	Period 3	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Generation kW	Annual Demand (kW)	PSEG Summer kW (kW)	Supply Generation (kW)	Supply Transmission (kW)	Supply On Peak Energy(kWh) Winter	Supply Off Peak Energy(kWh) Winter	Supply On Peak Energy(kWh) Summer		Calc Cost	($)	(%)
10/22/18	$14,318	39,526	105,703	0	296	0	0	371	211	118	1,144	0	1,113	0				3,139	8,394		$14,490	-172.61	-1%
11/20/18	$14,775	51,488	98,620	0	333	0	0	371	275	110	1,182	0	1,252	0				4,089	7,832		$15,111	-335.73	-2%
12/21/18	$17,527	65,253	117,785	0	323	0	0	371	348	132	1,441	0	1,214	0				5,182	9,354		$18,042	-514.42	-3%
1/24/19	$19,957	74,080	134,129	0	340	0	0	371	395	150	1,639	0	1,280	0				5,883	10,652		$20,371	-414.18	-2%
2/22/19	$16,686	65,644	106,173	0	330	0	0	371	350	119	1,353	0	1,241	0				5,213	8,432		$17,078	-392.48	-2%
3/25/19	$13,551	31,114	104,146	0	316	0	0	371	166	117	1,065	0	1,189	0				2,471	8,271		$13,650	-98.91	-1%
4/24/19	$10,881	13,109	92,207	0	308	0	0	371	70	103	829	0	1,158	0				1,041	7,323		$10,895	-13.94	0%
5/23/19	$11,534	22,328	85,403	0	291	291	0	371	119	96	848	0	1,096	0				1,773	6,782		$11,085	448.95	4%
6/24/19	$13,870	14,274	80,297	0	356	280	0	371	76	90	745	0	1,338	3,184				1,134	6,377		$13,315	555.05	4%
7/24/19	$13,908	20,990	85,078	0	286	284	0	371	112	95	835	0	1,076	2,560				1,667	6,757		$13,473	434.21	3%
8/22/19	$12,092	12,006	74,801	0	281	276	0	371	64	84	684	0	1,056	2,512				953	5,940		$11,664	428.02	4%
9/23/19	$13,858	20,773	84,934	0	282	277	0	371	111	95	832	0	1,062	2,527				1,650	6,745		$13,393	464.73	3%
10/22/19	$14,031	43,363	92,239	0	297	293	0	371	231	103	1,068	0	1,117	0				3,444	7,325		$13,659	371.91	3%

Pollution Control Plant – Natural Gas meter

Meter Information	
First Bill Number to Use	11
Account Number	4200603918 NG1
Utility Code	NG1
Utility	Natural Gas (Therm, Therm/hr)
Number of Bills	22

Utility Company	PSE&G
Tariff Name	LVG

Utility Company: PSEG — Tariff Name: LVG

Tariff Charges

Description	Charge	Description	Charge	Description
Tier 1 (first 1000)	$0.0130	Monthly Service Charge	$139.84	
Tier 2	$0.0158	DE Supply	$0.5283	
Demand	$0.1900			
Balancing Charge	$0.1300			
Societal Benefits	$0.0486			

Utility Bill Data									Tariff Simulation										Total	Error	Error
Read Date	Total Cost	Consumption-Therm Period 1	Period 2	Period 3	Period 4	Demand-Therm/hr Period 1	Period 2	Period 3	Service Charge	Tier 1	Tier 2	Demand	Month	Societal Benefits	Days	Avg Daily Use	Balancing Charge	DE Supply	Calc Cost	($)	(%)
12/18/18	$1,711	1,676	0	0	0	0	0	0	140	13	11	319	1	81	33	51	121	886	1,570	141	8%
1/18/19	$1,631	1,595	0	0	0	0	0	0	140	13	9	303	1	78	31	51	116	843	1,502	129	8%
2/19/19	$1,639	1,786	0	0	0	0	0	0	140	13	12	339	1	87	32	56	138	944	1,673	-34	-2%
3/20/19	$1,309	1,420	0	0	0	0	0	0	140	13	7	270	1	69	29	49	99	750	1,348	-39	-3%
4/18/19	$600	785	0	0	0	0	0	0	140	10	0	0	0	38	29	27	0	415	603	-3	0%
5/20/19	$554	724	0	0	0	0	0	0	140	9	0	0	0	35	32	23	0	382	567	-13	-2%
6/19/19	$504	639	0	0	0	0	0	0	140	8	0	0	2	31	30	21	0	338	517	-13	-3%
7/19/19	$511	679	0	0	0	0	0	0	140	9	0	0	2	33	30	23	0	359	540	-29	-6%
8/19/19	$432	560	0	0	0	0	0	0	140	7	0	0	2	27	31	18	0	296	470	-38	-9%
9/12/19	$386	522	0	0	0	0	0	0	140	7	0	0	2	25	24	22	0	276	448	-62	-16%
10/11/19	$460	591	0	0	0	0	0	0	140	8	0	0	0	29	29	20	0	312	489	-28	-6%
11/11/19	$774	714	0	0	0	0	0	0	140	9	0	136	1	35	31	23	93	377	790	-16	-2%

Main Water Treatment Plant – electric meter

Meter Information	
First Bill Number to Use	13
Account Number	4201028305A
Utility Code	E
Utility	Electricity (kWh, kW)
Number of Bills	24

Utility Company	PSE&G
Tariff Name	LPLS

Utility Company	PSE&G	Tariff Name	LPLS		
Tariff Charges					
Description	Charge	Description	Charge	Description	Charge
PSEG Service	$370.8100	kWh Summer Off Peak (kW	$0.0011190		
Annual Demand (kW)	$3.7617	Societal Benefits (kWh)	$0.0079		
kWh Winter Peak (kWh)	$0.0053350	Securitization. (kWh)		Supply On Peak Energy(kW	$0.0794
kWh Winter Off Peak (kWh)	$0.0011190	PSEG Summer kW (kW)	$8.9495	Supply Off Peak Energy(kW	$0.0794
kWh Summer Peak (kWh)	$0.0053350				

Utility Bill Data

Read Date	Total Cost	Consumption-kWh Period 1	Period 2	Period 3	Period 4	Demand-kW Period 1	Period 2	Period 3	Period 4
12/11/18	$6,101	24,420	29,786	0	0	179	190	0	0
1/11/19	$4,742	13,758	25,152	0	0	199	200	0	0
2/11/19	$5,967	16,840	36,248	0	0	217	249	0	0
3/13/19	$5,829	14,909	37,666	0	0	234	228	0	0
4/11/19	$4,080	2,817	28,702	0	0	209	260	0	0
5/13/19	$4,252	5,930	27,142	0	0	222	205	0	0
6/12/19	$7,068	9,452	30,398	0	0	238	233	0	0
7/12/19	$7,403	15,530	27,927	0	0	238	216	0	0
8/12/19	$6,991	1,846	36,561	0	0	247	246	0	0
9/11/19	$6,937	9,722	31,744	0	0	241	241	0	0
10/10/19	$5,232	10,925	35,520	0	0	222	222	0	0
11/8/19	$4,484	13,843	21,507	0	0	216	216	0	0

Tariff Simulation

Read Date	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Securitization. (kWh)	Annual Demand (kW)	PSEG Summer kW (kW)	Supply On Peak Energy(kWh) Constelation	Supply Off Peak Energy(kWh) Constelation	Total Calc Cost	Error ($)	Error (%)
12/11/18	371	130	33	427	0	673	0	1,939	2,365	$5,939	161.98	3%
1/11/19	371	73	28	306	0	747	0	1,093	1,997	$4,616	126.12	3%
2/11/19	371	90	41	418	0	816	0	1,337	2,879	$5,952	15.19	0%
3/13/19	371	80	42	414	0	882	0	1,184	2,991	$5,964	-134.08	-2%
4/11/19	371	15	32	248	0	785	0	224	2,279	$3,954	125.36	3%
5/13/19	371	32	30	260	0	834	0	471	2,156	$4,154	98.04	2%
6/12/19	371	50	34	314	0	895	2,129	751	2,414	$6,958	109.88	2%
7/12/19	371	83	31	342	0	896	2,133	1,233	2,218	$7,307	95.34	1%
8/12/19	371	10	41	302	0	927	2,206	147	2,904	$6,907	83.42	1%
9/11/19	371	52	36	327	0	907	2,159	772	2,521	$7,144	-206.96	-3%
10/10/19	371	58	40	366	0	836	0	868	2,821	$5,359	-126.94	-2%
11/8/19	371	74	24	278	0	813	0	1,099	1,708	$4,367	116.33	3%

Main Water Treatment Plant – natural gas meter

Meter Information	
First Bill Number to Use	13
Account Number	4201028305C
Utility Code	NG1
Utility	Natural Gas (Therm, Therm/hr)
Number of Bills	24

Utility Company	PSE&G
Tariff Name	GSG

Utility Company	PSEG	Tariff Name	GSG		
Tariff Charges					
Description	Charge	Description	Charge	Description	Charge
customer charge	$15.5700				
first	$0.2419				
next	$0.2429				
balancing charge	$0.0935			Societal benefits	$0.0486
				Supply charges	$0.5030

Utility Bill Data

Read Date	Total Cost	Consumption-Therm Period 1	Period 2	Period 3	Demand-Therm/hr Period 1	Period 2	Period 3
12/12/18	$1,062	1,058	0	0	0	0	0
1/14/19	$1,220	1,129	0	0	0	0	0
2/12/19	$1,398	1,392	0	0	0	0	0
3/13/19	$1,354	1,329	0	0	0	0	0
4/12/19	$575	684	0	0	0	0	0
5/14/19	$240	279	0	0	0	0	0
6/13/19	$52	45	0	0	0	0	0
7/15/19	$51	45	0	0	0	0	0
8/13/19	$69	70	0	0	0	0	0
9/12/19	$73	76	0	0	0	0	0
10/11/19	$117	123	0	0	0	0	0
11/11/19	$481	530	0	0	0	0	0

Tariff Simulation

Read Date	cust	consumption	Balance nov-mar	Societal benefits	Supply charges	Total Calc Cost	Error ($)	Error (%)
12/12/18	16	257	99	51	532	955	106	10%
1/14/19	16	274	106	55	568	1,018	202	17%
2/12/19	16	338	130	68	700	1,251	146	10%
3/13/19	16	323	124	65	668	1,195	159	12%
4/12/19	16	166	0	33	344	559	16	3%
5/14/19	16	68	0	14	140	237	3	1%
6/13/19	16	11	0	2	23	52	0	0%
7/15/19	16	11	0	2	23	51	-1	-1%
8/13/19	16	17	0	3	35	72	-3	-4%
9/12/19	16	18	0	4	38	76	-3	-4%
10/11/19	16	30	0	6	62	114	3	3%
11/11/19	16	129	50	26	267	486	-6	-1%

Administrative Building – electric meter

Meter Information			
First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7049628018 &7340760008	Tariff Name	GLP
Utility Code	E		
Utility	Electricity (kWh, kW)		
Number of Bills	40		

Utility Company: PSE&G — Tariff Name: GLP

Tariff Charges					
Description	**Charge**	**Description**	**Charge**	**Description**	**Charge**
PSEG Service	$4.72	kWh Summer Off Peak (l	$0.0080000	Supply Generation (kW)	
Annual Demand (kW)	$3.9274	Societal Benefits (kWh)	$0.007644	Supply Transmission (kW)	
kWh Winter Peak (kWh)	$0.0080000	Securitization. (kWh)		Supply On Peak Energy(kWh)	$0.0921
kWh Winter Off Peak (kWh)	$0.0080000	PSEG Summer kW (kW)	$9.8480	Supply Off Peak Energy(kWh)	$0.0921
kWh Summer Peak (kWh)	$0.0080000				

Utility Bill Data

Read Date	Total Cost	Consumption-kWh Period 1	Period 2	Period 3	Demand-kW Period 1	Period 2	Period 3
11/20/18	$328	2,360	0	0	15	0	0
12/20/18	$269	1,720	0	0	7	0	0
1/24/19	$338	2,180	0	0	9	0	0
2/22/19	$267	1,720	0	0	9	0	0
3/25/19	$248	1,630	0	0	6	0	0
4/24/19	$271	1,830	0	0	8	0	0
5/23/19	$302	1,940	0	0	12	0	0
6/24/19	$520	3,010	0	0	12	0	0
7/24/19	$756	5,140	0	0	16	0	0
8/22/19	$677	4,520	0	0	15	0	0
9/12/19	$397	2,460	0	0	14	0	0
10/11/19	$404	3,050	0	0	28	0	0

Tariff Simulation

Read Date	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Securitization. (kWh)	Annual Demand (kW)	PSEG Summer kW (kW)				Supply On Peak Energy(kWh)	Supply Off Peak Energy(	Total Calc Cost	Error ($)	Error (%)
11/20/18	5	19	0	18	0	60	0		0	0	217	0	$319	9.28	3%
12/20/18	5	14	0	13	0	26	0		0	0	158	0	$216	52.96	20%
1/24/19	5	17	0	17	0	35	0		0	0	201	0	$275	62.83	19%
2/22/19	5	14	0	13	0	35	0		0	0	158	0	$225	42.35	16%
3/25/19	5	13	0	12	0	24	0		0	0	150	0	$204	43.69	18%
4/24/19	5	15	0	14	0	29	0		0	0	169	0	$231	39.85	15%
5/23/19	5	16	0	15	0	46	0		0	0	179	0	$260	42.11	14%
6/24/19	5	24	0	23	0	48	120		0	0	277	0	$497	22.66	4%
7/24/19	5	41	0	39	0	64	162		0	0	474	0	$785	-28.34	-4%
8/22/19	5	36	0	35	0	59	149		0	0	416	0	$700	-22.98	-3%
9/12/19	3	20	0	19	0	27	135		0	0	227	0	$430	-33.37	-8%
10/11/19	5	24	0	23	0	111	0		0	0	281	0	$444	-39.76	-10%

Administrative Building – natural gas meter

Meter Information			
First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7340760008	Tariff Name	GSG
Utility Code	NG1		
Utility	Natural Gas (Therm, Therm/hr)		
Number of Bills	40		

Utility Company: PSEG — Tariff Name: GSG

Tariff Charges					
Description	**Charge**	**Description**	**Charge**	**Description**	**Charge**
customer charge	$15.5700				
first	$0.2419				
next	$0.2429				
balancing charge	$0.0935			Societal benefits	$0.0486
				Supply charges	$0.5030

Utility Bill Data

Read Date	Total Cost	Consumption-Therm Period 1	Period 2	Period 3	Demand-Therm/hr Period 1	Period 2	Period 3
11/20/18	$354	364	0	0	0	0	0
12/20/18	$503	467	0	0	0	0	0
1/24/19	$590	550	0	0	0	0	0
2/22/19	$475	472	0	0	0	0	0
3/25/19	$439	452	0	0	0	0	0
4/24/19	$171	190	0	0	0	0	0
5/23/19	$61	57	0	0	0	0	0
6/24/19	$22	8	0	0	0	0	0
7/24/19	$20	6	0	0	0	0	0
8/22/19	$22	8	0	0	0	0	0
9/12/19	$14	4	0	0	0	0	0
10/11/19	$27	14	0	0	0	0	0

Tariff Simulation

Read Date	cust	consumption	Balance nov-mar	Societal benefits	pply char	Total Calc Cost	Error ($)	Error (%)
11/20/18	16	88	34	18	183	339	16	4%
12/20/18	16	113	44	23	235	430	73	15%
1/24/19	16	134	51	27	277	504	85	14%
2/22/19	16	115	44	23	237	435	40	8%
3/25/19	16	110	42	22	227	416	22	5%
4/24/19	16	46	0	9	96	167	4	2%
5/23/19	16	14	0	3	29	61	0	0%
6/24/19	16	2	0	0	4	22	0	0%
7/24/19	16	2	0	0	3	21	0	-1%
8/22/19	16	2	0	0	4	22	0	-2%
9/12/19	16	1	0	0	2	19	-5	-35%
10/11/19	16	3	0	1	7	26	0	2%

Well 1 – electric meter

Utility Company	PSE&G	Tariff Name	GLP BGS

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7340759808A	Tariff Name	GLP BGS
Utility Code	E		
Utility	Electricity (kWh, kW)		
Number of Bills	40		

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.74	Transmission kW	76	Supply Transmission (kW)	$10.0165
Annual Demand (kW)	$3.9313	Societal Benefits (kWh)	$0.007758	Supply On Peak Energy(kWh) Winter	$0.0450
kWh Winter Peak (kWh)	$0.0129000	Generation kW	60	Supply Off Peak Energy(kWh) Winter	$0.0450
kWh Winter Off Peak (kWh)	$0.0129000	PSEG Summer kW (kW)	$9.8490	Supply On Peak Energy(kWh) Summer	$0.0450
kWh Summer Peak (kWh)	$0.0129000	Supply Generation (kW)	$5.1470	Supply Off Peak Energy(kWh) Summer	$0.0450

Utility Bill Data

Read Date	Total Cost	Consumption-kWh Period 1	Period 2	Period 4	Demand-kW Period 1	Period 2	Period 3
11/9/18	$4,540	53,307	0	0	123	0	0
12/12/18	$6,306	72,508	0	0	129	0	0
1/14/19	$4,775	42,953	0	0	128	0	0
2/12/19	$5,505	45,544	0	0	131	0	0
3/14/19	$5,827	48,523	0	0	133	0	0
4/12/19	$4,123	29,688	0	0	129	0	0
5/14/19	$4,869	36,042	0	0	123	0	0
6/13/19	$6,322	45,101	0	0	118	0	0
7/15/19	$6,280	50,364	0	0	119	0	0
8/13/19	$5,318	38,818	0	0	117	0	0
9/12/19	$5,807	50,549	0	0	118	0	0
10/11/19	$4,761	49,271	0	0	118	0	0

Tariff Simulation

Read Date	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Generation kW	Annual Demand (kW)	PSEG Summer kW (kW)	Supply Generation (kW)	Supply Transmission (kW)	Supply On Peak Energy(kWh) Winter	Supply Off Peak Energy(kWh) Winter	Supply On Peak Energy(kWh) Summer	Supply Off Peak Energy(kWh) Summer	Winter or Summer	Month	Total Calc Cost	Error ($)	Error (%)
11/9/18	5	688	0	414		482	0	309	761	2,399	0	0	0	W	11	$5,057	-516.47	-11%
12/12/18	5	935	0	563		506	0	309	761	3,263	0	0	0	W	12	$6,341	-34.78	-1%
1/14/19	5	554	0	333		504	0	309	761	1,933	0	0	0	W	1	$4,399	376.37	8%
2/12/19	5	588	0	353		514	0	309	761	2,049	0	0	0	W	2	$4,579	925.95	17%
3/14/19	5	626	0	376		524	0	309	761	0	0	2,184	0	S	3	$4,784	1,042.50	18%
4/12/19	5	383	0	230		507	0	309	761	0	0	1,336	0	S	4	$3,531	592.08	14%
5/14/19	5	465	0	280		483	0	309	761	0	0	1,622	0	S	5	$3,924	944.69	19%
6/13/19	5	582	0	350		465	1,164	309	761	0	0	2,030	0	S	6	$5,665	656.72	10%
7/15/19	5	650	0	391		469	1,174	309	761	0	0	2,266	0	S	7	$6,024	255.68	4%
8/13/19	5	501	0	301		460	1,151	309	761	0	0	1,747	0	S	8	$5,234	83.43	2%
9/12/19	5	652	0	392		464	1,163	309	761	0	0	2,275	0	S	9	$6,021	-214.38	-4%
10/11/19	5	636	0	382		463	0	309	761	2,217	0	0	0	W	10	$4,773	-11.51	0%

Well 1- natural gas meter

Utility Company	PSEG	Tariff Name	GSG

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7340759808D	Tariff Name	GSG
Utility Code	NG1		
Utility	Natural Gas (Therm, Therm/hr)		
Number of Bills	40		

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
customer charge	$15.5700				
first	$0.2419				
next	$0.2429				
balancing charge	$0.1500			Societal benefits	$0.0486
				Supply charges	$0.5030

Utility Bill Data / Tariff Simulation

Read Date	Total Cost	Consumption-Therm Period 1	Period 2	Period 3	Demand-Therm/hr Period 1	Period 2	Period 3	cust	consumption	Balance nov-mar	Societal benefits	Supply charges	Total Calc Cost	Error ($)	Error (%)
11/9/18	$125	118	0	0	0	0	0	16	29	18	6	59	127	-2	-2%
12/12/18	$216	201	0	0	0	0	0	16	49	30	10	101	205	10	5%
1/14/19	$375	338	0	0	0	0	0	16	82	51	16	170	335	40	11%
2/12/19	$348	332	0	0	0	0	0	16	81	50	16	167	329	18	5%
3/14/19	$309	311	0	0	0	0	0	16	76	47	15	157	310	0	0%
4/15/19	$189	212	0	0	0	0	0	16	51	0	10	106	184	5	3%
5/14/19	$44	36	0	0	0	0	0	16	9	0	2	18	44	0	1%
6/13/19	$20	5	0	0	0	0	0	16	1	0	0	3	20	0	0%
7/15/19	$15	0	0	0	0	0	0	16	0	0	0	0	16	0	-1%
8/13/19	$15	0	0	0	0	0	0	16	0	0	0	0	16	0	-1%
9/12/19	$15	0	0	0	0	0	0	16	0	0	0	0	16	0	-1%
10/11/19	$16	0	0	0	0	0	0	16	0	0	0	0	16	0	0%

Well 5a – electric meter

Meter Information

First Bill Number to Use	15
Account Number	4246355704-1
Utility Code	E
Utility	Electricity (kWh, kW)
Number of Bills	27

Utility Company	PSE&G
Tariff Name	GLP BGS

Tariff Charges (Utility Company: PSE&G; Tariff Name: GLP BGS)

Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.74	Transmission kW	126	Supply Transmission (kW)	$10.0165
Annual Demand (kW)	$3.9313	Societal Benefits (kWh)	$0.0078	Supply On Peak Energy(kWh) Wi	$0.0450
kWh Winter Peak (kWh)	$0.0129000	Generation kW	140	Supply Off Peak Energy(kWh) Wi	$0.0450
kWh Winter Off Peak (kWI	$0.0129000	PSEG Summer kW (kW)	$9.8490	Supply On Peak Energy(kWh) Sur	$0.0450
kWh Summer Peak (kWh)	$0.0129000	Supply Generation (kW)	$5.1470	Supply Off Peak Energy(kWh) Su	$0.0450

Utility Bill Data

Read Date	Total Cost	Consumption-kWh Period 1	Consumption-kWh Period 2	Consumption-kWh Period 3	Demand-kW Period 1	Demand-kW Period 2	Demand-kW Period 3
11/9/18	$2,120	11,880	0	0	266	0	0
12/12/18	$2,334	13,520	0	0	133	0	0
1/14/19	$2,873	13,520	0	0	133	0	0
2/12/19	$3,376	11,880	0	0	133	0	0
3/14/19	$3,478	12,320	0	0	133	0	0
4/12/19	$16,859	182,640	0	0	151	0	0
5/14/19	$4,363	23,440	0	0	139	0	0
6/13/19	$4,742	12,320	0	0	133	0	0
7/15/19	$8,648	65,120	0	0	148	0	0
8/12/19	$5,111	17,280	0	0	143	0	0
9/12/19	$4,754	13,720	0	0	140	0	0
10/11/19	$3,249	10,920	0	0	282	0	0

Tariff Simulation

Read Date	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Generation kW	Annual Demand (kW)	PSEG Summer kW (kW)	Supply Generation (kW)	Supply Transmission (kW)	Supply On Peak Energy(kWh) Winter	Supply Off Peak Energy(kWh) Winter	Supply On Peak Energy(kWh) Summer	Supply Off Peak Energy(kWh) Summer	Winter or Summer	Month	Total Calc Cost	Error ($)	Error (%)
11/9/18	5	153	0	92		1,044	0	721	1,260	535	0	0	0	W	11	$3,810	-1,689.73	-80%
12/12/18	5	174	0	105		522	0	721	1,260	608	0	0	0	W	12	$3,395	-1,061.74	-45%
1/14/19	5	174	0	105		522	0	721	1,260	608	0	0	0	W	1	$3,395	-522.75	-18%
2/12/19	5	153	0	92		522	0	721	1,260	535	0	0	0	W	2	$3,288	88.54	3%
3/14/19	5	159	0	96		522	0	721	1,260	0	0	554	0	S	3	$3,317	161.54	5%
4/12/19	5	2,356	0	1,417		594	0	721	1,260	0	0	8,219	0	S	4	$14,572	2,287.00	14%
5/14/19	5	302	0	182		546	0	721	1,260	0	0	1,055	0	S	5	$4,070	292.72	7%
6/13/19	5	159	0	96		522	1,308	721	1,260	0	0	554	0	S	6	$4,624	117.70	2%
7/15/19	5	840	0	505		583	1,462	721	1,260	0	0	2,930	0	S	7	$8,306	341.81	4%
8/12/19	5	223	0	134		561	1,406	721	1,260	0	0	778	0	S	8	$5,088	22.77	0%
9/12/19	5	177	0	106		550	1,379	721	1,260	0	0	617	0	S	9	$4,816	-61.12	-1%
10/11/19	5	141	0	85		1,107	0	721	1,260	491	0	0	0	W	10	$3,810	-560.67	-17%

Well 5a – natural gas meter

Meter Information

First Bill Number to Use	15
Account Number	4246355704-2
Utility Code	NG1
Utility	Natural Gas (Therm, Therm/hr)
Number of Bills	27

Utility Company	PSE&G
Tariff Name	LVG

Tariff Charges (Utility Company: PSEG; Tariff Name: LVG)

Description	Charge	Description	Charge	Description	Charge
Tier 1 (first 1000)	$0.0123	Monthly Service Charge	$137.29		
Tier 2	$0.0158	DE Supply	$0.5283		
Demand	$0.2100				
Balancing Charge	$0.1131				
Societal Benefits	$0.0473				

Utility Bill Data

Read Date	Total Cost	Consumption-Therm Period 1	Consumption-Therm Period 2	Consumption-Therm Period 3	Demand-Therm/hr Period 1	Demand-Therm/hr Period 2	Demand-Therm/hr Period 3
11/9/18	$527	424	0	0	0	0	0
12/12/18	$969	939	0	0	0	0	0
1/14/19	$1,059	945	0	0	0	0	0
2/12/19	$921	857	0	0	0	0	0
3/13/19	$842	814	0	0	0	0	0
4/12/19	$598	778	0	0	0	0	0
5/14/19	$483	599	0	0	0	0	0
6/13/19	$199	109	0	0	0	0	0
7/16/19	$171	61	0	0	0	0	0
8/13/19	$214	145	0	0	0	0	0
9/12/19	$154	31	0	0	0	0	0
10/11/19	$139	2	0	0	0	0	0

Tariff Simulation

Read Date	Service Charge	Tier 1	Tier 2	Demand	Month	Societal Benefits	Days	Avg Daily Use	Balancing Charge	DE Supply			Total Calc Cost	Error ($)	Error (%)
11/9/18	137	5	0	89	1	20	29	15	31	224			506	20	4%
12/12/18	137	12	0	197	1	44	33	28	87	496			973	-4	0%
1/14/19	137	12	0	198	1	45	33	29	88	499			978	81	8%
2/12/19	137	11	0	180	1	41	29	30	80	453			901	20	2%
3/13/19	137	10	0	171	1	39	29	28	75	430			862	-19	-2%
4/12/19	137	10	0	0	0	37	30	26	0	411			595	4	1%
5/14/19	137	7	0	0	0	28	32	19	0	317			490	-6	-1%
6/13/19	137	1	0	0	2	5	30	4	0	58			201	-2	-1%
7/16/19	137	1	0	0	2	3	33	2	0	32			173	-2	-1%
8/13/19	137	2	0	0	2	7	28	5	0	77			223	-9	-4%
9/12/19	137	0	0	0	2	1	30	1	0	17			156	-2	-1%
10/11/19	137	0	0	0	0	0	29	0	0	1			139	1	1%

Well 6 – electric meter

Utility Company	PSE&G	Tariff Name	LPLS

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	4200785706 (new - 4246457604)	Tariff Name	LPLS
Utility Code	E		
Utility	Electricity (kWh, kW)		
Number of Bills	40		

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
PSEG Service	$370.81	kWh Summer Off Peak (kW	$0.0011190	Supply Generation (kW)	
Annual Demand (kW)	$3.7570	Societal Benefits (kWh)	$0.007874	Supply Transmission (kW)	
kWh Winter Peak (kWh)	$0.0053350	Securitization. (kWh)		Supply On Peak Energy(kW	$0.0794
kWh Winter Off Peak (kWh	$0.0011190	PSEG Summer kW (kW)	$8.9495	Supply Off Peak Energy(kW	$0.0794
kWh Summer Peak (kWh)	$0.0053350				

Utility Bill Data								Tariff Simulation											
Read Date	Total Cost	Consumption-kWh Period 1	Period 2	Period 3	Demand-kW Period 1	Period 2	Period 3	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Securitization. (kWh)	Annual Demand (kW)	PSEG Summer kW (kW)	Supply On Peak Energy(kWh)	Supply Off Peak Energy(kWh)	Total Calc Cost	Error ($)	Error (%)
11/12/18	$3,076	21,537	0	0	211	0	0	371	115	0	170	0	791	0	1,710	0	$3,156	-79.74	-3%
12/13/18	$3,848	30,170	0	0	220	0	0	371	161	0	238	0	827	0	2,395	0	$3,992	-143.58	-4%
1/15/19	$3,605	27,985	0	0	210	0	0	371	149	0	220	0	789	0	2,222	0	$3,751	-146.53	-4%
2/13/19	$3,192	23,473	0	0	213	0	0	371	125	0	185	0	801	0	1,864	0	$3,345	-153.54	-5%
3/15/19	$3,819	30,375	0	0	226	0	0	371	162	0	239	0	848	0	2,412	0	$4,032	-212.41	-6%
4/15/19	$3,464	26,136	0	0	227	0	0	371	139	0	206	0	852	0	2,075	0	$3,643	-178.69	-5%
5/15/19	$3,061	20,917	0	0	216	0	0	371	112	0	165	0	810	0	1,661	0	$3,118	-57.23	-2%
6/14/19	$5,158	22,496	0	0	217	0	0	371	120	0	177	0	817	1,946	1,786	0	$5,217	-58.51	-1%
7/16/19	$4,766	20,214	0	0	202	0	0	371	108	0	159	0	760	1,810	1,605	0	$4,812	-46.36	-1%
8/14/19	$5,263	23,175	0	0	221	0	0	371	124	0	182	0	830	1,978	1,840	0	$5,325	-61.72	-1%
9/13/19	$5,341	24,444	0	0	218	0	0	371	130	0	192	0	819	1,950	1,941	0	$5,403	-62.04	-1%
10/14/19	$3,143	22,090	0	0	205	0	0	371	118	0	174	0	772	0	1,754	0	$3,188	-45.10	-1%

Well 6 – natural gas meter

Utility Company	PSE&G	Tariff Name	GSG

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7145914808	Tariff Name	GSG
Utility Code	NG1		
Utility	Natural Gas (Therm, Therm/hr)		
Number of Bills	40		

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
Tier 1 (first 1000)	$0.2385	Monthly Service Charge	$15.46		
Tier 2	$0.2385	DE Supply	$0.5283		
Demand					
Balancing Charge	$0.1131				
Societal Benefits	$0.0470				

Utility Bill Data								Tariff Simulation												
Read Date	Total Cost	Consumption-Therm Period 1	Period 2	Period 3	Demand-Therm/hr Period 1	Period 2	Period 3	Service Charge	Tier 1	Tier 2	Demand	Month	Societal Benefits	Days	Avg Daily Use	Balancing Charge	DE Supply	Total Calc Cost	Error ($)	Error (%)
11/9/18	$13	0	0	0	0	0	0	15	0	0	0	1	0	29	0	0	0	15	-3	-20%
12/12/18	$17	2	0	0	0	0	0	15	1	0	0	1	0	33	0	0	1	17	0	-2%
1/14/19	$15	0	0	0	0	0	0	15	0	0	0	1	0	33	0	0	0	15	0	-2%
2/12/19	$19	4	0	0	0	0	0	15	1	0	0	1	0	29	0	0	2	18	0	1%
3/13/19	$19	5	0	0	0	0	0	15	1	0	0	1	0	29	0	0	2	19	0	0%
4/12/19	$15	0	0	0	0	0	0	15	0	0	0	0	0	30	0	0	0	15	0	0%
5/14/19	$17	2	0	0	0	0	0	15	1	0	0	0	0	32	0	0	1	17	0	0%
6/13/19	$19	5	0	0	0	0	0	15	1	0	0	2	0	30	0	0	2	19	0	0%
7/16/19	$107	117	0	0	0	0	0	15	28	0	0	2	6	33	4	0	62	111	-4	-3%
8/13/19	$23	9	0	0	0	0	0	15	2	0	0	2	0	28	0	0	5	23	-1	-2%
9/12/19	$17	2	0	0	0	0	0	15	1	0	0	2	0	30	0	0	1	17	0	-1%
10/11/19	$17	2	0	0	0	0	0	15	1	0	0	0	0	29	0	0	1	17	0	0%

Well 9 – electric meter

Utility Meter 1

Utility Company	PSE&G	Tariff Name	GLP

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7340760318	Tariff Name	GLP
Utility Code	E		
Utility	Electricity (kWh, kW)		
Number of Bills	40		

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.72	kWh Summer Off Peak (kW	$0.0080000	Supply Generation (kW)	
Annual Demand (kW)	$3.9274	Societal Benefits (kWh)	$0.007644	Supply Transmission (kW)	
kWh Winter Peak (kWh)	$0.0080000	Securitization. (kWh)		Supply On Peak Energy(kW	$0.0989
kWh Winter Off Peak (kWI	$0.0080000	PSEG Summer kW (kW)	$9.8490	Supply Off Peak Energy(kV	$0.0989
kWh Summer Peak (kWh)	$0.0080000				

Utility Bill Data / Tariff Simulation

Read Date	Total Cost	Consumption-kWh Period 1	Consumption-kWh Period 2	Consumption-kWh Period 3	Demand-kW Period 1	Demand-kW Period 2	Demand-kW Period 3	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Securitization. (kWh)	Annual Demand (kW)	PSEG Summer kW (kW)				Supply On Peak Energy(kWh)	Supply Off Peak Energy(kWh)	Total Calc Cost	Error ($)	Error (%)
11/9/18	$1,720	6,711	0	0	169	0	0	5	54	0	51	0	664	0		0	0	664	0	$1,437	282.85	16%
12/12/18	$3,646	26,896	0	0	84	0	0	5	215	0	206	0	329	0		0	0	2,660	0	$3,415	231.71	6%
1/14/19	$3,682	26,907	0	0	84	0	0	5	215	0	206	0	331	0		0	0	2,661	0	$3,417	264.38	7%
2/12/19	$3,523	22,846	0	0	173	0	0	5	183	0	175	0	679	0		0	0	2,259	0	$3,301	221.59	6%
3/14/19	$3,070	22,572	0	0	84	0	0	5	181	0	173	0	331	0		0	0	2,232	0	$2,921	148.62	5%
4/12/19	$2,934	21,356	0	0	85	0	0	5	171	0	163	0	332	0		0	0	2,112	0	$2,783	150.43	5%
5/14/19	$5,739	49,248	0	0	85	0	0	5	394	0	376	0	332	0		0	0	4,871	0	$5,978	-238.40	-4%
6/13/19	$4,351	27,892	0	0	83	0	0	5	223	0	213	0	326	817		0	0	2,759	0	$4,343	7.61	0%
7/15/19	$4,918	34,001	0	0	85	0	0	5	272	0	260	0	335	839		0	0	3,363	0	$5,073	-154.64	-3%
8/13/19	$4,833	21,318	0	0	173	0	0	5	171	0	163	0	680	1,706		0	0	2,108	0	$4,833	0.02	0%
9/12/19	$4,549	31,651	0	0	82	0	0	5	253	0	242	0	323	810		0	0	3,130	0	$4,763	-213.63	-5%
10/11/19	$4,195	34,802	0	0	167	0	0	5	278	0	266	0	657	0		0	0	3,442	0	$4,649	-453.58	-11%

Well 9 – natural gas meter

Utility Company	PSE&G	Tariff Name	GSG

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7145915308	Tariff Name	GSG
Utility Code	NG1		
Utility	Natural Gas (Therm, Therm/hr)		
Number of Bills	40		

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
Tier 1 (first 1000)	$0.2385	Monthly Service Charge	$15.46		
Tier 2	$0.2385	DE Supply	$0.5283		
Demand					
Balancing Charge	$0.1131				
Societal Benefits	$0.0470				

Utility Bill Data / Tariff Simulation

Read Date	Total Cost	Consumption-Therm Period 1	Consumption-Therm Period 2	Consumption-Therm Period 3	Demand-Therm/hr Period 1	Demand-Therm/hr Period 2	Demand-Therm/hr Period 3	Service Charge	Tier 1	Tier 2	Demand	Month	Societal Benefits	Days	Avg Daily Use	Balancing Charge	DE Supply			Total Calc Cost	Error ($)	Error (%)
11/9/18	$13	0	0	0	0	0	0	15	0	0	0	1	0	29	0	0	0			15	-3	-20%
12/12/18	$16	1	0	0	0	0	0	15	0	0	0	1	0	33	0	0	1			16	0	-2%
1/14/19	$15	0	0	0	0	0	0	15	0	0	0	1	0	33	0	0	0			15	0	-2%
2/12/19	$16	1	0	0	0	0	0	15	0	0	0	1	0	29	0	0	1			16	0	0%
3/13/19	$17	2	0	0	0	0	0	15	1	0	0	1	0	29	0	0	1			17	0	0%
4/12/19	$15	0	0	0	0	0	0	15	0	0	0	0	0	30	0	0	0			15	0	0%
5/14/19	$15	0	0	0	0	0	0	15	0	0	0	0	0	32	0	0	0			15	0	0%
6/13/19	$30	18	0	0	0	0	0	15	4	0	0	2	1	30	1	0	10			30	0	-1%
7/16/19	$15	0	0	0	0	0	0	15	0	0	0	2	0	33	0	0	0			15	0	0%
8/13/19	$29	18	0	0	0	0	0	15	4	0	0	2	1	28	1	0	10			30	-1	-4%
9/12/19	$17	2	0	0	0	0	0	15	1	0	0	2	0	30	0	0	1			17	0	-1%
10/11/19	$16	0	0	0	0	0	0	15	0	0	0	0	0	29	0	0	0			15	0	1%

Well 10 – electric meter

Utility Company	PSE&G	Tariff Name	GLP

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7340760504	Tariff Name	GLP
Utility Code	E		
Utility	Electricity (kWh, kW)		
Number of Bills	40		

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.72	kWh Summer Off Peak (kW	$0.0080000	Supply Generation (kW)	
Annual Demand (kW)	$3.9274	Societal Benefits (kWh)	$0.007644	Supply Transmission (kW)	
kWh Winter Peak (kWh)	$0.0080000	Securitization. (kWh)		Supply On Peak Energy(kW	$0.0814
kWh Winter Off Peak (kWl	$0.0080000	PSEG Summer kW (kW)	$9.8480	Supply Off Peak Energy(kV	$0.0814
kWh Summer Peak (kWh)	$0.0080000				

Utility Bill Data / **Tariff Simulation**

Read Date	Total Cost	Consumption-kWh Period 1	Period 2	Period 3	Demand-kW Period 1	Period 2	Period 3	PSEG Service	On Peak kWh	Kwh Consumption	Benefits Benefits	n. (kWh) Transition	Demand Charge	PSEG Summer kW (kW)				Peak On Peak	Supply Off Peak Energy(kWh)	Total Calc Cost	Error ($)	Error (%)
11/9/18	$3,976	36,548	0	0	180	0	0	5	292	0	279	0	705	0		0	0	2,973	0	$4,255	-279.30	-7%
12/12/18	$445	712	0	0	2	0	0	5	6	0	5	0	8	0		0	0	58	0	$82	362.93	82%
1/14/19	$774	1,053	0	0	76	0	0	5	8	0	8	0	299	0		0	0	86	0	$406	368.21	48%
2/12/19	$5,089	48,814	0	0	69	0	0	5	391	0	373	0	273	0		0	0	3,971	0	$5,012	77.01	2%
3/15/19	$9,517	96,364	0	0	86	0	0	5	771	0	737	0	339	0		0	0	7,839	0	$9,691	-173.51	-2%
4/15/19	$4,906	47,107	0	0	69	0	0	5	377	0	360	0	272	0		0	0	3,832	0	$4,846	59.74	1%
5/15/19	$4,581	41,942	0	0	69	0	0	5	336	0	321	0	269	0		0	0	3,412	0	$4,342	238.39	5%
6/14/19	$4,531	32,979	0	0	89	0	0	5	264	0	252	0	350	877		0	0	2,683	0	$4,431	99.93	2%
7/15/19	$4,778	39,231	0	0	67	0	0	5	314	0	300	0	263	659		0	0	3,191	0	$4,731	46.65	1%
8/13/19	$4,407	35,743	0	0	67	0	0	5	286	0	273	0	263	659		0	0	2,908	0	$4,393	13.81	0%
9/13/19	$5,204	44,109	0	0	68	0	0	5	353	0	337	0	265	666		0	0	3,588	0	$5,214	-10.05	0%
10/11/19	$4,107	37,578	0	0	135	0	0	5	301	0	287	0	532	0		0	0	3,057	0	$4,181	-74.19	-2%

Well 10 – natural gas meter

Utility Company	PSE&G	Tariff Name	GSG

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7240560708	Tariff Name	GSG
Utility Code	NG1		
Utility	Natural Gas (Therm, Therm/hr)		
Number of Bills	40		

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
cust charge	$15.4600				
consumption	$0.7532				

Utility Bill Data / **Tariff Simulation**

Read Date	Total Cost	Consumption-Therm Period 1	Period 2	Period 3	Demand-Therm/hr Period 1	Period 2	Period 3	cust	cons	Total Calc Cost	Error ($)	Error (%)
11/9/18	$21	10	0	0	0	0	0	15	7	23	-1	-7%
12/12/18	$15	0	0	0	0	0	0	15	0	15	-1	-4%
1/14/19	$15	0	0	0	0	0	0	15	0	15	0	-2%
2/12/19	$16	1	0	0	0	0	0	15	1	16	0	1%
3/13/19	$17	2	0	0	0	0	0	15	2	17	0	1%
4/12/19	$15	0	0	0	0	0	0	15	0	15	0	0%
5/14/19	$23	9	0	0	0	0	0	15	7	22	0	2%
6/13/19	$20	6	0	0	0	0	0	15	4	20	0	1%
7/16/19	$15	0	0	0	0	0	0	15	0	15	0	0%
8/13/19	$16	1	0	0	0	0	0	15	1	16	0	0%
9/12/19	$49	45	0	0	0	0	0	15	34	49	0	0%
10/11/19	$16	1	0	0	0	0	0	15	1	16	0	1%

Beechnut Pump Station – electric meter

Utility Company	PSE&G	Tariff Name	GLP

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7340759905	Tariff Name	GLP
Utility Code	E		
Utility	Electricity (kWh, kW)		
Number of Bills	33		

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.72	kWh Summer Off Peak (kWh	$0.0080000	Supply Generation (kW)	
Annual Demand (kW)	$3.9274	Societal Benefits (kWh)	$0.007644	Supply Transmission (kW)	
kWh Winter Peak (kWh)	$0.0080000	Securitization. (kWh)		Supply On Peak Energy(kW	$0.0834
kWh Winter Off Peak (kWI	$0.0080000	PSEG Summer kW (kW)	$9.8480	Supply Off Peak Energy(kV	$0.0834
kWh Summer Peak (kWh)	$0.0080000				

Utility Bill Data / Tariff Simulation

Read Date	Total Cost	Consumption-kWh Period 1	Consumption-kWh Period 2	Consumption-kWh Period 3	Demand-kW Period 1	Demand-kW Period 2	Demand-kW Period 3	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Securitization. (kWh)	Annual Demand (kW)	PSEG Summer kW (kW)				Supply On Peak Energy(kWh)	Supply Off Peak Energy(kWh)	Total Calc Cost	Error ($)	Error (%)
11/9/18	$129	1,128	0	0	6	0	0	5	9	0	9	0	22	0		0	0	94	0	$138	-9.55	-7%
12/11/18	$261	2,478	0	0	4	0	0	5	20	0	19	0	17	0		0	0	207	0	$267	-6.31	-2%
1/11/19	$177	1,578	0	0	4	0	0	5	13	0	12	0	15	0		0	0	132	0	$176	0.96	1%
2/11/19	$238	2,214	0	0	4	0	0	5	18	0	17	0	17	0		0	0	185	0	$241	-2.87	-1%
3/13/19	$243	2,274	0	0	5	0	0	5	18	0	17	0	18	0		0	0	190	0	$248	-5.42	-2%
4/11/19	$207	1,854	0	0	6	0	0	5	15	0	14	0	22	0		0	0	155	0	$210	-2.99	-1%
5/13/19	$187	1,644	0	0	4	0	0	5	13	0	13	0	15	0		0	0	137	0	$182	4.99	3%
6/12/19	$169	1,146	0	0	4	0	0	5	9	0	9	0	14	35		0	0	96	0	$168	1.49	1%
7/12/19	$141	1,068	0	0	2	0	0	5	9	0	8	0	8	21		0	0	89	0	$139	1.41	1%
8/12/19	$135	1,032	0	0	2	0	0	5	8	0	8	0	8	20		0	0	86	0	$134	0.51	0%
9/11/19	$136	1,050	0	0	2	0	0	5	8	0	8	0	8	20		0	0	88	0	$136	0.22	0%
10/10/19	$121	1,032	0	0	5	0	0	5	8	0	8	0	18	0		0	0	86	0	$125	-3.69	-3%

Beechnut Pump Station – natural gas meter

Utility Company	PSE&G	Tariff Name	GSG

Meter Information

First Bill Number to Use	15	Utility Company	PSE&G
Account Number	7244420404	Tariff Name	GSG
Utility Code	NG1		
Utility	Natural Gas (Therm, Therm/hr)		
Number of Bills	33		

Tariff Charges

Description	Charge	Description	Charge	Description
Tier 1 (first 1000)	$0.2419	Monthly Service Charge	$15.57	
Tier 2	$0.2429	DE Supply	$0.5283	
Demand				
Balancing Charge	$0.1131			
Societal Benefits	$0.0470			

Utility Bill Data / Tariff Simulation

Read Date	Total Cost	Consumption-Therm Period 1	Consumption-Therm Period 2	Consumption-Therm Period 3	Demand-Therm/hr Period 1	Demand-Therm/hr Period 2	Demand-Therm/hr Period 3	Service Charge	Tier 1	Tier 2	Demand	Month	Societal Benefits	Days	Avg Daily Use	Balancing Charge	DE Supply	Total Calc Cost	Error ($)	Error (%)
11/8/18	$13	0	0	0	0	0	0	16	0	0	0	1	0	29	0	0	0	16	-3	-21%
12/11/18	$15	0	0	0	0	0	0	16	0	0	0	1	0	33	0	0	0	16	-1	-4%
1/11/19	$31	14	0	0	0	0	0	16	3	0	0	1	1	31	0	0	8	27	3	11%
2/11/19	$15	0	0	0	0	0	0	16	0	0	0	1	0	31	0	0	0	16	0	-1%
3/13/19	$17	1	0	0	0	0	0	16	0	0	0	1	0	30	0	0	1	16	0	0%
4/11/19	$15	0	0	0	0	0	0	16	0	0	0	0	0	29	0	0	0	16	0	-1%
5/13/19	$15	0	0	0	0	0	0	16	0	0	0	0	0	32	0	0	0	16	0	-1%
6/12/19	$16	1	0	0	0	0	0	16	0	0	0	2	0	30	0	0	1	16	0	-1%
7/12/19	$15	0	0	0	0	0	0	16	0	0	0	2	0	30	0	0	0	16	0	-1%
8/12/19	$25	12	0	0	0	0	0	16	3	0	0	2	1	31	0	0	6	25	-1	-3%
9/11/19	$15	0	0	0	0	0	0	16	0	0	0	2	0	30	0	0	0	16	0	-1%
10/10/19	$16	0	0	0	0	0	0	16	0	0	0	0	0	29	0	0	0	16	0	0%

Tweedstone Pump Station – electric meter

Utility Company	PSE&G	Tariff Name	GLP

Meter Information

First Bill Number to Use	15
Account Number	7049863602
Utility Code	E
Utility	Electricity (kWh, kW)
Number of Bills	40

Utility Company	PSE&G
Tariff Name	GLP

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.72	kWh Summer Off Peak (kW	$0.0080000	Supply Generation (kW)	
Annual Demand (kW)	$3.9274	Societal Benefits (kWh)	$0.007644	Supply Transmission (kW)	
kWh Winter Peak (kWh)	$0.0080000	Securitization. (kWh)		Supply On Peak Energy(kW	$0.0860
kWh Winter Off Peak (kWI	$0.0080000	PSEG Summer kW (kW)	$9.8480	Supply Off Peak Energy(kV	$0.0860
kWh Summer Peak (kWh)	$0.0080000				

Utility Bill Data								Tariff Simulation														
Read Date	Total Cost	Consumption-kWh Period 1	Period 2	Period 3	Demand-kW Period 1	Period 2	Period 3	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Securitization. (kWh)	Annual Demand (kW)	PSEG Summer kW (kW)				Supply On Peak Energy(kWh)	Supply Off Peak Energy(kWh)	Total Calc Cost	Error ($)	Error (%)
11/8/18	$303	2,715	0	0	11	0	0	5	22	0	21	0	42	0		0	0	233	0	$322	-19.07	-6%
12/11/18	$392	3,526	0	0	7	0	0	5	28	0	27	0	26	0		0	0	303	0	$389	2.33	1%
1/11/19	$314	2,726	0	0	6	0	0	5	22	0	21	0	23	0		0	0	234	0	$304	9.60	3%
2/11/19	$370	3,308	0	0	6	0	0	5	26	0	25	0	25	0		0	0	284	0	$366	4.01	1%
3/13/19	$308	2,722	0	0	6	0	0	5	22	0	21	0	24	0		0	0	234	0	$305	3.25	1%
4/11/19	$309	2,635	0	0	9	0	0	5	21	0	20	0	33	0		0	0	227	0	$306	2.90	1%
5/13/19	$296	2,519	0	0	5	0	0	5	20	0	19	0	20	0		0	0	217	0	$281	15.31	5%
6/12/19	$322	2,396	0	0	5	0	0	5	19	0	18	0	20	49		0	0	206	0	$317	4.58	1%
7/12/19	$324	2,394	0	0	5	0	0	5	19	0	18	0	21	52		0	0	206	0	$321	2.77	1%
8/12/19	$371	2,499	0	0	8	0	0	5	20	0	19	0	32	81		0	0	215	0	$372	-1.04	0%
9/11/19	$305	2,307	0	0	5	0	0	5	18	0	18	0	19	47		0	0	198	0	$305	0.22	0%
10/10/19	$261	2,244	0	0	9	0	0	5	18	0	17	0	34	0		0	0	193	0	$266	-5.42	-2%

Tweedstone Pump Station – natural gas meter

Utility Company	PSE&G	Tariff Name	GSG

Meter Information

First Bill Number to Use	15
Account Number	7340760709
Utility Code	NG1
Utility	Natural Gas (Therm, Therm/hr)
Number of Bills	40

Utility Company	PSE&G
Tariff Name	GSG

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
Tier 1 (first 1000)	$0.2385	Monthly Service Charge	$15.46		
Tier 2	$0.2385	DE Supply	$0.5283		
Demand					
Balancing Charge	$0.1131				
Societal Benefits	$0.0470				

Utility Bill Data								Tariff Simulation														
Read Date	Total Cost	Consumption-Therm Period 1	Period 2	Period 3	Demand-Therm/hr Period 1	Period 2	Period 3	Service Charge	Tier 1	Tier 2	Demand	Month	Societal Benefits	Days	Avg Daily Use	Balancing Charge	DE Supply			Total Calc Cost	Error ($)	Error (%)
11/8/18	$14	1	0	0	0	0	0	15	0	0	0	1	0	29	0	0	1			16	-3	-19%
12/11/18	$15	0	0	0	0	0	0	15	0	0	0	1	0	33	0	0	0			15	-1	-4%
1/11/19	$22	7	0	0	0	0	0	15	2	0	0	1	0	31	0	0	4			21	1	3%
2/11/19	$16	1	0	0	0	0	0	15	0	0	0	1	0	31	0	0	1			16	0	0%
3/13/19	$20	5	0	0	0	0	0	15	1	0	0	1	0	30	0	0	3			20	0	0%
4/11/19	$15	0	0	0	0	0	0	15	0	0	0	0	0	29	0	0	0			15	0	0%
5/13/19	$15	0	0	0	0	0	0	15	0	0	0	0	0	32	0	0	0			15	0	0%
6/12/19	$18	3	0	0	0	0	0	15	1	0	0	2	0	30	0	0	2			18	0	0%
7/12/19	$15	0	0	0	0	0	0	15	0	0	0	2	0	30	0	0	0			15	0	0%
8/12/19	$60	58	0	0	0	0	0	15	14	0	0	2	3	31	2	0	31			63	-3	-6%
9/11/19	$16	1	0	0	0	0	0	15	0	0	0	2	0	30	0	0	1			16	0	0%
10/9/19	$16	0	0	0	0	0	0	15	0	0	0	0	0	28	0	0	0			15	0	1%

Windsor Park Pump Station – electric meter

Meter Information	
First Bill Number to Use	15
Account Number	4233150718
Utility Code	E
Utility	Electricity (kWh, kW)
Number of Bills	41

Utility Company	PSE&G
Tariff Name	GLP

Utility Company	PSE&G	Tariff Name	GLP		
Tariff Charges					
Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.72	kWh Summer Off Peak (k	$0.0080000	Supply Generation (kW)	
Annual Demand (kW)	$3.9274	Societal Benefits (kWh)	$0.007644	Supply Transmission (kW	
kWh Winter Peak (kWh)	$0.0080000	Securitization. (kWh)		Supply On Peak Energy(k	$0.0680
kWh Winter Off Peak (kW	$0.0080000	PSEG Summer kW (kW)	$9.8480	Supply Off Peak Energy(l	$0.0902
kWh Summer Peak (kWh)	$0.0080000				

Utility Bill Data

Read Date	Total Cost	Consumption-kWh Period 1	Period 2	Period 3	Period 4	Demand-kW Period 1	Period 2	Period 3	Period 4
11/20/18	$794	9,082	0	0	0	24	0	0	0
12/21/18	$1,066	11,723	0	0	0	27	0	0	0
1/24/19	$1,234	13,084	0	0	0	25	0	0	0
2/22/19	$1,091	9,870	0	0	0	22	0	0	0
3/25/19	$1,078	10,342	0	0	0	21	0	0	0
4/24/19	$918	8,337	0	0	0	17	0	0	0
5/23/19	$979	8,405	0	0	0	18	0	0	0
6/24/19	$1,184	9,372	0	0	0	24	0	0	0
7/24/19	$920	7,509	0	0	0	17	0	0	0
8/22/19	$796	6,471	0	0	0	15	0	0	0
9/23/19	$746	6,754	0	0	0	13	0	0	0
10/22/19	$615	6,007	0	0	0	14	0	0	0

Tariff Simulation

Read Date	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Securitization. (kWh)	Annual Demand (kW)	PSEG Summer kW (kW)				Supply On Peak Energy(kWh)	Supply Off Peak Energy(kWh)		Generation	Transmission	Total Calc Cost	Error ($)	Error (%)
11/20/18	5	73	0	69	0	95	0		0	0	617	0				$859	-65.42	-8%
12/21/18	5	94	0	90	0	106	0		0	0	797	0				$1,091	-25.01	-2%
1/24/19	5	105	0	100	0	97	0		0	0	890	0				$1,196	37.32	3%
2/22/19	5	79	0	75	0	85	0		0	0	671	0				$915	175.19	16%
3/25/19	5	83	0	79	0	82	0		0	0	703	0				$952	125.98	12%
4/24/19	5	67	0	64	0	68	0		0	0	567	0				$770	147.73	16%
5/23/19	5	67	0	64	0	70	0		0	0	571	0				$778	201.90	21%
6/24/19	5	75	0	72	0	94	235		0	0	637	0				$1,118	65.89	6%
7/24/19	5	60	0	57	0	65	162		0	0	511	0				$860	60.01	7%
8/22/19	5	52	0	49	0	60	152		0	0	440	0				$758	37.94	5%
9/23/19	5	54	0	52	0	51	128		0	0	459	0				$749	-2.48	0%
10/22/19	5	48	0	46	0	53	0		0	0	408	0				$560	54.66	9%

Windsor Park Pump Station – natural gas meter

Meter Information	
First Bill Number to Use	15
Account Number	7340760601
Utility Code	NG1
Utility	Natural Gas (Therm, Therm/hr)
Number of Bills	41

Utility Company	PSE&G
Tariff Name	GSG

Utility Company	PSE&G	Tariff Name	GSG		
Tariff Charges					
Description	Charge	Description	Charge	Description	Charge
Tier 1 (first 1000)	$0.2419	Monthly Service Charge	$15.57		
Tier 2	$0.2429	DE Supply	$0.5283		
Demand					
Balancing Charge	$0.1131				
Societal Benefits	$0.0470				

Utility Bill Data

Read Date	Total Cost	Consumption-Therm Period 1	Period 2	Period 3	Demand-Therm/hr Period 1	Period 2	Period 3
11/9/18	$15	2	0	0	0	0	0
12/12/18	$15	0	0	0	0	0	0
1/14/19	$15	0	0	0	0	0	0
2/12/19	$15	0	0	0	0	0	0
3/13/19	$15	0	0	0	0	0	0
4/14/19	$15	0	0	0	0	0	0
5/13/19	$16	1	0	0	0	0	0
6/13/19	$20	6	0	0	0	0	0
7/16/19	$19	4	0	0	0	0	0
8/13/19	$184	224	0	0	0	0	0
9/12/19	$45	40	0	0	0	0	0
10/11/19	$34	23	0	0	0	0	0

Tariff Simulation

Read Date	Service Charge	Tier 1	Tier 2	Demand	Month	Societal Benefits	Days	Avg Daily Use	Balancing Charge	DE Supply			Total Calc Cost	Error ($)	Error (%)
11/9/18	16	1	0	0	1	0	29	0	0	1			17	-3	-18%
12/12/18	16	0	0	0	1	0	33	0	0	0			16	-1	-4%
1/14/19	16	0	0	0	1	0	33	0	0	0			16	0	-3%
2/12/19	16	0	0	0	1	0	29	0	0	0			16	0	-1%
3/13/19	16	0	0	0	1	0	29	0	0	0			16	0	-1%
4/14/19	16	0	0	0	0	0	32	0	0	0			16	0	-1%
5/13/19	16	0	0	0	0	0	29	0	0	1			16	0	-1%
6/13/19	16	1	0	0	2	0	31	0	0	3			20	0	-1%
7/16/19	16	1	0	0	2	0	33	0	0	2			19	0	-1%
8/13/19	16	54	0	0	2	11	28	8	0	118			198	-14	-8%
9/12/19	16	10	0	0	2	2	30	1	0	21			48	-3	-6%
10/11/19	16	6	0	0	0	1	29	1	0	12			34	-1	-2%

Lake Drive Pump Station – electric meter

Meter Information	
First Bill Number to Use	15
Account Number	4001774810
Utility Code	E
Utility	Electricity (kWh, kW)
Number of Bills	33

Utility Company	PSE&G
Tariff Name	GLP

Utility Company: PSE&G — Tariff Name: GLP

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
PSEG Service	$4.72	kWh Summer Off Peak (kW	$0.0080000	Supply Generation (kW)	
Annual Demand (kW)	$3.9274	Societal Benefits (kWh)	$0.007644	Supply Transmission (kW)	
kWh Winter Peak (kWh)	$0.0080000	Securitization. (kWh)		Supply On Peak Energy(kW	$0.0884
kWh Winter Off Peak (kWl	$0.0080000	PSEG Summer kW (kW)	$8.0320	Supply Off Peak Energy(kW	$0.0884
kWh Summer Peak (kWh)	$0.0080000				

Utility Bill Data								Tariff Simulation														
Read Date	Total Cost	Consumption-kWh Period 1	Period 2	Period 4	Demand-kW Period 1	Period 2	Period 3	PSEG Service	On Peak kWh	Off Peak Kwh	Societal Benefits (kWh)	Securitization. (kWh)	Annual Demand (kW)	PSEG Summer kW (kW)				Supply On Peak Energy(kWh)	Supply Off Peak Energy(kWh)	Total Calc Cost	Error ($)	Error (%)
11/15/18	$104	863	0	0	4	0	0	5	7	0	7	0	16	0		0	0	76	0	$110	-6.43	-6%
12/17/18	$125	1,063	0	0	2	0	0	5	9	0	8	0	9	0		0	0	94	0	$124	1.25	1%
1/18/19	$127	1,071	0	0	2	0	0	5	9	0	8	0	8	0		0	0	95	0	$124	2.67	2%
2/19/19	$137	1,158	0	0	3	0	0	5	9	0	9	0	11	0		0	0	102	0	$136	0.66	0%
3/20/19	$112	948	0	0	2	0	0	5	8	0	7	0	8	0		0	0	84	0	$112	0.46	0%
4/18/19	$105	865	0	0	2	0	0	5	7	0	7	0	9	0		0	0	76	0	$103	1.47	1%
5/20/19	$108	863	0	0	2	0	0	5	7	0	7	0	7	0		0	0	76	0	$102	6.19	6%
6/19/19	$168	811	0	0	6	0	0	5	6	0	6	0	22	45		0	0	72	0	$156	12.17	7%
7/19/19	$109	749	0	0	2	0	0	5	6	0	6	0	7	14		0	0	66	0	$104	4.55	4%
8/19/19	$102	710	0	0	2	0	0	5	6	0	5	0	6	13		0	0	63	0	$98	4.10	4%
9/18/19	$155	723	0	0	5	0	0	5	6	0	6	0	21	43		0	0	64	0	$145	10.59	7%
10/17/19	$110	758	0	0	11	0	0	5	6	0	6	0	44	0		0	0	67	0	$128	-18.06	-16%

Lake Drive Pump Station – natural gas meter

Meter Information	
First Bill Number to Use	15
Account Number	7244470703
Utility Code	NG1
Utility	Natural Gas (Therm, Therm/hr)
Number of Bills	33

Utility Company	PSE&G
Tariff Name	GSG

Utility Company: PSE&G — Tariff Name: GSG

Tariff Charges

Description	Charge	Description	Charge	Description	Charge
Tier 1 (first 1000)	$0.2385	Monthly Service Charge	$15.46		
Tier 2	$0.2385	DE Supply	$0.5283		
Demand					
Balancing Charge	$0.1131				
Societal Benefits	$0.0470				

Utility Bill Data								Tariff Simulation														
Read Date	Total Cost	Consumption-Therm Period 1	Period 2	Period 3	Demand-Therm/hr Period 1	Period 2	Period 3	Service Charge	Tier 1	Tier 2	Demand	Month	Societal Benefits	Days	Avg Daily Use	Balancing Charge	DE Supply			Total Calc Cost	Error ($)	Error (%)
11/15/18	$14	1	0	0	0	0	0	15	0	0	0	1	0	29	0	0	1			16	-2	-13%
12/17/18	$17	2	0	0	0	0	0	15	1	0	0	1	0	32	0	0	1			17	0	-1%
1/18/19	$15	0	0	0	0	0	0	15	0	0	0	1	0	32	0	0	0			15	0	-2%
2/19/19	$18	3	0	0	0	0	0	15	1	0	0	1	0	32	0	0	2			18	0	1%
3/20/19	$16	1	0	0	0	0	0	15	0	0	0	1	0	29	0	0	1			16	0	0%
4/18/19	$16	1	0	0	0	0	0	15	0	0	0	0	0	29	0	0	1			16	0	0%
5/20/19	$17	2	0	0	0	0	0	15	1	0	0	0	0	32	0	0	1			17	0	0%
6/19/19	$17	2	0	0	0	0	0	15	1	0	0	2	0	30	0	0	1			17	0	0%
7/19/19	$17	2	0	0	0	0	0	15	1	0	0	2	0	30	0	0	1			17	0	-1%
8/19/19	$18	3	0	0	0	0	0	15	1	0	0	2	0	31	0	0	2			18	0	-1%
9/18/19	$16	1	0	0	0	0	0	15	0	0	0	2	0	30	0	0	1			16	0	0%
10/17/19	$17	1	0	0	0	0	0	15	0	0	0	0	0	29	0	0	1			16	0	1%

7.2 Local Government Energy Audit (LGEA)

Please see the following pages for a copy of the Local Government Energy Audit (LGEA).

Local Government Energy Audit:
Energy Audit Report

MUA Administration Office

Willingboro Municipal Utilities Authority

433 John F. Kennedy Way
Willingboro, NJ 08046

April 5, 2017

Draft 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 saving 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.

Table of Contents

Table of Figures

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for the MUA Administration Office.

The goal of an LGEA report is to provide you with information on how your facility uses energy, identify energy conservation measures (ECMs) that can reduce your energy use, and provide information and assistance to help tour facility implement ECMs. The LGEA report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing ECMs.

This study was conducted by TRC Energy Services, as part of a comprehensive effort to assist the MUA Administration Office with efforts to control energy costs and protect our environment by offering a wide range of energy management options and advice.

1.1 Facility Summary

The MUA Administration Office is a single story 3,600 square foot facility with typical office spaces.

Additional descriptions 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 six (6) ECMs which together represent an opportunity for the MUA Administration Office to reduce its annual energy costs by roughly $4,085 and its annual greenhouse gas emissions by about 29,484 lbs CO_2e. We estimate that the measures would likely pay for themselves in energy savings in about 3.9 years. The breakdown of existing and potential utility costs (before and after installation) is shown in Figure 1 and Figure 2, respectively. These projects represent an opportunity to reduce annual energy usage at the MUA Administration Office by about 30.2%.

Figure 1 – Previous 12 Month Utility Costs

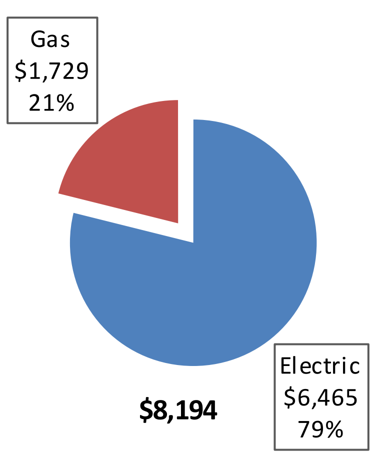
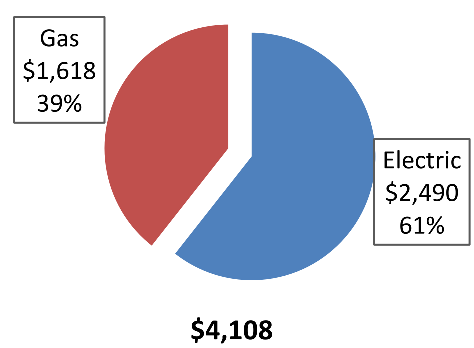


Figure 2 – Potential Post-Implementation Costs



A detailed description of the MUA Administration Office'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". Measures in the table below without an "ECM #" have been evaluated, but are not recommended for implementation.

Figure 3 – Summary of Energy Reduction Opportunities

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Natural Gas Savings (MMBtu)	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)
			12,621	3.3	0.0	0.0	$1,805.45	$9,773.71	$1,055.00	$8,718.71	4.83	12,709
ECM 1	Install LED Fixtures	Yes	4,261	1.2	0.0	0.0	$609.58	$3,696.62	$985.00	$2,711.62	4.45	4,291
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	5,301	1.5	0.0	0.0	$758.38	$5,332.62	$0.00	$5,332.62	7.03	5,338
ECM 3	Retrofit Fixtures with LED Lamps	Yes	2,115	0.6	0.0	0.0	$302.60	$314.25	$70.00	$244.25	0.81	2,130
ECM 4	Install LED Exit Signs	Yes	943	0.1	0.0	0.0	$134.89	$430.22	$0.00	$430.22	3.19	950
Lighting Control Measures			1,093	0.3	0.0	0.0	$156.37	$1,350.00	$175.00	$1,175.00	7.51	1,101
ECM 5	Install Occupancy Sensor Lighting Controls	Yes	1,093	0.3	0.0	0.0	$156.37	$1,350.00	$175.00	$1,175.00	7.51	1,101
Electric Unitary HVAC Measures			1,200	0.8	0.0	0.0	$171.67	$5,236.77	$322.00	$4,914.77	28.63	1,208
	Install High Efficiency Electric AC	No	1,200	0.8	0.0	0.0	$171.67	$5,236.77	$322.00	$4,914.77	28.63	1,208
HVAC System Improvements			12,870	0.0	12.9	12.9	$1,951.89	$989.61	$0.00	$989.61	0.51	14,466
ECM 6	Install Programmable Thermostats	Yes	12,870	0.0	12.9	12.9	$1,951.89	$989.61	$0.00	$989.61	0.51	14,466
TOTALS			27,784	4.5	12.9	12.9	$4,085.38	$17,350.09	$1,552.00	$15,798.09	3.87	29,484

* - 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.

Electric Unitary HVAC measures generally involve replacing old inefficient air conditioning systems with modern energy efficient systems. New air conditioning systems can provide cooling equivalent to older air condition systems, but use less energy. These measures save energy by reducing the power used by the air condition system due to improved electrical efficiency.

HVAC System Improvements generally involve the installation of automated controls to reduce heating and cooling demand when conditions allow. These measures could encompass changing temperature setpoints, using outside air for free cooling, or limiting excessive outside air during extreme outdoor air temperatures. These measures save energy by reducing the demand on the systems and the amount of time systems operate.

Energy Efficient Practices

TRC Energy Services also identified 12 low (or no) cost energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral and operational adjustments as well as performing routine maintenance on building systems. Through these practices equipment lifetime can be extended; occupant comfort, health and safety can be improved; and annual energy, operation, and maintenance costs can be reduced. Opportunities identified at the MUA Administration Office include:

- Reduce Air Leakage
- Close Doors and Windows
- Use Window Treatments/Coverings
- Perform Proper Lighting Maintenance
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Check for and Seal Duct Leakage
- Perform Proper Boiler Maintenance
- Perform Proper Water Heater Maintenance
- Replace Computer Monitors
- Water Conservation

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

Self-Generation Measures

TRC Energy Services evaluated the potential for installing self-generation sources for the MUA Administration Office. Based on the configuration of the site and its loads there is a low potential for installing any PV and 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)
- Energy Savings Improvement Program (ESIP)

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, as well as the other programs as mentioned below.

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 8.3 for additional information on the ESIP Program.

The Demand Response Energy Aggregator is a (non-NJCEP) program designed to reduce 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. 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. By enabling grid operators to call upon commercial facilities to reduce their 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 facilities receive payments whether or not they are called upon to curtail their load during times of peak demand. Refer to Section 7 for additional information on this program.

Additional descriptions of all relevant incentive programs are located in Section 8. You may also check the following website for further information on available rebates and incentives: 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 x105
TRC Energy Services			
Moussa Traore	Auditor	MTraore@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On August 2, 2016, TRC Energy Services performed an energy audit at the MUA Administration Office located in Willingboro, NJ. TRC Energy Services' team met with Victor DeMaise to review the facility operations and focus the investigation on specific energy-using systems.

Willingboro MUA Administration Office is a single story 3,600 square foot facility with typical office spaces.

The building was constructed in 1969 and an addition was built in 1994.

2.3 Building Occupancy

The building is open Monday through Friday year round. The typical schedule is presented in the table below. During a typical day, the facility is occupied by approximately seven staff.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Administration Office	Weekday	7:30 am - 7:00 pm
Administration Office	Weekend	unoccupied

2.4 Building Envelope

The building is a mix of wood frame and masonry construction with stucco or brick exterior. The windows are dual pane, metal framed and some are operable double-hung style. Some air infiltration was reported in the building and you can refer to Section 5, "Energy Efficient Practices" for more information.

2.5 On-site Generation

The MUA Administration Office does not have any on-site electric generation capacity.

2.6 Energy-Using Systems

Lighting System

Interior lighting at the facility is provided predominately by 32 Watt fluorescent T8 U-shaped lamps as well as compact fluorescent lamps (CFL). Most of the fixtures are 2'x2' T8 U-Bend fixtures with two lamps each. Lighting control is provided by manual switches.

Exterior lighting is provided by a mix of fixtures using metal halide or compact fluorescent lamps that are controlled with photocell and motion sensor controls.

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

Heating System

The hot water system consists of a Weil McLain 117,000 Btu/hour natural draft boiler. The boiler has a nominal combustion efficiency of 83.5%. The boiler is manually turned off during the cooling season. The boilers provide hot water to small air handlers that condition most of the building.

The boiler is reported to be in fair condition.

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

Air Conditioning (DX)

Cooling is provided by three split system direct expansion units that serve small air handlers. There is a 4 ton Rheem unit manufactured in 2011, a 3.5 ton Rheem unit manufactured in 2009, and a 3.5 ton York unit manufactured in 1994.

The units are controlled by individual thermostats and are manually turned off during the heating season.

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

Domestic Hot Water

Domestic hot water is provided by a 50 gallon A.O. Smith water heater.

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

2.7 Water-Using Systems

There are two restrooms and a break room with sinks at this facility. The faucets are rated at 2 gpm.

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 per square foot and energy usage per square foot. These metrics are an estimate of the relative energy efficiency of this building. There are a number of factors that could cause the energy use of this building to vary from the "typical" energy usage profile for facilities with similar characteristics. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and energy efficient behavior of occupants all contribute to benchmarking scores. Please refer to the Benchmarking section within Section 3.4 for additional information.

3.1 Total Cost of Energy

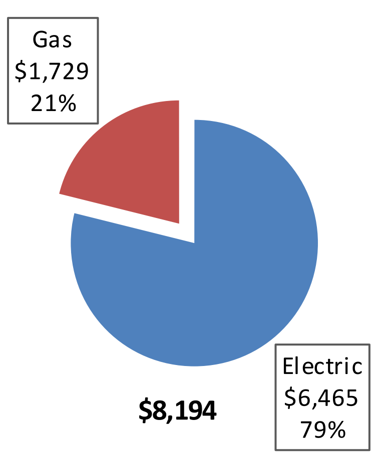
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 6 - Utility Summary

Utility Summary for Willingboro MUA Administration Office		
Fuel	Usage	Cost
Electricity	45,190 kWh	$6,465
Natural Gas	2,008 Therms	$1,729
Total		$8,194

The current utility cost for this site is $8,194 as shown in the chart below.

Figure 7 - Energy Cost Breakdown



3.2 Electricity Usage

The site purchases electricity from Consolidated Edison Solutions and electric delivery is provided by PSE&G. The average electric cost (combined for commodity, transmission and distribution) for the past 12 months is $0.143/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.

Figure 8 - Graph of 12 Months Electric Usage & Demand

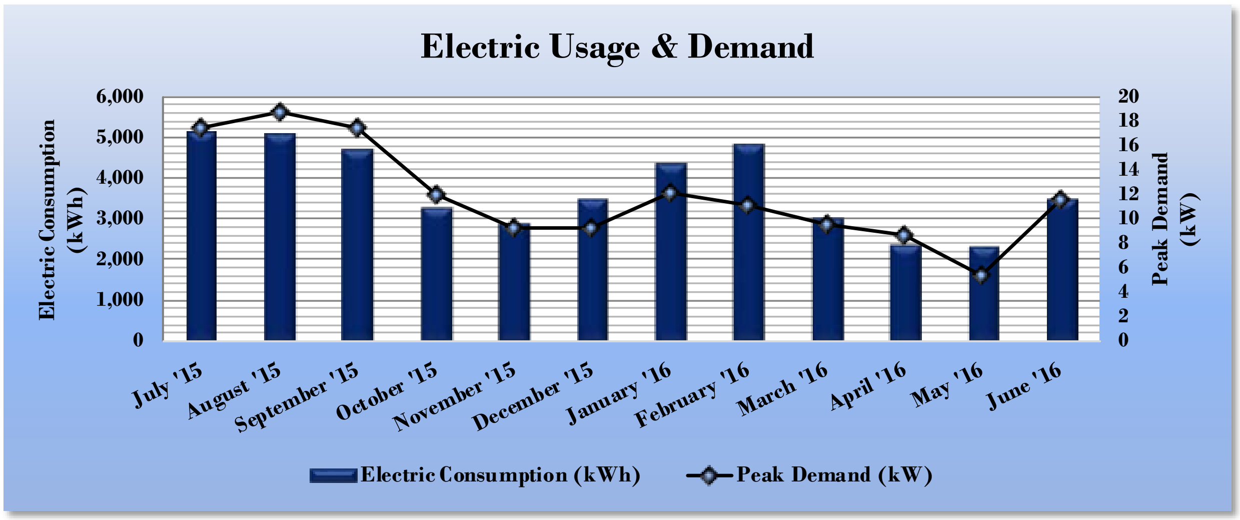


Figure 9 - Table of 12 Months Electric Usage & Demand

Electric Billing Data for Willingboro MUA Administration Office				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
7/23/15	30	5,150	17.5	$888
8/21/15	29	5,100	18.8	$883
9/21/15	31	4,720	17.5	$815
10/21/15	30	3,280	12.0	$445
11/19/15	29	2,920	9.3	$389
12/22/15	33	3,520	9.3	$443
1/22/16	31	4,380	12.1	$537
2/23/16	32	4,830	11.1	$571
3/23/16	29	3,040	9.6	$371
4/22/16	30	2,400	8.7	$299
5/23/16	31	2,340	5.4	$278
6/22/16	30	3,510	11.5	$547
Totals	365	45,190	18.8	$6,465
Annual	365	45,190	18.8	$6,465

3.3 Natural Gas Usage

Natural Gas is provided by PSE&G. The average gas cost for the past 12 months is $0.861/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 10 - Graph of 12 Months Natural Gas Usage

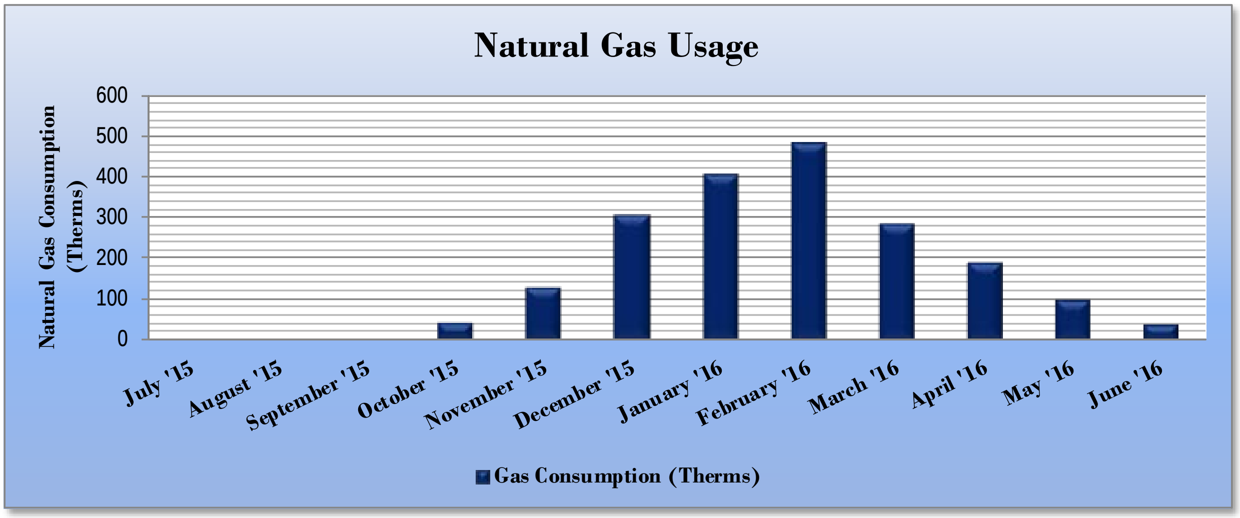


Figure 11 - Table of 12 Months Natural Gas Usage

Gas Billing Data for Willingboro MUA Administration Office			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
7/23/15	30	7	$17
8/21/15	29	5	$15
9/21/15	31	7	$17
10/21/15	30	44	$44
11/19/15	29	131	$116
12/22/15	33	308	$263
1/22/16	31	406	$348
2/23/16	32	484	$404
3/23/16	29	286	$233
4/22/16	30	189	$147
5/23/16	31	101	$85
6/22/16	30	39	$40
Totals	365	2,008	$1,729
Annual	365	2,008	$1,729

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 building's consumption data, cost information, and operational use details and compares its performance against a yearly baseline, national medians, or similar buildings 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 square foot, and it is the standard metric for comparing buildings' energy performance. Comparing the EUI of a building with the national median EUI for that building type illustrates whether that building uses more energy than similar buildings on a square foot basis or if that building 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 building 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 12 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Willingboro MUA Administration Office	National Median Building Type: Office
Source Energy Use Intensity (kBtu/ft^2)	193.1	148.1
Site Energy Use Intensity (kBtu/ft^2)	98.6	67.3

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

Figure 13 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Willingboro MUA Administration Office	National Median Building Type: Office
Source Energy Use Intensity (kBtu/ft^2)	110.2	148.1
Site Energy Use Intensity (kBtu/ft^2)	69.8	67.3

Many types of commercial buildings are also eligible to receive an ENERGY STAR™ score. This score is a percentile ranking from 1 to 100. It 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. Your building is not is one of the building categories that are eligible to receive a score. **ENERGY STAR™ Portfolio Manager only provides scores for office buildings over 5,000 SF. Therefore, a score is not available for this building.**

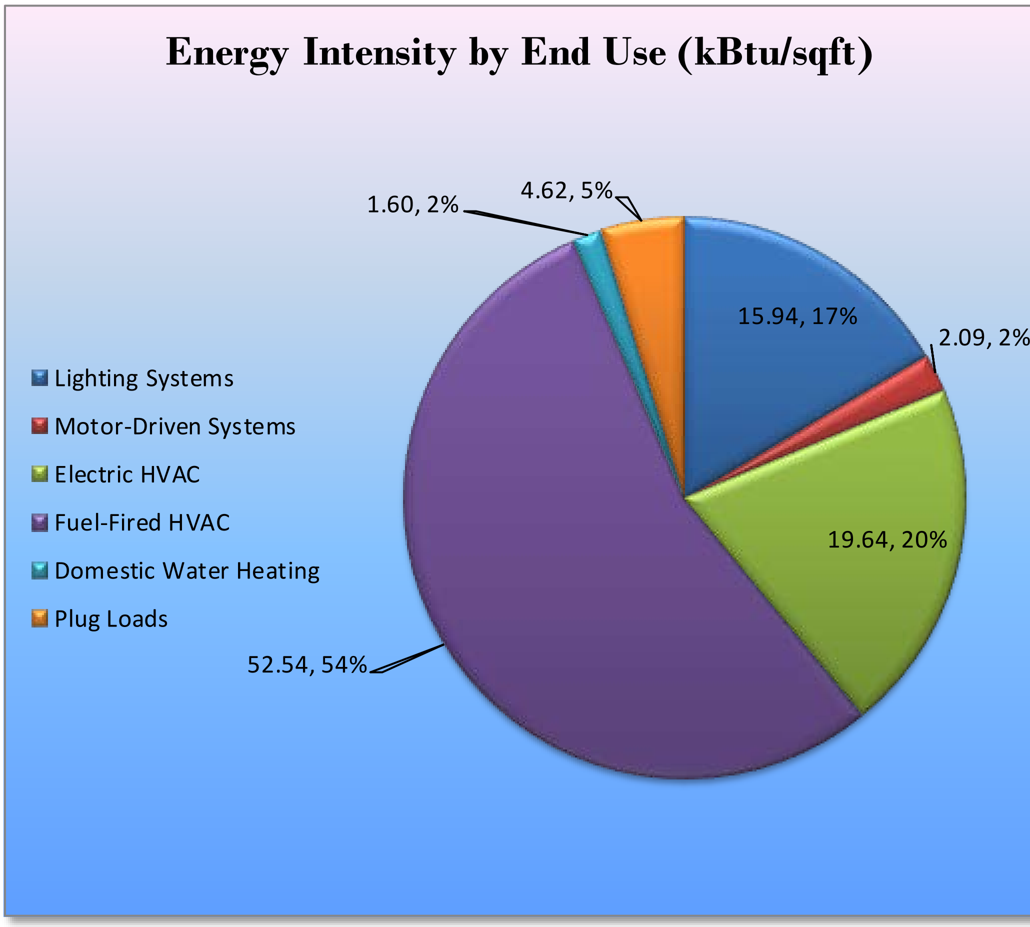
In place of Appendix B there is a document from Portfolio Manage titled "ENERGY STAR™ Data Trends in Offices" and will be helpful when trying to make comparisons to other offices.

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 building 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 found in a building and determine their proportional contribution to overall building energy usage. This visual representation of energy end uses highlights systems that may benefit most from energy efficiency projects.

Figure 14 - Energy Balance (% and kBtu/SF)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to Willingboro MUA regarding financial incentives for which they may qualify to implement the recommended measures at the Administration Office. 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 usually considered sufficient to demonstrate project cost-effectiveness and help prioritize energy measures. Savings are based on the New Jersey Clean Energy Program Protocols to Measure Resource Savings dated June 29, 2016, approved by the New Jersey Board of Public Utilities. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances. A higher level of investigation may be necessary to support any custom SmartStart or Pay for Performance, or Direct Install incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJCEP prescriptive SmartStart program. Some measures and proposed upgrade projects may be eligible for higher incentives than those shown below through other NJCEP programs as described in 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 15 – Summary of Recommended ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Natural Gas Savings (MMBtu)	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)
			12,621	3.3	0.0	0.0	$1,805.45	$9,773.71	$1,055.00	$8,718.71	4.83	12,709
ECM 1	Install LED Fixtures	Yes	4,261	1.2	0.0	0.0	$609.58	$3,696.62	$985.00	$2,711.62	4.45	4,291
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	5,301	1.5	0.0	0.0	$758.38	$5,332.62	$0.00	$5,332.62	7.03	5,338
ECM 3	Retrofit Fixtures with LED Lamps	Yes	2,115	0.6	0.0	0.0	$302.60	$314.25	$70.00	$244.25	0.81	2,130
ECM 4	Install LED Exit Signs	Yes	943	0.1	0.0	0.0	$134.89	$430.22	$0.00	$430.22	3.19	950
Lighting Control Measures			1,093	0.3	0.0	0.0	$156.37	$1,350.00	$175.00	$1,175.00	7.51	1,101
ECM 5	Install Occupancy Sensor Lighting Controls	Yes	1,093	0.3	0.0	0.0	$156.37	$1,350.00	$175.00	$1,175.00	7.51	1,101
Electric Unitary HVAC Measures			1,200	0.8	0.0	0.0	$171.67	$5,236.77	$322.00	$4,914.77	28.63	1,208
	Install High Efficiency Electric AC	No	1,200	0.8	0.0	0.0	$171.67	$5,236.77	$322.00	$4,914.77	28.63	1,208
HVAC System Improvements			12,870	0.0	12.9	12.9	$1,951.89	$989.61	$0.00	$989.61	0.51	14,466
ECM 6	Install Programmable Thermostats	Yes	12,870	0.0	12.9	12.9	$1,951.89	$989.61	$0.00	$989.61	0.51	14,466
TOTALS			27,784	4.5	12.9	12.9	$4,085.38	$17,350.09	$1,552.00	$15,798.09	3.87	29,484

* - 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).

4.1.1 Lighting Upgrades

Recommended upgrades to existing lighting fixtures are summarized in Figure 16 below.

Figure 16 – 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)
		12,621	**3.3**	**$1,805.45**	**$9,773.71**	**$1,055.00**	**$8,718.71**	**4.83**	**12,709**
ECM 1	Install LED Fixtures	4,261	1.2	$609.58	$3,696.62	$985.00	$2,711.62	4.45	4,291
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	5,301	1.5	$758.38	$5,332.62	$0.00	$5,332.62	7.03	5,338
ECM 3	Retrofit Fixtures with LED Lamps	2,115	0.6	$302.60	$314.25	$70.00	$244.25	0.81	2,130
ECM 4	Install LED Exit Signs	943	0.1	$134.89	$430.22	$0.00	$430.22	3.19	950

ECM 1: Install LED Fixtures

Measure Description

We recommend replacing existing fluorescent and HID exterior lighting fixtures with new high performance LED lighting fixtures. This measure saves energy by installing LED fixtures which use less than half as much power as other most other lighting technologies with a comparable light output.

Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice that of fluorescent tubes and more than 10 times longer than many incandescent lamps.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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.

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

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

ECM 3: Retrofit Fixtures with LED Lamps

Measure Description

We recommend replacing incandescent screw-in lamps with LED lamps. Screw-in or plug-in LED lamps can be used as a direct replacement for most types of screw-in or plug-in lamps. This measure saves energy by installing LED sources which use less power than other technologies with a comparable light output.

Maintenance savings are anticipated since LEDs have rated lifetimes which are more than 10 times that of an incandescent bulb.

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

ECM 4: Install LED Exit Signs

Measure Description

We recommend replacing incandescent and compact fluorescent lighting in 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.

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

Recommend lighting control measures are summarized in Figure 17 below.

Figure 17 – 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		1,121	0.3	0.0	$160.30	$1,350.00	$175.00	$1,175.00	7.33	1,128
ECM 4	Install Occupancy Sensor Lighting Controls	1,121	0.3	0.0	$160.30	$1,350.00	$175.00	$1,175.00	7.33	1,128

ECM 5: Install Occupancy Sensor Lighting Controls

Measure Description

We recommend installing occupancy sensors to control light fixtures that are currently manually controlled in conference rooms and offices. 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 HVAC System Improvements

Recommended HVAC system improvement measures are summarized in Figure 18 below.

Figure 18 - Summary of HVAC System Improvement 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)
HVAC System Improvements		12,870	0.0	12.9	$1,951.89	$989.61	$0.00	$989.61	0.51	14,466
ECM 5	Install Programmable Thermostats	12,870	0.0	12.9	$1,951.89	$989.61	$0.00	$989.61	0.51	14,466

ECM 6: Install Programmable Thermostats

Measure Description

We recommend replacing manual thermostats with programmable thermostats. Manual thermostats are generally adjusted to a single heating and cooling setpoint and left at that setting regardless of occupancy in the area served by the HVAC equipment. As a result, the same level of heating and cooling is provided regardless of the occupancy in the space. Programmable thermostats can be set to maintain different temperature settings for different times of day and days of the week. By setting the heating temperature setpoint down and the cooling temperature setpoint up, for times that the conditioned space is not occupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures during unoccupied periods.

The thermostat measure provides savings by reducing heating and cooling energy when a room is unoccupied.

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

4.2 ECMs Evaluated But Not Recommended

The measures below have been evaluated by the auditor but are not recommended for implementation at the facility. Reasons for exclusion can be found in the measure description section below.

Figure 19 – Summary of ECMs Evaluated but Not Recommended

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)
Electric Unitary HVAC Measures		1,200	0.8	0.0	$171.67	$5,236.77	$322.00	$4,914.77	28.63	1,208
	Install High Efficiency Electric AC	1,200	0.8	0.0	$171.67	$5,236.77	$322.00	$4,914.77	28.63	1,208
TOTALS		1,200	0.8	0.0	$171.67	$5,236.77	$322.00	$4,914.77	28.63	1,208

* - 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).

Install High Efficiency Electric AC

Measure Description

This measure evaluates replacing the York package air conditioner with a high efficiency package air conditioner. There have been significant improvements in both compressor and fan motor efficiencies in the past several years. Therefore, electricity savings can be achieved by replacing old units with new high efficiency units. A higher EER or SEER rating indicates a more efficient cooling system. The magnitude of energy savings for this measure depends on the relative efficiency of the old and new unit, the cooling load, and the annual operating hours.

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

Reasons for not Recommending

This measure is not recommended based on energy savings due to the long simple payback period (SPP=28.6 yrs). However, the unit is approaching the end of its useful life. When it is due for replacement, we recommend replacing it with a high efficiency unit.

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.

Reduce Air Leakage

Air leakage, or infiltration, occurs when outside air enters a building uncontrollably through cracks and openings. Properly sealing such cracks and openings can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment. This includes caulking or installing weather stripping around leaky doors and windows allowing for better control of indoor air quality through controlled ventilation.

Close Doors and Windows

Ensure doors and windows are closed in conditioned spaces. Leaving doors and windows open leads to a significant increase in heat transfer between conditioned spaces and the outside air. Reducing a facility's air changes per hour (ACH) can lead to increased occupant comfort as well as significant heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

Use Window Treatments/Coverings

A substantial amount of heat gain can occur through uncovered or untreated windows, especially older single pane windows and east or west-facing windows. Treatments such as high-reflectivity films or covering windows with shades or shutters can reduce solar heat gain and, consequently, cooling load and can reduce internal heat loss and the associated heating load.

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.

Practice Proper Use of Thermostat Schedules and Temperature Resets

Ensure thermostats are correctly set back. By employing proper set back temperatures and schedules, facility heating and cooling costs can be reduced dramatically during periods of low or no occupancy. As such, thermostats should be programmed for a setback of 5-10 °F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced further 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.

Clean Evaporator/Condenser Coils on AC Systems

Dirty evaporators and condensers coils cause a restriction to air flow and restrict heat transfer. This results in increased evaporator and condenser fan load and a decrease in cooling system performance. Keeping the coils clean allows the fans and cooling system to operate more efficiently.

Clean and/or Replace HVAC Filters

Air filters work to reduce the amount of indoor air pollution and increase occupant comfort. Over time, filters become less and less effective as particulate buildup increases. In addition to health concerns related to clogged filters, filters that have reached saturation also restrict air flow through the facility's air conditioning or heat pump system, increasing the load on the distribution fans and decreasing occupant comfort levels. Filters should be checked monthly and cleaned or replaced when appropriate.

Check for and Seal Duct Leakage

Duct leakage in commercial buildings typically accounts for 5 to 25 percent of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building, significantly increasing cooling and heating costs. By sealing sources of leakage, cooling, heating, and ventilation energy use can be reduced significantly, depending on the severity of air leakage.

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.

Perform Proper Water Heater Maintenance

At least once a year, 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. Once a year check for any leaks or heavy corrosion on the pipes and valves. For gas water heaters, check the draft hood and make sure it is placed properly, with a few inches of air space between the tank and where it connects to the vent. Look for any 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 any 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 over three to four years old have a technician inspect the sacrificial anode annually.

Replace Computer Monitors

Replacing old computer monitors or displays with efficient monitors will reduce energy use. ENERGY STAR® rated monitors have specific requirements for on mode power consumption as well as idle and sleep mode power. According to the ENERGY STAR® website monitors that have earned the ENERGY STAR® label are 25% more efficient than standard monitors.

Water Conservation

Installing low flow faucets or faucet aerators, low flow showerheads, and kitchen sink pre-rinse spray valves saves both energy and water. These devices save energy by reducing the overall amount of hot water used hence reducing the energy used to heat the water. The flow ratings for EPA WaterSense (http://www3.epa.gov/watersense/products) labeled devices are 1.5 gpm for bathroom faucets, 2.0 gpm for showerheads, and 1.28 gpm for pre-rinse spray valves.

Installing dual flush or low flow toilets and low flow or waterless urinals are additional ways to reduce the sites water use, however, these devices do not provide energy savings at the site level. Any reduction in water use does however ultimately reduce grid level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users. The EPA WaterSense ratings for urinals is 0.5 gallons per flush (gpf) and toilets that use as little as 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

6 On-Site Generation Measures

On-Site Generation measure options include both renewable (e.g., solar, wind) and non-renewable (e.g., fuel cells) 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.

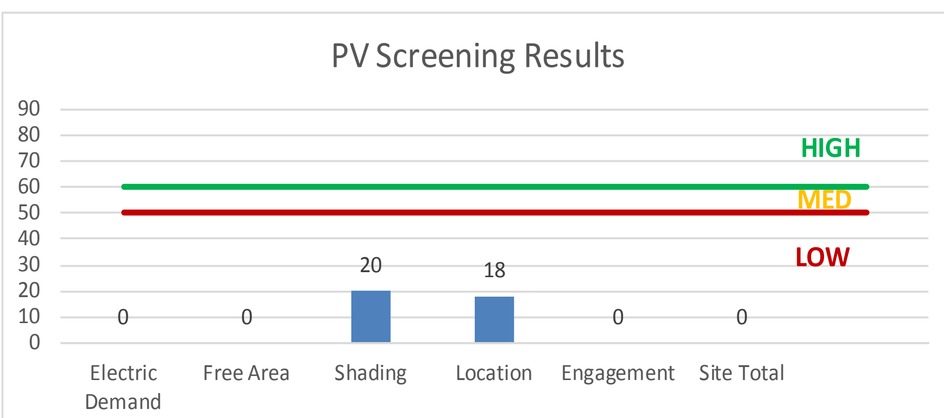
6.1 Photovoltaic

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.

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

In order to be cost-effective though, a solar PV array generally needs a minimum of 4,000 SF of flat or south-facing rooftop, or other unshaded space, on which to place the PV panels. In our opinion, the facility does not appear meet the minimum criteria necessary for a cost-effective PV installation.

Figure 20 - Photovoltaic Screening



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. Refer to Section 8.6 for additional information.

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 develop 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.

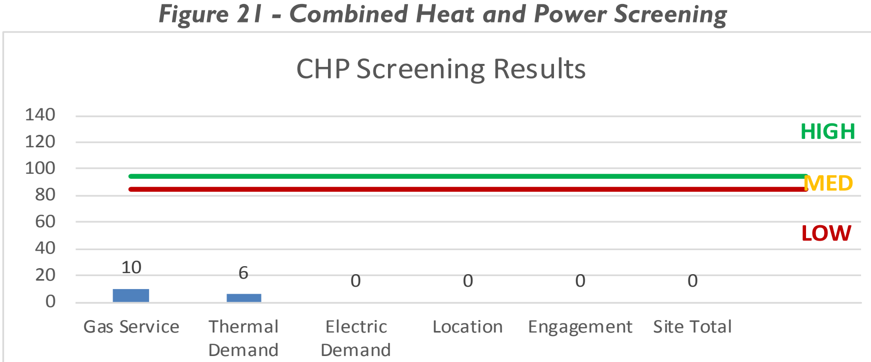
CHP systems are typically used to produce a portion of the electricity needed by a facility, with the balance of electric needs satisfied by purchase from the grid. The heat is used to supplement (or supplant) existing boilers for the purpose of space heating and/or domestic hot water heating. Waste 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 or infrequent thermal load, and lack of space near the existing thermal generation are the most significant factors 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/

Figure 21 - Combined Heat and Power Screening



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 22 for a list of the eligible programs identified for each recommended ECM.

Figure 22 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings
ECM 1	Install LED Fixtures	X		X	
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers			X	
ECM 3	Retrofit Fixtures with LED Lamps	X		X	
ECM 4	Install LED Exit Signs			X	
ECM 5	Install Occupancy Sensor Lighting Controls	X		X	
ECM 6	Install Programmable Thermostats			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 is comprised of New Construction and Retrofit components that offer incentives for installing prescriptive and custom energy efficiency measures at your facility. Routinely the program adds, removes or modifies incentives for various energy efficiency equipment based on national/market trends, new technologies or changes in efficiency baselines.

<u>Prescriptive Equipment Incentives Available</u>:

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

All customer sizes and types may be served by this program. This program provides an effective mechanism for securing incentives for individual projects that may be completed at once or over several years.

Incentives

The prescriptive path provides fixed incentives for specific energy efficiency measures whereas the custom measure path provides incentives for unique or specialized technologies that are not addressed through prescriptive offerings.

Since your facility is an existing building, only the Retrofit incentives have been applied in this report. Custom Measure incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings, capped at the lesser of 50% of the total installed incremental project cost, or a buy down to a one year payback. Program incentives 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 SmartStart program you will need to submit an application for the specific equipment 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.

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

8.2 Direct Install

Overview

Direct Install (DI) is a turnkey program available to existing small to mid-sized facilities with a peak electric demand that did not exceed 200 kW in any of the preceding 12 months. You will work directly with a pre-approved contractor who will perform a free energy assessment at your facility, identify specific eligible measures, and install those 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, up to $125,000 per project. Direct Install participants will also be held to a fiscal year cap of $250,000 per entity.

How to Participate

To participate in the DI program you will need to contact the participating contractor assigned to the county where your facility is located; a complete list is provided on the DI website identified below. The contractor will be paid the program incentive directly 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 program, subject to program caps mentioned above, and the remaining 30% of the cost is your responsibility to the contractor.

Since DI offers a free assessment, LGEA applicants that do not meet the audit program eligibility requirements, but do meet the DI requirements, may be moved directly into this program.

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

8.3 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.*

8.4 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
Hallway	4	U-Bend Fluorescent - T12: U T12 (34W) - 2L	Wall Switch	72	2,300	LED Retrofit	No	4	LED - Linear Tubes: (2) U-Lamp	Wall Switch	32	2,300	0.13	431	0.0	$61.59	$453.84	$0.00	7.37
Conf Room	18	LED Screw-In Lamps: recessed	Wall Switch	11	2,300	None	Yes	18	LED Screw-In Lamps: recessed	Occupancy Sensor	11	1,610	0.05	160	0.0	$22.87	$270.00	$35.00	10.28
Conf Room	4	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,300	None	Yes	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,610	0.02	55	0.0	$7.85	$0.00	$0.00	0.00
Office	6	U-Bend Fluorescent - T12: U T12 (34W) - 2L	Wall Switch	72	2,300	LED Retrofit	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	32	1,610	0.24	801	0.0	$114.57	$950.76	$35.00	7.99
Reception	9	U-Bend Fluorescent - T12: U T12 (34W) - 2L	Wall Switch	72	2,875	LED Retrofit	No	9	LED - Linear Tubes: (2) U-Lamp	Wall Switch	32	2,875	0.29	1,211	0.0	$173.23	$1,021.14	$0.00	5.89
Office	14	U-Bend Fluorescent - T12: U T12 (34W) - 2L	Wall Switch	72	2,300	LED Retrofit	Yes	14	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	32	1,610	0.55	1,869	0.0	$267.32	$1,858.44	$35.00	6.82
Womens RR	5	Incandescent: general	Wall Switch	100	2,300	LED Retrofit	No	5	LED Screw-In Lamps: screw in LED	Wall Switch	16	2,300	0.33	1,130	0.0	$161.69	$133.75	$50.00	0.52
Office	8	U-Bend Fluorescent - T12: U T12 (34W) - 2L	Wall Switch	72	2,300	LED Retrofit	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	32	1,610	0.32	1,068	0.0	$152.75	$1,177.68	$35.00	7.48
Exec Director	6	U-Bend Fluorescent - T12: U T12 (34W) - 2L	Wall Switch	72	2,300	LED Retrofit	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	32	1,610	0.24	801	0.0	$114.57	$950.76	$35.00	7.99
Restroom	2	Incandescent: general	Wall Switch	100	2,300	LED Retrofit	No	2	LED Screw-In Lamps: screw in LED	Wall Switch	16	2,300	0.13	452	0.0	$64.67	$53.50	$20.00	0.52
Exit Sign	4	Exit Signs: Incandescent	None	25	8,760	Fixture Replacement	No	4	LED Exit Signs: 2 W Lamp	None	2	8,760	0.07	943	0.0	$134.89	$430.22	$0.00	3.19
Exterior	7	Compact Fluorescent: recessed	Occupancy Sensor	32	2,190	LED Retrofit	No	7	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	2,190	0.08	269	0.0	$38.49	$402.57	$35.00	9.55
Exterior	8	Metal Halide: (1) 150W Lamp	Occupancy Sensor	190	2,190	Fixture Replacement	No	8	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Occupancy Sensor	40	2,190	0.95	3,075	0.0	$439.86	$2,670.32	$800.00	4.25
Exterior	4	Compact Fluorescent: Pole	Daylight Dimming	43	4,380	Relamp	No	4	LED Screw-In Lamps: 17W LED bulbs	Daylight Dimming	17	4,380	0.08	533	0.0	$76.24	$127.00	$0.00	1.67
Exterior	1	Metal Halide: (1) 50W Lamp	Occupancy Sensor	72	2,190	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Occupancy Sensor	14	2,190	0.05	149	0.0	$21.26	$277.54	$100.00	8.35
Exterior	1	Metal Halide: (1) 150W Lamp	Daylight Dimming	190	4,380	Fixture Replacement	No	1	LED - Fixtures: Outdoor Pole/Arm-Mounted Decorative Fixture	Daylight Dimming	40	4,380	0.12	769	0.0	$109.97	$346.19	$50.00	2.69

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
AHU Attic	Conference Room	3	Supply Fan	0.3	78.2%	No	3,120	No	78.2%	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
Outside	Conference Room	1	Split-System AC	4.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outside	Two Offices	1	Split-System AC	3.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outside	Older part of Building	1	Split-System AC	3.50		Yes	1	Split-System AC	3.50		14.00		No	0.80	1,200	0.0	$171.67	$5,236.77	$322.00	28.63
Break Room	Break Room	1	Electric Resistance Heat		20.48	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rest room	Rest room	1	Electric Resistance Heat		20.48	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
Mech Room	Building	1	Non-Condensing Hot Water Boiler	117.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Programmable Thermostat Recommendations

		Recommendation Inputs				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	Thermostat Quantity	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Building	Air Handlers	3	11.00		117.00	0.00	12,870	12.9	$1,951.89	$989.61	$0.00	0.51

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
Basement	Building	1	Storage Tank Water Heater (≤ 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Offices	5	Desktop computers	250.0	Yes
Offices	7	Computer printers	50.0	Yes
Break Room	1	Refrigerator	180.0	No

ENERGY STAR® Portfolio Manager®

DataTrends

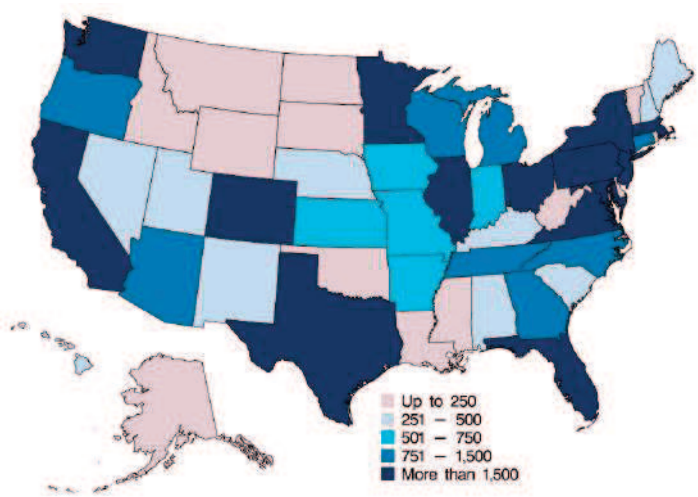
Energy Use in Offices

Offices Using Portfolio Manager

- 60,848 Properties
- 8.7 Billion ft²
- 63 Average ENERGY STAR Score

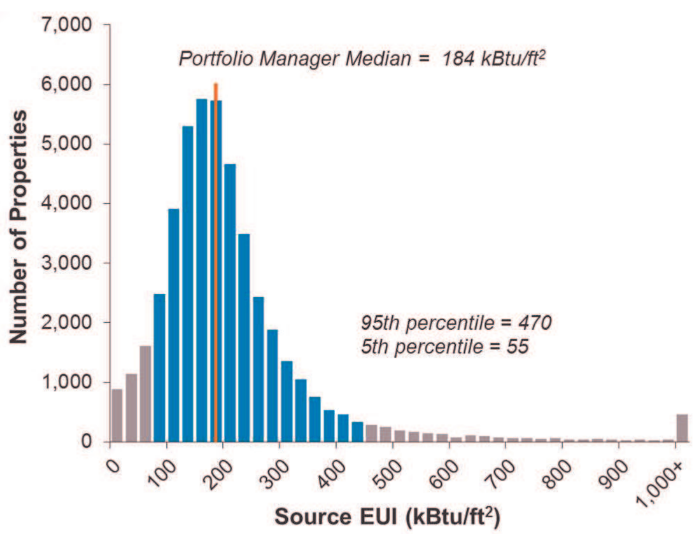
The U.S. Environmental Protection Agency's (EPA) ENERGY STAR Portfolio Manager is changing the way organizations track and manage energy. Because of this widespread market adoption, EPA has prepared the DataTrends series to examine benchmarking and trends in energy and water consumption in Portfolio Manager. To learn more, visit www.energystar.gov/DataTrends.

Benchmarking by State
Number of Offices



What is a typical operating profile?

Energy use intensity (EUI) ranges from less than 100 to more than 1,000 kBtu/ft² across all offices, with those at the 95th percentile using almost 9 times the energy of those at the 5th percentile. The distribution has a negative skew, which means the most energy intensive properties are further away from the median than the most efficient. Properties may use more or less energy for many reasons, including variable equipment efficiency and energy management practices, as well as variations in climate and business activities.



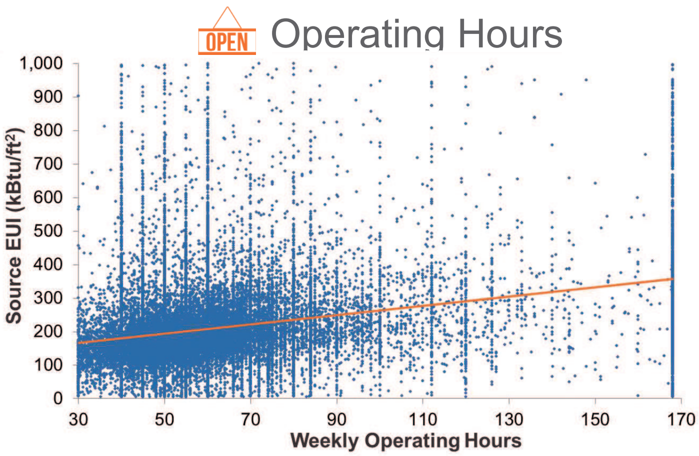
The median office in Portfolio Manager is about 63,000 square feet and operates 60 hours per week. But the typical property use patterns observed in Portfolio Manager vary just as much as energy. As you can see, there are offices of all shapes and sizes benchmarking in Portfolio Manager.

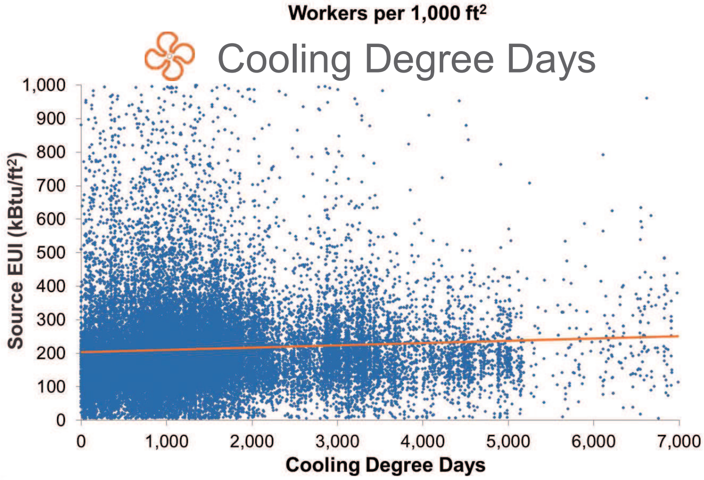
Property Characteristic	Range of Values: 5th percentile	Median	95th percentile
Square Feet	7,381	63,463	522,173
Operating Hours	40	60	105
Workers per 1,000 ft²	0.6	2.3	5.5
Computers per 1,000 ft²	0.6	2.3	6.5
Heating Degree Days	738	4,215	7,360
Cooling Degree Days	124	1,108	3,643

What is Source Energy? Source energy is the amount of raw fuel required to operate your property. In addition to what you use on site, source energy includes losses from generation, transmission, and distribution of energy. Source energy enables the most complete and equitable energy assessment. Learn more at: www.energystar.gov/SourceEnergy.

What characteristics affect energy use in offices?

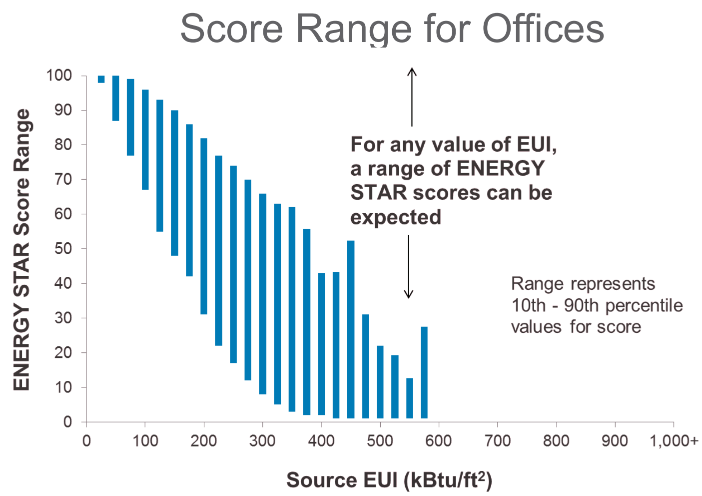
Business activity and climate are often correlated with energy consumption. For example, offices that are open longer hours, have more workers per square foot, and/or experience more cooling degree days (CDD) use more energy, on average. The orange trend lines in the graphs below are steeper for hours and workers, meaning that these characteristics have a stronger effect on energy than CDD. While these trends hold true on average, two properties with the same hours could have very different energy, as shown by the range in the blue dots. Similar trends can be seen for other indicators of business activity, such as number of computers.



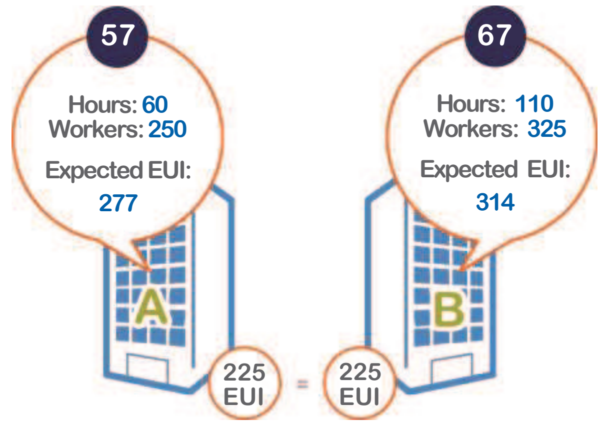


How does EPA's ENERGY STAR score vary with energy use?

EPA's ENERGY STAR score normalizes for the effects of operation. While properties with lower EUI generally earn higher scores on the 1-100 scale, an individual property's result depends on its business activities. For any given EUI, a range of scores is possible.



Let's look at two offices, Office A and Office B. They have the same EUI of 225 kBtu per square foot, and are identical except that Office B is open longer hours and has more workers per square foot. Because Office B has more intensive activities, it is expected to have a higher EUI than Office A, based on ENERGY STAR scoring models. Since Office B is *expected* to use more energy, but *actually* uses the same energy, it earns a higher score.



***Note:** Total number and floor area of properties benchmarked reflects cumulative data through 2013. Analysis of energy use and operational characteristics includes 46,306 properties benchmarked in the most recent 5 years. The data is self reported and has been filtered to exclude outliers, incomplete records, and test facilities. Portfolio Manager is not a randomly selected sample and is not the basis of the ENERGY STAR score. To learn more, visit: www.energystar.gov/DataTrends.*

Local Government Energy Audit:
Energy Audit Report

Water Treatment Plant

Willingboro Municipal Utilities Authority

Meribrook Circle
Willingboro, NJ 08046

April 5, 2017

Draft 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 saving 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.

Table of Contents

Table of Figures

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

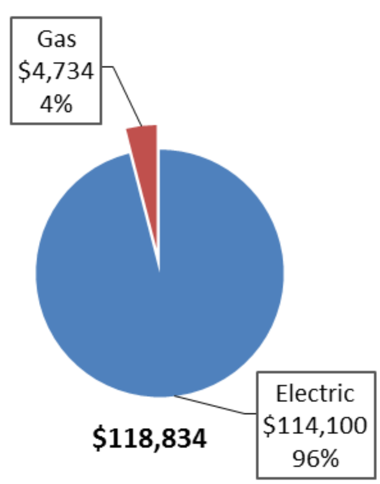
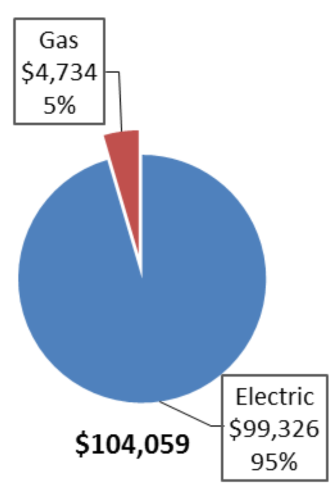


Figure 2 – Potential Post-Implementation Costs



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 8.3 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 x105
TRC Energy Services			
Moussa Traore	Auditor	MTraore@trcsolutions.com	(732) 855-0033

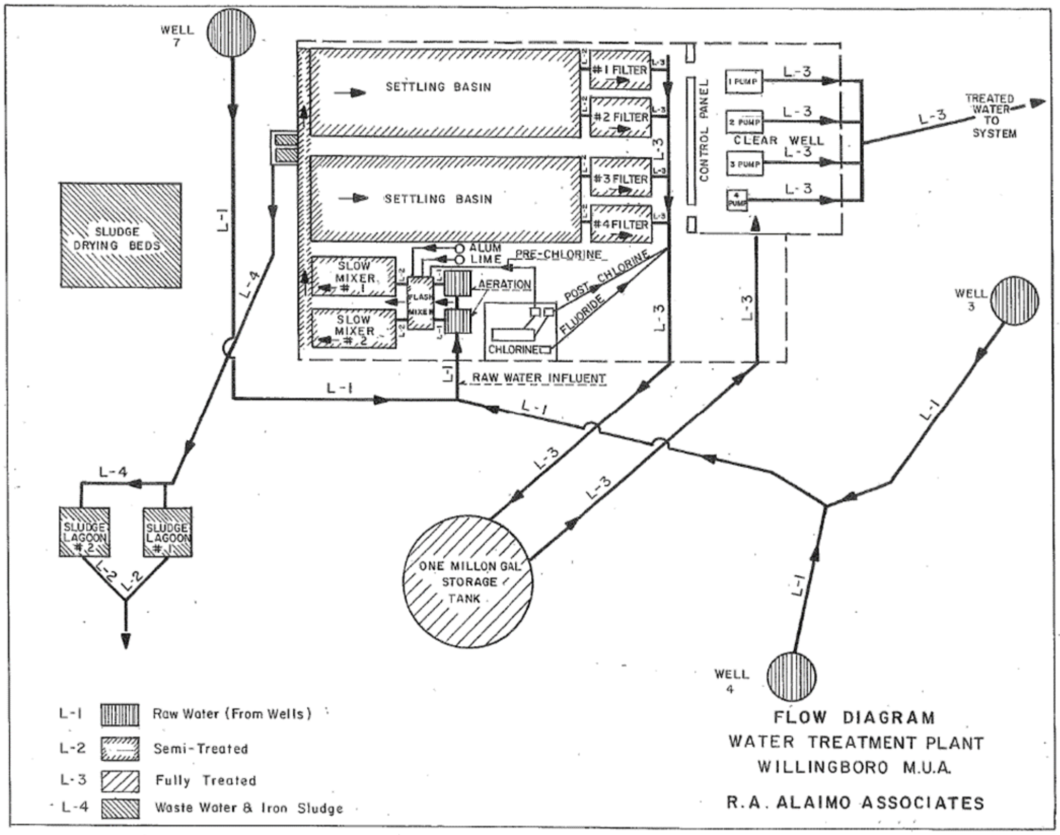
2.2 General Site Information

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 3.4 for additional information.

3.1 Total Cost of Energy

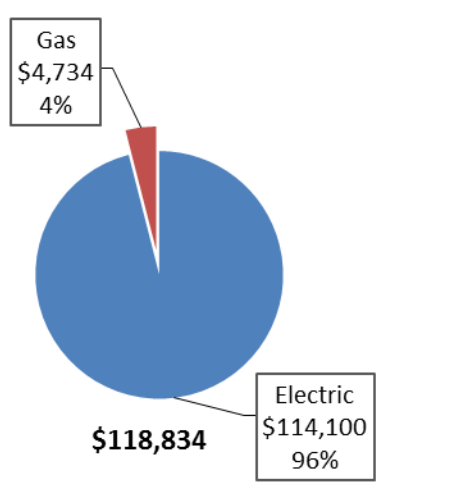
The following energy consumption and cost data is based on the last 12 month period of utility usage data that was provided for each utility. The annual consumption and cost was developed from this information.

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

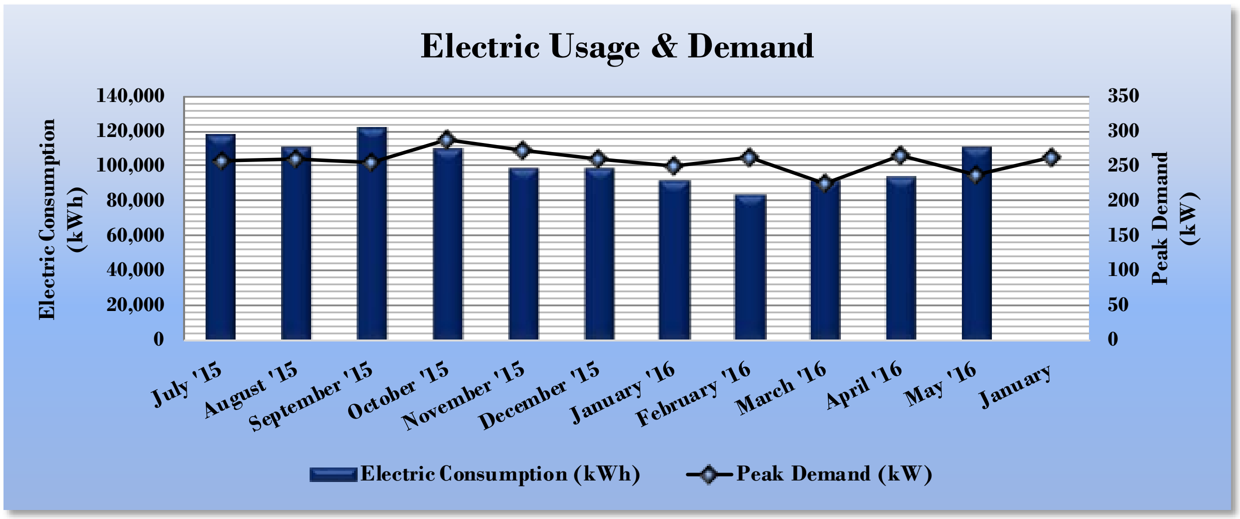


Figure 8 - Table of 12 Months Electric Usage & Demand

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

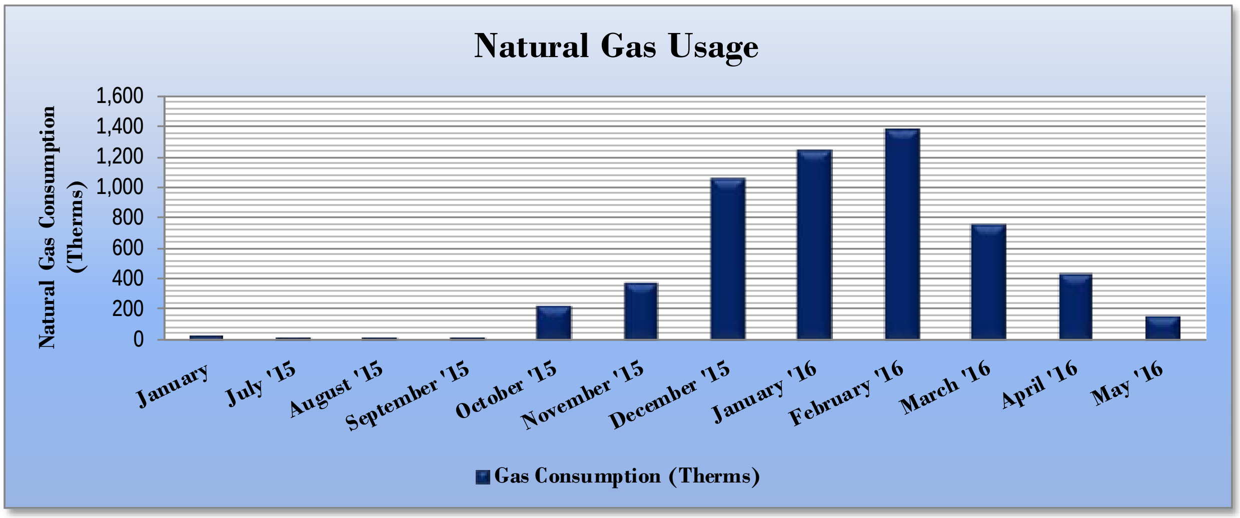


Figure 10 - Table of 12 Months Natural Gas Usage

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.

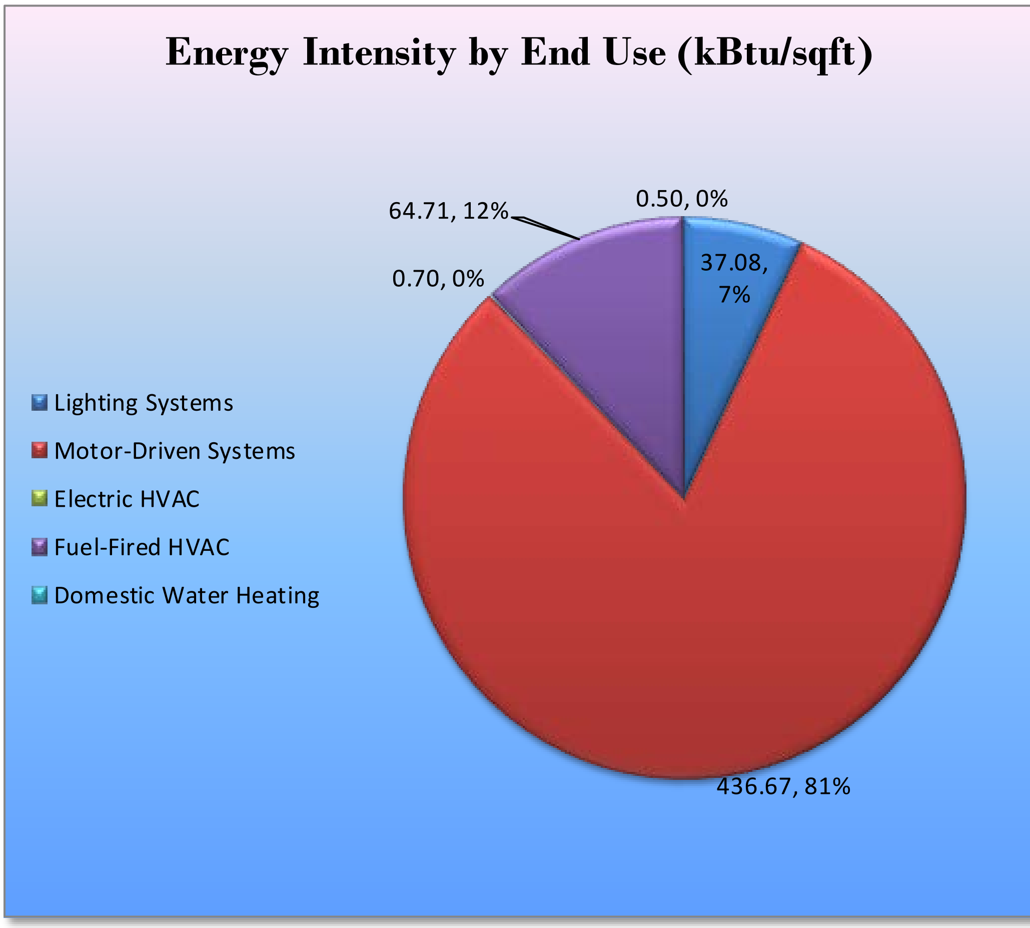
The Portfolio Manager, Statement of Energy Performance can be found in Appendix B: EPA Statement of Energy Performance.

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
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).

4.1.1 Lighting Upgrades

Recommended lighting upgrades are summarized in Figure 16 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
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	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	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	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 17 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 20 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)

Local Government Energy Audit:

Energy Audit Report

Pollution Control Plant

Willingboro Municipal Utilities Authority

Ironside Court
Willingboro, NJ 08046

April 5, 2017

Draft Report by:
TRC Energy Services

Disclaimer

The intent of this energy analysis report is to identify energy savings opportunities associated with recommended upgrades to the facility's systems at this site. Approximate saving are included in this report to make decisions about reducing energy use at the facility. This report, however, is not intended to serve as a detailed engineering design document. It should be noted that detailed design efforts are required in order to implement several of the improvements evaluated as part of this energy analysis.

The energy conservation measures and estimates of energy consumption contained in this report have been reviewed for technical accuracy. However, all estimates contained herein of energy consumption at the site are not guaranteed, because energy consumption ultimately depends on behavioral factors, the weather, and many other uncontrollable variables. The energy assessor and New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy consumption vary from the estimated consumption shown herein.

Estimated installation costs are based on a variety of sources, including our own experience at similar facilities, our own pricing research using local contractors and vendors, and cost estimating handbooks such as those provided by RS Means. The cost estimates represent our best judgment for the proposed action. The Owner 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 a particular installation, and for conditions which cannot be known prior to in-depth investigation and design, the energy assessor does not guarantee installed cost estimates and shall in no event be liable should actual installed costs vary from the estimated costs herein.

New Jersey's Clean Energy Program (NJCEP) incentive values provided in this report are estimates and are based on program information available at the time this report is written. The NJBPU reserves the right to extend, modify, or terminate programs without prior or further notice, including incentive levels and eligibility requirements. The Owner should review available program incentives and requirements prior to selecting and/or installing any recommended measures.

Table of Contents

Table of Figures

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for the Pollution Control 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 Water Pollution Control Plant is located at the end of Ironside Court and is comprised of the five buildings included in the table below. A thorough description of the facility and our observations are located in Section 2, "Facility Information and Existing Conditions".

Building Name	SF	Construction Year
Pump and Control	5,100	1958
Chemical	1,430	1992
Sludge Digester	2,100	1958
Filter	1,900	1958
Garage	3,050	1958
Total:	**13,580**	

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC Energy Services recommends six (6) measures which together represent an opportunity for the Pollution Control Plant to reduce annual energy costs by roughly $191,346 and annual greenhouse gas emissions by 1,569,482 lbs CO_2e. We estimate that the measures would pay for themselves in roughly 1.15 years. The breakdown of existing and potential utility costs is illustrated in Figure 1 and Figure 2, respectively. These projects represent an opportunity to reduce the Pollution Control Plant's annual energy use by 52.0%.

Figure 1 – Previous 12 Month Utility Costs

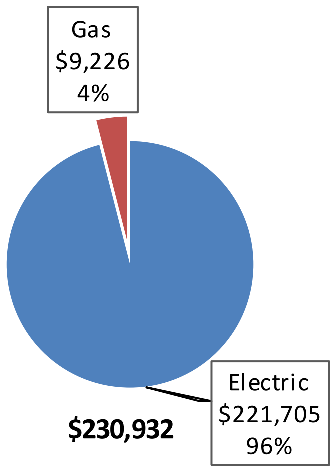
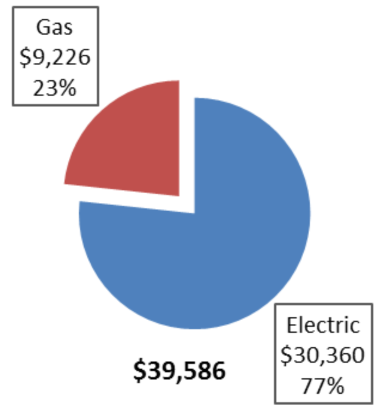


Figure 2 – Potential Post-Implementation Costs



A detailed description of the Pollution Control 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			128,327	17.4	$15,754.56	$19,003.77	$850.00	$18,153.77	1.15	129,224
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	25,740	3.2	$3,160.09	$5,018.64	$760.00	$4,258.64	1.35	25,920
ECM 2	Retrofit Fixtures with LED Lamps	Yes	101,637	14.1	$12,477.80	$12,264.25	$90.00	$12,174.25	0.98	102,347
ECM 3	Install LED Exit Signs	Yes	950	0.1	$116.67	$1,720.88	$0.00	$1,720.88	14.75	957
Lighting Control Measures			8,201	1.0	$1,006.85	$3,476.00	$530.00	$2,946.00	2.93	8,258
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	8,201	1.0	$1,006.85	$3,476.00	$530.00	$2,946.00	2.93	8,258
Motor Upgrades			42,442	9.9	$5,210.60	$88,287.88	$0.00	$88,287.88	16.94	42,739
ECM 5	Premium Efficiency Motors	Yes	42,442	9.9	$5,210.60	$88,287.88	$0.00	$88,287.88	16.94	42,739
Variable Frequency Drive (VFD) Measures			1,379,614	315.0	$169,373.64	$114,119.90	$0.00	$114,119.90	0.67	1,389,260
ECM 6	Install VFDs on WW Process Pumps	Yes	1,379,614	315.0	$169,373.64	$114,119.90	$0.00	$114,119.90	0.67	1,389,260
TOTALS			1,558,585	343.3	$191,345.65	$224,887.55	$1,380.00	$223,507.55	1.17	1,569,482

* - 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 (IHP 2014). 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.

Variable Frequency Drives measures generally involve controlling the speed of a motor to achieve a flow or temperature rather than using a valve, damper, or no means at all. These measures save energy by slowing a motor which is an extremely efficient method of control.

Energy Efficient Practices

TRC Energy Services also identified five (5) low (or no) cost energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral and operational adjustments as well as performing routine maintenance on building systems. Through these practices equipment lifetime can be extended; occupant comfort, health and safety can be improved; and annual energy, operation, and maintenance costs can be reduced. Opportunities identified at the Pollution Control Plant include:

- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Perform Routine Motor Maintenance
- Clean Evaporator/Condenser Coils on AC Systems
- Perform Maintenance on Compressed Air Systems

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

On-Site Generation Measures

TRC Energy Services evaluated the potential for installing self-generation sources for the Pollution Control Plant. Based on the configuration of the site and its loads, there is a low potential for installing any PV and combined heat and power self-generation measures beyond what WMUA has already implemented.

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)
- Pay for Performance – Existing Buildings

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 8.3 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 x105
TRC Energy Services			
Moussa Traore	Auditor	MTraore@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On August 2, 2016, TRC Energy Services performed an energy audit of the Pollution Control Plant located in Willingboro, NJ. TRC Energy Services' team met with Victor DeMaise to review the facility operations and focus the investigation on specific energy-using systems.

The Water Pollution Control Plant is located at the end of Ironside Court. The following five buildings make up the Water Pollution Control Plant.

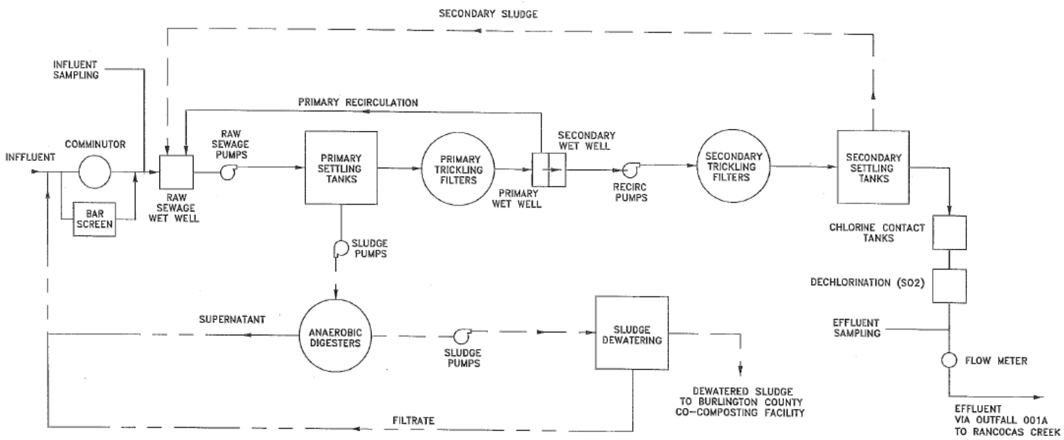
Building Name	**SF**	**Construction Year**
Pump and Control	5,100	1958
Chemical	1,430	1992
Sludge Digester	2,100	1958
Filter	1,900	1958
Garage	3,050	1958
Total:	**13,580**	

The Pump and Control building houses pumping and control equipment, offices and laboratory space. The Chemical Building contains chemical storage tanks, pumping equipment, sampling equipment and controls. The Sludge Digester building houses sludge pumping equipment and a natural gas/digester gas boiler. There is a filter press and pumping equipment controls in the Filter Building. The Garage is used for vehicle parking, vehicle maintenance and includes a lunchroom and locker/shower room.

This is a two-stage trickling filter plant with a design treatment capacity of 5.22 million gallons per day (MGD) and a typical processing rate of 3.2 MGD. The plant consists of:

- Headworks which include the raw sewage pumps
- Four primary settling tanks – 230,000 gallons each
- Two primary trickling filters – 450,000 gallons each
- Recirculation pumps
- Two secondary trickling filters – 450,000 gallons each
- Four secondary settling tanks – 200,000 gallons each

- Chlorine disinfection
- Anaerobic digesters
- Sludge dewatering



2.3 Building Occupancy

The plant operates two shifts per day, every day, with thirteen employees that move between these buildings as required. The typical building occupancy schedules are presented in the table below.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Pump and Control	Weekday	7:00 am - 11:00 pm
Pump and Control	Weekend	7:00 am - 11:00 pm
Chemical	Weekday	available 7 am - 11 pm
Chemical	Weekend	available 7 am - 11 pm
Sludge Digester	Weekday	available 7 am - 11 pm
Sludge Digester	Weekend	available 7 am - 11 pm
Filter	Weekday	available 7 am - 11 pm
Filter	Weekend	available 7 am - 11 pm
Garage	Weekday	available 7 am - 11 pm
Garage	Weekend	available 7 am - 11 pm

2.4 Building Envelope

All of the buildings are constructed of concrete masonry block (CMU) with a brick veneer.

2.5 On-site Generation

The site installed 3,398 solar panel modules rated for 230 watts per module (781 kW dc) near the end of 2010. A 65 kW microturbine was installed in 2010 at the Sludge Digester building. The microturbine was installed to utilize methane gas produced from the anaerobic digesters to generate electricity and to produce waste heat to supplement the heating requirements of the digesters. The microturbine has been shut down since 2013.

In January 2016 Richard A. Alaimo Associates provided an evaluation of lost revenue from under performance of the solar system at the Water Pollution Control 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 $78,300 to $156,800.

The table below summarizes the Water Treatment plant monthly solar array output. The 2012 through 2014 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 has remained reasonably consistent over time. The annual production for 2016 is 97% of the 2012 production and effectively the same as the 2013 production. The variation in annual solar array output appears to be within the expected range due to variations in climate conditions. Since the array performance is comparable to when it was installed, it does not appear to have significant performance degradation at this time.

Month	2012 kWh	2013 kWh	2014 kWh	2015 kWh	2016 kWh
January	54,292	45,696	29,089	38,349	52,417
February	68,953	52,028	40,228	56,625	52,607
March	93,999	82,205	79,293	72,683	82,613
April	113,155	114,100	110,536	92,443	104,898
May	100,775	113,779	102,474	100,287	81,754
June	117,826	91,048	116,518	88,123	111,977
July	111,577	104,590	103,658	91,428	79,592
August	72,877	84,152	44,730	85,040	88,926
September	49,002	56,834	58,620	56,273	51,277
October	39,151	55,580	52,974	66,036	72,813
November	45,244	46,619	51,120	44,738	59,030
December	34,217	27,174	23,151	30,431	37,432
Total	901,068	873,805	812,391	822,456	875,336

2.6 Energy-Using Systems

Lighting System

Interior lighting is provided primarily by fixtures using fluorescent or high intensity discharge (HID) lamps. Most of the fixtures in the facility use one to three 4 foot fluorescent lamps and are a mix of T8 and T12 lamps. The HID fixtures typically use 175 W metal halide lamps. Light fixtures are controlled by manual switches.

Exterior lighting is provided by a mix of fixtures using metal halide lamps. The exterior light fixtures have photocell controls.

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

Heating, Ventilating, and Air Conditioning

Space heating and air conditioning is provided by distributed stand-alone equipment. The Garage, Filter, Pump and Control, and Digester buildings are heated by natural gas fired unit heaters. The Garage also has a furnace to heat the lunch room and locker room. The Chemical building is heated with electric resistance unit heaters. The Pump and Control building also has a four (4) ton rooftop package unit and three (3) through the wall heat pumps that provide heating and cooling.

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

Domestic Hot Water

There are two large tank water heaters. The Chemical building has a 119 gallon electric water heater and the Garage has a 50 gallon natural gas fired water heater.

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

Process Systems

Process pumps that are used to move raw sewage and treated wastewater account for the majority of the power associated with process systems at this facility. There are two (2) 150 HP raw sewage pumps in the Pump and Control building that pump sewage to the primary settling tanks. There are two (2) 200 HP recirculation pumps in the Pump and Control building that move waste water from the primary trickling filters to the secondary trickling filters. Both sets of pumps are constant speed. These two sets of pumps account for over three-quarters of the process equipment electric load.

The sludge heating boiler in the Digester building accounts for most of the connected gas load at the facility. However, since the boiler runs off both gas produced by the digesters and purchased natural gas it accounts for a relatively low percentage of the purchased gas. Over 90% of the fuel used by the boiler is supplied by the digesters.

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 3.4 for additional information.

3.1 Total Cost of Energy

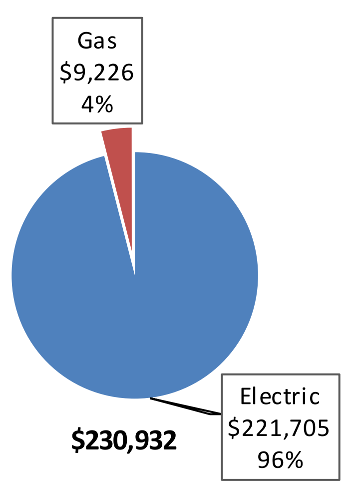
The following energy consumption and cost data is based on the last 12 month period of utility usage data that was provided for each utility. The annual consumption and cost was developed from this information.

Figure 6 - Utility Summary

Utility Summary for Pollution Control Plant		
Fuel	Usage	Cost
Electricity	2,666,088 kWh	$221,705
Natural Gas	11,380 Therms	$9,226
Total		$230,932

The current utility cost for this site is $230,932 as shown in the chart below.

Figure 7 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G and generated on-site with 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 third of the total electricity use is generated on-site.

Figure 8 - Graph of 12 Months Electric Usage & Demand

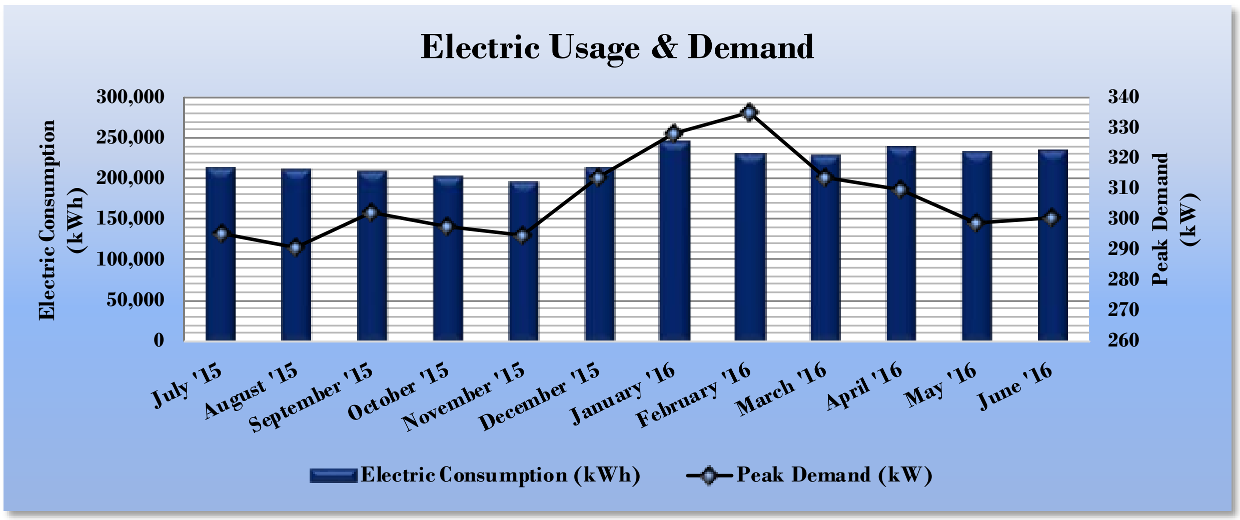


Figure 9 - Table of 12 Months Electric Usage & Demand

Electric Billing Data for Pollution Control Plant				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
7/23/15	30	215,059	295.5	$18,106
8/21/15	29	211,667	290.9	$18,164
9/21/15	31	208,861	301.9	$21,443
10/21/15	30	202,504	297.3	$16,749
11/19/15	29	197,929	294.5	$18,836
12/22/15	33	213,572	313.5	$21,379
1/22/16	31	246,889	328.3	$22,082
2/23/16	32	230,810	334.9	$19,945
3/23/16	29	228,906	313.9	$16,409
4/22/16	30	239,783	309.4	$15,037
5/23/16	31	233,462	298.5	$16,929
6/22/16	30	236,646	300.7	$16,627
Totals	365	2,666,088	334.9	$221,705
Annual	365	2,666,088	334.9	$221,705

3.3 Natural Gas Usage

Natural Gas is provided by PSE&G. The average gas cost for the past 12 months is $0.811/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is represented graphically in the chart below. Most of the gas used on-site is produced by the digesters and used in the sludge heating boiler.

Figure 10 - Graph of 12 Months Natural Gas Usage

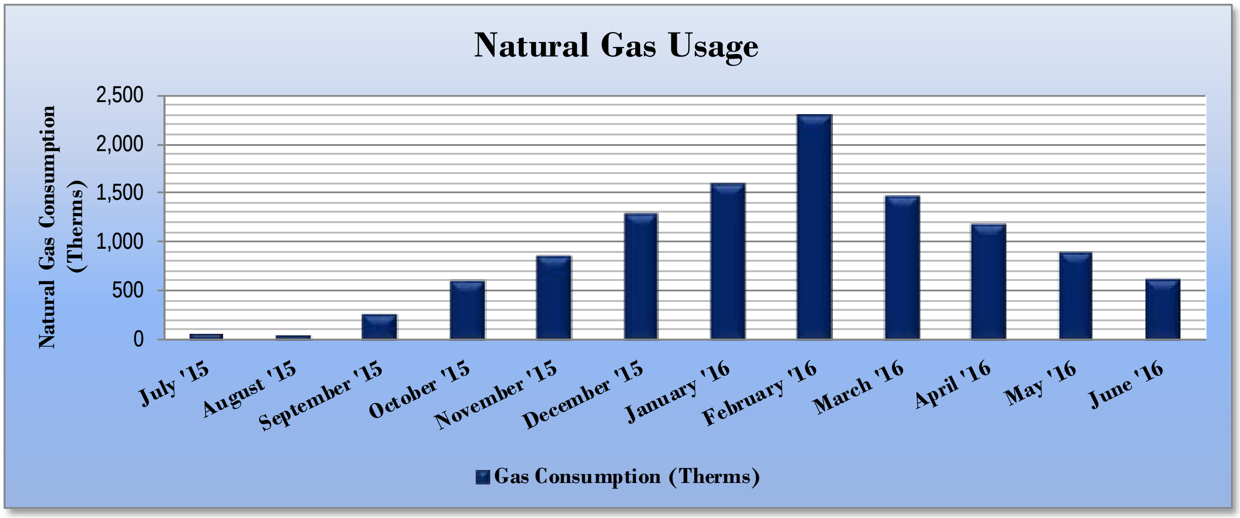


Figure 11 - Table of 12 Months Natural Gas Usage

Gas Billing Data for Pollution Control Plant			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
7/23/15	30	73	156
8/21/15	29	66	153
9/21/15	31	283	276
10/21/15	30	625	454
11/19/15	29	874	848
12/22/15	33	1,307	1,141
1/22/16	31	1,610	1,351
2/23/16	32	2,307	1,820
3/23/16	29	1,488	1,195
4/22/16	30	1,200	761
5/23/16	31	910	623
6/22/16	30	637	447
Totals	365	11,380	$9,226
Annual	365	11,380	$9,226

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 wastewater 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 12 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Pollution Control Plant	National Median Wastewater Treatment
Source Energy Use Intensity (kBtu/gal-day)	8.53	8.52
Site Energy Use Intensity (kBtu/gal-day)	2.94	2.89

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

Figure 13 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Pollution Control Plant	National Median Wastewater Treatment
Source Energy Use Intensity (kBtu/gal-day)	3.75	8.52
Site Energy Use Intensity (kBtu/gal-day)	1.41	2.89

Many buildings can also receive a 1 – 100 ENERGY STAR® score. This score compares your facility's energy performance to similar facilities nationwide. A score of 50 represents median energy performance, while a score of 75 means your facility performs better than 75 percent of all similar facilities nationwide — and may be eligible for ENERGY STAR® certification. **This facility has a current score of 45.**

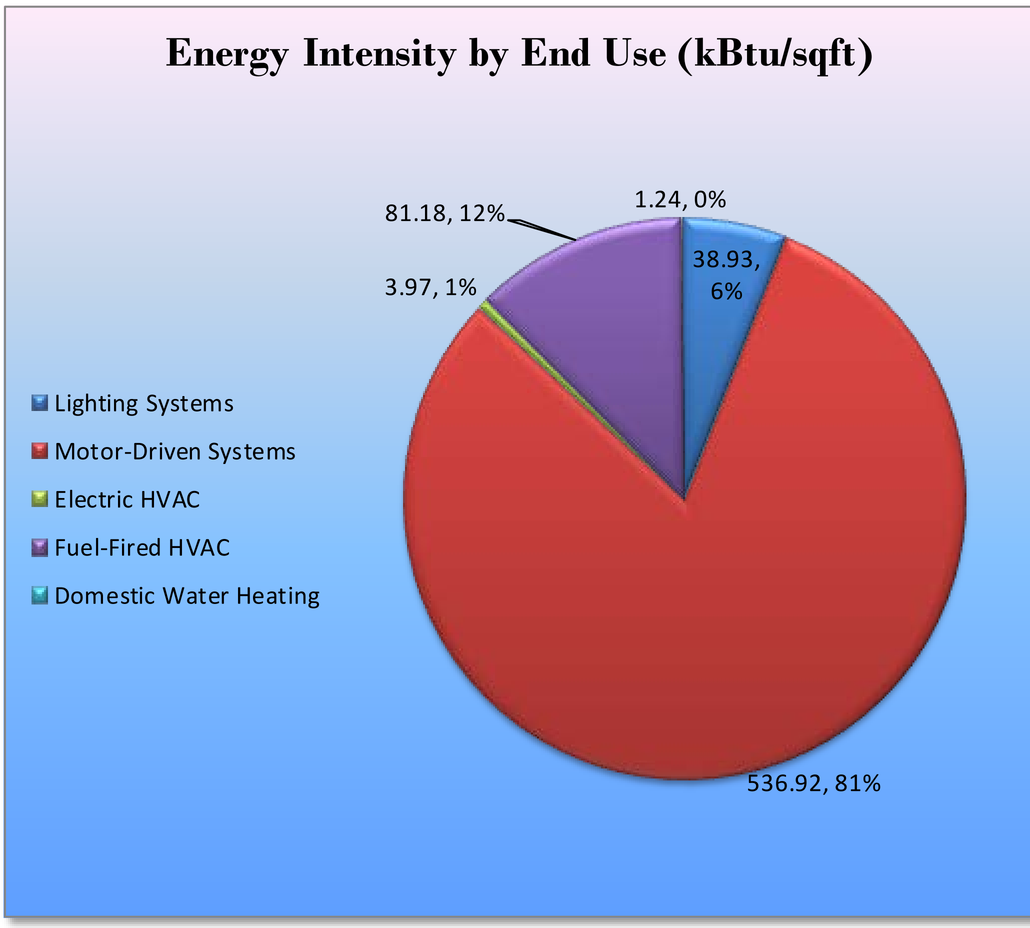
The Portfolio Manager, Statement of Energy Performance can be found in Appendix B: EPA Statement of Energy Performance.

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 found at the facility 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 14 - Energy Balance (% and kBtu/SF)



4 Energy Conservation Measures

4.1 Level of Analysis

The goal of this audit report is to identify potential energy projects, help prioritize specific measures for implementation, and set Pollution Control 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.

4.2 Recommended ECMs

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

Figure 15 – 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			128,327	17.4	$15,754.56	$19,003.77	$850.00	$18,153.77	1.15	129,224
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	25,740	3.2	$3,160.09	$5,018.64	$760.00	$4,258.64	1.35	25,920
ECM 2	Retrofit Fixtures with LED Lamps	Yes	101,637	14.1	$12,477.80	$12,264.25	$90.00	$12,174.25	0.98	102,347
ECM 3	Install LED Exit Signs	Yes	950	0.1	$116.67	$1,720.88	$0.00	$1,720.88	14.75	957
Lighting Control Measures			8,201	1.0	$1,006.85	$3,476.00	$530.00	$2,946.00	2.93	8,258
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	8,201	1.0	$1,006.85	$3,476.00	$530.00	$2,946.00	2.93	8,258
Motor Upgrades			42,442	9.9	$5,210.60	$88,287.88	$0.00	$88,287.88	16.94	42,739
ECM 5	Premium Efficiency Motors	Yes	42,442	9.9	$5,210.60	$88,287.88	$0.00	$88,287.88	16.94	42,739
Variable Frequency Drive (VFD) Measures			1,379,614	315.0	$169,373.64	$114,119.90	$0.00	$114,119.90	0.67	1,389,260
ECM 6	Install VFDs on WW Process Pumps	Yes	1,379,614	315.0	$169,373.64	$114,119.90	$0.00	$114,119.90	0.67	1,389,260
TOTALS			1,558,585	343.3	$191,345.65	$224,887.55	$1,380.00	$223,507.55	1.17	1,569,482

* - 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).

4.2.1 Lighting Upgrades

Recommended lighting upgrades are summarized in Figure 16 below.

Figure 16 – Summary of Lighting Upgrade 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			128,327	17.4	$15,754.56	$19,003.77	$850.00	$18,153.77	1.15	129,224
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	25,740	3.2	$3,160.09	$5,018.64	$760.00	$4,258.64	1.35	25,920
ECM 2	Retrofit Fixtures with LED Lamps	Yes	101,637	14.1	$12,477.80	$12,264.25	$90.00	$12,174.25	0.98	102,347
ECM 3	Install LED Exit Signs	Yes	950	0.1	$116.67	$1,720.88	$0.00	$1,720.88	14.75	957

ECM 1: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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 LED sources 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 rater lifetimes which are more than twice that of a fluorescent source. Maintenance savings may be partially offset by the higher material costs associated with LED sources.

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	62,660	7.7	0.0	$7,692.70	$7,098.25	$90.00	$7,008.25	0.91	63,098
Exterior	38,977	6.4	0.0	$4,785.10	$5,166.00	$0.00	$5,166.00	1.08	39,249

Measure Description

We recommend replacing incandescent, compact fluorescent and high intensity discharge (HID) screw-in based 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 LED sources 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

Measure Description

We recommend replacing existing lighting in 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.

4.2.2 Lighting Control Measures

Recommended lighting control measures are summarized in Figure 17 below.

Figure 17 – 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		8,201	1.0	0.0	$1,006.85	$3,476.00	$530.00	$2,946.00	2.93	8,258
ECM 4	Install Occupancy Sensor Lighting Controls	8,201	1.0	0.0	$1,006.85	$3,476.00	$530.00	$2,946.00	2.93	8,258

ECM 4: Install Occupancy Sensor Lighting Controls

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.

Maintenance savings are anticipated due to reduced lamp operation, however, additional maintenance costs may be incurred because the occupancy sensors may require periodic adjustment; it is anticipated that the net effect on maintenance costs will be negligible.

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

4.2.3 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)
42,442	9.9	0.0	$5,210.60	$88,287.88	$0.00	$88,287.88	16.94	42,739

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.

4.2.4 Variable Frequency Drive Measures

Recommended variable frequency drive (VFD) measures are summarized in Figure 18 below.

Figure 18 – Summary of Variable Frequency Drive 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)
Variable Frequency Drive (VFD) Measures		1,379,614	315.0	0.0	$169,373.64	$114,119.90	$0.00	$114,119.90	0.67	1,389,260
ECM 6	Install VFDs on WW Process Pumps	1,379,614	315.0	0.0	$169,373.64	$114,119.90	$0.00	$114,119.90	0.67	1,389,260

ECM 6: Install VFDs on Process Pumps

Measure Description

We recommend installing a variable frequency drives (VFDs) to control the 150 HP raw sewage and 200 HP recirculation pumps.

The raw sewage pumps are rated at 9,000 gpm. The typical plant operation is 3.2 MGD which is the equivalent of 2,200 gpm. This means that the pumps could typically operate at significantly reduced speed. Implementing this measure will require determining the minimum flow requirements of other systems at the plant and the minimum flow required to maintain effluent quality. Modifications would also need to be made to the current flow control system which uses a recirculation butterfly valve. An automated system to track the plant flow could be used or plant operators could adjust the VFD speed to track the plant flow. All of these decisions would need to be made during the design process.

Energy savings result from reducing the pump motor speed (and power) to more closely match the process flow through the plant. The savings calculations for this measure assume that the pumps operate at 50% speed continuously. The final savings will depend on how the pumps are actually operated. The pumps were also included in the energy efficient motor measure assuming that new inverter rated motors would be required when VFDs are installed. Only the least efficient raw sewage pump motor is a good candidate for an energy efficiency motor retrofit if the VFD measure is not implemented.

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.

Clean Evaporator/Condenser Coils on AC Systems

Dirty evaporators and condensers coils cause a restriction to air flow and restrict heat transfer. This results in increased evaporator and condenser fan load and a decrease in cooling system performance. Keeping the coils clean allows the fans and cooling system to operate more efficiently.

Perform Maintenance on Compressed Air Systems

Like all electro-mechanical equipment, compressed air systems require periodic maintenance to operate at peak efficiency. A maintenance plan should be developed for process related compressed air systems to 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, checking for system leaks and adjustment of loose connections, and overall system cleaning. Contact a qualified technician for help with setting up periodic maintenance schedule.

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 Pollution Control Plant facility has a PV array that provides approximately one third 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 develop 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.

This Pollution Control Plant has a 65 kW microturbine that was installed in 2010 and has been shut down since 2013 (see Section 2.5). The Alaimo Group prepared an evaluation study of the microturbine in August 2016. The conclusion of their study was that the microturbine is financially viable to operate and they recommended further evaluation to determine what would be required to make the microturbine operational.

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 facilities 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 19 for a list of the eligible programs identified for each recommended ECM.

Figure 19 - ECM Incentive Program Eligibility

	`	SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	X			X
ECM 2	Retrofit Fixtures with LED Lamps	X			X
ECM 3	Install LED Exit Signs				X
ECM 4	Install Occupancy Sensor Lighting Controls	X			X
ECM 5	Premium Efficiency Motors		X		X
ECM 6	Install VFDs on WW Process Pumps		X		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) and ECM 6 (Install VFDs on Process Pumps). 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 Pay for Performance - Existing Buildings

Overview

The Pay for Performance – Existing Buildings (P4P EB) program is designed for larger customers with a peak demand over 200 kW in any of the preceding 12 months. Under this program the minimum installed scope of work must include at least two unique measures resulting in at least 15% energy savings, where lighting cannot make up the majority of the savings. P4P is a generally a good option for medium to large sized facilities looking to implement as many measures as possible under a single project in order to achieve deep energy savings. This program has an added benefit of evaluating a broad spectrum of measures that may not otherwise qualify under other programs. Many facilities pursuing ESIP also utilize the P4P program.

Incentives

Incentives are calculated based on estimated and achieved energy savings ranging from $0.18-$0.22/kWh and $1.80-$2.50/therm, capped at the lesser of 50% total project cost, or $1 million per electric account and $1 million per natural gas account, per fiscal year, not to exceed $2 million per project. An incentive of $0.10/square foot is also available to offset the cost of developing the Energy Reduction Plan (see below) contingent on the project moving forward with measure installation.

How to Participate

To participate in the P4B EB program you will need to contact one of the pre-approved consultants and contractors (“Partners”). Under direct contract to you, the Partner will help further evaluate the measures identified in this report through development of the Energy Reduction Plan (ERP), assist you in implementing selected measures, and verify actual savings one year after the installation. At each of these three milestones your Partner will also facilitate securing program incentives.

Approval of the final scope of work is required by the program prior to installation completion. Although installation can be accomplished by a contractor of your choice (some P4P Partners are also contractors) or by internal personnel, the Partner must remain involved to ensure compliance with the program guidelines and requirements.

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

8.3 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.

8.4 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
Filter building	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	5,840	LED Retrofit	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.47	3,853	0.0	$472.98	$1,070.94	$175.00	1.89
FB Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	5,840	LED Retrofit	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,088	0.10	826	0.0	$101.35	$246.02	$50.00	1.93
FB Storage	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	5,840	LED Retrofit	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.10	826	0.0	$101.35	$287.63	$50.00	2.34
Filter building	4	Metal Halide: (1) 200W Lamp	None	232	5,840	LED Retrofit	No	4	LED Screw-In Lamps: MH screw-in replacement	None	45	5,840	0.61	4,936	0.0	$606.01	$504.00	$0.00	0.83
Chemical Building	4	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	5,840	LED Retrofit	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.22	1,787	0.0	$219.40	$344.84	$60.00	1.30
Chemical Building	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	5,840	LED Retrofit	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,088	0.02	144	0.0	$17.70	$131.00	$25.00	5.99
Chemical Building	6	Metal Halide: (1) 175W Lamp	Wall Switch	215	5,840	LED Retrofit	No	6	LED Screw-In Lamps: MH screw-in replacement	Wall Switch	45	5,840	0.83	6,731	0.0	$826.38	$756.00	$0.00	0.91
P&C 1st Floor	2	Metal Halide: (1) 150W Lamp	Wall Switch	190	5,840	LED Retrofit	Yes	2	LED Screw-In Lamps: MH screw-in replacement	Occupancy Sensor	45	4,088	0.26	2,092	0.0	$256.83	$522.00	$35.00	1.90
P&C 1st Floor	4	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	5,840	LED Retrofit	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.22	1,787	0.0	$219.40	$344.84	$60.00	1.30
P&C Mech Room	6	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	5,840	LED Retrofit	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,840	0.29	2,336	0.0	$286.80	$343.26	$60.00	0.99
P&C Super Ofc	5	Linear Fluorescent - T12: 4' T12 (40W) - 3L	Wall Switch	127	5,840	LED Retrofit	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,088	0.39	3,186	0.0	$391.11	$441.05	$95.00	0.88
P&C Women RR	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	5,840	LED Retrofit	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.06	447	0.0	$54.85	$173.21	$20.00	2.79
P&C Women RR	2	Compact Fluorescent: screw in	Wall Switch	32	5,840	LED Retrofit	Yes	2	LED Screw-In Lamps: screw in	Occupancy Sensor	16	4,088	0.03	275	0.0	$33.70	$169.50	$20.00	4.44
P&C Men RR	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	5,840	LED Retrofit	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.06	447	0.0	$54.85	$173.21	$20.00	2.79
P&C Lab	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	5,840	LED Retrofit	No	14	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,840	0.38	3,049	0.0	$374.30	$800.94	$140.00	1.77
P&C Lab	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	5,840	LED Retrofit	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	5,840	0.01	106	0.0	$12.96	$57.21	$10.00	3.64
P&C Lab Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	5,840	LED Retrofit	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,088	0.10	826	0.0	$101.35	$246.02	$50.00	1.93
P&C Phone rm	1	Compact Fluorescent: screw in	Wall Switch	32	400	LED Retrofit	No	1	LED Screw-In Lamps: screw in	Wall Switch	16	400	0.01	7	0.0	$0.89	$26.75	$10.00	18.87
P&C Pump Room	8	Metal Halide: (1) 175W Lamp	Wall Switch	215	5,840	LED Retrofit	Yes	8	LED Screw-In Lamps: MH screw-in replacement	Occupancy Sensor	45	4,088	1.19	9,688	0.0	$1,189.34	$1,278.00	$35.00	1.05
P&C Pump Room 1	2	Linear Fluorescent - T8: 8' T8 (59W) - 2L	Wall Switch	110	5,840	LED Retrofit	Yes	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,088	0.10	787	0.0	$96.57	$120.00	$0.00	1.24
P&C Pump Room 2	6	Metal Halide: (1) 175W Lamp	Wall Switch	215	5,840	LED Retrofit	Yes	6	LED Screw-In Lamps: MH screw-in replacement	Occupancy Sensor	45	4,088	0.90	7,266	0.0	$892.00	$1,026.00	$35.00	1.11
Digester 1st Floor	17	Metal Halide: (1) 175W Lamp	Wall Switch	215	5,840	LED Retrofit	Yes	17	LED Screw-In Lamps: MH screw-in replacement	Occupancy Sensor	45	4,088	2.54	20,586	0.0	$2,527.34	$2,412.00	$35.00	0.94
Digester RR	1	Incandescent: bathroom	Wall Switch	100	5,840	LED Retrofit	No	1	LED Screw-In Lamps: screw in	Wall Switch	16	5,840	0.07	554	0.0	$68.05	$26.75	$10.00	0.25
Digester Bsmt	11	Metal Halide: (1) 175W Lamp	Wall Switch	215	5,840	LED Retrofit	Yes	11	LED Screw-In Lamps: MH screw-in replacement	Occupancy Sensor	45	4,088	1.64	13,320	0.0	$1,635.34	$1,656.00	$35.00	0.99
Garage	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	5,840	LED Retrofit	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.11	894	0.0	$109.70	$230.42	$20.00	1.92

	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
Garage main	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	5,840	LED Retrofit	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,088	0.10	826	0.0	$101.35	$246.02	$50.00	1.93
Garage main	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	5,840	LED Retrofit	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.20	1,651	0.0	$202.71	$459.26	$80.00	1.87
Garage main	1	Incandescent: general	Wall Switch	100	5,840	LED Retrofit	No	1	LED Screw-In Lamps: screw in	Wall Switch	16	5,840	0.07	554	0.0	$68.05	$26.75	$10.00	0.25
Garage women locker	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	5,840	LED Retrofit	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.07	550	0.0	$67.57	$230.42	$40.00	2.82
Garage women locker	2	Compact Fluorescent: screw in	Wall Switch	32	5,840	LED Retrofit	No	2	LED Screw-In Lamps: screw in	Wall Switch	16	5,840	0.03	211	0.0	$25.93	$53.50	$20.00	1.29
Garage men locker	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	5,840	LED Retrofit	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.17	1,376	0.0	$168.92	$402.05	$70.00	1.97
Garage men locker	4	Compact Fluorescent: screw in	Wall Switch	32	5,840	LED Retrofit	No	4	LED Screw-In Lamps: screw in	Wall Switch	16	5,840	0.05	422	0.0	$51.85	$107.00	$40.00	1.29
Garage mechanical	1	Linear Fluorescent - T12: 4' T12 (40W) - 1L	Wall Switch	46	5,840	LED Retrofit	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,088	0.03	237	0.0	$29.04	$49.41	$0.00	1.70
Garage mechanical	9	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	5,840	LED Retrofit	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,088	0.50	4,021	0.0	$493.64	$630.89	$20.00	1.24
Various	16	Exit Signs: Fluorescent	None	22	8,760	LED Retrofit	No	16	LED Exit Signs: 2 W Lamp	None	16	8,760	0.08	950	0.0	$116.67	$1,720.88	$0.00	14.75
Filter Building	11	Metal Halide: (1) 150W Lamp	Daylight Dimming	190	4,380	LED Retrofit	No	11	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	1.30	7,894	0.0	$969.17	$1,386.00	$0.00	1.43
Chemical Building	8	Metal Halide: (1) 175W Lamp	Daylight Dimming	215	4,380	LED Retrofit	No	8	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	1.11	6,731	0.0	$826.38	$1,008.00	$0.00	1.22
Pump & Control	1	Metal Halide: (1) 175W Lamp	Daylight Dimming	215	4,380	LED Retrofit	No	1	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	0.14	841	0.0	$103.30	$126.00	$0.00	1.22
Digester roof	1	Metal Halide: (1) 175W Lamp	Daylight Dimming	215	4,380	LED Retrofit	No	1	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	0.14	841	0.0	$103.30	$126.00	$0.00	1.22
Digester basin	12	Metal Halide: (1) 250W Lamp	Daylight Dimming	295	4,380	LED Retrofit	No	12	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	2.44	14,848	0.0	$1,822.90	$1,512.00	$0.00	0.83
Digester basin	4	Metal Halide: (1) 250W Lamp	Daylight Dimming	295	4,380	LED Retrofit	No	4	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	0.81	4,949	0.0	$607.63	$504.00	$0.00	0.83
Garage front	2	Metal Halide: (1) 150W Lamp	Daylight Dimming	190	4,380	LED Retrofit	No	2	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	0.24	1,435	0.0	$176.21	$252.00	$0.00	1.43
Garage parking	2	Metal Halide: (1) 150W Lamp	Daylight Dimming	190	4,380	LED Retrofit	No	2	LED Screw-In Lamps: MH screw-in replacement	Daylight Dimming	45	4,380	0.24	1,435	0.0	$176.21	$252.00	$0.00	1.43

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
Chemical Building	Chlorine Tanks	3	Process Pump	0.5	86.0%	No	2,920	No	86.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Chemical Building	Chlorine Tanks	3	Process Pump	0.5	74.0%	Yes	2,920	No	74.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outside Wall Chemical Building	Sodium Hypochloride Room	1	Exhaust Fan	0.1	60.0%	No	8,760	No	60.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outside Wall Chemical Building	Sodium Hypochloride Room	1	Exhaust Fan	0.3	69.5%	No	8,760	No	69.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Filter Building	Wash Water Pump	1	Process Pump	10.0	90.2%	No	1,095	No	90.2%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Filter Building	Polymer Feed Pumps	2	Process Pump	0.5	75.0%	Yes	4,380	No	75.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Filter Building	Compressor	2	Air Compressor	2.0	84.0%	No	1,095	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Side of Filter Building	Scrubber	2	Other	3.0	80.0%	No	4,380	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Side of Filter Building	Building	1	Exhaust Fan	5.0	87.5%	No	8,760	No	87.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Filter building	Filter Pressure Belt Drive	1	Other	3.0	87.5%	No	2,080	No	87.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump & Control	Building	1	Exhaust Fan	0.8	81.1%	No	8,760	No	81.1%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump & Control	Building	2	Supply Fan	2.0	84.0%	No	8,760	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump & Control	Raw Sewage Pumps	1	Process Pump	150.0	91.0%	No	4,380	Yes	95.4%	Yes	1	27.35	320,335	0.0	$39,327.11	$47,870.66	$0.00	1.22
Pump & Control	Raw Sewage Pumps	1	Process Pump	150.0	94.5%	No	4,380	Yes	95.4%	Yes	1	24.32	302,381	0.0	$37,123.01	$47,870.66	$0.00	1.29
Pump & Control	Raw Sludge Transfer Pumps	1	Process Pump	10.0	91.7%	No	1,460	No	91.7%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump & Control	Raw Sludge Transfer Pumps	1	Process Pump	10.0	91.7%	No	1,460	No	91.7%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump & Control	Recirculation pumps	2	Process Pump	200.0	95.0%	No	4,380	Yes	96.2%	Yes	2	64.96	803,445	0.0	$98,637.99	$100,493.30	$0.00	1.02
Pump & Control	Utility Water Pumps	3	Water Supply Pump	15.0	85.5%	No	2,920	Yes	90.2%	No		1.51	5,974	0.0	$733.41	$5,368.31	$0.00	7.32
Pump & Control	Macerator Pump	1	Other	3.0	76.0%	No	2,920	Yes	89.5%	No		0.33	1,297	0.0	$159.23	$804.84	$0.00	5.05
Pump & Control	Communitor	1	Other	1.5	84.0%	No	8,760	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Sludge Digester	Sludge transfer pumps	2	Process Pump	20.0	91.0%	No	1,040	No	91.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Sludge Digester	Filter Press	1	Other	10.0	91.0%	Yes	2,080	No	91.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Sludge Digester	Primary Settling Tanks	6	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
Sludge Digester	Secondary Settling Tanks	6	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

Electric HVAC Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Proposed Conditions: 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?	Energy Impact & Financial Analysis: 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
Filter Bldg Storage	Storage	1	Electric Forced Air Furnace		13.40	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump & Control Building	Offices/Laboratory storage & office	3	Packaged Terminal HP	1.20	13.40	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump & Control Building	Roof Top	1	Packaged AC	4.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Chemical Building	General	3	Electric Forced Air Furnace		6.83	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Fuel Heating Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	System Type	Output Capacity per Unit (MBh)	Proposed Conditions: Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Energy Impact & Financial Analysis: 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
FB Chemical Feed Room	Chemical Feed Room	1	Warm Air Unit Heater	75.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
FB Chemical Feed Room	Chemical Feed Room	1	Warm Air Unit Heater	75.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
FB Storage	Storage	1	Warm Air Unit Heater	75.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Digester	Sludge heating	1	Non-Condensing Hot Water Boiler	1,250.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump & Control	Building Heat	2	Warm Air Unit Heater	75.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pump & Control	Building Heat	1	Furnace	109.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Building Heat	3	Warm Air Unit Heater	75.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Digester	Building Heat	2	Warm Air Unit Heater	75.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Building Heat	1	Furnace	100.00	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
Chemical Building	Eye Wash	1	Storage Tank Water Heater (> 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage Mechanical Room	Garage	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

45

ENERGY STAR® Score[1]

Willingboro MUA Pollution Control Plant

Primary Property Type: Wastewater Treatment Plant
Gross Floor Area (ft²): 13,580
Built: 1958

For Year Ending: May 31, 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 Pollution Control Plant 72 Ironside Court Willingboro Township, New Jersey 08046	________________ , (___)___-_____	____ _______ , (___)___-_____ ________________

Property ID: 5735959

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
748.8 kBtu/ft²

Source EUI
1,726.8 kBtu/ft²

Annual Energy by Fuel	
Electric - Solar (kBtu)	2,870,973 (28%)
Natural Gas (kBtu)	1,117,406 (11%)
Electric - Grid (kBtu)	6,180,191 (61%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	712
National Median Source EUI (kBtu/ft²)	1,642.1
% Diff from National Median Source EUI	5%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	1,097

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)

Local Government Energy Audit:
Energy Audit Report

Well Pumps, Water Tanks & Pump Station

Willingboro Municipal Utilities Authority

April 5, 2017

Draft Report by:
TRC Energy Services

Disclaimer

The intent of this energy analysis report is to identify energy savings opportunities associated with recommended upgrades to the facility's systems at this site. Approximate saving are included in this report to make decisions about reducing energy use at the facility. This report, however, is not intended to serve as a detailed engineering design document. It should be noted that detailed design efforts are required in order to implement several of the improvements evaluated as part of this energy analysis.

The energy conservation measures and estimates of energy consumption contained in this report have been reviewed for technical accuracy. However, all estimates contained herein of energy consumption at the site are not guaranteed, because energy consumption ultimately depends on behavioral factors, the weather, and many other uncontrollable variables. The energy assessor and New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy consumption vary from the estimated consumption shown herein.

Estimated installation costs are based on a variety of sources, including our own experience at similar facilities, our own pricing research using local contractors and vendors, and cost estimating handbooks such as those provided by RS Means. The cost estimates represent our best judgment for the proposed action. The Owner 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 a particular installation, and for conditions which cannot be known prior to in-depth investigation and design, the energy assessor does not guarantee installed cost estimates and shall in no event be liable should actual installed costs vary from the estimated costs herein.

New Jersey's Clean Energy Program (NJCEP) incentive values provided in this report are estimates and are based on program information available at the time this report is written. The NJBPU reserves the right to extend, modify, or terminate programs without prior or further notice, including incentive levels and eligibility requirements. The Owner should review available program incentives and requirements prior to selecting and/or installing any recommended measures.

Table of Contents

Table of Figures

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for the Well Pumps, Water Tanks, and Pump Station.

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

Six wells, one pumping station, and two water tanks were included in this study with at total enclosed area of approximately 3,765 square foot. The facilities vary from sites with no buildings to sites with small buildings.

Building Name	SF
Well 1	1,360
Well 5A	740
Well 6	1,200
Well 9	N/A
Well 10	N/A
Well 11	N/A
Windsor Park Pump Station	465
Holyoke Water Tank	N/A
Edge Lane Water Tank	N/A
Total:	**3,765**

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC Energy Services recommends five (5) ECMs which together represent an opportunity to reduce annual energy costs by roughly $68,577 and annual greenhouse gas emissions by 458,405 lbs CO_2e. We estimate that the measures would likely pay for themselves in in energy savings in roughly 1.3 years. The existing and potential utility costs is shown in Figure 1 . These projects represent an opportunity to reduce combined annual energy use at these sites by 23.4%.

Figure 1 – Previous 12 Month Utility Costs

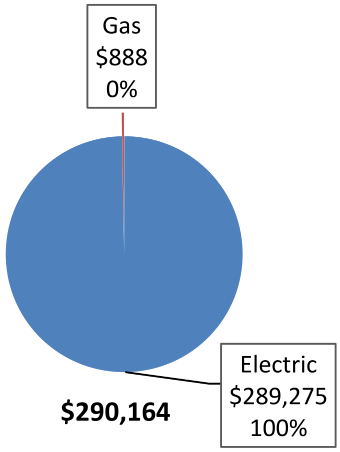
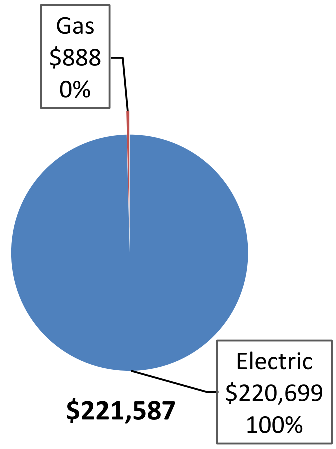


Figure 2 – Potential Post-Implementation Costs



A detailed description of site'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 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 Upgrades			31,406	4.7	0.0	$4,731.13	$5,870.00	$1,670.00	$4,200.00	0.89	31,626
ECM 1	Install LED Fixtures	Yes	8,820	1.4	0.0	$1,328.66	$4,500.00	$1,500.00	$3,000.00	2.26	8,881
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	1,388	0.5	0.0	$209.14	$850.00	$170.00	$680.00	3.25	1,398
ECM 3	Retrofit Fixtures with LED Lamps	Yes	21,198	2.8	0.0	$3,193.34	$520.00	$0.00	$520.00	0.16	21,346
Variable Frequency Drive (VFD) Measures			422,069	145.2	0.0	$63,582.22	$85,382.80	$0.00	$85,382.80	1.34	425,020
ECM 4	Install VFDs on Well Pumps	Yes	422,069	145.2	0.0	$63,582.22	$85,382.80	$0.00	$85,382.80	1.34	425,020
HVAC System Improvements			1,747	0.0	0.0	$263.17	$715.62	$225.00	$490.62	1.86	1,759
ECM 5	Install Occupancy-Controlled Thermostats	Yes	1,747	0.0	0.0	$263.17	$715.62	$225.00	$490.62	1.86	1,759
TOTALS			455,222	149.8	0.0	$68,576.52	$91,968.42	$1,895.00	$90,073.42	1.31	458,405

* - 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.

Variable Frequency Drives measures generally involve controlling the speed of a motor to achieve a flow or temperature rather than using a valve, damper, or no means at all. These measures save energy by slowing a motor which is an extremely efficient method of control.

HVAC System Improvements generally involve the installation of automated controls to reduce heating and cooling demand when conditions allow. These measures could encompass changing temperature setpoints, using outside air for free cooling, or limiting excessive outside air during extreme outdoor air temperatures. These measures save energy by reducing the demand on the systems and the amount of time systems operate.

Energy Efficient Practices

TRC Energy Services also identified 4 low (or no) cost energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral and operational adjustments as well as performing routine maintenance on building systems. Through these practices equipment lifetime can be extended; occupant comfort, health and safety can be improved; and annual energy, operation, and maintenance costs can be reduced. Opportunities identified at sites include:

- Reduce Air Leakage
- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Perform Routine Motor 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 on-site generation at the Well Pumps, Water Tanks, and Pump Station sites. Based on the configuration of the sites, the available area, and their load profiles, there is low potential for installing any PV or combined heat and power self-generation measures.

For details on our evaluation and solar PV -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 x105
TRC Energy Services			
Moussa Traore	Auditor	MTraore@trcsolutions.com	(732) 855-0033

2.2 General Site Information

Six wells, one pumping station, and two water tanks were included in this study with at total enclosed area of 3,765 square feet. The facilities vary from sites with no buildings to sites with small buildings.

Building Name	SF
Well 1	1,360
Well 5A	740
Well 6	1,200
Well 9	N/A
Well 10	N/A
Well 11	N/A
Windsor Park Pump Station	465
Holyoke Water Tank	N/A
Edge Lane Water Tank	N/A
Total:	**3,765**

2.3 Building Occupancy

The typical schedules for the various sites are presented in the table below.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Well 6	Weekday	56 hours per week
Well 6	Weekend	
Well 1, Well 5A, Windsor Park Pump Station	Weekday	normally unoccupied
Well 1, Well 5A, Windsor Park Pump Station	Weekend	
Well 9, Well 10, Well 11, Tanks	Weekday	no building
Well 9, Well 10, Well 11, Tanks	Weekend	

2.4 On-site Generation

None of the facilities have any on-site electric generation capacity for normal use.

2.5 Facility Descriptions

Well 1

Well 1 is located on Sylvan Lane. The building is constructed of CMU block with a brick veneer and was built in 1960. The building houses the well pump, chemical feed systems and electrical controls. Total building area is approximately 1,360 square feet. This building is normally unoccupied but does have a 75,000 Btu/hr natural gas fired heater that is manually controlled at the thermostat.

Interior lighting is provided by fixtures with compact fluorescent lamps and manual switches. Exterior lighting consists metal halide fixtures with photocell controls.

Well 1 has one 1,400 gpm pump driven by a 150 HP motor.

Well 5A

Well 5A is located on Baldwin Lane. The plant building was constructed of CMU block with a brick veneer in 1997. The building houses electrical control equipment and lime feed equipment. The building area is approximately 740 square feet and it is normally unoccupied. The building is conditioned by manually controlled electric heaters and also has a small air conditioner.

All of the interior lighting is provided by fluorescent fixtures. Exterior lighting consists of high-pressure sodium and mercury vapor fixtures.

Well 5A has one 1,000 gpm pump driven by a 125 HP motor which has not operated since April 2012. A radium removal project is in progress and scheduled to be completed mid-2017.

Well 6

Well 6 is located on Medallion Lane. The building is constructed of CMU block with brick veneer and was built in 1975. The building houses the well pump, pressure filtration piping and controls, high service pump, chemical feed systems and a standby generator. The total building area is approximately 1,200 square feet. There is one operator at the building for approximately 56 hours per week. The building is conditioned by electric heaters with thermostat control and a small air conditioner.

Interior lighting consists of two lamp, 4-foot fluorescent fixtures with manual switches. The exterior light fixtures use LED lamps.

Well 6 has a 100 HP well pump, 150 high service pump, and a 25 HP aerator transfer pump. The well pump has a design flow rate of 1,500 gpm. In 2015 electrical upgrades were implemented at this facility including a new natural gas fired emergency generator, motor control center, and motor and VFD for the high service pump.

Wells 9, 10 & 11

These wells are located on Middlebury Lane, Barnwell Drive, and Pageant Lane. None of the wells have a building. Well 9 was built in 1979, Well 10 was built in 1986, and Well 11 was built in 1988. Each of the well sites only have a single well pump. Wells 9 and 10 have 100 HP motors and Well 11 has a 200 HP motor with a VFD. All three of the pumps have a design flow rate of 1,500 gpm. Each of the well sites has a natural gas fired emergency generator. The wells supply water to the Meribrook water treatment plant.

Windsor Park Pumps Station

The Windsor Park Pump Station is located on Club House. The building was constructed in 1958 of CMU block with brick veneer. The building houses two 40 HP sewage pumps with controls that are used to pump wastewater to the Water Pollution Control plant. Total building area is approximately 465 square feet. The building is normally not occupied but does have a 10 kW electric heater.

Interior lighting is provided by a mix of fluorescent and high pressure sodium vapor fixtures with manual controls. Exterior lighting is provided by a high pressure sodium vapor fixture.

Water Tanks

The Holyoke Water Tank is located on Holyoke Lane and the Edge Lane Water Tank is located on Edge Lane. Both are elevated tanks used to store potable water. The Holyoke tank was constructed in 1959 and the Edge Lane tank was constructed in 1968. The only energy using equipment at the tank sites are incandescent exterior lights.

Please refer to Appendix A: Equipment Inventory & Recommendation for an inventory of equipment at all of the sites.

3 SITE ENERGY USE AND COSTS

Utility data for electricity and natural gas was analyzed to identify opportunities for savings. There are a number of factors that could cause the energy use of these sites to vary from the energy use for other similar facilities. The primary factors are the system capacity relative to end use requirements, system efficiency, and system operation.

3.1 Total Cost of Energy

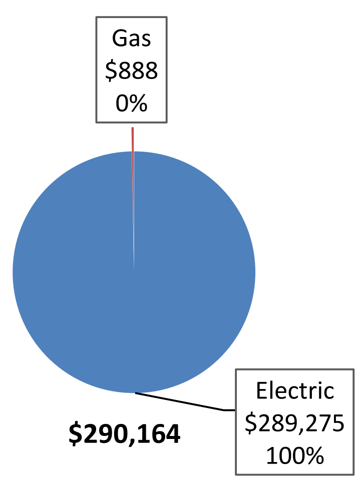
The following energy consumption and cost data summarizes the usage for all of the sites. This is based on the last 12 month period of utility usage data that was provided for each utility. The annual consumption and cost was developed from this information. Specific information for each site is also provided in Section 3.3.

Figure 6 - Utility Summary

Utility Summary for Well Pumps, Water Tanks, Pump Station		
Fuel	Usage	Cost
Electricity	1,920,256 kWh	$289,275
Natural Gas	938 Therms	$888
Total		$290,164

The current utility cost for this site is $290,164 as shown in the chart below.

Figure 7 - Energy Cost Breakdown



3.2 Total Electricity Usage (All Sites)

Electricity is provided by PSE&G. The average electric cost (combined for commodity, transmission and distribution) for the past 12 months is $0.151/kWh, which is the blended rate used throughout the analyses in this report. The monthly electricity consumption and peak demand is represented graphically in the chart below.

Figure 8 - Graph of 12 Months Electric Usage & Demand

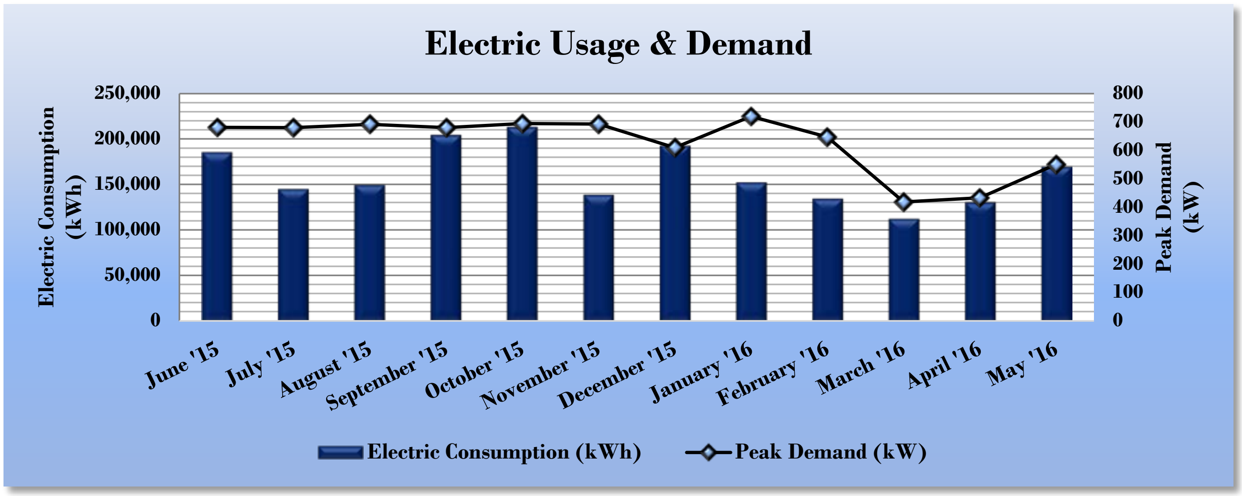


Figure 9 - Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
6/23/15	32	185,756	681	$546	$33,155
7/23/15	30	145,269	680	$455	$27,937
8/21/15	29	149,866	692	$327	$28,138
9/22/15	32	204,549	680	$551	$34,774
10/21/15	29	213,436	695	$387	$29,021
11/19/15	29	138,771	693	$356	$20,126
12/22/15	33	192,959	610	$516	$24,944
1/23/16	32	152,376	719	$420	$20,072
2/23/16	31	134,740	647	$388	$18,404
3/23/16	29	112,557	419	$209	$15,247
4/22/16	30	130,752	433	$280	$17,095
5/23/16	31	169,747	551	$441	$21,946
Totals	367	1,930,778	719.4	$4,877	$290,860
Annual	365	1,920,256	719.4	$4,850	$289,275

3.3 Site Electricity Usage

Well 1

Figure 10 – Well #1: Graph of 12 Months Electric Usage & Demand

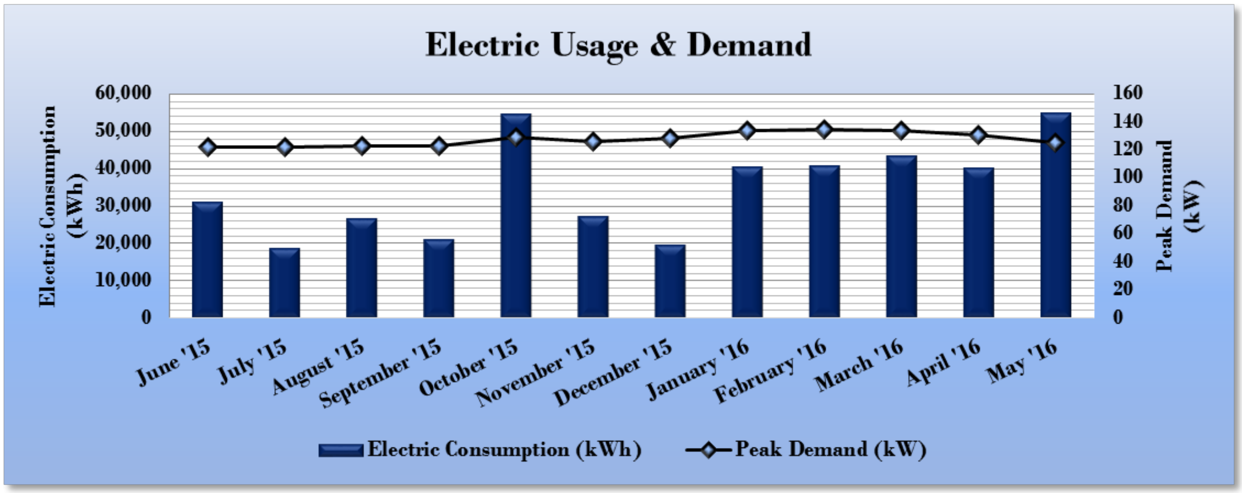


Figure 11 – Well #1: Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
6/23/15	32	31,081	122.2	$5,548
7/23/15	30	18,933	122.2	$3,966
8/21/15	29	26,628	122.6	$4,901
9/22/15	32	21,161	122.7	$4,188
10/21/15	29	54,905	129.1	$7,056
11/19/15	29	27,307	125.8	$3,774
12/22/15	33	19,699	128.3	$2,805
1/23/16	32	40,555	134.2	$5,027
2/23/16	31	40,955	135.0	$4,988
3/23/16	29	43,677	133.6	$5,254
4/22/16	30	40,468	131.1	$4,902
5/23/16	31	55,192	125.6	$6,451
Totals	367	420,561	135.0	$58,858
Annual	365	418,269	135.0	$58,537

Well 5A

Figure 12 – Well #5A: Graph of 12 Months Electric Usage & Demand

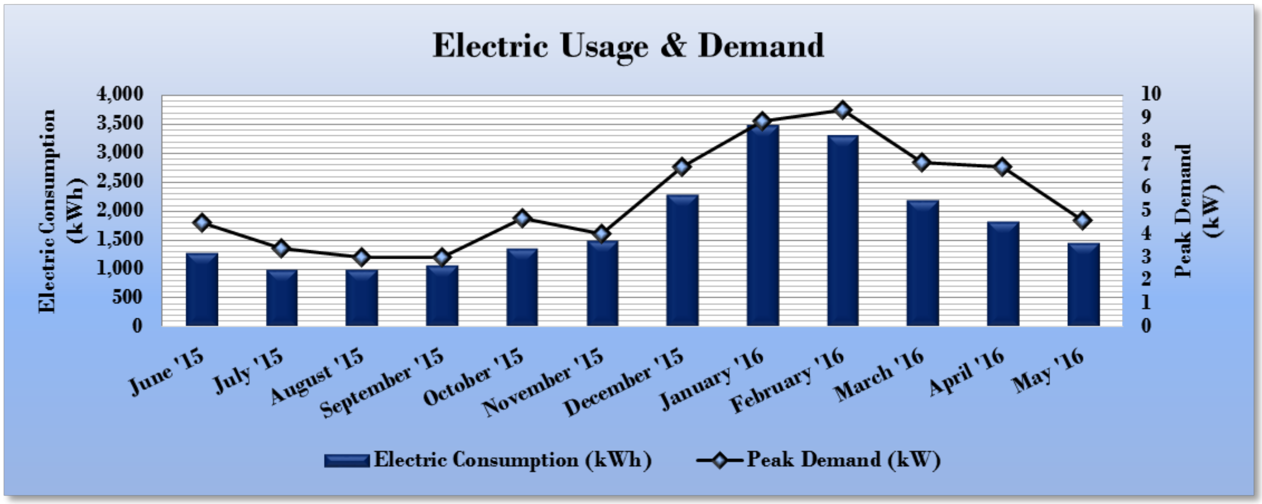


Figure 13 – Well #5A: Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
6/23/15	32	1,272	4.5	$579
7/23/15	30	987	3.4	$517
8/21/15	29	984	3.0	$520
9/22/15	32	1,052	3.0	$528
10/21/15	29	1,342	4.7	$543
11/19/15	29	1,492	4.0	$557
12/22/15	33	2,283	6.9	$647
1/23/16	32	3,466	8.9	$771
2/23/16	31	3,293	9.4	$747
3/23/16	29	2,182	7.1	$623
4/22/16	30	1,812	6.9	$584
5/23/16	31	1,438	4.6	$537
Totals	367	21,603	9.4	$7,154
Annual	365	21,485	9.4	$7,115

Well 6

Figure 14 – Well #6: Graph of 12 Months Electric Usage & Demand

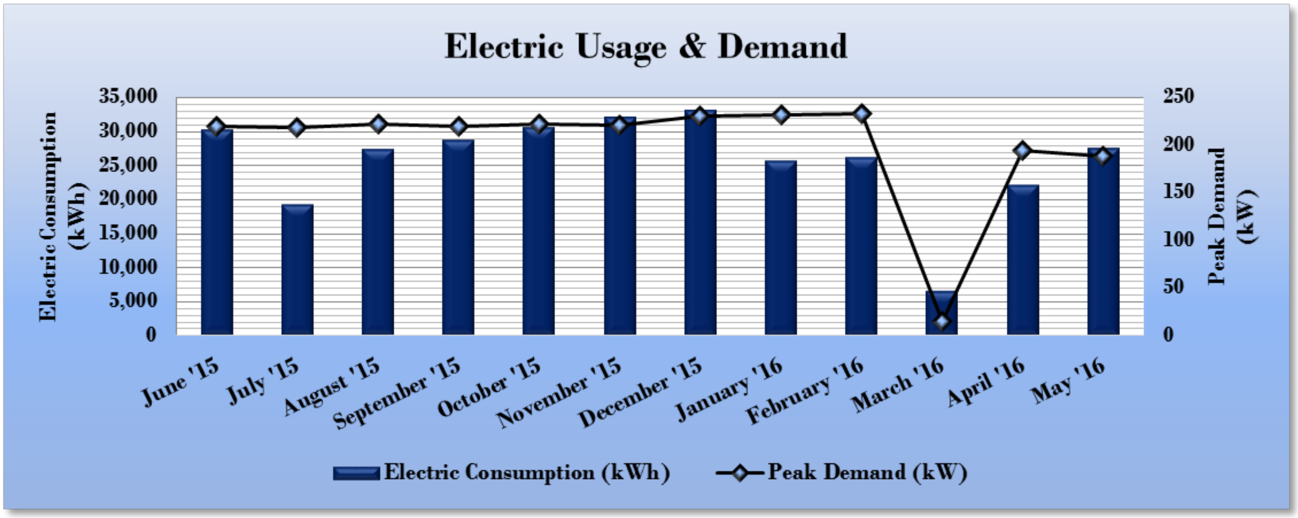


Figure 15 – Well #6: Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
6/15/15	32	30,234	219.6	$6,650
7/15/15	30	19,185	218.5	$5,320
8/13/15	29	27,298	222.1	$6,287
9/14/15	32	28,708	219.7	$6,367
10/13/15	29	30,501	223.0	$4,686
11/11/15	29	32,047	221.8	$4,840
12/14/15	33	33,082	231.3	$4,886
1/14/16	31	25,709	232.4	$3,947
2/12/16	29	26,119	233.0	$3,953
3/15/16	32	6,547	15.3	$1,103
4/14/16	30	22,028	194.7	$3,357
5/13/16	29	27,536	189.2	$3,905
Totals	365	308,994	233.0	$55,301
Annual	365	308,994	233.0	$55,301

Well 9

Figure 16 – Well #9: Graph of 12 Months Electric Usage & Demand

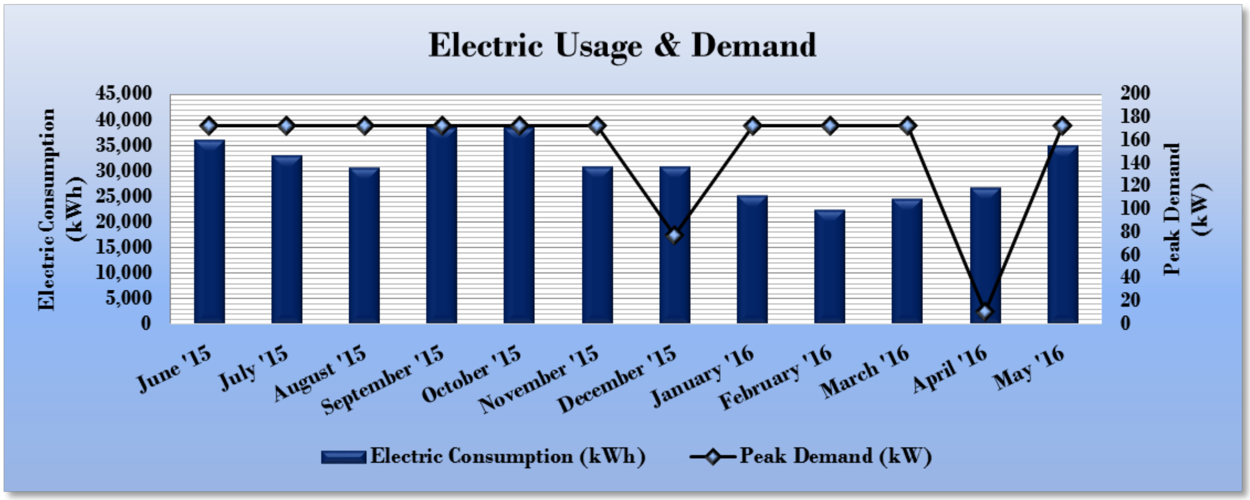


Figure 17 – Well #9: Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
6/23/15	32	35,946	173.2	$6,813
7/23/15	30	32,922	173.2	$6,412
8/21/15	29	30,600	173.0	$6,023
9/22/15	32	38,358	173.2	$6,978
10/21/15	29	38,394	173.0	$5,300
11/19/15	29	30,906	173.2	$4,405
12/22/15	33	30,780	77.8	$3,825
1/23/16	32	25,110	173.0	$3,509
2/23/16	31	22,428	173.0	$3,167
3/23/16	29	24,588	172.8	$3,388
4/22/16	30	26,784	11.0	$2,912
5/23/16	31	34,830	173.0	$4,485
Totals	367	371,646	173.2	$57,216
Annual	365	369,621	173.2	$56,905

Well 10

Figure 18 – Well #10: Graph of 12 Months Electric Usage & Demand

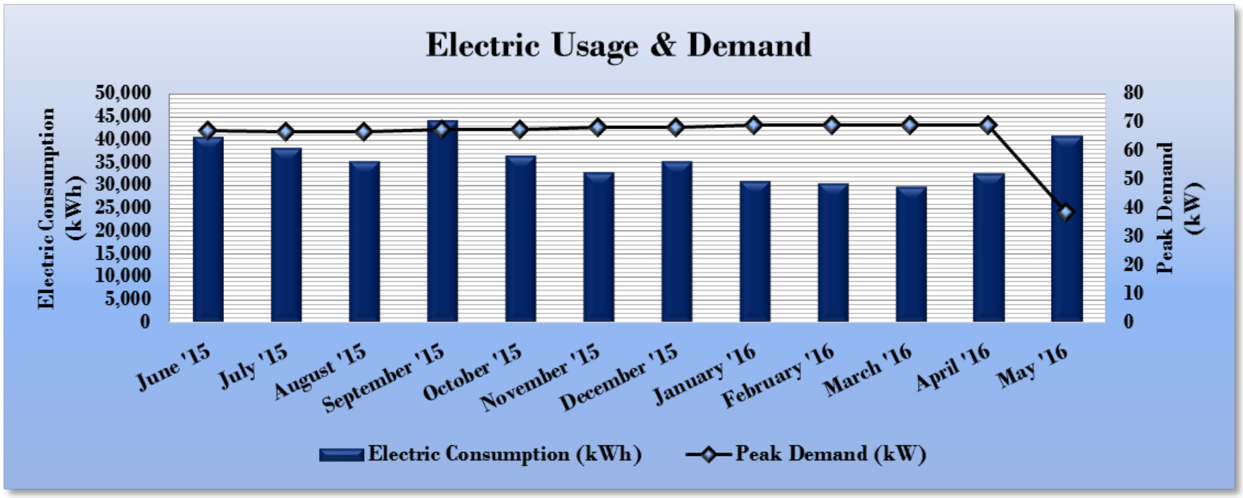


Figure 19 – Well #10: Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
6/23/15	32	40,613	67.4	$6,107
7/23/15	30	38,030	66.9	$5,755
8/21/15	29	35,171	66.9	$5,286
9/22/15	32	44,188	67.6	$6,397
10/21/15	29	36,386	67.7	$4,603
11/19/15	29	32,874	68.4	$4,180
12/22/15	33	35,297	68.4	$4,295
1/23/16	32	30,971	69.3	$3,698
2/23/16	31	30,417	69.4	$3,573
3/23/16	29	29,535	69.2	$3,461
4/22/16	30	32,660	69.3	$3,796
5/23/16	31	40,802	38.6	$4,663
Totals	367	426,944	69.4	$55,814
Annual	365	424,617	69.4	$55,509

Well 11

Figure 20 – Well #11: Graph of 12 Months Electric Usage & Demand

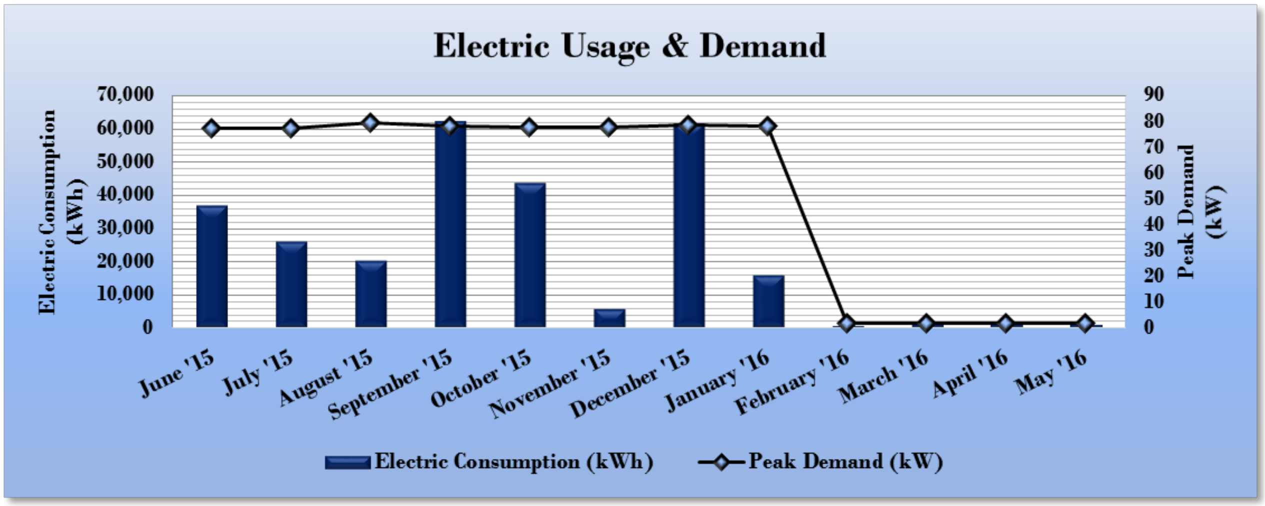


Figure 21 – Well #11: Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
6/23/15	32	36,702	77.5	$5,725
7/23/15	30	26,009	77.5	$4,331
8/21/15	29	20,182	79.7	$3,547
9/22/15	32	62,088	78.2	$8,778
10/21/15	29	43,518	78.1	$5,492
11/19/15	29	5,631	77.8	$1,008
12/22/15	33	61,600	78.7	$7,315
1/23/16	32	15,774	78.4	$1,898
2/23/16	31	490	2.0	$739
3/23/16	29	831	2.0	$885
4/22/16	30	879	2.0	$903
5/23/16	31	1,109	2.0	$940
Totals	367	274,813	79.7	$41,559
Annual	365	273,315	79.7	$41,333

Windsor Park Pump Station

Figure 22 – Windsor Park Pump Station: Graph of 12 Months Electric Usage & Demand

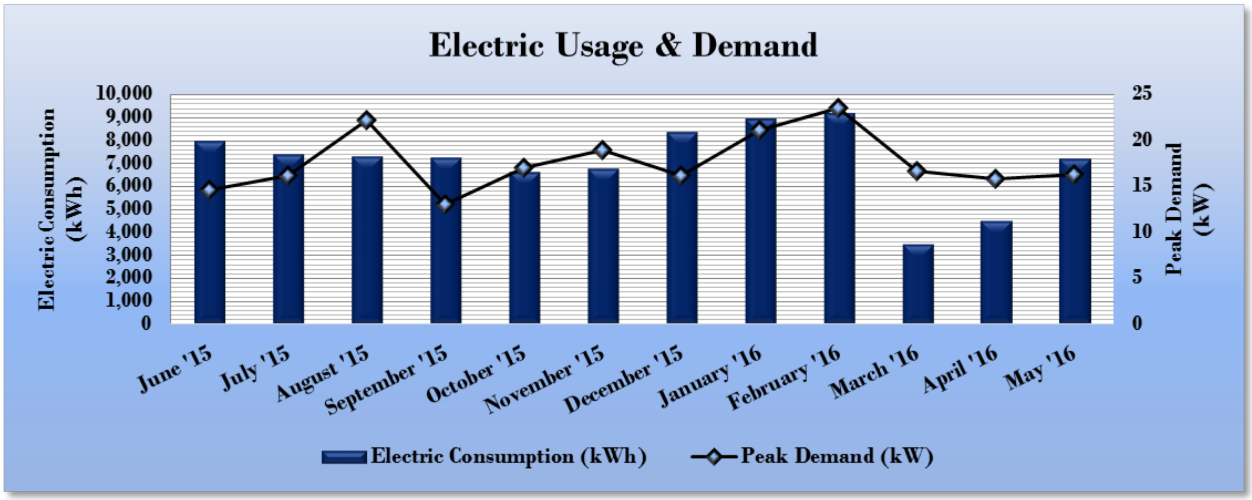


Figure 23 – Windsor Park Pump Station: Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
6/23/15	32	7,970	14.6	$546	$1,530
7/23/15	30	7,373	16.2	$455	$1,448
8/21/15	29	7,293	22.3	$327	$1,406
9/22/15	32	7,212	13.1	$551	$1,365
10/21/15	29	6,626	17.1	$387	$1,194
11/19/15	29	6,768	19.0	$356	$1,215
12/22/15	33	8,352	16.2	$516	$1,018
1/23/16	32	8,907	21.2	$420	$1,072
2/23/16	31	9,154	23.6	$388	$1,089
3/23/16	29	3,487	16.7	$209	$404
4/22/16	30	4,459	15.9	$280	$518
5/23/16	31	7,196	16.3	$441	$844
Totals	367	84,797	23.6	$4,877	$13,103
Annual	365	84,334	23.6	$4,850	$13,032

Holyoke Water Tank

Figure 24 – Holyoke Water Tank: Graph of 12 Months Electric Usage & Demand

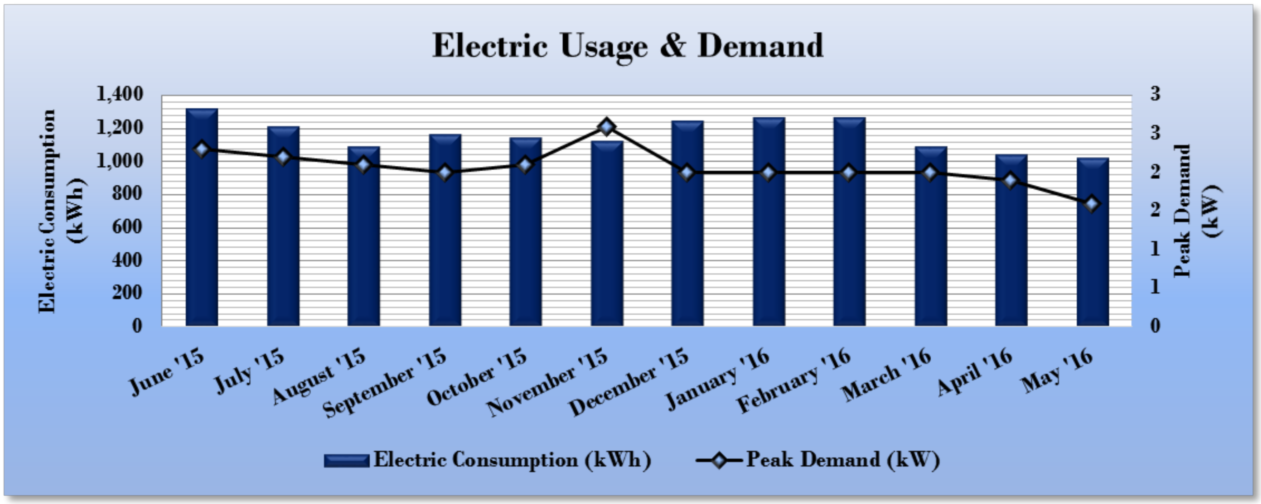


Figure 25 – Holyoke Water Tank: Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
6/23/15	32	1,314	2.3	$203
7/23/15	30	1,206	2.2	$188
8/21/15	29	1,086	2.1	$168
9/22/15	32	1,158	2.0	$175
10/21/15	29	1,140	2.1	$148
11/19/15	29	1,122	2.6	$148
12/22/15	33	1,242	2.0	$153
1/23/16	32	1,260	2.0	$151
2/23/16	31	1,260	2.0	$148
3/23/16	29	1,086	2.0	$129
4/22/16	30	1,038	1.9	$123
5/23/16	31	1,020	1.6	$120
Totals	367	13,932	2.6	$1,854
Annual	365	13,856	2.6	$1,844

Edge Lane Water Tank

Figure 26 – Edge Lane Water Tank: Graph of 12 Months Electric Usage & Demand

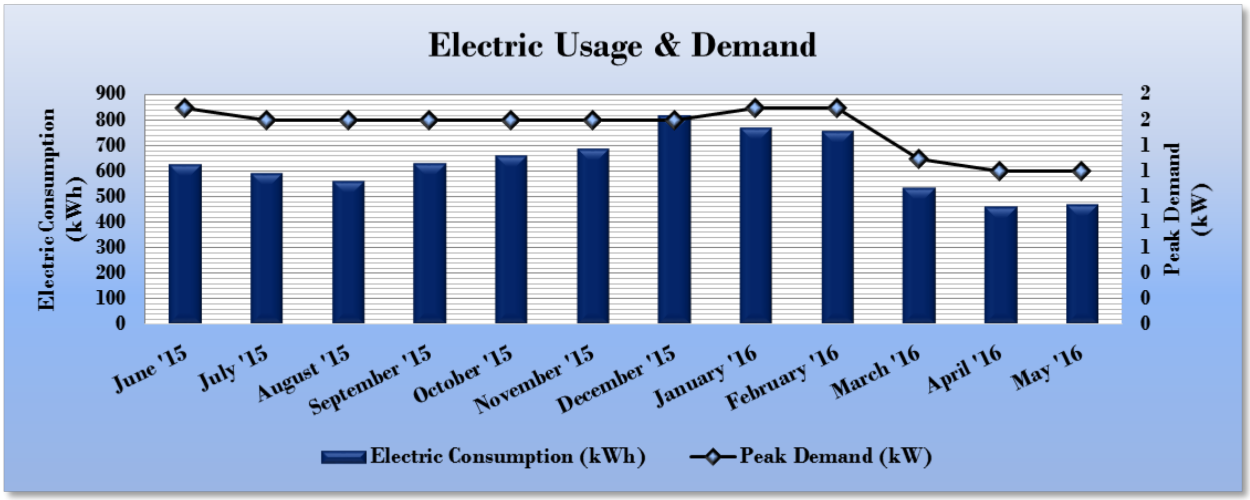


Figure 27 – Edge Lane Water Tank: Table of 12 Months Electric Usage & Demand

Electric Billing Data for Well Pumps, Water Tanks, Pump Station				
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost
6/23/15	32	624	1.7	$106
7/23/15	30	588	1.6	$100
8/21/15	29	558	1.6	$95
9/22/15	32	630	1.6	$103
10/21/15	29	660	1.6	$89
11/19/15	29	684	1.6	$92
12/22/15	33	816	1.6	$103
1/23/16	32	768	1.7	$96
2/23/16	31	756	1.7	$93
3/23/16	29	534	1.3	$67
4/22/16	30	462	1.2	$59
5/23/16	31	468	1.2	$59
Totals	367	7,548	1.7	$1,063
Annual	365	7,507	1.7	$1,057

3.4 Natural Gas Usage

Natural Gas is provided by PSE&G. The average gas cost for the past 12 months is $0.947/therm, which is the blended rate used throughout the analyses in this report. Natural gas data was only provided for Well 1. The monthly gas consumption is represented graphically in the chart below.

Figure 28 - Graph of 12 Months Natural Gas Usage

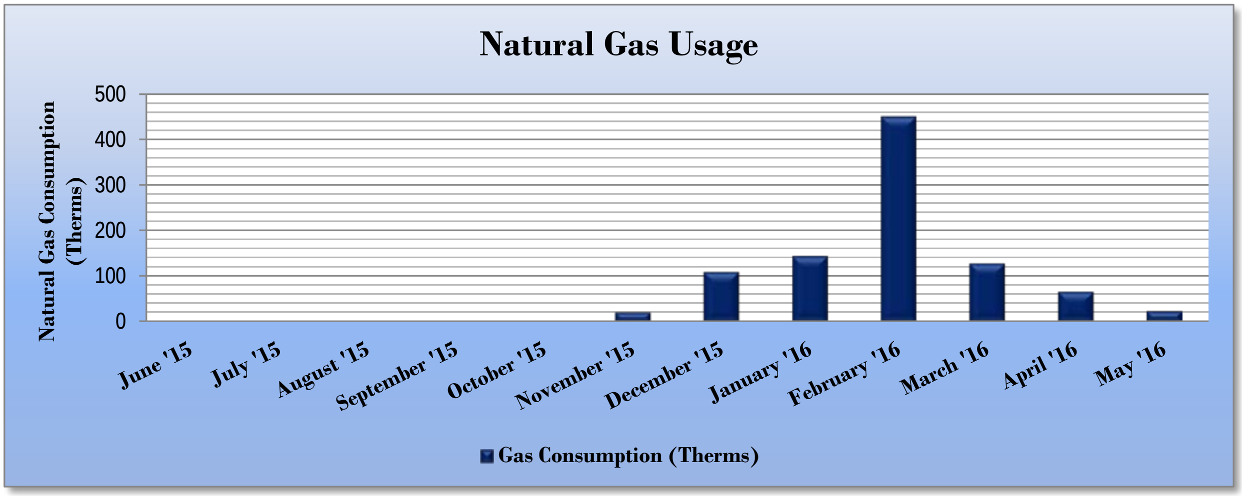


Figure 29 - Table of 12 Months Natural Gas Usage

Gas Billing Data for Well Pumps, Water Tanks, Pump Station			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
6/23/15	32	0	$11
7/23/15	30	0	$11
8/24/15	32	0	$11
9/21/15	28	0	$11
10/21/15	30	0	$12
11/19/15	29	21	$28
12/22/15	33	109	$101
1/22/16	31	144	$131
2/23/16	32	451	$378
3/23/16	29	128	$111
4/22/16	30	66	$59
5/23/16	31	23	$28
Totals	367	943	$893
Annual	365	938	$888

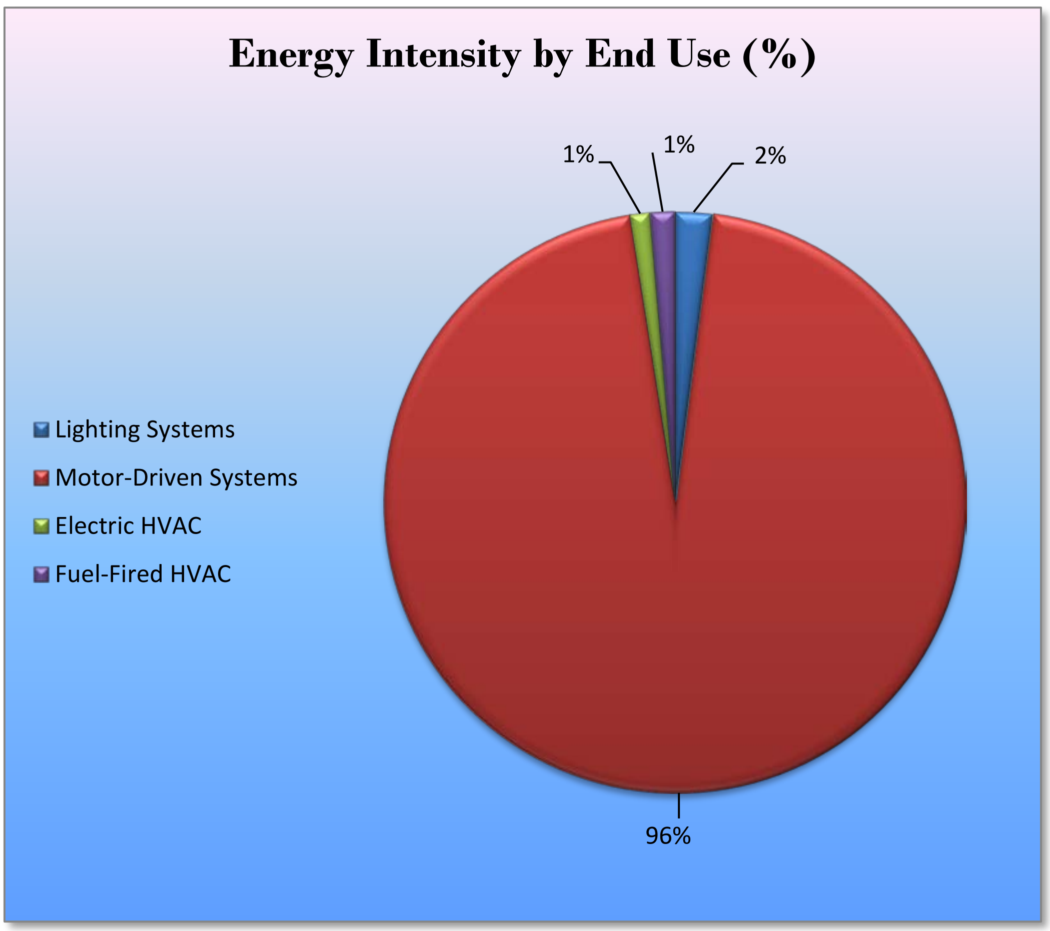
3.5 Benchmarking

Portfolio Manager, an online tool created and managed by the United State Environmental Protection Agency (EPA) through the ENERGY STAR® program does not have benchmarking data for the types of facilities included in this report. The energy use of well pumps and pump stations will vary based on system capacity relative to end use requirements, system efficiency, and system operation. As a result a meaningful benchmark could not be developed as part of this study.

3.6 Energy End-Use Breakdown

In order to provide a complete overview of energy consumption across systems, an energy balance was performed for the sites. 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 energy usage. This visual representation of energy end uses highlights systems that may benefit most from energy efficiency projects.

Figure 30 - Energy Balance (%)



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 WMUA on the path to receive financial incentives for the appropriate measures. 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 31 – Summary of Recommended 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 Upgrades		31,406	4.7	0.0	$4,731.13	$5,870.00	$1,670.00	$4,200.00	0.89	31,626
ECM 1	Install LED Fixtures	8,820	1.4	0.0	$1,328.66	$4,500.00	$1,500.00	$3,000.00	2.26	8,881
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	1,388	0.5	0.0	$209.14	$850.00	$170.00	$680.00	3.25	1,398
ECM 3	Retrofit Fixtures with LED Lamps	21,198	2.8	0.0	$3,193.34	$520.00	$0.00	$520.00	0.16	21,346
Variable Frequency Drive (VFD) Measures		422,069	145.2	0.0	$63,582.22	$85,382.80	$0.00	$85,382.80	1.34	425,020
ECM 4	Install VFDs on Well Pumps	422,069	145.2	0.0	$63,582.22	$85,382.80	$0.00	$85,382.80	1.34	425,020
HVAC System Improvements		1,747	0.0	0.0	$263.17	$715.62	$225.00	$490.62	1.86	1,759
ECM 5	Install Occupancy-Controlled Thermostats	1,747	0.0	0.0	$263.17	$715.62	$225.00	$490.62	1.86	1,759
TOTALS		455,222	149.8	0.0	$68,576.52	$91,968.42	$1,895.00	$90,073.42	1.31	458,405

* - 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).

4.1.1 Lighting Upgrades

Recommended lighting upgrades measures are summarized in Figure 28 below.

Figure 32 – Summary of Lighting Upgrade 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 Upgrades		31,406	4.7	0.0	$4,731.13	$5,870.00	$1,670.00	$4,200.00	0.89	31,626
ECM 1	Install LED Fixtures	8,820	1.4	0.0	$1,328.66	$4,500.00	$1,500.00	$3,000.00	2.26	8,881
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	1,388	0.5	0.0	$209.14	$850.00	$170.00	$680.00	3.25	1,398
ECM 3	Retrofit Fixtures with LED Lamps	21,198	2.8	0.0	$3,193.34	$520.00	$0.00	$520.00	0.16	21,346

ECM 1: Install LED Fixtures

Measure Description

We recommend replacing existing exterior fixtures containing HID lamps with new high performance LED light fixtures. This measure saves energy by installing LED sources which use less power than other technologies with a comparable light output.

During planning and design for the installation of new fixtures, 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 & Recommendation for a detailed list of the locations and light fixtures affected by this measure.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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 LED sources 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 LED sources have burn hours which are more than twice that of a fluorescent source. 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 & Recommendation for a detailed list of the locations and light fixtures affected by this measure.

ECM 3: Retrofit Fixtures with LED Lamps

Measure Description

We recommend replacing incandescent screw-in lamps with LED lamps at the water tanks. 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.

Maintenance savings are anticipated since LEDs have burn hours which are more than 10 times incandescent sources. Maintenance savings may be partially offset by the higher material costs associated with LED sources.

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

4.1.2 Variable Frequency Drive Measures

Recommended variable frequency drive (VFD) measures include the measure noted in Figure 29 below.

Figure 33 – Summary of Variable Frequency Drive 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)
Variable Frequency Drive (VFD) Measures		422,069	145.2	0.0	$63,582.22	$85,382.80	$0.00	$85,382.80	1.34	425,020
ECM 4	Install VFDs on Well Pumps	422,069	145.2	0.0	$63,582.22	$85,382.80	$0.00	$85,382.80	1.34	425,020

ECM 4: Install VFDs on Well Pumps

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)
422,069	145.2	0.0	$63,582.22	$85,382.80	$0.00	$85,382.80	1.34	425,020

Measure Description

We recommend installing variable frequency drives (VFD) to control the well pumps for Well 1, Well 6, Well 9 and Well 10. The VFDs will modulate pump speed based on tank level. Energy savings result from reducing pump motor speed (and power) during much of the pump operation. The initial savings is based on running the pumps at an average of 80% speed over the year and increasing the pump run time correspondingly to maintain the total water flow.

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

4.1.3 HVAC System Improvements

Recommended HVAC system improvement measures are summarized in Figure 30 below.

Figure 34 - Summary of HVAC System Improvement 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)
HVAC System Improvements		1,747	0.0	0.0	$263.17	$715.62	$225.00	$490.62	1.86	1,759
ECM 5	Install Occupancy-Controlled Thermostats	1,747	0.0	0.0	$263.17	$715.62	$225.00	$490.62	1.86	1,759

ECM 5: Install Occupancy-Controlled Thermostats

Measure Description

We recommend installing occupancy-controlled thermostats in place of existing manually thermostats, which are controlled by occupants to regulate temperature within the facility. An occupancy controlled thermostat is a thermostat paired with a sensor and/or door detector to identify movement and determine if a room is occupied or unoccupied. If occupancy is sensed by the sensor, the thermostat goes into an occupied mode and enables programmed temperature setpoint. After a pre-programmed time frame elapses and no occupancy is sensed, the thermostat switches to unoccupied mode and enables the temperature reset until occupancy is sensed again. By resetting the heating temperature setpoint down and the cooling temperature setpoint up, for times that the conditioned space is not occupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures during unoccupied periods. This type of thermostat is often used in residence facilities such as hotels and dormitories to conserve energy.

The occupancy controlled thermostat provides savings by reducing heating and cooling energy when a room is unoccupied.

Please refer to Appendix A: Equipment Inventory & Recommendation 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.

Reduce Air Leakage

Air leakage, or infiltration, occurs when outside air enters a building uncontrollably through cracks and openings. Properly sealing such cracks and openings can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment. This includes caulking or installing weather stripping around leaky doors and windows allowing for better control of indoor air quality through controlled ventilation.

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.

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.

A preliminary screening was conducted on the nine (9) sites included in this report. Based on electric demand, size and location of free area and shading elements, we've determined these facilities have a **Low Potential** for installing a PV array.

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 natural gas availability, thermal load, electrical demand, siting, and interconnection shows that the sites do not meet the minimum requirements for a cost-effective CHP installation.

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 facilities 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 31 for a list of the eligible programs identified for each recommended ECM.

Figure 35 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings
ECM 1	Install LED Fixtures	X			
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	X			
ECM 3	Retrofit Fixtures with LED Lamps				
ECM 4	Install VFDs on Well Pumps		X		
ECM 5	Install Occupancy-Controlled Thermostats				

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 4 (Install VFDs on Well Pumps). 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 & Recommendation

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
Well #1	4	Metal Halide: (1) 250W Lamp	Daylight Dimming	295	4,380	LED Retrofit	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	90	4,380	0.67	4,059	0.0	$611.39	$1,200.00	$400.00	1.31
Well #1	5	Metal Halide: (1) 150W Lamp	Daylight Dimming	190	4,380	LED Retrofit	No	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	90	4,380	0.41	2,475	0.0	$372.80	$1,500.00	$500.00	2.68
Well #1 - Ceiling	11	Compact Fluorescent: 32 W Screw-in	Wall Switch	32	200	None	No	11	Compact Fluorescent: 32 W Screw-in	Wall Switch	32	200	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #1	2	Compact Fluorescent: 64 W Screw-in	Wall Switch	64	200	None	No	2	Compact Fluorescent: 64 W Screw-in	Wall Switch	64	200	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #5A	3	High-Pressure Sodium: (1) 150W Lamp	Daylight Dimming	188	4,380	LED Retrofit	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	90	4,380	0.24	1,455	0.0	$219.21	$900.00	$300.00	2.74
Well #5A	2	Mercury Vapor: (1) 100W Lamp	Daylight Dimming	125	4,380	LED Retrofit	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	90	4,380	0.06	346	0.0	$52.19	$600.00	$200.00	7.66
Well #6	17	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,190	LED Retrofit	No	17	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,190	0.46	1,388	0.0	$209.14	$850.00	$170.00	3.25
Well #6	9	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	50	4,380	None	No	9	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	50	4,380	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Windsor Park Pump Station	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	200	None	No	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	200	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Windsor Park Pump Station	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	200	None	No	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	200	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Windsor Park Pump Station	1	High-Pressure Sodium: (1) 150W Lamp	Wall Switch	188	200	None	No	1	High-Pressure Sodium: (1) 150W Lamp	Wall Switch	188	200	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Windsor Park Pump Station	1	High-Pressure Sodium: (1) 150W Lamp	Daylight Dimming	188	4,380	LED Retrofit	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	90	4,380	0.08	485	0.0	$73.07	$300.00	$100.00	2.74
Holyoke WT	8	Incandescent: area lighting	None	300	5,805	LED Retrofit	No	8	LED Screw-In Lamps: screw in	None	38	5,805	1.71	13,749	0.0	$2,071.21	$320.00	$0.00	0.15
Edge Lane WT	5	Incandescent: area lighting	None	300	5,032	LED Retrofit	No	5	LED Screw-In Lamps: screw in	None	38	5,032	1.07	7,449	0.0	$1,122.13	$200.00	$0.00	0.18

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
Well #1	Well Pump	1	Water Supply Pump	150.0	95.8%	No	3,800	No	95.8%	Yes	1	23.48	257,440	0.0	$38,781.84	$24,899.35	$0.00	0.64
Well #1	Lime Slury Mixer	1	Other	0.5	80.0%	No	3,800	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #1	Peristaltic Pump	1	Process Pump	1.5	88.5%	No	3,800	No	88.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #1	Chemical Feed Pumps	2	Process Pump	0.3	80.0%	No	3,800	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #5A	Well Pump	1	Water Supply Pump	125.0	94.5%	No	0	No	94.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #5A	Aeration Blower	1	Process Fan	7.5	89.5%	No	2,000	No	89.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #5A	Lime Slury Mixer	1	Other	0.5	80.0%	No	8,760	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #5A	Calcium Hypochlorite Feeder	1	Other	0.3	80.0%	No	0	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #6	Well Pump	1	Water Supply Pump	100.0	95.4%	No	1,400	No	95.4%	Yes	1	15.72	63,496	0.0	$9,565.30	$20,161.15	$0.00	2.11
Well #6	High Service Pump	1	Water Supply Pump	150.0	95.8%	Yes	1,400	No	95.8%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #6	Aerator Transfer Pump	1	Process Pump	25.0	92.4%	No	1,400	No	92.4%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #6	Lime Slury Mixer	2	Other	0.3	80.0%	No	1,400	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #6	Chemical Feed Pumps	3	Process Pump	0.3	80.0%	No	1,400	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #9	Well Pump	1	Water Supply Pump	100.0	95.0%	No	5,230	No	95.0%	Yes	1	15.78	238,202	0.0	$35,883.69	$20,161.15	$0.00	0.56
Well #10	Well Pump	1	Water Supply Pump	100.0	94.5%	No	6,200	No	94.5%	Yes	1	15.87	283,875	0.0	$42,764.06	$20,161.15	$0.00	0.47
Well #11	Well Pump	1	Water Supply Pump	200.0	95.8%	Yes	3,500	No	95.8%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Windsor Park Pump Station	Sewage Pumps	2	Other	40.0	93.0%	No	4,900	No	93.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Windsor Park Pump Station	Building Exhaust	2	Exhaust Fan	3.0	87.5%	No	200	No	87.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Windsor Park Pump Station	Building Supply	2	Makeup Air Fan	3.0	87.5%	No	200	No	87.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #6	Recirc	1	Process Pump	3.0	87.5%	No	8,760	No	87.5%	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
Well #5A	Building	2	Electric Resistance Heat		34.13	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #5A	Building	1	Through-The-Wall AC	2.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #6	Building	3	Electric Resistance Heat		17.07	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Windsor Park Pump Station	Building	1	Electric Resistance Heat		34.13	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Well #6	Office	1	Window AC	0.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

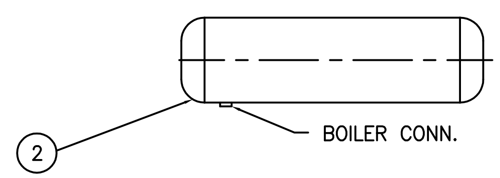
Fuel Heating Inventory & Recommendations

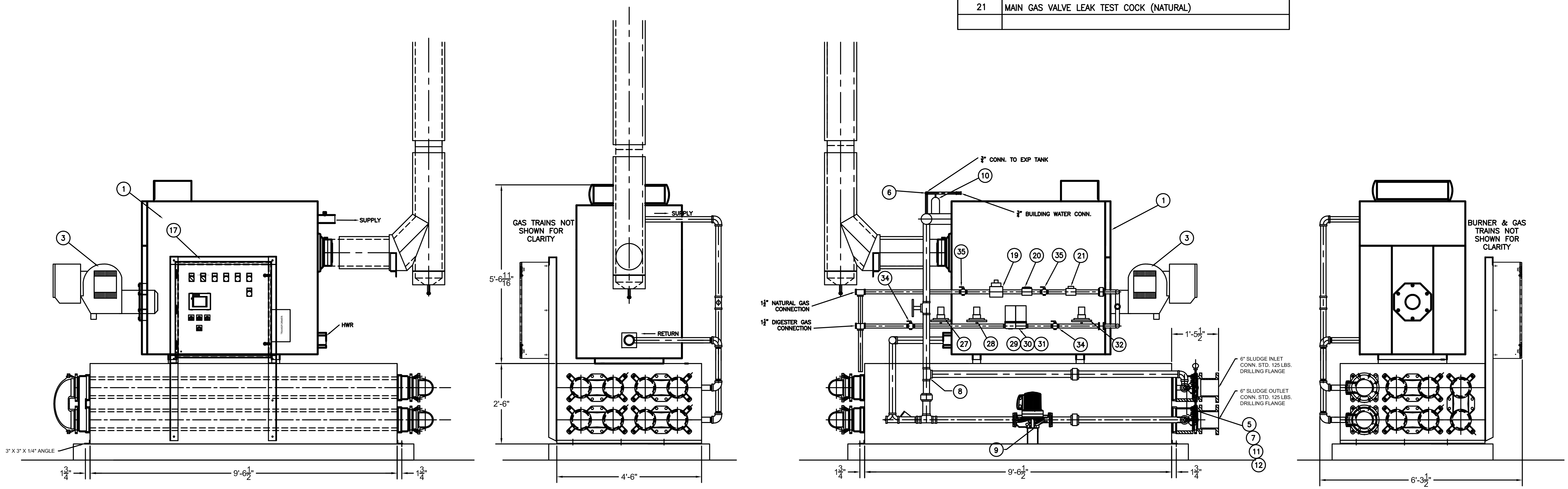
		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency 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
Well #1	Building	1	Warm Air Unit Heater	60.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

7.3 Digester Boiler & Heat Exchanger Schematic

PART NO.	PARTS LIST DESCRIPTION	PART NO.	PARTS LIST DESCRIPTION
1	CONDENSING BOILER	26	
2	EXPANSION TANK	27	AUTO RESET LOW GAS PRESSURE SW. (DIGESTER)
3	BURNER	28	LOW GAS PRESS. SW. (DIGESTER)
4		29	DUAL VALVE BODY (DIGESTER)
5	WATER THERMOMETER RTD	30	MAIN GAS VALVE W/ REGULATOR (DIGESTER)
6	MANUAL AIR VENT VALVE	31	AUX. GAS VALVE (DIGESTER)
7	SLUDGE THERMOMETER RTD	32	MAIN GAS LEAK TEST COCK (DIGESTER)
8	THERMOSTATIC THROTTLING & MIXING VALVES ELEC. MOTOR	33	FLAME ARRESTOR (BY OTHERS)
9	HEAT EXCHANGER HOT WATER CIRCULATING PUMP	34	DIGESTER GAS VALVE
10	PRESSURE REDUCING VALVE- OPV	35	NATURAL GAS VALVE
11	SLUDGE WELL AND SENSOR	39	
12	WATER WELL AND SENSOR	41	
14		42	
16		45	
17	CONTROL PANEL	46	
18			
19	AUX. GAS VALVE W/ REGULATOR (NATURAL)		
20	MAIN GAS VALVE (NATURAL)		
21	MAIN GAS VALVE LEAK TEST COCK (NATURAL)		

EXPANSION TANK





NOTES:
1. EXHAUST FLUE & APPURTENCES BY OTHERS
2. DIMENSIONS ARE FOR REFERENCE ONLY.

REV	DESCRIPTION	DATE

JDV Equipment Corporation
Incorporating Ralph B. Carter Company
WWW.JDVEQUIPMENT.COM
973.366.6556

DRAWING TITLE: SLUDGE HEATER PRELIMINARY

CUSTOMER:

PROJECT NO: -
DRAWN BY: JDV
SCALE: NTS
DATE: 05/10/16
CHECKED BY: JDV
SIZE: H1500C61
DRAWING NUMBER: H1500C61
REV: -

7.4 CHP Specification & Schematic

Technical specification

agenitor 404c BG

Design:

160 kW el.

60 Hz / 480 V

biogas (50% CH_4, 50% CO_2)

Calorific Value = 481 BTU/ft³

NOx < 1.0 g/BHP-h

Exhaust cooling to 356 °F

Subject to technical changes!

Note: Figure on cover page may differ

1. Genset

	50 %	75 %	100 %	Load
Electrical power	80	120	160	kW (5)
Useful thermal power	346.138	467.375	578.419	MBTU/hr (2)
Fuel cosumption	777.839	1091.998	1376.676	MBTU/hr (1)
Efficiency Electrical	35.1	37.5	39.7	% (1)
Efficiency Thermal	44.5	42.8	42.0	% (1), (2)
Efficiency Combined (el. + th.)	79.6	80.3	81.7	% (1), (2)

	NOx	CO	VOC (8)	
Exh. emissions without catalytic converter	< 1.0	< 2.3	< 0.7	g/BHP-h
	< 91	< 300		ppm (4),(6)
Exh. emissions with catalytic converter	< 1.0	< 0.7	< 0.7	g/BHP-h
	< 91	< 90		ppm (4),(6)

Engine surface noise **	104	dB(A) (7)
Engine surface noise with sound enclosure (optional) ***	70	dB(A) (7)

1.1 Engine

Engine manufacturer	2G	
Engine type	agenitor 404c	
Type	row	
No. of cylinders	4	
Operating method	4-stroke	
Engine displacement	8000	ccm
Bore	5.12	in
Stroke	5.91	in
RPM	1800	1/min
ISO standard power (mech.)	226	bhp
compression ratio	14,0 : 1	
average effective pressure	203.3	psi
average piston speed	29.5	ft/s
body of balance wheel	SAE 1	
Direction of rotation (based on balance wheel)	left	
tooth rim with number of teeth	167	
Engine dead weight	2094	lbs
Mixture cooling to	122	°F

** Total sound power level at full engine load in accordance with DIN EN ISO 3746

*** Average sound pressure level under open area conditions at distance of 1 m in accordance with DIN 45635
An increased noise load must be taken into account with fresh air intake from the installation room.

1.2 Generator (utility planning data)

Manufacturer	Leroy Somer	
Type	LSA 46.3 S3/4p	
Generator type	Synchronous, directly coupled	
Voltage regualtor (AVR)	D510C	
Rated speed	1800	1/min
Frequency	60	Hz
Effective electrical power	160	kW
Apparent electrical power (cos φ 0.8)	200	kVA
Apparent electrical power (cos φ 1.0)	160	kVA
Rated generator current (cos φ 0.8)	241	A
Rated generator current (cos φ 1.0)	192	A
Rated generator voltage (± 10 %)	480	V
Subtransient reactance X"d	12.0	%
Short-circuit current Ik"3	2.5	kA
Power factor cos φ (lagging / leading)	0.8 / 0.95	
Generator circuit breaker	400	A
Additional section switch (VDE-AR-N 4105)	400	A
Efficiency (full load) at Cos φ = 1	95.1	%
Mass moment of inertia	59.80	lb · ft²
Ambient air temperature	104	°F
Stator circuit	star	
Protection class	IP 23	
Generator weight	1321	lbs
Compensation	not available	
Engine startup	not available	

2 Mixture composition

2.1 Combustion air

Combustion air mass flow	1854	lbs/hr
Combustion air volume flow (25 °C, 1013 mbar)	418	SCFM

2.2 Fuel

Fuel requirements in accordance with 'TA-004 Gas'		
Reference methane number - minimum methane number	150 / 130	
Combustible mass flow	240.5	lbs/hr (1)
Combustible volume flow	47.6	SCFM (6),(1)
Gas pressure at rated load min. *	0.435	psig
Gas flow pressure at rated load max. *	1.015	psig
Gas regulation line safety pressure	7.252	psig

* At the inlet to the gas regulation line

3 Integrated heat extraction

3.1 Customer Heat Recovery Circuit

Heating water requirements in accordance with 'TA-002 Heating circuit'		
Heating water volume flow (at Δt = 15 K)	42.8	gpm
Internal pressure loss in heating circuit (approx.) *	4.35	psig
Pressure reserve (approx.) *	16.75	ft
Heating water return temperature (max)	158	°F
Heating water flow temperature (max) **	194	°F
Safety valve	87.02	psi

3.2 Engine circuit

Coolant requirements in accordance with 'TA-001 Coolant'		
Jacket Water Heat	249.120	MBTU/hr
Exhaust Gas Heat up to 356°F	262.733	MBTU/hr
Engine inlet temperature (min.)	176	°F
Engine outlet temperature (max.)	190	°F
Differential inlet / outlet (max.)	10.8	°F
Engine jacket water flow (min.)	53.6	gpm
Total cooling water circulation volume	82.2	gpm
Operating pressure (max.)	29.0	psi
Safety valve	43.5	psi
Safety temperature limiter	230	°F
Intercooler heat high temperature circuit	66.566	MBTU/hr
Intercooler inlet high water temperature (max.)	180	°F
Intercooler coolant flow high temperatue circuit (min.)	28.6	gpm

3.3 Mixture cooling water circuit - low temperature (LT)

Coolant requirements in accordance with 'TA-001 Coolant'		
Intercooler heat low temperature circuit	40.977	MBTU/hr
Intercooler inlet low water temperature (max.)	100	°F
Intercooler outlet low water temperature (max.)	106	°F
Intercooler coolant flow low temperature circuit (min.)	17.6	gpm
Safety valve	44	psi

* Up to / from module interface

** Heating water supply temperature in partial load operation < 90°C

4. Exhaust system

Exhaust gas temperature after turbo charger	824	°F (3)
Exhaust temperature after exhaust heat exchanger	356	°F
exhaust gas volume flow wet	427	SCFM (6)
exhaust gas volume flow dry	383	SCFM (6)
exhaust gas mass flow wet	2094	lbs/hr
exhaust gas mass flow dry	1950	lbs/hr
Exhaust back pressure downstream of turbine max.	0.73	psig
Pressure reserve approx. (with catalytic converter) *	0.57 (0.48)	psig
Exhaust outlet noise **	123	dB (7)

5 Ventilation

Radiation heat of engine and generator (approx.)	106.599	MBTU/hr
Supply air volume flow min. (at Δt = 15 K)	4127	SCFM

6 Operating fluids

Lubricating oil approvals, see 'TA-003 Lubricating oil'		
Lubrication oil consumption (max.)	0.30	g/kWh
Filling capacity lubricant (max.)	6.34	gallons
Lubricating oil filling tank fill capacity ***	9.25	gallons
Lubricating oil volume extension tank (optional)	18.49	gallons
Coolant approvals, see 'TA-001 Coolant'		

7 Electronics and software

Generator Protection Relay	Deif GPC 3 | optional redundant Relay SEL 700GT	
Touchscreen display	10	"
Protection class Control cabinet	Type 12	
Protection class Power switch cabinet	Type 1	
Switch cabinet environmental temperature	32 - 95	°F
Switch cabinet relative air humidity (max.)	65	%

* From module interface (exhaust heat exchanger / catalytic converter in standard version and new condition)

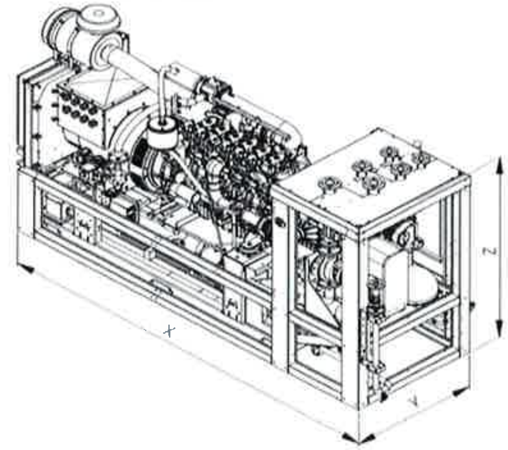
** Total sound power level at full engine load in accordance with DIN 45635-11 Annex A

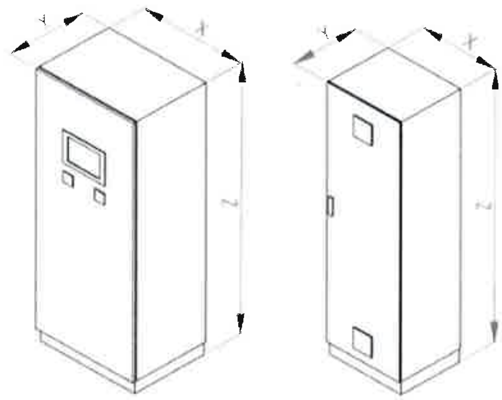
*** Filling tank omitted with installation of a lubricating oil volume auxiliary tank

8 Interfaces

8.1 Dimensions and weights

(Figures may differ)





Length Module	X	157.09	in
Width Module	Y	51.18	in
Height Module	Z	78.74	in
Weight Module		9083	lbs
Weight Module with sound enclosure (optional)		10847	lbs
Powder-coated CHP frame		RAL 6002	

Width Control cabinet	X	39.37	in
Depth Control cabinet	Y	23.62	in
Height Control cabinet	Z	82.68	in
Weight Control cabinet		441	lbs
Control cabinet powder coated		RAL 7035	

Width Power switch cabinet	X	23.62	in
Depth Power switch cabinet	Y	19.69	in
Height Power switch cabinet	Z	78.74	in
Weight Power switch cabinet		331	lbs
Power switch cabinet powder coated		RAL 7035	

8.2 Mechanical Connections

Interface Gas	50 / 10	DN / PN
Interface Exhaust	150 / 10	DN / PN
Interface Heating circuit	50 / 16	DN / PN
Interface Emergency cooling circuit	65 / 16	DN / PN
Interface Mixture cooling circuit LT	40 / 16	DN / PN

8.3 Electrical connections / utility interface

Grid connection with pre-fuse (customer-provided)	60 Hz / 480 V	
Grid system	Y	
Short-circuit proof Icc (max.)	50	kA

8.4 Data interfaces

Remote maintenance access (optional) *	DSL / UMTS (SIM)
Interfaces / Data interfaces (optional):	- Profibus - Profinet - Modbus RTU - Modbus TCP - Ethernet IP - Hardware signals
Access virtual power plant (optional)	Possible after technical clarification (bus or hardware signals)

* Access for remote maintenance must be provided by the customer

9 Technical boundary conditions

Unless otherwise specified, all data is based on full engine load with the respective indicated media temperatures and subject to technical improvements. The generator output measured at the generator terminals serves as the basis for the delivered electrical power. All power and efficiency specifications are gross specifications. The fuel gas quality must conform to the specifications of 'TA-004 Gas'. The operating fluids and plant system layout must conform to the 'Technical instructions' of 2G.

(1) Performance conditions in accordance with DIN ISO 3046. Tolerance for specific fuel use amounts to + 5% of nominal performance. Efficiency specifications are based on an engine in new condition. An abatement in efficiency over the service life is reduced with observance of the maintenance requirements.

(2) The tolerance for usable heat output is +/- 8 % under normal load.

(3) The tolerance for the exhaust temperature is +/- 8 %.

(4) Corresponding to a residual oxygen concentration in the exhaust of 15 %.

(5) Electrical generator terminal power at cos φ = 1.0

(6) Volume specifications for normal status:

Pressure	14.69 psig
Temperature	32 °F

(7) Standard deviation of reproducibility 4 dB in accordance with DIN EN ISO 3746

(8) Assumed gas composition (VOC calculated as NMHC):
CH_4=50 %, CO_2=50 %

Power specifications in this document relate to standard reference conditions.

Standard reference conditions in accordance with DIN ISO 3046-1:

Air pressure	14.50 psig
Air temperature	77 °F
Relative air humidity	30 %

Power reduction

Power reduction due to installation at altitude > 958ft a.s.l. and/or air suction temperature > 77°F shall be determined specifically for each project according "TI-049 Load reduction".

Internal power consumption

agenitor 404c BG

Standard components[1]	Power in kW
engine cooling pump	1,26
gas mixture cooling pump[1]	0,32
heating pump	0,46
control unit / measurement	1,00
Sum	3,04

Power-regulated components[2]	Power in kW (max.)
dump radiator cooler	3,88
gas mixture cooler	1,94
room fan	1,85
Sum (max.)	7,67

Optional components[3]	Power in kW (max.)
gas condenser	1,10
gas cooler	2,49
Gas reheating	0,22
air-conditioning control cabinets	0,86
oil pump	0,08
buffer discharge pump	3,90
Sum (max.)	8,65

Standby mode of the CHP[4]	Power in kW (max.)
engine preheating	1,50
Oil refill pump	0,75
Sum (max.)	2,25

Rev.: -, 24.03.2017, Doc.-ID.: 309615

[1]: The component generally runs at full load during CHP operation. Components can be omitted from 2G's scope of delivery as an option.

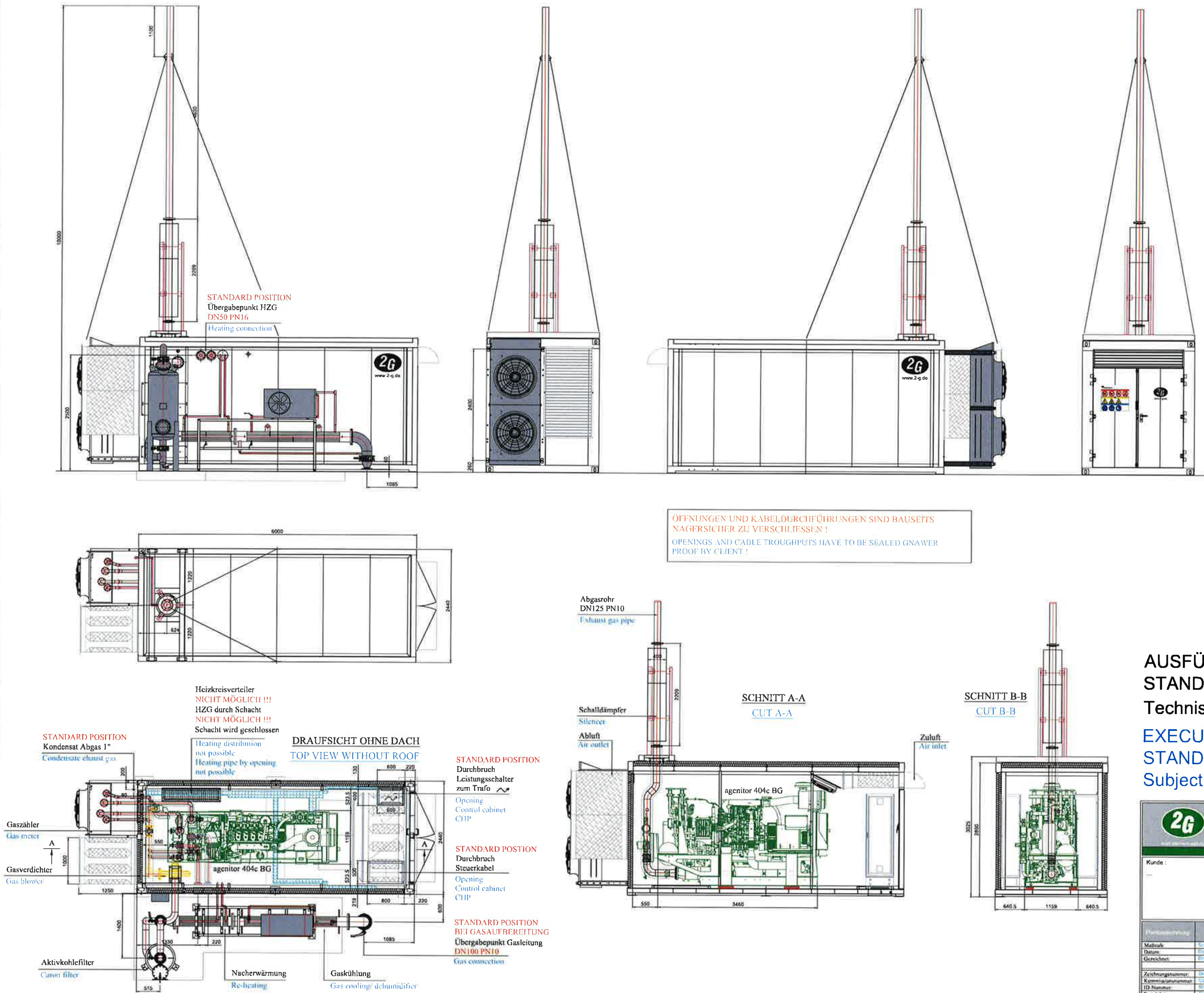
[2]: Component is power-regulated depending on its operating mode and/or external conditions.

[3]: Component is an optional furnishing, partially power-regulated.

[4]: Component is only operational during CHP downtime (optional).

Note:

The values stated are maximum/nominal values taken from the documentation of the relevant manufacturers. The internal power consumption depends to a high degree on the temperature, aggregate equipment and operating mode. Equipment options beyond the specified scope could have furter influence on internal power consumption.



Containerfarbe: RAL 6005 - Moosgrün
Container color: RAL 6005 - Moss green

Standard Ausführung:
Ausgelegt auf einem Schalldruckpegel von 65 dB(A) in 10m (Mittelwert unter Freifeldbedingungen) Entfernung
Standard execution:
Designed to a sound pressure level of 65 dB(A) in a distance of 10m (mean value, open field conditions)

Container ist ausgelegt auf:
Windzone 2
Schneelastzone 2 (bis 285m ü.d.M.)
Container is designed to:
Wind Zone II according to DIN 1055-4
Snow Zone II according to DIN 1055-5

AUSFÜHRUNGSPLAN
STANDARD-COMPACT CONTAINER
Technische Änderungen vorbehalten!

EXECUTION PLAN
STANDARD-COMPACT CONTAINER
Subject to technical changes!

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Endkunde + Lieferanschrift: Customer Delivery Address

Maßstab	Scale	Unmaßstäblich
Datum	Date	01.09.2017
Gezeichnet	Drawn	K.Rakoczy
Zeichnungsnummer	Drawing Number	—
Kommissionsnummer	Commission Number	—
ID Nummer	ID Number	—
Projektleiter	Project Manager	—

genehmigt/Stempel — Approval/stamp

Datum	Name	Art der Änderung	Index	Geprüft
Date	Name	Kind of change	Index	Checked

7.5 Lighting Line by Line

SPACE DATA						CURRENT SYSTEM		ECM				HOURS & CENTS				
Line	Building	Floor	Hours Group	Fixture Quantity	Lamp Type	System Description	Fixture Description	Description	ECM System Wattage	ECM System Lumens	ECM Quantity	Annual Hours	Existing Annual kW	Existing Annual kWh	ECM Annual kW	ECM Annual kWh
84	Admin	1	RRU	1	F	1L3' 30W T12/EE MAGNETIC	/1X3 WALL MOUNT VANITY	RETRO LED TYPE B LAMP	12	1300	1	520	0.042	21.84	0.012	6.24
89	Admin	1	CLO	1	I	75W INC	/1X1 SURFACE MOUNT ACRYLIC CANOPY	9W LED A-line Screw In	9	800	1	260	0.075	19.5	0.009	2.34
102	Admin	Basement	STO	4	F	3L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	4	520	0.544	282.88	0.104	54.08
104	Admin	Basement	STO	1	CIR	2L 22W & 32W CIRCULINE	/14" SURFACE MOUNT ACRYLIC CANOPY	14" Round LED Ceiling	24	1810	1	520	0.054	28.08	0.024	12.48
105	Admin	Basement	CLO	1	I	75W INC	/10" SURFACE MOUNT GLASS CANOPY	9W LED A-line Screw In	9	800	1	260	0.075	19.5	0.009	2.34
107	Admin		EXT	4	CFL	1L 13W COMPACT SI	/1X1 FLANGE GLASS CANOPY	9W LED A-line Screw In	9	800	4	4380	0.052	227.76	0.036	157.68
110	Admin		EXT	1	HPS	70W HPS	FLOOD	39W FFLED 5K	39	5699	1	4380	0.09	394.2	0.039	170.82
111	Admin		EXT	1	HPS	100W HPS	FLOOD	52W FFLED 5K	52	6935	1	4380	0.13	569.4	0.052	227.76
112	Admin		EXT	4	CFL	1L 15W COMPACT SI	/6" RECESSED GLASS CAN	9W LED A-line Screw In	9	800	4	4380	0.06	262.8	0.036	157.68
114	Admin		EXT	1	H	250W HALOGEN LAMP	WALL PACK PHOTO CELL	12W WPTLED 4K	14	1374	1	4380	0.25	1095	0.014	61.32

SPACE DATA							CURRENT SYSTEM		ECM				Hours and Cents				
Line	Building	Floor	Hours Group	Room Description	Fixture Quantity	Lamp Type	System Description	Fixture Description	ECM Description	**ECM System Wattage**	**ECM System Lumens**	ECM Quantity	Annual Hours	Existing Annual kW	Existing Annual kWh	ECM Annual kW	ECM Annual kWh
9	Water Treatmemt		EXT		3	MPS	250W MH CWA	POST TOP FLOOD	80W FFLED 5K	88	9157	3	4380	0.864	3784.32	0.264	1156
10	Water Treatmemt		EXT		2	MPS	250W MH CWA	WALL PACK	108W WP3LED 4K	108	15531	2	4380	0.576	2522.88	0.216	946.1
12	Water Treatmemt		EXT		1	MPS	175W MH CWA	WALL PACK	108W WP3LED 4K	108	15531	1	4380	0.208	911.04	0.108	473
17	Water Treatmemt	1	STO		1	F	2L4'T8/EEMAG	/1X4 SURFACE MOUNT INDUSTRIAL	RETRO LED TYPE B LAMP	26	3400	1	260	0.07	18.2	0.026	6.76
20	Water Treatmemt	1	CLO		1	I	75W INC	BARE SOCKET	11W LED A-Line Screw In	11	1100	1	260	0.075	19.5	0.011	2.86
21	Water Treatmemt	1	URO	Boiler room	1	F	2L8' EE/EEMAG	/1x8 SURFACE MOUNT ACRYLIC VAPOR TIGHT	LED Retrofit Kit 8'	46	6020	1	520	0.123	63.96	0.046	23.92
22	Water Treatmemt	1	JC		1	I	75W INC	BARE SOCKET	11W LED A-Line Screw In	11	1100	1	260	0.075	19.5	0.011	2.86
24	Water Treatmemt	1	URO	Pipe gallery	4	MPS	175W MH CWA	PENDANT STEM REFRACTOR LOW BAY	81W PHZ12L LED High Bay	81	11895	4	8760	0.832	7288.32	0.324	2838
25	Water Treatmemt	2	URO	Filter room	7	F	2L8' EE/EEMAG	/1x8 SURFACE MOUNT ACRYLIC VAPOR TIGHT	LED Retrofit Kit 8'	46	6020	7	8760	0.861	7542.36	0.322	2821
26	Water Treatmemt	2	URO	Filter room	8	MPS	70W MH LINEAR	WALL MOUNT GLASS FLOOD	Diva RKT Retrofit Kitr	60	8000	8	8760	0.68	5956.8	0.48	4205
27	Water Treatmemt		RRU		2	F	4L4'T8/ELIG	/2X4 SURFACE MOUNT PRISMATIC WRAP	RETRO LED TYPE B LAMP	26	3400	2	520	0.224	116.48	0.052	27.04
30	Water Treatmemt		LRM		1	F	4L4'T8/ELIG	/1X4 SURFACE MOUNT STRIP	RETRO LED TYPE B LAMP	52	6800	1	8760	0.112	981.12	0.052	455.5
33	Water Treatmemt		STO	Chemical room	8	F	4L4'T8/ELIG	/1X4 SURFACE MOUNT WIRE GUARD INDUSTRIAL	RETRO LED TYPE B LAMP	52	6800	8	8760	0.896	7848.96	0.416	3644
35	Water Treatmemt		WRK	Tool room	2	F	4L4'T8/EEMAG	/1X4 SURFACE MOUNT PRISMATIC WRAP	RETRO LED TYPE B LAMP	52	6800	2	1456	0.28	407.68	0.104	151.4
36	Water Treatmemt		WRK	Tool room	1	F	4L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	LED Panel	30	3800	1	1456	0.172	250.432	0.03	43.68
37	Water Treatmemt		WRK	Machine shop	1	F	4L4'T8/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	LED Panel	30	3800	1	1456	0.14	203.84	0.03	43.68
41	Water Treatmemt		EXT	Small pump house	1	HPS	150W HPS	FLOOD	26W FFLED 5K	28	4000	1	8760	0.19	1664.4	0.028	245.3
42	Water Treatmemt		URO	Small pump house	1	F	2L4'T8/ELIG	/1X4 SURFACE MOUNT INDUSTRIAL	RETRO LED TYPE B LAMP	26	3400	1	8760	0.06	525.6	0.026	227.8

SPACE DATA					CURRENT SYSTEM				ECM				HOURS & CENTS				
Line	Building	Floor	Hours Group	Room Description	Fixture Quantity	Lamp Type	System Description	Fixture Description	Description	ECM System Wattage	ECM System Lumens	ECM Quantity	Annual Hours	Existing Annual kW	Existing Annual kWh	ECM Annual kW	ECM Annual kWh
1	Pump and Control	1	COR		6	F	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	6	4380	0.516	2260.1	0.156	683.28
2	Pump and Control	1	PRO	Superintendent	5	F	3L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	39	5100	5	1040	0.68	707.2	0.195	202.8
3	Pump and Control	1	RRF		1	F	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	1	260	0.086	22.36	0.026	6.76
4	Pump and Control	1	RRM		1	F	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	1	260	0.086	22.36	0.026	6.76
5	Pump and Control	1	OPO	Laboratory	9	F	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	9	2600	0.774	2012.4	0.234	608.4
6	Pump and Control	1	OPO	Laboratory	1	F	2L2' STD/STD	/2X2 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	14	1700	1	2600	0.074	192.4	0.014	36.4
8	Pump and Control	1	PRO	Laboratory	2	F	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	2	2600	0.172	447.2	0.052	135.2
9	Pump and Control	1	STO	Laboratory	2	F	2L4'T8/ELIG	/1X4 PENDANT CHAIN INDUSTRIAL	RETRO LED TYPE B LAMP	26	3400	2	260	0.12	31.2	0.052	13.52
10	Pump and Control	1	URO	Telecom	1	CFL	1L 13W COMPACT SI	BARE SOCKET	9W LED A-line Screw In	9	800	1	260	0.013	3.38	0.009	2.34
11	Pump and Control	1	JC		1	CFL	1L 42W COMPACT SI	BARE SOCKET	13W LED Par 38 Screw In	13	1200	1	260	0.042	10.92	0.013	3.38
12	Pump and Control	1	URO	Mech / Elec	4	F	2L4' STD/EEMAG	/1X4 PENDANT CHAIN INDUSTRIAL	RETRO LED TYPE B LAMP	26	3400	4	5824	0.344	2003.5	0.104	605.696
13	Pump and Control	Basement	URO	Dry well	14	MPS	175W MH CWA	STRUT / TRUSS REFRACTOR LOW BAY	81W PHZ12L LED High Bay	81	11895	14	8760	2.912	25509	1.134	9933.84
14	Pump and Control	Basement	URO	Dry well	1	F	2L8'TW T8/ELIG	/1x8 PENDANT CHAIN STRIP	NEW T8 LED STRIP WITH MOTION SENSOR	46	6020	1	8760	0.055	481.8	0.046	402.96
15	Pump and Control		EXT		1	H	2 LAMP PAR30	BARE SOCKET	13W LED Par 38 Screw In	26	2400	1	2190	0.144	315.36	0.026	56.94
17	Pump and Control		EXT		1	HPS	250W HPS	WALL PACK	108W WP3LED 4K	108	15531	1	4380	0.295	1292.1	0.108	473.04
18	Pump and Control		EXT		1	HPS	50W HPS	WALL PACK	12W WPTLED 4K	14	1374	1	4380	0.065	284.7	0.014	61.32
19	Storage	1	STO	Grounds	6	F	2L4' STD/EEMAG	/1X4 STRUT / TRUSS ACRYLIC VAPOR TIGHT	RETRO LED TYPE B LAMP	26	3400	6	1300	0.516	670.8	0.156	202.8
21	Storage	1	STO	Chemical storage	6	MPS	175W MH CWA	STRUT / TRUSS GLASS CANOPY	HPLED 42 700 LS	98	11245	6	5824	1.248	7268.4	0.588	3424.512
24	Storage	1	STO	Control room	5	F	2L4' STD/EEMAG	/1X4 STRUT / TRUSS ACRYLIC VAPOR TIGHT	RETRO LED TYPE B LAMP	26	3400	5	5824	0.43	2504.3	0.13	757.12
27		1	STO	Small grounds shed	2	F	2L4' STD/EEMAG	/1X4 SURFACE MOUNT ACRYLIC VAPOR TIGHT	RETRO LED TYPE B LAMP	26	3400	2	260	0.172	44.72	0.052	13.52
29			EXT		6	MPS	250W MH CWA	POLE MOUNT FLOOD PHOTO CELL	Diva RKT Retrofit Kit	60	8000	6	4380	0	0	0.36	1576.8
32	Digestor	1	COR		2	MPS	175W MH CWA	SURFACE MOUNT GLASS CANOPY	61W BAILD LED FIXTURE	61	8093	2	5824	0.416	2422.8	0.122	710.528
33	Digestor	1	URO	Gas room	4	MPS	175W MH CWA	SURFACE MOUNT GLASS CANOPY	61W BAILD LED FIXTURE	61	8093	4	5824	0.832	4845.6	0.244	1421.056
34	Digestor	1	URO	Valve control	6	MPS	175W MH CWA	SURFACE MOUNT GLASS CANOPY	61W BAILD LED FIXTURE	61	8093	6	5824	1.248	7268.4	0.366	2131.584
36	Digestor	1	URO	Boiler	4	MPS	175W MH CWA	SURFACE MOUNT GLASS CANOPY	61W BAILD LED FIXTURE	61	8093	4	5824	0.832	4845.6	0.244	1421.056
38	Digestor	Basement	URO	Basement	11	MPS	175W MH CWA	SURFACE MOUNT GLASS CANOPY	61W BAILD LED FIXTURE	61	8093	11	5724	2.288	13097	0.671	3840.804
40	Digestor		EXT	Roof top	1	MPS	175W MH CWA	POST TOP GLASS CANOPY	20W Vapor Tight Jelly Jar	20	1700	1	4380	0.208	911.04	0.02	87.6
41	Open canopy		EXT		3	MPS	250W MH CWA	STRUT / TRUSS HIGH BAY	105W VL 15L 5K	15569	105	3	4380	0.864	3784.3	46.707	204576.66
42	Garage	1	GAR	Garage	12	F	2L4' STD/EEMAG	/1X4 PENDANT CHAIN INDUSTRIAL	RETRO LED TYPE B LAMP	26	3400	12	1040	1.032	1073.3	0.312	324.48
44	Garage	1	COR		2	F	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	2	5824	0.172	1001.7	0.052	302.848
45	Garage	1	URO	Mech	1	F	1L4' STD/EEMAG	/1X4 SURFACE MOUNT STRIP	RETRO LED TYPE B LAMP	26	3400	1	5824	0.05	291.2	0.026	151.424
46	Garage	1	LRM		5	F	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	5	5824	0.43	2504.3	0.13	757.12
47	Garage	1	LRM		2	CFL	4L 13W COMPACT SI	/1X3 WALL MOUNT VANITY	9W LED A-line Screw In	9	800	2	5824	0.104	605.7	0.018	104.832
48	Garage	1	LRM	Shower	2	I	100W INC	/1X1 SURFACE MOUNT PRISMATIC CANOPY	9W LED A-line Screw In	9	800	1	520	0.2	104	0.009	4.68
49	Garage	1	LRF		3	F	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	3	5824	0.258	1502.6	0.078	454.272
50	Garage	1	LRF		1	CFL	4L 13W COMPACT SI	/1X3 WALL MOUNT VANITY	9W LED A-line Screw In	9	800	1	2524	0.052	131.25	0.009	22.716
51	Garage	1	LRF	Shower	1	I	100W INC	/1X1 SURFACE MOUNT PRISMATIC CANOPY	9W LED A-line Screw In	9	800	1	260	0.1	26	0.009	2.34
52	Garage	1	BRK		6	F	2L4' STD/EEMAG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	6	5824	0.516	3005.2	0.156	908.544
53	Garage	1	BRK	Closet	1	I	100W INC	/14" SURFACE MOUNT GLASS CANOPY	14" Round LED Ceiling	24	1810	1	260	0.1	26	0.024	6.24
54	Garage		EXT		1	HPS	50W HPS	WALL PACK	12W WPTLED 4K	14	1374	1	4380	0.065	284.7	0.014	61.32
56	Garage		EXT		2	H	250W HALOGEN LAMP	WALL PACK PHOTO CELL	12W WPTLED 4K	14	1374	2	4380	0.5	2190	0.028	122.64
57	Filter Building	1	URO		15	F	2L4'T8/ELIG	/1X4 PENDANT THREAD ROD PRISMATIC VAPOR TIGHT	RETRO LED TYPE B LAMP	26	3400	15	5824	0.9	5241.6	0.39	2271.36
58	Filter Building	1	RRU		2	F	3L4'T8/ELIG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	2	520	0.176	91.52	0.052	27.04
59	Filter Building	1	RRU		1	F	2L2' 17W T8/ELIG LOW	/2X2 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	14	1700	1	520	0.027	14.04	0.014	7.28
60	Filter Building	1	RRU		1	F	1L2' 17W T8/ELIG	/1X2 SURFACE MOUNT PRISMATIC VANITY	RETRO LED TYPE B LAMP	7	850	1	520	0.017	8.84	0.007	3.64
61	Filter Building	1	JC		1	F	2L2' 17W T8/ELIG LOW	/1X2 SURFACE MOUNT PRISMATIC VANITY	RETRO LED TYPE B LAMP	14	1700	1	260	0.027	7.02	0.014	3.64
62	Filter Building	1	STO		2	F	3L4'T8/ELIG	/2X4 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	26	3400	2	260	0.176	45.76	0.052	13.52
63	Filter Building	1	URO	Elec	3	F	2L4'T8/ELIG	/1X4 STRUT / TRUSS INDUSTRIAL	RETRO LED TYPE B LAMP	26	3400	3	1040	0.18	187.2	0.078	81.12
64	Filter Building		EXT	Bay	4	MPS	175W MH CWA	SURFACE MOUNT GLASS CANOPY REFLECTOR	78W CLED LED Canopy	78	7635	4	2496	0.832	2076.7	0.312	778.752
	Filter Building		EXT		7	HPS	150W HPS	WALL PACK	65W WP2LED 4K	60	7591	7	4380	1.33	5825.4	0.42	1839.6
66	Storage	1	STO		6	F	2L4' STD/EEMAG	/1X4 PENDANT CHAIN INDUSTRIAL	RETRO LED TYPE B LAMP	26	3400	6	260	0.516	134.16	0.156	40.56
68	Storage	1	STO		3	F	2L4' STD/EEMAG	/1X4 PENDANT CHAIN INDUSTRIAL	RETRO LED TYPE B LAMP	26	3400	3	260	0.258	67.08	0.078	20.28
70	Storage		EXT		1	HPS	50W HPS	WALL PACK PHOTO CELL	12W WPTLED 4K	14	1374	1	4380	0.065	284.7	0.014	61.32

SPACE DATA					CURRENT SYSTEM				ECM				Hours and Cents				
Line	Building	Floor	Hours Group	Room Description	Fixture Quantity	Lamp Type	System Description	Fixture Description	ECM Description	**ECM System Wattage**	**ECM System Lumens**	ECM Quantity	Annual Hours	Existing Annual kW	Existing Annual kWh	ECM Annual kW	ECM Annual kWh
43	6 Well		URO		20	F	2L4'T8/ELIG	/1X4 SURFACE MOUNT WIRE GUARD INDUSTRIAL	RETRO LED TYPE B LAMP	26	3400	20	520	1.2	624	0.52	270.4
44	6 Well		PRO		1	F	2L4'T8/ELIG	/1X4 SURFACE MOUNT STRIP	RETRO LED TYPE B LAMP	26	3400	1	520	0.06	31.2	0.026	13.52
46	6 Well		URO	Poly room	1	CFL	1L 23W COMPACT SI	SURFACE MOUNT RLM	15W LED A-Line Screw In	14	1500	1	520	0.025	13	0.014	7.28
47	6 Well		URO	Chlorine room	2	CFL	1L 23W COMPACT SI	SURFACE MOUNT RLM	15W LED A-Line Screw In	14	1500	2	520	0.05	26	0.028	14.56
49	6 Well		RRU		1	F	2L4' STD/EEMAG	/1X4 WALL MOUNT ACRYLIC VANITY	RETRO LED TYPE B LAMP	26	3400	1	520	0.086	44.72	0.026	13.52
50	6 Well		URO	Small shed	1	CFL	1L 42W COMPACT SI	WALL MOUNT JELLY JAR	16.5W LED A-Line Screw In	16.5	2000	1	520	0.042	21.84	0.017	8.58
52	1 Well		EXT		6	HPS	70W HPS	WALL MOUNT FLOOD PHOTO CELL	26W FFLED 5K	28	4000	1	4380	0.54	2365.2	0.028	122.6
53	1 Well		EXT		2	MPS	250W MH CWA	WALL MOUNT FLOOD PHOTO CELL	80W FFLED 5K	88	9157	2	4380	0.576	2522.88	0.176	770.9
54	1 Well		EXT		1	CFL	1L 42W COMPACT SI	/8" RECESSED CAN	16.5W LED A-Line Screw In	16.5	2000	1	4380	0.042	183.96	0.017	72.27
57	1 Well		PRO		3	F	2L4' STD/EEMAG	/1X4 SURFACE MOUNT PRISMATIC WRAP	RETRO LED TYPE B LAMP	26	3400	3	520	0.258	134.16	0.078	40.56
58	1 Well		PRO		2	F	2L4' EE/EEMAG	/2X2 RECESSED PRISMATIC TROFFER	RETRO LED TYPE B LAMP	36	4300	2	520	0.14	72.8	0.072	37.44
60	1 Well		URO	Pump room	2	CFL	1L 23W COMPACT SI	SURFACE MOUNT RLM	15W LED A-Line Screw In	14	1500	2	520	0.05	26	0.028	14.56
64	1 Well		RRU		1	I	45W INC	/1X1	6W LED A-Line Screw In	6	485	1	260	0.045	11.7	0.006	1.56
66	1 Well		EXT		2	I	45W INC	WALL MOUNT JELLY JAR	6W LED A-Line Screw In	6	485	2	4380	0.09	394.2	0.012	52.56
70	5 Well		EXT	Scada bldg	1	HPS	150W HPS	POLE MOUNT SHOE BOX	Diva RKT Retrofit Kitr	60	8000	1	4380	0.19	832.2	0.06	262.8
78	9 Well		EXT		1	CFL	60W CFL SI	PENDANT ARM BARN / SECURITY PHOTO CELL	LED Yardblaster	30	3626	1	4380	0.065	284.7	0.03	131.4
79	10 Well		EXT		1	CFL	2L 9W 2PIN VERTICAL MOUNT	POLE MOUNT GLASS VAPOR TIGHT PHOTO CELL	20W Vapor Tight Jelly Jar	20	1700	1	4380	0.019	83.22	0.02	87.6
80	10 Well		EXT		2	MPS	250W MH CWA	POLE MOUNT SHOE BOX	Diva RKT Retrofit Kitr	60	8000	2	4380	0.576	2522.88	0.12	525.6

SPACE DATA						CURRENT SYSTEM		ECM				HOURS & CENTS				
Line	Building	Floor	Hours Group	Fixture Quantity	Lamp Type	System Description	Fixture Description	Description	ECM System Wattage	ECM System Lumens	ECM Quantity	Annual Hours	Existing Annual kW	Existing Annual kWh	ECM Annual kW	ECM Annual kWh
71	Windsor		EXT	2	HPS	70W HPS	WALL PACK	30W WP1LED 4K	30	3392	2	4380	0.18	788.4	0.06	262.8
72	Windsor	Surface	URO	3	F	2L4' STD/EEMAG	/1X4 SURFACE MOUNT ACRYLIC VAPOR TIGHT	RETRO LED TYPE B LAMP	26	3400	3	260	0.258	67.08	0.078	20.28
73	Windsor	Subsurface	URO	1	CFL	2L 9W 2PIN VERTICAL	WALL MOUNT GLASS WALL PACK	20W Vapor Tight Jelly Jar	20	1700	1	260	0.019	4.94	0.02	5.2
76	Windsor	Subsurface	URO	1	HPS	150W HPS	WALL MOUNT GLASS CANOPY	42W HAZXLEDC 5K	42	3810	1	8760	0.19	1664.4	0.042	367.92
77	Beechnut	Surface	URO	1	CFL	2L 9W 2PIN VERTICAL	POLE MOUNT GLASS VAPOR TIGHT MOTION SENSOR	20W Vapor Tight Jelly Jar	20	1700	1	260	0.019	4.94	0.02	5.2
78	Beechnut	Surface	EXT	1	MPS	250W MH CWA	POLE MOUNT SHOE BOX	Diva RKT Retrofit Kit	60	8000	1	260	0.288	74.88	0.06	15.6
79	Tweed stone	Surface	EXT	2	HPS	250W HPS	POLE MOUNT SHOE BOX	Diva RKT Retrofit Kit	60	8000	2	260	0.59	153.4	0.12	31.2
80	Lake Drive	Surface	EXT	1	CFL	2L 9W 2PIN VERTICAL	POLE MOUNT GLASS VAPOR TIGHT MOTION SENSOR	20W Vapor Tight Jelly Jar	20	1700	1	260	0.019	4.94	0.02	5.2
81	Lake Drive	Surface	EXT	1	MPS	250W MH CWA	POLE MOUNT SHOE BOX	Diva RKT Retrofit Kit	60	8000	1	260	0.288	74.88	0.06	15.6

7.6 Digester Boiler Maintenance – Historical Costs

The following depicts the charges incurred by WMUA for repairing the digester boiler from January 1, 2017 through March 3, 2020.

```
March 3, 2020                    Willingboro Municipal Utilities Auth.                        Page No: 1
08:52 AM                        Detail Vendor Activity Report By Vendor Id

   Vendor Range: SOUTH005 to SOUTH005                                          Status: Active
     Report Type: All                        Include Open Requsitions: N
Threshold Amount:         0.00        Include Tax Id: Y      Contracts: N      Bid: Y  State: Y  Other: Y  Exempt: Y
 Date Range Type: Both            First Enc Date Range: 01/01/17 to 03/03/20        Paid Date Range: 01/01/17 to 03/03/20

Vendor # Name                       Status         1099 Type              Tax Id                                  1099
  First    P.O. #  Item Description                Prch. Type Status                   Invoice            Amount      Excl
  Enc Date Contract Id  Account Type  Charge Account          Account Description

SOUTH005 SOUTH JERSEY BOILER AND        Active                            222680865
  07/11/18 18-00517   1 REPAIR DIGESTER PRE-HEATER    Other     Pd  Ck: 87112 07/19/18                 2,540.00
                        Budget        01-200-7210               EQUIPMENT MAINTENANCE
  07/11/18 18-00517   2 MATERIAL                      Other     Pd  Ck: 87112 07/19/18                   671.40
                        Budget        01-200-7210               EQUIPMENT MAINTENANCE
  02/21/19 19-00184   1 REPAIR BOILER & PARTS         Other     Pd  Ck: 88066 03/20/19                 3,716.00
                        Budget        01-200-7210               EQUIPMENT MAINTENANCE
  03/01/19 19-00208   1 repair boiler 2/20/19         Other     Pd  Ck: 88066 03/20/19                 2,389.21
                        Budget        01-200-7220               SYSTEM MAINTENANCE
  09/10/19 19-00754   1 Repair Boiler                 Other     Pd  Ck: 88799 09/18/19                 3,440.98
                        Budget        01-200-7210               EQUIPMENT MAINTENANCE

    Total Open P.O.: Bid:        0.00  State:         0.00  Other:         0.00  Exempt:         0.00  All:         0.00
    Total Paid P.O.:             0.00                 0.00            12,757.59                  0.00          12,757.59
  Vendor P.O. Total:             0.00                 0.00            12,757.59                  0.00          12,757.59

Total Vendors:     1 Total Open P.O.:           0.00     Total Paid P.O.:       12,757.59     Total Open & Paid:      12,757.59
```

7.7 Third Party Review & Approval Report

To be provided once complete.

April 3, 2020

Mr. Diallyo Diggs
Director of Finance
Willingboro Municipal Utilities Authority
433 John F. Kennedy Way
Willingboro, NJ 08046-2119

Subject: Independent Third-Party Review of the Energy Savings Plan
ESP Original Draft Date: January 31, 2020
ESP Revision 1 Issue Date: March 12, 2020

Dear Mr. Diggs,

Gabel Associates, Inc. (Gabel) has completed a detailed review of the Energy Savings Plan (ESP) developed by Schneider Electric as part of the Willingboro Municipal Utilities Authority Energy Savings Improvement Program (ESIP). Following an initial review of the Original Draft ESP plan, Gabel submitted a list of questions to the Schneider Electric team in Memorandum No. 1 dated February 20, 2020, attached hereto as Exhibit 1. This was followed by two conference calls on February 21 and March 9, 2020 in order to discuss specific items listed in the Memorandum as well as in the original ESP. Schneider Electric provided responses to these questions and released Revision 1 of ESP document on March 12, 2020. Gabel conducted a review of Revision 1 and discussed additional questions via a conference call on March 26, 2020 which was then followed by an email correspondence by Schneider Electric on March 27, 2020 which formally addressed all questions and clarifications, attached hereto as Exhibit 2.

Please see the attached memorandum, emails, and documented responses from Schneider Electric.

Based on the information provided and clarifications by the Schneider Electric team, Gabel finds the ESP to be developed in accordance with the Board of Public Utilities' Office of Clean Energy protocols and as directed in the Local Finance Notice for ESIPs. Therefore we recommend the ESP be submitted to the Board of Public Utilities for approval.

If the WMUA, BPU, or project team has any questions, please contact me via email at bojan@gabelassociates.com.

Regards,

Bojan Mitrovic

Bojan Mitrovic, C.E.M, C.E.A
Senior Associate – Advanced Energy Solutions
Gabel Associates, Inc.

Exhibit 1

Willingboro Municipal Utilities Authority

Third Party Review

ESP Review Comments

Memorandum No. 1

To: Pam Janney, Schneider Electric

CC: Diallyo Diggs, Willingboro MUA
Andrew Weber, Willingboro MUA
Ryan Scerbo, Decotiis

From: Bojan Mitrovic & Andrew Conte, Gabel Associates

Date: February 20, 2020

Subject: Energy Savings Plan Review

Gabel Associates (Gabel) has conducted a preliminary review of the Willingboro MUA (WMUA) Energy Savings Plan (ESP) prepared by Schneider Electric. We have completed our first review of the ESP and developed a list of questions and requests for clarifications. We anticipate that the responses to the items listed below will result in subsequent rounds of review. Gabel would like to reserve the ability to follow up the Schneider Electric's responses to these questions with further inquiry as needed.

We ask that Schneider Electric provide a written response to this memorandum along with the requested and revised documentation. The following is our list of questions and requests for clarification:

1. As a general comment - please expand the ESP report to include description of each facility and inventory of existing mechanical equipment.

   SE Response: The ESP report has been revised to include existing facility descriptions in Section 3.0. Mechanical equipment inventory shown in LGEA reports have been verified and are referenced in the revised ESP Report.

2. Were energy cost savings calculated based on current electric and natural gas utility tariffs for each account and any current third party supply agreements, blended rates for each account, or based on blended rates as shown in the Baseline Energy Use

table (page 21)? For example, in case of relatively small kWh monthly usage, a significant portion of the bill may be attributed to fixed charges and demand charges resulting in high blended cost per kWh. These costs will then result in unrealistic total cost savings.

SE Response: Actual rate tariffs were used to calculate energy cost savings. Rate tariff simulations were performed for each utility meter using a spreadsheet-based tool that simulates utility baseline cost using current rate tariffs. The simulated rates are then compared to actual historical utility billing information and an error rate is calculated for each time period covered under the simulation. Rate tariff simulations for all meters have been included in Appendix 7.1 of the revised ESP Report.

Once the rate tariff simulation is approved (within acceptable error range) and any variances are justified, such as escalation or change in charges or rates during the baseline period, each ECM is evaluated by running the energy unit savings through the tariff simulation to yield accurate energy cost savings that consider time of use, tiered rates for energy and demand, ratchet clauses and any other aspects of the tariff.

3. Please expand section 4.1 Baseline Energy Use to include utility, tariffs and third-party supply information.

SE Response: Additional information regarding the utility, rate tariffs and third-party supply information has been provided in Section 4.1 of the revised ESP Report.

Project Summary Table in Section 4.2 indicates total demand savings of 2.2 Megawatts of electrical energy which is a sum of kW savings of 12 months. This way of presenting savings can be misleading to the client since electrical demand for all sites varies between 1.2 and 1.4 MW.

SE Response: The demand savings of 2.2 MW is an annual total. A statement clarifying this value has been added to the revised ESP Report.

<u>Recommended Measures Savings Calculations</u>

As a general note regarding energy cost savings calculations, different $/kWh rates were used for different ECMs at the same location. For example, as per tables below, blended electrical rate for WMUA PCP is $0.069/kWh and energy cost savings for various measures were calculated using rates ranging from $0.06 - $0.11/kwh. Please explain your rational in using different rates, especially if they are higher what WMUA is paying currently.

SE Response: As stated in response to question 2 above, actual rate tariffs are used to calculate energy cost savings. Rate tariff simulations have been created to approximate the energy charges for each meter. Depending on whether an ECM impacts on-peak demand, of-peak demand, or both, or energy only, the resulting tariff simulation will yield a different dollar cost savings per energy unit saved. In the example cited in this question, the WMUA PCP, the varying energy rates used reflect whether the ECM impacts on peak demand, off peak demand and energy, as in the case of the lighting, or only off peak energy use, in the case of plug load controls.

<u>Summary of electric and natural gas usage/costs (based on tables on pages 22-24)</u>

	kWh	Elec. Cost	$/kWh	MCF	gas cost	$/MCF
Administrative Office	30,100	$ 4,460	$ 0.148	286	$ 2,722	$ 9.52
WMUA WTP	802,407	$ 66,401	$ 0.083	664	$ 6,083	$ 9.16
WMUA PCP	2,538,996	$ 176,335	$ 0.069	1338	$ 12,389	$ 9.26
Well 1 - Sylvan Lane	568,687	$ 60,736	$ 0.107	152	$ 1,620	$ 10.66
Well 5A - Baldwin Lane	385,981	$ 62,934	$ 0.163	610	$ 6,666	$ 10.93
Well 6 - Medallion	290,588	$ 48,691	$ 0.168	15	$ 308	$ 20.53
Well 9 - Middlebury Lane	326,200	$ 47,174	$ 0.145	4	$ 221	$ 55.25
Well 10 - Barnwell	462,180	$ 51,694	$ 0.112	7	$ 242	$ 34.57
Windsor Park	108,473	$ 10,748	$ 0.099	29	$ 425	$ 14.66
Beechnut	18,524	$ 2,173	$ 0.117	3	$ 211	$ 70.33
Tweedstone	32,147	$ 3,890	$ 0.121	8	$ 250	$ 31.25
Lake Drive	10,560	$ 1,435	$ 0.136	2	$ 203	$ 101.50

Summary of electrical savings for WMUA PCP

WMUA PCP			
	kwh savings	$ savings	$/kWh
Pump VFD	730,736	$ 65,888	$ 0.09
Premium Eff Motors	14,587	$ 1,450	$ 0.10
CHP	1,177,720	$ 112,897	$ 0.10
Lighting	74,176	$ 7,802	$ 0.11
Occupancy Sensors	10,565	$ 953	$ 0.09
Building Envelope	47,047	$ 4,358	$ 0.09
Transformers	23,432	$ 1,592	$ 0.07
Plug load	968	$ 56	$ 0.06

a) Pump VFDs

- Please provide more info on how pre and post kWh usage was calculated. It appears that for 'Baseline Pump kWh' it was assumed pumps run continuously 24/7 and full load while for 'Post Pump kWh' number of hours is reduced.
- **SE Response:** For Recirc Pumps at the PCP, baseline operation assumes one of the two pumps runs 8760 hours/year. Savings are estimated assuming the same annual operating hours and the VFD is used to vary flow, and thus kWh and kW, based on plant loading. A chart was provided showing how the plant loading changes over the course of one calendar year.
  For the Well Pumps, baseline annual operating hours was provided, and it varies by each pump, ranging from 3800 hours for Well 1 to 6200 hours for Well 10. Savings were estimated assuming that the VFD is set at 90% speed, reducing the peak kW. However, the well pumps still need to provide the same amount of total

flow, so the operating hours actually increase, even though energy use (kWhr) and peak demand (kW) both decrease, thus driving energy cost savings.
Revisions have been made to Appendix 7.1 to clarify the pump/VFD operating assumptions.

- Was post pump kWh calculated using single % load factor reduction (per month) or based on power curve (% of time at different kW)?
- **SE Response:** For the Recirc Pumps, the calculation is based on a single, average % load factor for each pump. The monthly load factor corresponds to the average monthly historical loading of the PCP. As stated in response to question 3a, VFDs are being installed on the Water Well pumps to permanently reduce speed to a fixed 90%, rather than to allow the pump to follow a changing load curve.

b) Premium Efficiency Motors
- As per scope of work on page 10 there are three motors rated at 15 hp that will be replaced with premium efficiency motors. Please provide assumptions used in calculations (existing and proposed motor efficiency, operating time and load factor).
- **SE Response**: Assumptions used in the calculations have been provided in Appendix 7.1 of the revised ESP report.

c) Digester Boiler Replacement
- As per Scope of Work on page 10 "the installation of a new boiler and heat exchanger to replace the current equipment will reduce maintenance costs and improve system reliability", however, there are no calculations in the report explaining these savings. Please provide additional calculations if available.
- **SE Response:** Appendix 7.1 of the ESP has been revised to show assumptions for savings from the new digester boiler.

d) Replace existing Microturbine with new CHP unit
- Please provide rationale for selecting an engine rated at 160kW. If the current price of electricity and natural gas is $0.069/kWh and $9.26/MCF respectively, it appears it would be more beneficial for the WMUA to minimize consumption of additional natural gas used in blended fuel at the expense of producing less electrical energy.
- **SE Response:** The CHP unit was sized to consume the majority of the digester gas that is expected to be produced after other projects are completed at the PCP to improve plant process operation but that are outside the scope of the ESP. These projects are listed in Section 6.2 of the ESP Report and will result in an increase in the quantity of digester gas being produced over current levels. Therefore, future operation of the CHP unit is based on only burning digester biogas and not purchased natural gas.

e) Lighting Retrofits
- Please clarify scope of work on page 13 – does the proposed retrofit consist of relamp/reballast, retrofit kit or new fixture installation?
- **SE Response:** Lighting retrofits consist of a combination of new LED fixtures, LED lamp and ballast retrofit, LED retrofit kits and LED screw-in lamps. The

ECM description in Section 3.2 has been modified to show the quantity of these different retrofits by facility.

f) Lighting Occupancy Sensor Controls
    - No savings calculations provided in the report. Please update ESP with additional information
    - **SE Response**: Savings calculations for the lighting occupancy sensors has been included in Appendix 7.1 of the Revised ESP.

g) Programmable Thermostats
    - No savings calculations provided in the report. Please update ESP with additional information
    - **SE Response:** Schneider Electric has provided the information used to estimate savings for this ECM in Appendix 7.1 of the revised ESP.

h) Building Envelope Improvements
- No savings calculations provided in the report. Please update ESP with additional information
- **SE Response:** Details of crack length and size, associated CFM leakage and corresponding heating and cooling savings have been provided in Appendix 7.1 of the revised ESP.

i) Secondary Transformer Replacement
- No savings calculations provided in the report. Please update ESP with additional information
- **SE Response:** Details of existing transformer losses, new transformer losses and resulting savings have been provided in Appendix 7.1 of the revised ESP.

j) Plug Load Energy Management
- No savings calculations provided in the report. Please update ESP with additional information
- **SE Response:** Calculation details and assumptions have been provided in Appendix 7.1 of the revised ESP.

4. <u>Financial Analysis</u>

a) Please add asbestos and hazardous material abatement costs, if necessary.

SE Response: Hazardous material abatement costs are included for disposal of lighting fixtures, lamps and ballasts. No other hazardous material is expected to be encountered since asbestos abatement has already been done by the client.

b) Are energy savings for all technologies applied for full 20 years? Are there any ECMs that have lower life expectancy? Please confirm savings are only taken out for appropriate life expectancy. If they are taken out longer, are replacement costs are included?

SE Response: All energy savings has been carried for the full 20-year term. The only equipment whose life expectancy would not extend beyond this term includes VFD equipment plug load controls, and some light fixtures/lamps.

Schneider Electric VFDs, included in the scope of this project, are of very high quality and therefore have a life expectancy of about 10 to 12 years. The project cash flow has been revised to the replacement of the Well pump VFDs at year 11. VFD hardware cost only has been included as it is assumed that WMUA would be able to replace the equipment on a one-for-one basis. There is no equipment replacement included for Recirc Pump VFDs as only one recirc pump operates at any given time and pump operation is alternated periodically. Therefore, life expectancy for those VFDs is assumed to be double or 20 to 24 years.

The cash flow has also been revised to include plug load control replacement at year 10. Costs include hardware purchase only as WMUA will be able to replace this equipment on a one-for-one basis.

LED lamps have varying life expectancy depending on type. With burn hours shown in the Lighting Line by line, LED lamps can be expected to last between 8 and 22 years, as shown below:

Retrofit Type	**Avg Burn hrs/yr**	**L70 Life, hrs**	**Life Expectancy, yrs**
LED Flood Lights	4380	100,000	22.4
LED Wall packs	4380	100,000	22.4
LED T8 Tubes	2808	50,000	17.8
LED High Bays	5804	100,000	17.2
LED Retrofit Kit	4380	50,000	11.4
LED A-line Lamps	1877	15,000	8.0

No costs have been carried in the cash flow to accommodate LED lighting replacement for the following reason: Lamp replacement is a cost that is currently born by the client with their existing systems. As most existing fixtures do not contain LED lamps, current O&M costs to maintain lighting systems far exceeds future expected O&M costs, given the much longer expected life of LED lamps over fluorescent & HID lamps. Due to previous guidance from BPU to only carry O&M savings for 5 years, the cash flow vastly under represents the anticipated savings from lighting material costs over the life of the project.

c) Please provide more information on O&M savings - Are any invoices available showing actual O&M costs incurred by MUA in the past? Please confirm.

SE Response: Invoices are available for the digester boiler maintenance and repair. A copy of the charged amounts was provided by WMUA and is included in Appendix 7.6 in the revised ESP Report.

Exhibit 2

From: Pam Janney
To: Bojan Mitrovic
Subject: WMUA ESP - VFD Questions
Date: Friday, March 27, 2020 1:55:38 PM
Attachments: image001.jpg
image002.png
image003.png
image004.png

Bojan,

I consulted with our energy engineering team that performed the savings calculations for the VFDs in order to accurately address your questions, as follows:

1. PCP Recirc Pump VFDs
    a. Is the baseline assumption of 85% load for the pump is accurate? **We believe this is an accurate, but somewhat conservative, assumption as we believe the pump is more fully loaded due to the control mechanism installed, as described below.**
    b. Does the pump see varying load or is there a control mechanism that limits flow? **There is a control valve in the line that controls flow from the recirc pumps to the trickling filters. This valve is shown on the plant flow diagram and we have confirmed with the plant operator that this device is used to ensure continuous flow to the trickling filters.**
2. Well Pump VFDs:
    a. Since loading on the well pumps is mostly static (from fixed water level below ground to mostly fixed water level in a tank or to the plant) the pump efficiency will change as operation changes along the pump curve and to a certain degree, the affinity laws do not apply. Did you take varying pump efficiency into account when estimating savings due to motor speed/frequency changes? **We did account for various losses in efficiency associated with installation of a VFD on the Well Pumps. We accounted for motor and pump efficiency loss and VFD drive losses that do impose an energy penalty.**

Please let me know if these answers are sufficient or if you have any additional questions.
Thank you,
Pam

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7.8 Board of Public Utilities (BPU) Approval

To be provided once complete.