FINAL Energy Audit

New Jersey Clean Energy Program
Application No.: 04611MA

Rahway Valley Sewerage Authority

July 2016

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CDM Smith

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Executive Summary

As part of an initiative to reduce energy cost and consumption, Rahway Valley Sewerage Authority (RVSA) has secured the services of CDM Smith to perform an energy audit for the Authority's Wastewater Treatment Plant which is owned and operated by the Authority in an effort to develop comprehensive Energy Conservation and Retrofit Measures (ECRMs).

CDM Smith's energy audit team visited the facilities on January 13 and 19, 2016. As a result of the site visits, and the evaluation of historical energy usage at the facilities, CDM Smith was successful in identifying opportunities for energy savings measures.

CDM Smith has also evaluated the potential for renewable energy technologies to be implemented at the Authority's facilities to offset the electrical energy usage. Specifically, the use of anaerobic digestion with a combined heat and power system, solar electric photovoltaic panels, ground source heat pumps, and wind turbines were investigated.

Much of the WWTP has been built or upgraded within the last ten years. However, various wastewater process modifications or upgrades were identified including: the installation of variable frequency drives (VFDs) on the aerated grit blowers, programming changes to run the primary sludge pumps intermittently, use of the newer waste activated sludge and not older mixed liquor pumps, running at a slightly lower aerobic solids retention time to decrease the aeration oxygen demand and blower power consumption. One other recommendation was to install a new peracetic acid disinfection system in lieu of the (traveling bridge sand) effluent filters and ultraviolet light disinfection system at average daily flows.

Not all ECRMs identified as a result of the energy audit are recommended. ECRMs must be economically feasible to be recommended to the Authority for implementation. The feasibility of each ECRM was measured through a simple payback analysis. The simple payback period was determined after establishing Engineer's Opinion of Probable Construction Cost estimates.

Operation and Maintenance (O&M) cost estimates and projected annual energy savings estimates were developed, along with the potential value of New Jersey Clean Energy rebates, or Renewable Energy Credits, if applicable. In general, ECRMs with a payback period of 20 years or less are recommended for further consideration.

Historical Energy Usage

The following ES-1 summarizes the historical energy usage at the RVSA's Wastewater Treatment Plant as presented in Section 3. The data in ES-1 is representative of current flows and loads, and energy usage for the baseline and future condition per the Authority.

Table ES-1 - Summary of Annual Electrical Usage & Cost

Description	Electrical Energy Use (kWh)	Peake Summer Demand (kW)	Peak Winter Demand (kW)	Cost for Electric Service
Wastewater Treatment Plant	12,410,791	2806.0	5261.8	$1,515,712

Average annual usage and cost have been calculated using data supplied by RVSA for the time frame of December 2012 through November 2015

Table ES-2 - Summary of Annual Gas Usage & Cost

Description	Natural Gas Use (Therms)	Cost for Fuel
Service Building (No. 04)	165,804	$165,804
Pump & Blower Building (No. 06)	98	$5,151
Laboratory Building (No. 20)	13,210	$12,153
Administration Building (No. 21)	5,247	$5,247
Utility Garage (No. 22)	1,519	$1,656
Maintenance Shop (No. 25)	5,018	$4,817
Sludge Dewatering Building (No. 27)	7,981	$8,380
Employee Facilities Building (No. 29)	5,633	$5,802
Cogeneration/Sludge Drying Facility (No. 37)	634,828	$349,155

See Section 3 for average annual usage and cost calculation time frames using data supplied by RVSA

Recommended ECRMs

The recommended energy conservation and retrofit measures (ECRMs) are as follows:

- ECRM-1 – UV Disinfection - Automatic Mode Operation
- ECRM-2 - Return Sludge Pumping Station - WAS Pumps
- ECRM-3 - Aeration Tank - SRT Reduction
- ECRM-4 - Primary Settling Tank - Primary Sludge Pump Operation
- ECRM-5 – Headworks - Aerated Grit Blower VFD
- ECRM-6 - Site Wide Lighting Upgrades
- ECRM-7 - Utility Garage Building - Condensing Unit Heaters
- ECRM-8 - Annex, Administration, and Dewatering - Central Hot Water Loop
- ECRM-9 – Thermal Oil to Process Hot Water Heat Exchanger
- ECRM-10 – Three Site Locations – Solar Array Installation

ECRMs Not Recommended

- Wind power generation
- Employee facilities and laboratory condensing furnace upgrade
- Sludge process building solar thermal air heating system

The ECRMs above are not recommended due to unfavorably long payback periods.

Table ES-3 presents the ranking of ECRMs identified for the wastewater process upgrades, building lighting, and HVAC systems based on simple payback analysis. The table includes the Engineer's Opinion of Probable Construction Cost, projected annual energy usage savings, and simple payback period for each measure. The ECRMs are ranked based on payback period.

Table ES-3 - Ranking of Energy Savings Measures Summary

Overall Ranking (Based on Simple Payback)	Facility Measure	Base Cost[1]	Annual Energy Savings	Annual Fiscal Savings[2]	Simple Payback (Years)	Greenhouse Gas Emission Reduction (Metric Tons)
1	ECRM-1 UV Disinfection **Automatic Mode Operation**	N/A	1,900,900 kWh	$320,000	< 1, No associated cost	587
2	ECRM-2 Return Sludge Pumping Station **WAS Pumps**	N/A	75,000 kWh	$10,000	< 1, No associated cost	23
3	ECRM-3 Aeration Tank **SRT Reduction**	N/A	83,000 kWh	$9,000	< 1, No associated cost	26
4	ECRM-4 Primary Settling Tank **Primary Sludge Pump Operation**	N/A	113,000 kWh	$14,000	< 1, No associated cost	35
5	ECRM-5 Headworks **Aerated Grit Blower VFD**	$26,000	88,000 kWh	$11,000	2.4	27
6	ECRM-6 Site Wide **Lighting Upgrades**	$340,650	389,736 kWh	$59,312	5.8	120
7	ECRM-7 Utility Garage Building **Condensing Unit Heaters**	$10,354	1,537 Therms	$1,557	6.6	8
8	ECRM-8 Annex, Administration, and Dewatering **Central Hot Water Loop**	$82,492	0 Therms	$7,358	11.2	0
9	ECRM-9 **Thermal Oil to Process Hot Water HX**	$247,773	30,361 Therms	$14,877	16.7	176
10	ECRM-10 Three Site Locations **Solar Array Installation**	$2,908,200	546,247 kWh	$159,344	19.0	169

1. Engineers Probable Construction Cost takes into account any applicable rebates.
2. Annual Fiscal Savings takes into account additional O&M cost or savings associated with the measure.

Section 1

Introduction

1.1 General

As part of an initiative to reduce energy cost and consumption, the Rahway Valley Sewerage Authority (RVSA) has secured the services of CDM Smith to perform an energy audit at the Wastewater Treatment Facility in an effort to develop comprehensive energy conservation initiatives.

The performance of an Energy Audit requires a coordinated phased approach to identify, evaluate, and recommend energy conservation and retrofit measures. The various phased tasks performed under this Energy Audit include the following:

- Gather preliminary data on all facilities.
- Inspect facilities.
- Identify and evaluate potential ECRMs and evaluate renewable/distributed energy measures.
- Develop the energy audit report.

Figure 2 is a schematic representation of the phases utilized by CDM Smith to prepare the Energy Audit Report.

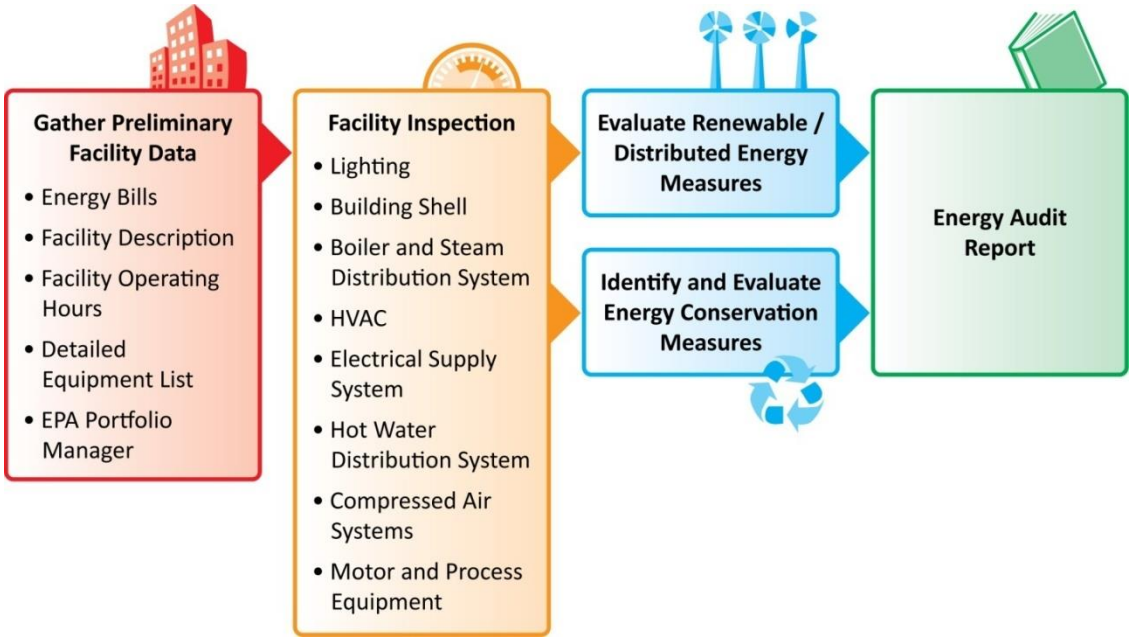


Figure 1-2 - Energy Audit Phases

1.2 Background

The RVSA Wastewater Treatment Plant (WWTP) is located in Rahway, New Jersey, and has been in operation since 1928.

The RVSA is a regional wastewater collection and treatment system serving 11 municipalities consisting of Clark, Cranford, Garwood, Kenilworth, Mountainside, Rahway, Roselle Park, Scotch Plains, Springfield, Westfield, Woodbridge. The RVSA currently serves Member Municipalities of Clark, Cranford, Garwood, Kenilworth, Mountainside, Rahway, Roselle Park, Scotch Plains, Springfield, Westfield, and Woodbridge and User Municipalities of Winfield Park, portions of Fanwood and Linden.

The WWTP includes the following processes which are discussed in further detail in Section 2:

- Headworks (Screening and Grit removal)
- Primary settling
- Activated sludge with fine bubble diffused aeration
- Final settling
- Effluent Filters
- Ultraviolet (UV) disinfection
- Post Aeration
- Gravity thickening of primary and waste activated sludge (WAS)
- Rotary drum thickening of primary sludge and WAS (not in use)
- Anaerobic digestion (mesophilic)
- Sludge storage tanks
- Centrifuge dewatering
- Thermal drying
- Dual fuel internal combustion engines for cogeneration

The facilities that were included in the energy audit for the RVSA were:

- Service Building (No. 04)
- Pump & Blower Building (No. 06)
- Sludge Pumping Station (No. 09)
- Sludge Thickening Building (No. 11)

- Digester Control Building (No. 13)
- Laboratory Building (No. 20)
- Administration Building (No. 21)
- Utility Garage (No. 22)
- Maintenance Shop (No. 25)
- Methane Filter Building (No. 26)
- Sludge Dewatering Building (No. 27)
- Lime Stabilization Building (No. 28)
- Employee Facilities Building (No. 29)
- Rotary Drum Thickener Facility (No. 34)
- Cogeneration/Sludge Drying Facility (No. 37)
- Administration Annex (No. 39)
- Headworks Facility (No. 44)
- Effluent Filter and UV Control Building (No. 56)
- Return Sludge Pumping Station (No. 62)

The buildings' combined square footage at the Main Facility have a combined square footage of approximately 128,000 square feet.

The following processes are included in this Energy Audit but have no associated square footage:

- Aeration Tanks Monitoring
- Sludge Thickening Tanks
- Digester Tanks
- Sludge Storage Tanks
- Final Clarifier Tanks
- Tunnels
- Effluent Pump Station (Archimedes Screw-type)
- Cascade Aeration

See Section 2 for more information on the buildings.

1.3 Purpose and Scope

The objective of the energy audit is to identify energy conservation and retrofit measures to reduce energy usage and to develop an economic basis to financially validate the planning and implementation of identified energy conservation and retrofit measures.

It should be noted that the magnitude of energy savings available is dependent not only on the type of process, electrical, heating/cooling, lighting or insulation systems in use, but also on the age and condition of the equipment. Due to the cost of power and the desire to minimize dependence on foreign oil supplies, energy consumption is taking a higher priority across the nation. Feasible alternatives for reducing energy consumption and operating costs must be evaluated on a case-by-case basis.

In addition, potential energy producing systems such as solar electric, ground source heat pumps, and wind energy systems are evaluated. A discussion of these technologies is included in Section 4 - Energy Conservation and Retrofit Measures (ECRM).

There is potential for further energy cost savings through continued use of a third party energy supplier and participation in a Demand Response Program. This is discussed further in Section 5.

1.4 Acknowledgement

This work could not have been done without the help and accessibility of the RVSA following staff: John Buonocore, P.E. and Andy Sasso, Operations Manager.

Section 2

Facility Description

The RVSA owns and operates a 40 MGD WWTP located in Rahway, NJ. The WWTP accepts flows from 11 municipalities consisting of Clark, Cranford, Garwood, Kenilworth, Mountainside, Rahway, Roselle Park, Scotch Plains, Springfield, Westfield, Woodbridge. The RVSA currently serves more than 250,000 residents with member Municipalities of Clark, Cranford, Garwood, Kenilworth, Mountainside, Rahway, Roselle Park, Scotch Plains, Springfield, Westfield, and Woodbridge and User Municipalities of Winfield Park, portions of Fanwood and Linden, along with 3,500 industrial users and commercial customers within a 49 square-mile area. The WWTP accepts approximately 100,000 gpd, 5 days per week of landfill leachate from the Monmouth County Resource Recovery Facility. No septage, liquid sludge or hauled wastes (feedstocks) are currently received.

The WWTP currently treats an average of 24-MGD and was designed for a peak hourly flow of 105-MGD. Treated effluent is discharged from the WWTP to Arthur Kill via outfall 001A. The RVSA WWTP operates under NJPDES Permit No. NJ0024643.

Key permit limits include:

- Total Suspended Solids (TSS) 30 mg/L monthly average
- TSS 45 mg/L weekly average
- Carbonaceous Biochemical Oxygen Demand (CBOD5) 25 mg/L monthly average
- CBOD5 40 mg/L weekly average
- Fecal coliform 200 colonies/100 mL monthly average
- Fecal coliform 400 colonies/100 mL weekly average
- Chlorine based oxidants 0.017 mg/L daily maximum
- Dissolved oxygen 3.0 mg/L daily minimum

The average influent concentration for key parameters from January 2012 through November 2015 includes:

- CBOD 119 mg/L
- TSS 164 mg/L
- Total Kjeldahl Nitrogen (TKN) 42 mg/L (very limited data)
- Ammonia 32 mg/L (very limited data)

This data shows a low to medium strength wastewater.

The plant was designed with the ability to nitrify, but is not currently required to use this capability. However, from the limited TKN and ammonia data received, there is nitrification occurring which increases the oxygen demand and thus aeration blower power consumption. For reference, the current aerobic solids retention time (SRT) is approximately 7 days and aeration tank mixed liquid suspended solids concentration (MLSS) is typically 1,500 to 2,000 mg/L based on 24-hour composite samples. This is with both aeration tanks in service.

The plant is required to disinfect year round. There are no effluent limits now or proposed for total nitrogen or phosphorus.

The liquid treatment process train at the RVSA WWTP includes: three mechanical coarse (3-inch spacing) and three fine bar screens (3/8-inch spacing), five influent pumps, four aerated grit chambers, four rectangular primary clarifiers, four intermediate pumps, two rectangular aeration tanks with fine bubble membrane disc diffusers, six circular secondary clarifiers, six effluent filters an ultraviolet (UV) light disinfection system, four effluent pumps and post aeration. The solids train consists of three rotary drum thickeners, three sludge gravity thickeners, a septage receiving station, three anaerobic digesters, four sludge storage tanks, three dewatering centrifuges, one thermal dryer, digester gas treatment system and four internal combustion engines for cogeneration.

2.1 Service Building (No. 04)

2.1.1 Description of Building Envelope

Service Building (No. 04) was constructed in the 1930s. The exterior walls of the Service Building (No. 04) are of brick and mortar façade with brick, or finished interior. The building roof is flat.

The building windows were noted to be double pane with aluminum frames.

2.1.2 Description of Building HVAC

The heating in Service Building (No. 04) is provided by hot water generated from boilers. Hot water is generated by two Cleaver-Brooks boilers. One is natural gas fired, while the other is fired by natural or digester gas. These boilers each have an input capacity of 6,000 MBH (1 MBH = 1,000 BTU/Hr. These boilers have an estimated operating efficiency of 80%. The hot water is pumped to the central hot water loop for the wastewater treatment plant. There are additional take offs from the central hot water loop for hot water pumps to deliver hot water to the hot water coils of the unit heaters in various locations throughout the building.

A window air conditioning unit provides cooling for the MCC room.

The rooms are controlled by local electric thermostats. The boilers and hot water pumps are controlled by a Preferred Instruments panel.

The boilers are in good condition. Most of the other HVAC equipment appeared to vary from fair to good condition.

2.1.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Several spaces in this building suffer from low lighting levels due to burned out lamps. Inefficient fluorescent and high intensity discharge (HID) fixtures are used throughout this building. Interior include single level manual switching for the fixtures within each space of the building.

The exterior lighting fixtures consist of several wall mounted HID fixtures and medium-sized floodlights for area lighting. Exterior fixtures operate during night time hours through photocell control.

Interior lighting consists of fluorescent 2-lamp T8 and T12 fixtures, metal halide fixtures, and incandescent bulbs. Several fluorescent fixtures are not operational. In particular, one side of the electrical room has very low light levels due to burned out lamps. Wall mounted and pendant mounted metal halide fixtures are used in process areas. Interior fixtures operate continuously and are controlled through manual single level switching for each area.

A summary of all conditions associated with this facility is provided in Appendix B.

2.2 Pump & Blower Building (No. 06)

2.2.1 Description of Building Envelope

The Pump & Blower Building (No. 06) was constructed in the 1970s. The exterior walls of the Pump & Blower Building (No. 06) are of brick and mortar façade with concrete masonry unit (CMU) back up blocks. The building roof is flat.

The building windows were noted to be single pane with weather-stripping with aluminum frames.

2.2.2 Description of Building HVAC

Hot water is generated by a gas-fired Buderus boiler. This boiler has an input capacity of 4,835 MBH (1 MBH = 1,000 BTU/Hr. This boiler has an estimated operating efficiency of 80%. The hot water is pumped to the central hot water loop for the wastewater treatment plant. The heating in Pump & Blower Building (No. 06) is provided from the central hot water loop and electric unit heaters. There are take offs from the central hot water loop for hot water pumps to deliver hot water to the hot water coils of the unit heaters, convectors, and heating and ventilating units in various locations throughout the building.

Split-system air conditioners and window air conditioning units provide localized cooling for the building.

A 2000 Bradford White Corporation electric domestic water heater with a 19 gallon storage tank located in the blower room has an input capacity of 1500 Watts. This domestic water heater provides domestic hot water throughout the building.

The HVAC equipment in this building appeared to vary from fair to good condition.

2.2.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. The lower level of the building suffers from low light levels due to many burned out fixtures. Inefficient fluorescent and HID fixtures are used throughout the building. Interior lighting controls include mostly single level switching. Multi-level switching is found in certain areas of the building.

The exterior lighting fixtures consist of small and large wall-mounted LED fixtures and medium and large floodlights for area lighting. Exterior fixtures operate during night time hours through photocell control.

The ground level of the blower building utilizes new high bay pendant LED fixtures with multi-level switching. The basement level has a mixture of metal halide and fluorescent 2-lamp T8 fixtures. Several fixtures in the basement are not operational, resulting in very low light levels in certain areas. Basement fixtures are controlled through manual multilevel switching.

Other rooms in the building include the chemical storage and feed station, unit substation, and offices, each of which contain fluorescent 2-lamp T8s controlled by manual single level switching.

A summary of all conditions associated with this facility is provided in Appendix B.

2.2.4 Process Description

The Pump & Blower Building (No. 6) houses three (3) single stage centrifugal aeration blowers, four (4) intermediate pumps, and two (2) waste activated sludge (WAS) pumps with associated piping and control panels. In this report, the WAS pumps are referred to as the existing mixed liquor pumps since they withdraw sludge from the aeration tanks and not the final clarifiers.

The centrifugal blowers (up to two duty, one standby) are 700 hp per unit, and are capable of providing 16,800 standard cubic-feet-per-minute (SCFM) of air each at a pressure rise of 8 psig on top of the blower inlet pressure of 14.42 psia to fine bubble diffusers located in the aeration tanks. The blowers are currently run manually with a set point operated by outlet diffuser vane position. RVSA typically runs one blower with inlet diffuser vane between 70 and 90% open, with higher values in the summer when more air is needed. The blower can be run down to 30% inlet diffuser vane open with a shut down at 25%. There is currently no automatic DO control or control using the blower inlet guide vanes.

The aeration blowers also provide post aeration to coarse bubble diffusers in the effluent filter channel. A manual butterfly valve controls the amount of air sent to this location. The flow meter has not been operational for some time and the approximate amount of air delivered is not known.

The air flow entering each aeration tank is measured with a thermal mass flow meter, DO probe and transmitter measures DO, and the air flow can be controlled using a modulating butterfly valve. The automatic DO control system includes a cascade Proportional Integral Derivative (PID) loop. The secondary loop consists of a PID loop of the air flow meter, Flow Indicating Controller (FIC), and the flow control valve. The primary loop is a PID loop of the DO transmitter, and output to the remote set point of the FIC. The master Programmable Logic Controller (PLC) is able to use the logic of “most open valve position” to calculate a pressure setpoint which will interact with up

to two blowers in service. RVSA does not use this system due to unreliable DO sensors and difficulties associated with control difficulties.

The intermediate pumps (two duty, two standby) are 100 hp per unit, and are each capable of providing 17,350 gpm at 14.5' of head. The pumps convey primary clarifier effluent to the aeration tanks. The intermediate pumps have VFDs and control similar to the influent pumps.

The existing mixed liquor (WAS) pumps (one duty, one standby) are 30 hp per unit, have a VFD, and are each capable of conveying 3,200 gpm at 25.3' of head. The pumps convey mixed liquor from the aeration tanks to the gravity thickener tanks. Typically, one pump operates at a set speed to maintain a target mass of solids under aeration (140,000 to 180,000 lbs). A higher mass is carried in the colder months. Currently, there is no SRT based control.

2.3 Sludge Pumping Station (No. 09)

2.3.1 Description of Building Envelope

The Sludge Pumping Station (No. 09) was constructed in the 1970s. The exterior walls of the Sludge Pumping Station (No. 09) are concrete masonry unit (CMU) block façade with tile interior. The building roof is flat over steel rook decks.

The building windows were noted to be single pane with steel frames.

2.3.2 Description of Building HVAC

The heating in the Sludge Pumping Station (No. 09) is provided by hot water unit heaters which appear to be in fair condition. There are take offs from the central hot water loop to deliver hot water to the hot water coils of the unit heaters in various locations throughout the building. The central hot water loop is supplied by the primary building boilers and the pump and blower building boilers.

2.3.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Interior lighting control is by single level manual switching.

One LED area lighting fixture is wall mounted on the exterior of the building. The interior fixtures are pendant mounted metal halide fixtures controlled through single level switching.

A summary of all conditions associated with this facility is provided in Appendix B.

2.3.4 Process Description

The Sludge Pumping Station (No. 09) houses two (2) 40 hp and one (1) out of service 100 hp conveyance pump with associated piping and control panels. The pumps convey sludge from the sludge storage tanks to the sludge dewatering building wet well.

2.4 Sludge Thickening Building (No. 11)

2.4.1 Description of Building Envelope

The Sludge Thickening Building (No. 11) was constructed in the 1970s. The exterior walls of the Sludge Thickening Building (No. 11) are poured concrete with brick and mortar façade.

2.4.2 Description of Building HVAC

The heating in the Sludge Thickening Building (No. 11) is provided by a heating and ventilating unit. There are take offs from the central hot water loop for hot water pumps to deliver hot water to the hot water coils of the heating and ventilating unit.

2.4.3 Description of Building Lighting

Lighting for this building consists of interior lighting fixtures. Most lighting fixtures appeared to be in relatively good condition. Lighting is mostly controlled through single level manual switching.

The interior lighting fixtures are a mixture of inefficient metal halide and incandescent fixtures. Most fixtures operate continuously. Lower level lighting has multilevel manual switching control. Upper level lighting has single level manual switching control.

A summary of all conditions associated with this facility is provided in Appendix B.

2.4.4 Process Description

The Sludge Thickening Building (No. 11) houses process equipment for three gravity thickener tanks. Each gravity thickener tank is supported by dedicated two (2) 7.5 hp and one (1) 10 hp thickened sludge conveyance pumps with associated piping and control panels. The pumps convey thickened sludge from the gravity thickener tanks to the WWTP's digesters.

2.5 Digester Control Building (No. 13)

2.5.1 Description of Building Envelope

The Digester Control Building (No. 13) was constructed in the 1970s. The exterior walls of the Digester Control Building (No. 13) are poured concrete or concrete masonry unit (CMU) back up blocks with brick and mortar façade. The building roof is flat.

2.5.2 Description of Building HVAC

The heating in the Digester Control Building (No. 13) is provided by a heating and ventilating unit which appear to be in fair condition. There are take offs from the central hot water loop to deliver hot water to the hot water coils of the heating and ventilating unit.

A Bradford White Corporation electric domestic water heater with a 40 gallon storage tank has an input capacity of 4500 Watts. This domestic water heater provides domestic hot water throughout the building and was in good condition.

2.5.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Most lighting fixtures appeared to be in relatively good condition, with the exception of those on the ground level, where several fixtures are burned out or not used. Inefficient HID fixtures are used throughout the building. Interior lighting controls include manual switching. Lighting levels are low at some points at the basement level. Multilevel switching is used on the ground level.

The exterior lighting fixtures consist of HID fixtures both on the roof and overlooking the digester tanks. Some of the exterior fixtures are controlled by photocell.

A summary of all conditions associated with this facility is provided in Appendix B.

2.5.4 Process Description

The Digester Control Building (No. 13) houses process equipment for three anaerobic digesters. Each digester is supported by dedicated one (1) sludge heat exchanger, two (2) 15 hp sludge recirculation pumps and a waste gas burner.

Each sludge heat exchanger is rated for 1,400,000 BTU/hr based on 700 gpm sludge at 95°F and 140 gpm water at 180°F.

Each sludge recirculation pump is rated for 350 gpm at 15' of head. RVSA typically only operates one pump per heat exchanger reportedly due to sludge/foam getting into the gas collection piping when both are in operation.

Each digester mixing systems consists of seven 30-inch diameter draft tubes and two 30 hp liquid ring compressors (duty/standby).

2.6 Laboratory Building (No. 20)

2.6.1 Description of Building Envelope

The Laboratory Building (No. 20) was constructed in 1998. The exterior walls of the Laboratory Building (No. 20) are precast panels. The building's roof is built-up with bitumen rolls and a tarred exterior over flat steel roof decks.

The building windows were noted to be double pane with aluminum frames with weather-stripping.

2.6.2 Description of Building HVAC

The heating in the Laboratory Building (No. 20) is provided by a gas-fired rooftop unit with an evaporative condenser. Electric unit heaters, and electric convectors also provide some heating for the building.

The aforementioned rooftop unit provides cooling for the building.

A 2012 A.O. Smith gas-fired, domestic water heater with a 78 gallon storage tank located in the mechanical room has an input capacity of 140 MBH. This domestic water heater provides domestic hot water throughout the building and was in good condition.

The HVAC equipment in this building appeared to vary from fair to good condition.

2.6.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Lights at this building operate at 277V. Exterior fixtures appeared to be in relatively good condition. An interior walkthrough was not conducted during the site visit. Calculations for this area are based on previous contract drawings.

Exterior lighting fixtures consist of LED fixtures. Interior fixtures are a mixture of inefficient 2-lamp and 3-lamp fluorescent troffers and strip lights. Multilevel switching is utilized inside the building.

A summary of all conditions associated with this facility is provided in Appendix B.

2.7 Administration Building (No. 21)

2.7.1 Description of Building Envelope

The Administration Building (No. 21) was constructed in the 1970s. The exterior walls of the Administration Building (No. 21) are of brick and mortar façade with concrete masonry unit (CMU) back up blocks or finished interior. The building's roof is built-up with an EPDM membrane over flat steel roof decks. Some of the roof has a new white thermal barrier coating, which was installed in 2013.Parts of the old roof was removed down to the metal deck and replaced with the new roof.

Some of the building windows are double pane with aluminum frames with weather-stripping. The other building windows are double pane with wood frames with interstitial blinds.

2.7.2 Description of Building HVAC

The heating in the Administration Building (No. 21) is provided by hot water generated from a boiler and electric unit heaters. Hot water is generated by a gas-fired Weil-McLain boiler. This boiler has an input capacity of 500 MBH (1 MBH = 1,000 BTU/Hr. This boiler has an estimated operating efficiency of 80%. Hot water pumps deliver hot water to the hot water coils of the unit heaters, convectors, cabinet heaters, and air handling units in various locations throughout the building.

There is an electric snow melt system that serves the Administration Building (No. 21).

Split-system air conditioners serve the direct expansion refrigeration coils in the aforementioned air handling units. These air handling units provide cooling for the building.

A 2011 Bradford White Corporation electric domestic water heater with a 40 gallon storage tank located in the boiler room has an input capacity of 4500 Watts. This domestic water heater provides domestic hot water throughout the building.

The HVAC equipment in this building appeared to vary from fair to good condition.

2.7.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. An interior walkthrough was not conducted during the site visit since the interior lighting was upgraded recently and would not offer sufficient scope for savings. Calculations for this area are based on information provided by the Authority.

Interior and exterior fixtures are newly installed LEDs. Inside the building, the LEDs are a mixture of 2'x2' and 2'x4' energy efficient troffers.

A summary of all conditions associated with this facility is provided in Appendix B.

2.8 Utility Garage (No. 22)

2.8.1 Description of Building Envelope

The Utility Garage (No. 22) was constructed in the 1970s. The building had a renovation performed around 2007. The exterior walls of the Utility Garage (No. 22) are of brick and mortar façade with concrete masonry unit (CMU) back up blocks. The building's roof is flat.

The building windows were noted to be double pane with aluminum clad frames. There are three partial insulated overhead garage doors.

2.8.2 Description of Building HVAC

The heating in the Utility Garage (No. 22) is provided by gas fired unit heaters.

A window air conditioning unit provides cooling for the break room.

The HVAC equipment in this building appeared to be in good condition.

2.8.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. An interior lighting assessment was not conducted during the site visit since the lighting was upgraded recently and would not offer sufficient scope for savings. Calculations for this area are based on information on lighting conditions provided by those familiar with the space. The interior fixtures are 8' 2-lamp T12 fluorescents. Exterior fixtures are newly installed LEDs controlled through photocell.

A summary of all conditions associated with this facility is provided in Appendix B.

2.9 Maintenance Shop (No. 25)

2.9.1 Description of Building Envelope

The Maintenance Shop (No. 25) was constructed in the 1980s. The Maintenance Shop (No. 25) is a steel structure building with a slightly pitched roof.

2.9.2 Description of Building HVAC

The heating in the Maintenance Shop (No. 25) is provided by gas fired infrared heaters, and electric unit heaters.

A window air conditioning unit provides cooling for the break room.

A 2012 A.O. Smith gas-fired, domestic water heater with a 40 gallon storage tank located in the shower room has an input capacity of 38 MBH. This domestic water heater provides domestic hot water throughout the building and was in good condition.

The HVAC equipment in this building appeared to vary from fair to good condition.

2.9.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Most lighting fixtures appeared to be in relatively good condition. Inefficient fluorescent fixtures are still used in the building interior. Interior lighting controls include single level manual switching. Interior fixtures

include new high bay LEDs in the maintenance bays. The fixtures in the other maintenance and storage areas are a mixture of inefficient T8s and T12s. Interior fixtures utilize multilevel switching for each area and operate continuously. Light levels are not optimal for the work performed in this area, and shadows are prevalent.

The exterior lighting fixtures consist of a mixture of LED wall mounted area fixtures and HID fixtures controlled by photocell.

A summary of all conditions associated with this facility is provided in Appendix B.

2.10 Methane Filter Building (No. 26)

2.10.1 Description of Building Envelope

The Methane Filter Building (No. 26) is not currently in service or occupied. The Methane Filter Building (No. 26) was constructed in 1989. The exterior walls of the Methane Filter Building (No. 26) are of concrete masonry unit (CMU) blocks. The building roof is flat. The doors are off of the building leaving the interior exposed to the elements.

2.10.2 Description of Building HVAC

The Methane Filter Building (No. 26) has no functional heating or cooling equipment.

2.10.3 Description of Building Lighting

Lighting for this building consists of interior and exterior fixtures. The lighting fixtures are in poor condition due to the corrosion which has developed throughout the structure. It was not determined whether any of the fixtures were operational and they do not appear to be used.

The one exterior fixture is a wall mounted HID fixture. The interior fixtures are compact fluorescent.

A summary of all conditions associated with this facility is provided in Appendix B.

2.11 Sludge Dewatering Building (No. 27)

2.11.1 Description of Building Envelope

The Sludge Dewatering Building (No. 27) was constructed in the 1980s. The exterior walls of the Sludge Dewatering Building (No. 27) are poured concrete with tile interior. The building's roof is built-up with an EPDM membrane over flat roof decks.

The building windows were noted to be double pane with aluminum frames with weatherstripping.

2.11.2 Description of Building HVAC

The heating in the Sludge Dewatering Building (No. 27) is provided by hot water generated from a boiler, electric unit heaters, and two roof mounted energy recovery units. Hot water is generated by a gas-fired HB Smith boiler. This boiler has an input capacity of 1,288 MBH (1 MBH = 1,000 BTU/Hr. This boiler has an estimated operating efficiency of 75%. Hot water pumps deliver hot water to the hot water coils of the unit heaters, and convectors. Hot water is also

supplied to one of the aforementioned energy recovery units. Both of the energy recover units have electric resistance coils.

A split-system air conditioner unit and the aforementioned energy recovery units provide localized cooling for the building.

A 2006 Bradford White Corporation gas-fired, domestic water heater with a 40 gallon storage tank located in the boiler room has an input capacity of 40 MBH. This domestic water heater provides domestic hot water throughout the building.

Most of the HVAC equipment in this building appeared to vary from fair to good condition. The boiler appeared to be in poor condition.

2.11.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Many fixtures are not operational in several areas resulting in low light levels. Inefficient fluorescent fixtures are used throughout the building. Interior fixtures include LEDs, incandescent lights, T8 strip lamps, and T12 U-lamps. Lighting levels in the ground level hallway are low due to many ceiling fixtures being out of operation. Single level manual switching is used in some areas, and multilevel switching is used in other areas such as the lower level pump area and the upper level centrifuge room.

The exterior lighting fixtures consist of a mixture of LED wall mounted area fixtures and HID fixtures. Some exterior fixtures are controlled by photocell and others by manual switching.

A summary of all conditions associated with this facility is provided in Appendix B.

2.11.4 Process Description

There are two dewatering centrifuges currently used (duty/standby), and one that has been out of service for many years. Each of the two active centrifuges has a 21-inch diameter bowl and is rated for 2,000 dry lb/hr. Each has a 60 hp electric main drive and 15 hp hydraulic backdrive (scroll) motor. Anaerobically digested sludge is pumped to a wet well by the sludge transfer pumps in the Sludge Pump House. From the wet well, typically one of five sludge feed pumps sends sludge and polymer to an operating centrifuge. Each sludge feed pump has a has a 20 hp motor.

2.12 Lime Stabilization Building (No. 28)

2.12.1 Description of Building Envelope

The Lime Stabilization Building (No. 28) is not currently in service or occupied. The Lime Stabilization Building (No. 28) was constructed in 1985.

2.12.2 Description of Building HVAC

The Lime Stabilization Building (No. 28) has electric unit heaters for space heating and no cooling equipment.

2.12.3 Description of Building Lighting

Lighting for this building consists of interior pendant mounted metal halide fixtures. The lighting is controlled through manual single level switching.

A summary of all conditions associated with this facility is provided in Appendix B.

2.12.4 Process Description

The Lime Stabilization Building (No. 28) has no functional process equipment and is not in service.

2.13 Employee Facilities Building (No. 29)

2.13.1 Description of Building Envelope

The Employee Facilities Building (No. 29) was constructed in the 1990s. The exterior walls of the Employee Facilities Building (No. 29) are of brick and mortar façade with concrete masonry unit (CMU) back up blocks. The building roof consists of asphalt shingles over pitched roof decks.

The building windows were noted to be double pane with weather-stripping. There is an overhead garage door.

2.13.2 Description of Building HVAC

The heating in the Employee Facilities Building (No. 29) is provided by a gas fired air handling units, and a unit heater.

A split-system air conditioner serves the direct expansion refrigeration coils in one of the aforementioned air handling units. This air handling unit provides cooling for the breakroom.

A 2003 A.O. Smith gas-fired, domestic water heater with a 100 gallon storage tank located in the mechanical room has an input capacity of 199 MBH and is in good condition. A 1996 Bradford White Corporation electric domestic water heater with an 80 gallon storage tank has an input capacity of 4500 Watts. These water heaters provide domestic hot water throughout the building.

The HVAC equipment in this building appeared to be in fair condition.

2.13.3 Description of Building Lighting

Lighting for this building consists of interior fixtures. A building walkthrough was not conducted during the site visit. Calculations for this facility are based on information from previous contract drawings as provided by the Authority.

The interior fixtures on the lower level are 2-lamp surface mounted fluorescent fixtures. Lights on the main level are a mixture of 2'x'2 U-lamps and compact fluorescents.

A summary of all conditions associated with this facility is provided in Appendix B.

2.14 Rotary Drum Thickener Facility (No. 34)

2.14.1 Description of Building Envelope

The Rotary Drum Thickener Building (No. 34) was constructed in 2005. The exterior walls of the Rotary Drum Thickener Building (No. 34) are of concrete masonry unit (CMU) blocks. The building's roof is flat over steel roof decks.

There are overhead garage doors.

2.14.2 Description of Building HVAC

The heating in the Rotary Drum Thickener Building (No. 34) is provided by hot water unit heaters and a packaged air conditioner with electric heat. There are three (3) hot water rooftop units. There are take offs from the central hot water loop to deliver hot water to the hot water coils of the unit heaters, and rooftop unit.

The aforementioned packaged air conditioner provides localized cooling for the MCC room.

The HVAC equipment in this building appeared to be in fair condition.

2.14.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Most lighting fixtures appeared to be in relatively good condition. Inefficient metal halide and fluorescent fixtures are used throughout the building. Interior lighting includes 2 lamp T8 fluorescents and pendant mounted metal halides in the washwater room. The electrical and OCS room are each controlled through single level manual switching, while the washwater room has multilevel switching.

The exterior lighting consists of LED wall mounted area lighting fixtures controlled by photocell.

A summary of all conditions associated with this facility is provided in Appendix B.

2.14.4 Process Description

The Rotary Drum Thickener Building (No. 34) houses three (3) rotary drum thickeners with provisions for a fourth unit. The rotary drum thickeners are supported by (2) hot water recirculation pumps, four (4) polymer feed pumps, one (1) polymer recirculation pump, three (3) polymer storage tanks, four (4) mixing motors, plant water pumps, and three (3) thickened sludge transfer pumps with associated piping and control panels. The rotary drum thickeners are not used by RVSA due to expenses related to polymer, odor control and Title V.

2.15 Cogeneration/Sludge Drying Facility (No. 37)

2.15.1 Description of Building Envelope

The Cogeneration/Sludge Drying Facility (No. 37) was constructed in 2005. The exterior walls of the Cogeneration/Sludge Drying Facility (No. 37) are poured concrete with concrete masonry unit (CMU) back up blocks. The building's roof is built-up with polyurethane foam and tarred exterior over flat roof decks.

There are overhead garage doors.

2.15.2 Description of Building HVAC

The heating in the Cogeneration/Sludge Drying Facility (No. 37) is provided by an air handling unit with an electric coil. A split-system air conditioner that serves the direct expansion refrigeration coils in the aforementioned air handling unit provides cooling for the control room. The cooling in the control room is supplemented by Portable AC units. There is process cooling equipment on the roof. See process description for more information.

A 2005 Ruud electric domestic water heater with a 119 gallon storage tank located in the janitor closet has an input capacity of 18000 Watts. This domestic water heater provides domestic hot water throughout the building and is in good condition.

2.15.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Most lighting fixtures appeared to be in relatively good condition. Lighting quality in the process areas is poor. Inefficient HID and fluorescent fixtures are used throughout the building. Interior lighting includes a mixture of pendant mounted metal halides and 2 lamp and 3 lamp T8's. Multilevel switching control is employed in multiple areas in this building. Interior fixtures operate continuously.

The exterior lighting consists of wall mounted LED and HID fixtures controlled by manual switching and by photocell.

A summary of all conditions associated with this facility is provided in Appendix B.

2.15.4 Process Description

This building includes digester gas treatment, cogeneration and thermal drying equipment.

A digester gas treatment system was installed as part of the construction of the Cogeneration Building. This system includes equipment intended to remove moisture, particulates, siloxanes, and boost the gas pressure to 60 to 70 psig so it could be fed to a gas blending system (natural gas and digester gas) and then to four dual fuel reciprocating engines. The system did not perform as anticipated and was offline during the time period of this audit. A new system was recently installed with similar components, plus media to adsorb hydrogen sulfide and placed into operation.

The Cogeneration Building houses four (4) Caterpillar Model 3608 lean burn, low BTU fuel engines that can run on digester gas, natural gas, or a combination of both (blended fuel). Each 900 rpm, 13,200 V synchronous engine generator is rated for a maximum electrical output of roughly 1.5 MW at 100% load. A minimum inlet gas pressure of 45 psig is required. The fuel input energy required for one engine is 250,144 BTU/min. Assuming a digester gas heating value of 550 BTU/scf, a digester gas flow rate of 455 scfm is needed for the engine at 100% load. The exhaust heat recovery system was designed to send hot exhaust to heat a thermal oil system for the sludge dryer.

The sludge dryer is rated to process 9,700 wet lb/hr at a minimum of 20% total solids on the inlet and 92% and greater discharge. The dryer is an indirect paddle type. The system includes a hot oil heater which is fired by natural gas to maintain proper temperatures if sufficient heat is not

provided from the engine exhaust. The design hot oil supply and hot oil return temperatures are 380°F and 350°F, respectfully at 1,200 gpm oil flow. Though the actual operating temperatures are lower, for calculation purposes the design temperatures are considered. Sludge is fed into an equalization hopper and pumped to the dryer. There are numerous conveyors and other motors related to the thermal dryer system.

2.16 Administration Annex (No. 39)

2.16.1 Description of Building Envelope

The Administration Annex (No. 39) was constructed in the 1990s. The exterior walls of the Administration Annex (No. 39) are hung precast panels. The building's roof is built-up with an EPDM membrane over flat steel roof decks.

The building windows were noted to be double pane with aluminum frames.

2.16.2 Description of Building HVAC

The heating in the Administration Annex (No. 39) is provided by hot water generated from a boiler. Hot water is generated by a gas-fired Raypak boiler. This boiler has an input capacity of 199 MBH (1 MBH = 1,000 BTU/Hr. This boiler has an estimated operating efficiency of 75%. Hot water pumps deliver hot water to the hot water coils of the unit heaters, and convectors in various locations throughout the building.

A split-system air conditioner serves the direct expansion refrigeration coil in the rooftop unit. This system and a window air conditioning unit provides cooling for the control room. Portable AC units are installed in other areas of the building.

An A.O. Smith electric domestic water heater with a 30 gallon storage tank located in the boiler room has an input capacity of 6000 Watts. This domestic water heater provides domestic hot water throughout the building and was in fair condition.

The HVAC equipment in this building appeared to vary from fair to good condition.

2.16.3 Description of Building Lighting

Lighting for this building consists of interior fixtures. An interior walkthrough was not conducted during the site visit since the interior lighting was upgraded recently and would not offer sufficient scope for savings. Calculations are based on information from previous contract drawings as provided by the Authority.

Interior fixtures are a mixture of 2-lamp and 3-lamp fluorescent troffer and strip T8 fixtures. Single level switching is utilized for each space within the facility.

A summary of all conditions associated with this facility is provided in Appendix B.

2.16.4 Process Description

No process equipment is located in the Administration Annex Building (No. 39).

2.17 Headworks Facility (No. 44)

2.17.1 Description of Building Envelope

The Headworks Facility (No. 44) was constructed in 2005. The exterior walls of the Headworks Facility (No. 44) are of concrete masonry unit (CMU) blocks. The building's roof is built-up with an EPDM membrane over flat roof decks.

The building windows were noted to be double pane with aluminum frames. There are overhead garage doors.

2.17.2 Description of Building HVAC

The heating in the Headworks Facility (No. 44) is provided by hot water cabinet heaters, roof mounted energy recovery units, and electric unit heaters. Hot water is not currently being supplied to the hot water coils of the energy recovery units. There are take offs from the central hot water loop for hot water pumps to deliver hot water to the hot water coils of the cabinet heaters in various locations throughout the building.

A packaged air conditioning rooftop unit, and the aforementioned energy recovery units provide localized cooling for the building

A 2009 Ruud electric domestic water heater with a 120 gallon storage tank located in the gallery has an input capacity of 30000 Watts. This domestic water heater provides domestic hot water throughout the building and is in good condition.

The HVAC equipment in this building appeared to vary from fair to good condition.

2.17.3 Description of Building Lighting

Lighting for this building operates at 277V, in contrast to other on site buildings, and consists of interior and exterior lighting fixtures. Most lighting fixtures appeared to be in relatively good condition. The main lighting controls include photo-sensor control for the exterior lighting fixtures and manual switching in each interior area.

Exterior lighting fixtures are a mixture of LEDs, stanchion mounted metal halides, wall mounted HIDs, and flood lights. Interior fixtures are a mixture of LEDs and inefficient fixtures of type T8, T12, and metal halide. New LEDs have been commissioned in parts of the ground level process areas. Multilevel switching is used in several but not all areas of this facility. Interior fixtures operate continuously.

Several areas have multiple fixtures burned out or out of operation, including the odor control area and the office.

A summary of all conditions associated with this facility is provided in Appendix B.

2.17.4 Process Description

The Headworks Facility (No. 44) houses screening equipment, influent pumps, scum thickening, grit removal and disposal equipment.

Sewage from the collection system enters RVSA WWTP and is screened using three coarse bar screens and three fine screens to remove large materials, rags, plastic materials, etc. Screened material is conveyed to a collection dumpster for disposal.

Process pumping includes five (5) 250 hp raw sewerage pumps. Raw sewerage (influent) pumps convey flow from the influent wet well to four (4) grit removal tanks. Each pump is rated for 18,900 gpm at 40' head and has a VFD. The wet well level controller output is used and converted to a pump speed set point between 0-100%. The first pump runs until the speed feedback signal reaches 95% of setpoint, and then a second pump starts. Once the second pump reaches 95%, then a third starts.

Grit removal is achieved via aeration of grit removal tanks with four (4) 20 hp blowers. The grit blowers are run at full and constant speed and thus maximum air flow. Bubble patterns allow organic material to remain in suspension, while grit particles settle and are removed via a lift tube. Removed grit is then cleaned via grit washers and conveyed to a collection dumpster for disposal.

Scum and grease collected at the primary settling tanks are pumped to the Headworks Facility to two (2) scum concentrator tanks. Thickened scum is then pumped via two (2) 3 hp pumps to a collection dumpster for disposal.

Site staff reported that the HVAC system supplies too much air for the odor control system to clean.

2.18 Effluent Filter and UV Control Building (No. 56)

2.18.1 Description of Building Envelope

The Effluent Filter and UV Control Building (No. 56) was constructed in 2005. The exterior walls of the Effluent Filter and UV Control Building (No. 56) are of concrete masonry unit (CMU) blocks. The building's roof is built-up with an EPDM membrane over flat steel roof decks.

2.18.2 Description of Building HVAC

The heating in the Effluent Filter and UV Control Building (No. 56) is provided by rooftop packaged air conditioners with electric heat.

The aforementioned packaged air conditioners provide localized cooling for the mechanical room.

The HVAC equipment in this building appeared to be in good condition.

2.18.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Most lighting fixtures appeared to be in relatively good condition. The main lighting controls include photo-sensor control for the exterior lighting fixtures and manual switching in each interior area.

Exterior lighting fixtures are wall mounted LEDs. Interior fixtures are 2 lamp T8 fluorescents with single level switching.

A summary of all conditions associated with this facility is provided in Appendix B.

2.18.4 Process Description

The Effluent Filter and UV Control Building (No. 56) houses process control equipment, service water pump VFDs, power feed for the effluent filter bridges, backwash return pumps VFDs and a compressor which operates UV lamp wipers.

Treated effluent flows through two parallel channels. Each channel contains two banks of UV lamps with each bank having 13 modules. Each module is comprised of 18 UV lamps for a total of 936 lamps. Each pair of lamps shares an electronic ballast card. A UV intensity sensor continuously measures the UV emission or transmittance within the reactor. A set UV dose is possible by using the UV sensor and effluent flow meter to calculate retention time. The power output of the UV lamps can be adjusted from 50 to 100% in automatic mode to achieve the desired UV dose. Currently, RVSA runs all the lamps at 100% power output. They reportedly have seen an increase in lamp life from 10,000 to 15,000 hours by running at full power output and not ramping up and down. This mode of operation has been utilized for the last two years.

The power consumption is highly dependent on the ultraviolet transmittance (UVT). The estimated power draw for the design UVT of 63% at the current average day flow of 25 MGD versus a lower UVT of 50% is shown below:

Table 2-1 - Power Consumption Variation with UVT

Description	Design Condition 1	Design Condition 2
Ultraviolet Transmittance (%)	50	63
Number of Channels Operating	1	1
Number of UV Banks per Channel Operating	2	1
Total Estimated Power Consumption at Design Conditions (kW)	104	56

This shows double the power if the water quality is less than expected at a UV Dose of 40 mJ/cm2. No UVT data was provided and is needed for but is not limited to further evaluation.

Service water is withdrawn from the Effluent Pump Station influent channel via a 14-inch pipeline to the Service Water Pump Station. This is a pad mounted trailer that houses three dry-pit, submersible, variable speed pumps. Three strainers are located on the pump discharge in the Pump and Blower Building. Each pump is rated for 600 gpm at 210-feet of head, and has a 75 hp motor with VFD. The service water (plant process water) system also requires a clean and adequate supply of water from the filtration process. Some process water uses at RVSA include but is not limited to:

- Carrier water for chemical dosing
- Exterior washdown water

- Pipe flushing
- Cooling water for instrument air and service air compressors
- Possible seal water use
- Offgas compressor use at cogeneration engines

2.19 Return Sludge Pumping Station (No. 62)

2.19.1 Description of Building Envelope

The Return Sludge Pumping Station (No. 62) was constructed in 2005. The exterior walls of the Return Sludge Pumping Station (No. 62) are of concrete masonry unit (CMU) blocks. The building's roof is built-up with an EPDM membrane over flat steel roof decks.

2.19.2 Description of Building HVAC

The heating in the Return Sludge Pumping Station (No. 62) is provided by electric unit heaters, and an air handling unit with an electric duct heater.

A packaged air conditioning rooftop unit provides localized cooling for the MCC room.

Most of the HVAC equipment in this building appeared to be in good condition.

2.19.3 Description of Building Lighting

Lighting for this building consists of interior and exterior lighting fixtures. Most lighting fixtures appeared to be in relatively good condition. Interior fixtures in the RAS/WAS room are pendant metal halides with multilevel switching. Fixtures in the electrical room are type T8 with single level switching.

Exterior lighting fixtures are wall mounted LEDs with night time photocell control.

A summary of all conditions associated with this facility is provided in Appendix B.

2.19.4 Process Description

The Return Sludge Pumping Station (No. 62) houses three (3) 200 hp RAS pumps and three (3) 30 hp WAS pumps. The RAS pumps convey RAS from the RAS wet well to the aeration tanks. Each RAS pump is rated for 14,500 gpm at 35' of head and has a VFD. RVSA historically ran one RAS pump at a set speed. This achieved a constant RAS rate of ~ 13 MGD or 50% of the influent flow rate. They periodically increase the speed for 1-2 hours/day to flush the lines. They intend to modify operations to flow pace the RAS at approximately 38% of influent flow. During the site visit, RAS pump No. 3 was running at 36 Hz, 355 rpm and a flow of 14.4 MGD. There were no functioning pressure gauges to confirm pump operation on the pump curve. The pump curve shows a minimum speed of 230 rpm with 593 rpm motors, so they may be able to run down to 38% speed if the VFD allows and head generated is able to overcome discharge check valves.

The WAS pumps convey WAS from the RAS wet well to rotary drum thickeners or the gravity thickener tanks. Currently, the WAS pumps located in the Return Sludge Pumping Station (No. 62) are not used by RVSA. Each WAS pump is rated for 600 gpm at 55' head and has a VFD.

2.20 Aeration Tanks Monitoring

2.20.1 Process Description

Two (2) Aeration Tanks (No. 07) are operated at RVSA to provide secondary treatment. Each aeration tank is 185-ft length x 170-ft width x 15-ft depth, with a volume of 468,605 CF (3.5 MG).

Each aeration tank is divided into six passes (A, B, C, D, E, F) with flow in a serpentine pattern. Primary effluent can be introduced into passes A, C, E through a sluice gate at each and RAS can be fed to the A and C passes with separate gates.

RVSA reports they currently send the following to the aeration tanks:

- Primary effluent + RAS (10% gate open), Pass A
- RAS (100% gate open), Pass C

The tanks have 9" membrane disc diffusers per the configuration in Table 2-2 below.

Table 2-2 – RVSA Grid Zone and Diffusers

Grid Zone	# of Grids per pass	Air dist per grid	Diff holders per grid	Diff installed per grid	Total diff installed per grid	Drop leg Dia, in	Total Air flow to Reactor Pass, scfm
1A	2	14	1078	980	1960	12	3920
2A	2	14	1078	980	1960	16	3920
1B	2	12	924	840	1680	12	3360
2B	2	11	847	770	1540	12	3080
1C	2	18	1386	1260	2520	12	5040
2C	2	12	924	840	1680	10	3360
1D	2	14	1078	980	1960	12	3920
2D	2	11	847	770	1540	12	3080
1E	2	0	847	770	1540	10	3080
2E	2	0	847	770	1540	10	3080
1F	2	8	616	560	1120	12	2240
2F	2	8	616	560	1120	12	2240

There are 12 fixed dissolved oxygen (DO) probes for monitoring only. However, RVSA has been unable to base process decisions on the fixed DO probes as they are unreliable and provide inaccurate data. Presently, RVSA takes samples into their lab and uses hand held DO probes for DO measurement and data collection.

2.21 Sludge Thickening Tanks

2.21.1 Process Description

Three (3) Sludge Thickening Tanks (No. 10) are operated at RVSA to thicken primary sludge and WAS by gravity to 2 to 4% solids. Each thickener is 60-ft diameter and has a 10-ft sidewater depth. The thickeners can also be sent effluent filter backwash water, although it is currently sent to the main influent pump wet well. The thickeners are operated by pumping thickened sludge manually to maintain a target sludge blanket of less than 2-ft (measured from bottom of the tank up). Sludge blankets are measured 4 times per shift. The thickened sludge pumps feed the anaerobic digesters and are operated as infrequently as 4 hours on and 20 hours off.

During CDM Smith's site visit, one sludge thickening tank was out of service and the two operating units were experiencing rising sludge conditions. This should be further evaluated to correct rising sludge conditions and the impact of the sludge recycle on downstream processes.

2.22 Digester Tanks

2.22.1 Process Description

Three (3) Digester Tanks (No. 12) are operated at RVSA to digest thickened sludge. Each tank is a circular (concrete) structure, 75'W x 33' H plus a 6’ cone, with a volume of 145,790 CF (1.1 MG). Equipment associated with Digester Tank operations are housed in the Digester Control Building (No. 13).

The nominal operating level is in the range of 28 to 31-ft, which provides a minimum freeboard of 5-ft. Digested sludge is manually removed from a digester once per day as necessary (lasting about an hour) by closing a valve at the sludge recirculation pump to divert flow from the digester to the sludge storage tanks. The flow still goes through the sludge heat exchanger.

Each digester has a supernatant/overflow pipe with three drawoff valves in the upper two thirds of the tank. Each supernatant/overflow pipe has a control valve used for manual control of the supernatant/overflow. This pipe ties into a common tee and a common pipe for all three digesters that continues through the tunnel to the plant process drain line and then the influent pump station wet well.

Each digester has a floating spiral cover that was installed in the 1970s. These are being replaced under a project currently about to bid.

2.23 Sludge Storage Tanks

2.23.1 Process Description

Four (4) Sludge Storage Tanks (No. 14) hold digested sludge for a detention period prior to pumping to the Dewatering Facility (No. 27). Typically, 2 to 3 tanks are in service.

2.24 Final Clarifier Tanks

2.24.1 Process Description

Six (6) Final Clarifier Tanks (No. 16) follow secondary treatment at RVSA. Each clarifier is a circular concrete basin 120-ft width, with tanks 1-4 having 11-ft side water depth and tanks 5-6 having 13-ft side water depth. Settled solids are either returned to the aeration tanks via three (3) 200 hp RAS pumps, or wasted to the gravity thickener tanks via three (3) 30 hp WAS pumps. Currently, the WAS pumps located in the Return Sludge Pumping Station (No. 62) are not used by RVSA.

The clarifiers are center feed, and have an organ or riser type sludge collection mechanism. Sludge is pushed by differential head through ten 4-inch pipes to the tank’s control gallery and then flows to the RAS Building Wet Well through 24-inch piping. There are no valves on the individual 4-inch suction pipes, just a common discharge valve.

During CDM Smith's site visit, Final Clarifier #1 was out of service.

2.25 Tunnels

2.25.1 Process Description

The Tunnels (No. 35) are pipe galleries which connect the service sludge pump house, digester control, rotary drum thickener, and pump and blower buildings. The Tunnels house RAS, WAS, primary sludge, thickened sludge, digested sludge, backwash, plant water, potable water, overflow, gas, and various chemical pipelines.

2.26 Effluent Pump Station

2.26.1 Process Description

The Effluent Pump Station (No. 58) consists of four (4) 150 hp screw pumps, which are used on an as-needed basis when additional head is required to discharge (treated effluent) to receiving waters. The pumps are constant speed and have 150 hp motors. Each pump is rated for 35 MGD at 11' of head.

2.27 Cascade Aeration

2.27.1 Process Description

Cascade Aeration (No. 59) is a stepped concrete structure immediately downstream of the Effluent Pump Station, thus both operate jointly on an as-needed basis. The structure provides additional DO of effluent prior to discharge to receiving waters for permit compliance.

Section 3

Baseline Energy Use

3.1 Utility Data Analysis

The Authority provided the facility's current and historical utility billing data for the energy audit. Analysis of the energy usage and billing rates for electricity and gas allows for precision in identifying areas in which energy consumption and costs can be reduced.

For this study, the monthly gas and electric bills were analyzed to obtain unit costs. Current electrical metering describes usage for the entire treatment plant, whereas the gas usage data allows for analysis of specific buildings at the plant. The unit cost of energy, as calculated from billing information, was used to detect the energy source elections and conservation measures which would allow for optimal revenue generation and cost savings.

3.1.1 Electric Charges

The Authority currently purchases electricity from Hudson Energy Services, LLC, a Third Party Supplier (TPS). Public Service Electric & Gas Company (PSE&G) is the publicly regulated utility serving the plant.

The electric supply (capacity, transmission, and energy) is currently being purchased from Hudson Energy; however, delivery is secured through PSE&G, resulting in the Authority being charged monthly by both utilities. Due to the magnitude of the measured monthly peak demand, and the incoming voltage at 13,200 Volts, PSE&G bills RVSA on a Large Power and Lighting Service – Primary (LPLP) rate schedule.

Electric charges are heavily based on the total usage and peak demand values within a given month. There are unit costs associated with both the total kilowatt hours (kWh) and the maximum real power demand (kW) - determined from the maximum average demand over any fifteen minute interval - supplied in a given month. These values determine the base charge. They are also used to determine auxiliary charges.

Other charges include summer demand (Jun-Sep), service charge, societal benefits, securitization transition, capacity, transmission, and various tariffs and sales taxes. Most costs are directly based on current demand and usage figures; some are products of existing infrastructure and historical demand at the plant. Through implementation of the ECRMs, these cost factors may be reduced, resulting in not only a drop in base charges, but also significant savings on surcharges.

Figure 3-1 the summer demand charge, shown in yellow, comprises a major portion of the bill when it is applied – more than 10% and around 30% in some cases. the summer demand charge, shown in yellow, comprises a major portion of the bill when it is applied – more than 10% and around 30% in some cases. the summer demand charge, shown in yellow, comprises a major portion of the bill when it is applied – more than 10% and around 30% in some cases.

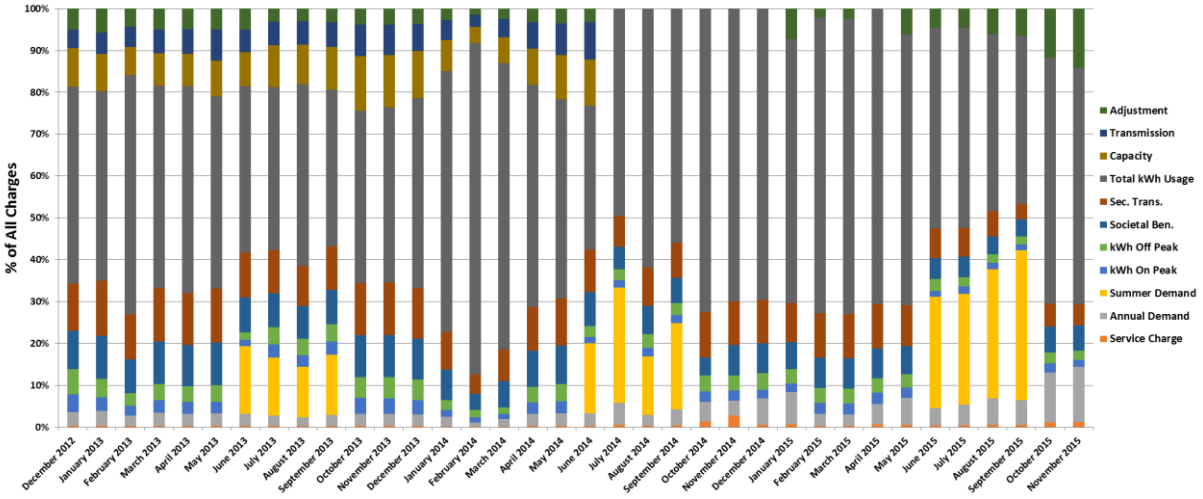


Figure 3-1 – Electric Bill by Charge Type

Most fees are determined as a product of either usage or demand and a set rate. In general, billed usage can be reduced through the installation of more efficient equipment and generation of additional power. Demand can be reduced by the same means, as well as through strategic load scheduling. It is possible to decrease billed usage and demand 15-25 percent without a sacrifice in system capability.

Figures in this report include data from years when the Authority was being billed by PSE&G and either Hess Electric, NRG, or Hudson Energy.

3.1.2 Natural Gas Charges

Elizabethtown Gas is the current distributor and Constellation Energy is the current supplier of natural gas for all of the Authority's facilities included in this report except for the Cogeneration/Sludge Drying Facility (No. 37). Direct energy is the current supplier for the Cogeneration/Sludge Drying Facility (No. 37). The Authority is charged for the cost of the natural gas, a delivery charge and a customer charge, which covers gas administration charges.

3.2 Facility Results

3.2.1 Rahway Valley Sewerage Authority WWTP

Electric power for the RVSA wastewater treatment facility is fed from primary distribution lines at 13,200 Volts from PSE&G. Figure 3-2 electrical energy consumption by month from December 2012 through November 2015. For example, for the month of January, the bar represents the average usage of January 2013, 2014, and 2015. This same graphical representation approach has been carried through for all applicable months and is typical for all graphs presented in this Section unless otherwise noted.

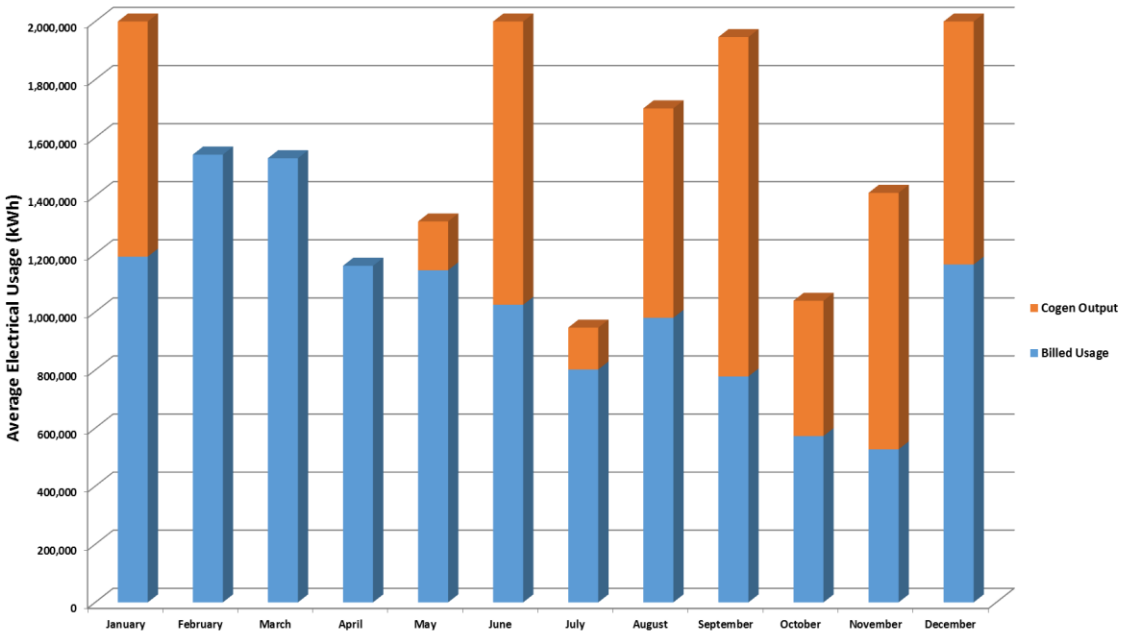


Figure 3-2 - Waste Water Treatment Facility Total Electrical Usage

Cogeneration output data from May 2014 to January 2015 is reflected in Figure 3-2. "Billed Usage" reflects data from December 2012 through November 2015. The average billed electrical consumption for the facility for this period is 1,034,232 kWh/month.

Table 3-1 - RVSA Wastewater Treatment Facility Seasonal Peak Demands

Season	Peak Demand (kW)
Summer	2806.0 (Jun 13)
Winter	5261.8 (Mar 15)

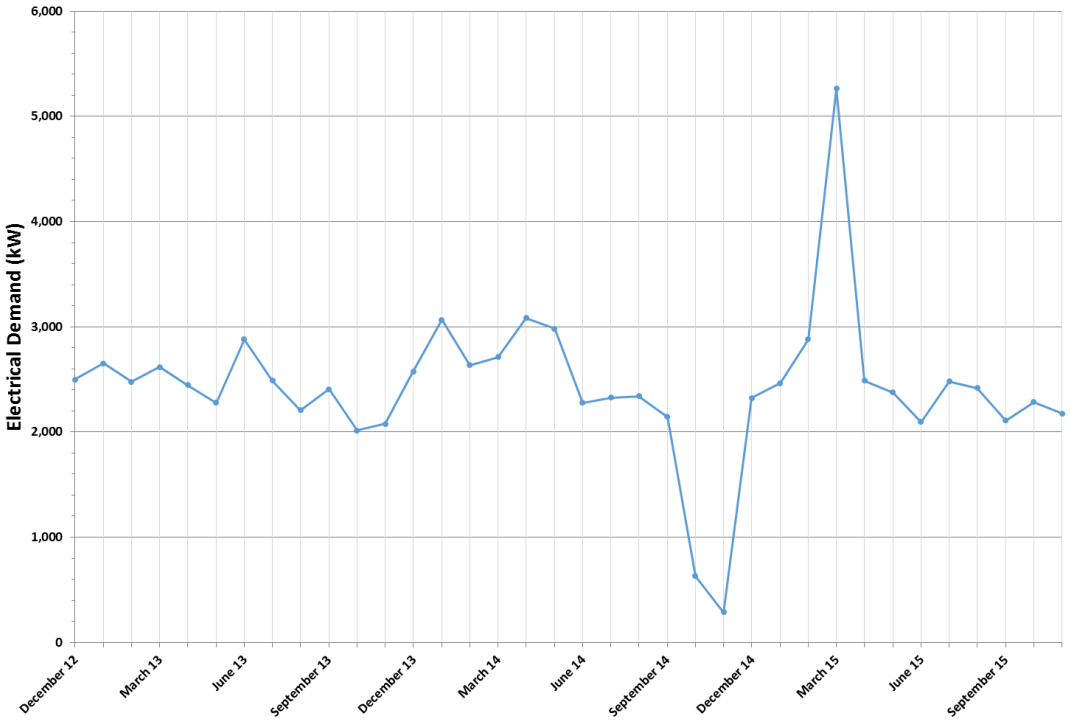


Figure 3-3- Waste Water Treatment Facility Electrical Demand

The average billed peak demand rate for the time period shown is 2,429 kilowatts.

Tariff rates, like the societal benefits and securitization transition charges, are subject to change monthly, quarterly, annually, or otherwise as approved by the New Jersey Board of Public Utilities. The most recent tariff rates available at the time of this audit for the electrical service at the Wastewater Treatment Facility, from PSE&G are as follows:

Table 3-2 - Tariff Rates Summary (Oct 2015) – RVSA WWTP

Description	Acct #: 42 004 579 03
PSE&G Charge	
Service Charge	$372.11
Annual Demand kW	2283.10 kW @ $1.715400114/kW
Summer Demand kW	2283.10 kW @ $9.523100171/kW
On Peak Delivery Service	111197 kWh @ $0.006605034/kWh
Off Peak Delivery Service	135678 kWh @ $0.006604976/kWh
Societal Benefits	246875 kWh @ $0.008177013/kWh
Securitization Transition	246875 kWh @ $0.007258005

Table 3-2 - Tariff Rates Summary (Oct 2015) – RVSA WWTP

Description	Acct #: 42 004 579 03
Third Party Supplier Charges	
Energy Usage	246881 kWh @ $0.07875/kWh
Adjustment	$3,882.16
PSE&G Subtotal	$31,471.86
TPS Subtotal	$23,324.06
Total Bill	$54,795.92

Note the relatively high summer demand charge at $9.52/kW resulting in a summer demand charge of $21,742.19 for the October billing cycle.

The average electrical aggregate cost for the plant from December 2012 to November 2015 is $0.122/kWh. Unless otherwise noted, that value has been used as the aggregate unit cost for power in financial calculations throughout this report. Refer to Section 3.3 for more aggregate costs and Appendix A for more historical data.

3.2.2 Service Building (No. 04)

Figure 3-4 shows gas usage at the building from January 2013 through November 2015.

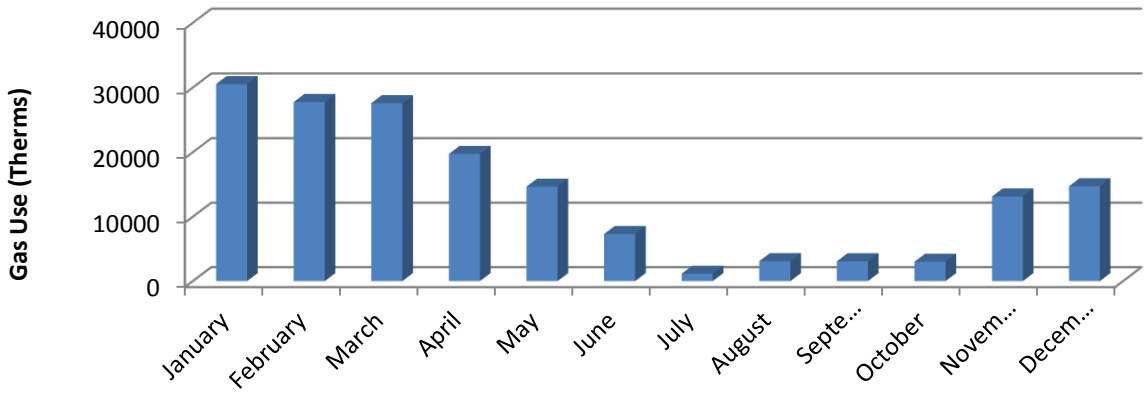


Figure 3-4 Service Building (No. 04) Gas Usage

3.2.3 Pump & Blower Building (No. 06)

Figure 3-5 shows the average monthly gas usage at the building from January 2013 through November 2015.

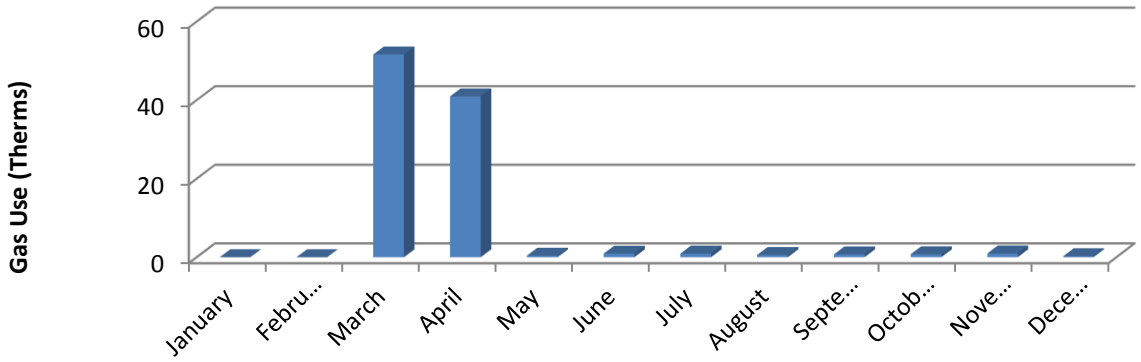


Figure 3-5 - Pump & Blower Building (No. 06) Gas Usage

3.2.5 Laboratory Building (No. 20)

Figure 3-6 shows the average monthly gas usage at the building from January 2013 through November 2015.

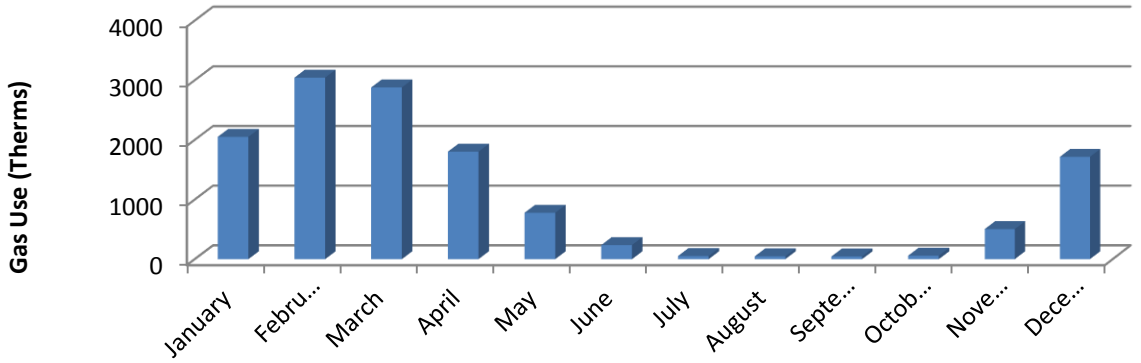


Figure 3-6 - Laboratory Building (No. 20) Gas Usage

3.2.6 Administration Building (No. 21)

Figure 3-7 shows the average monthly gas usage at the building from January 2013 through November 2015.

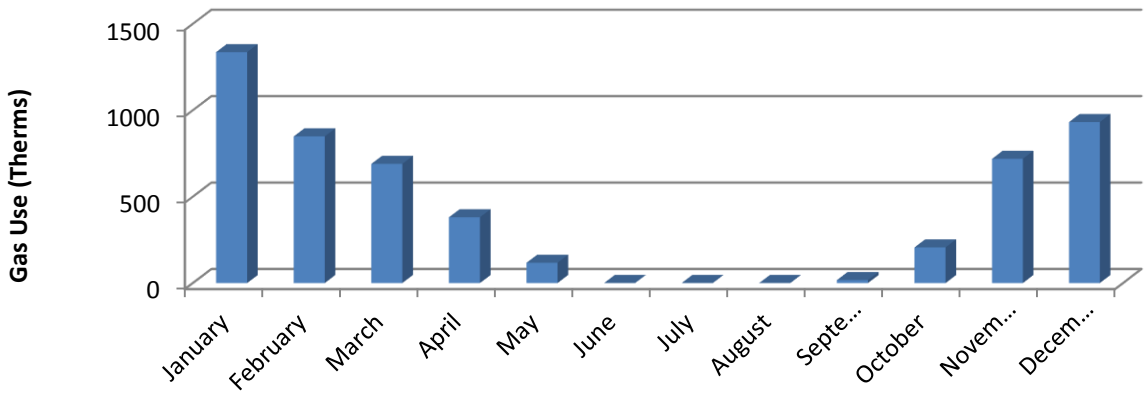


Figure 3-7 - Administration Building (No. 21) Gas Usage

3.2.7 Utility Garage (No. 22)

Figure 3-8 shows the average monthly from July 2014 through November 2015.

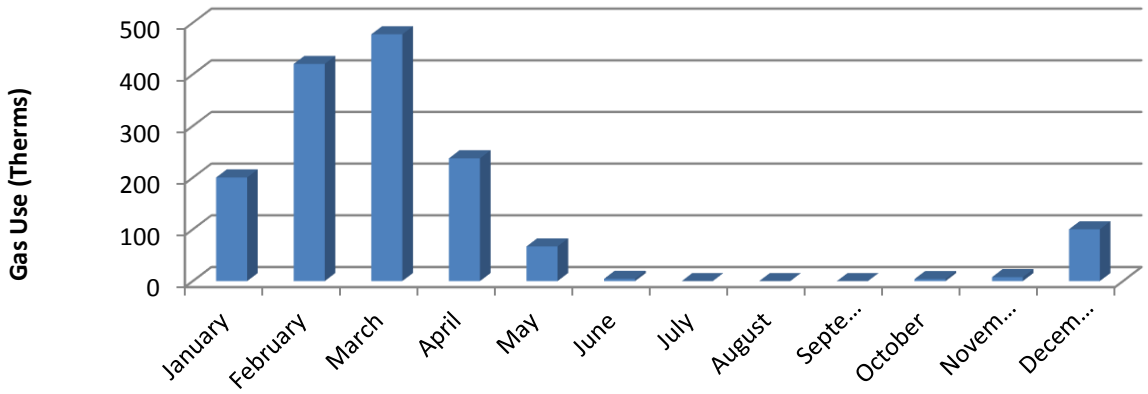


Figure 3-8 - Utility Garage (No. 22) Gas Usage

3.2.8 Maintenance Shop (No. 25)

Figure 3-9 shows the average monthly from August 2013 through November 2015.

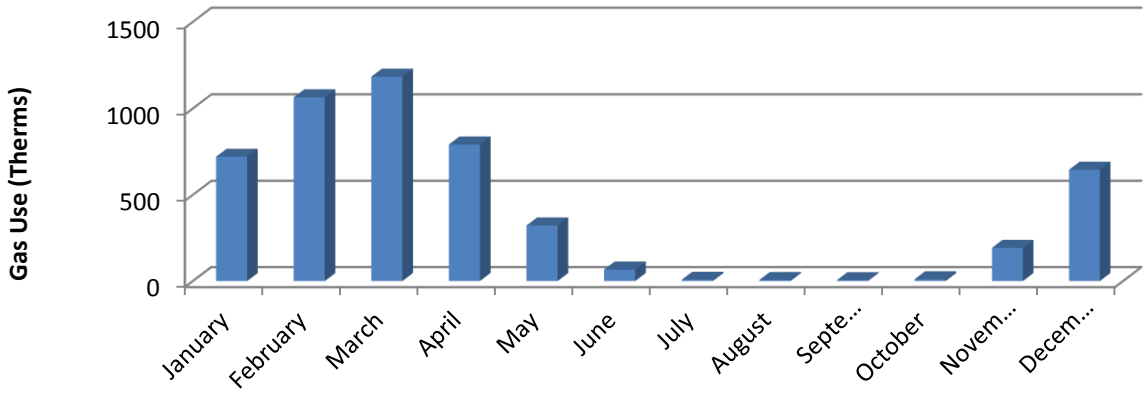


Figure 3-9 - Maintenance Shop (No. 25) Gas Usage

3.2.9 Sludge Dewatering Building (No. 27)

Figure 3-10 the average monthly from December 2012 through November 2015.

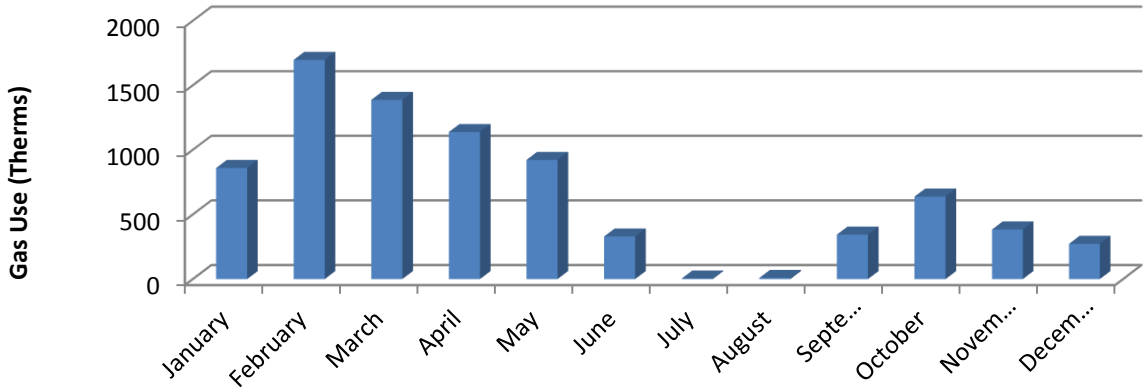


Figure 3-10 - Sludge Dewatering Building (No. 27) Gas Usage

3.2.10 Employee Facilities Building (No. 29)

Figure 3-11 the average monthly from February 2013 through November 2015.

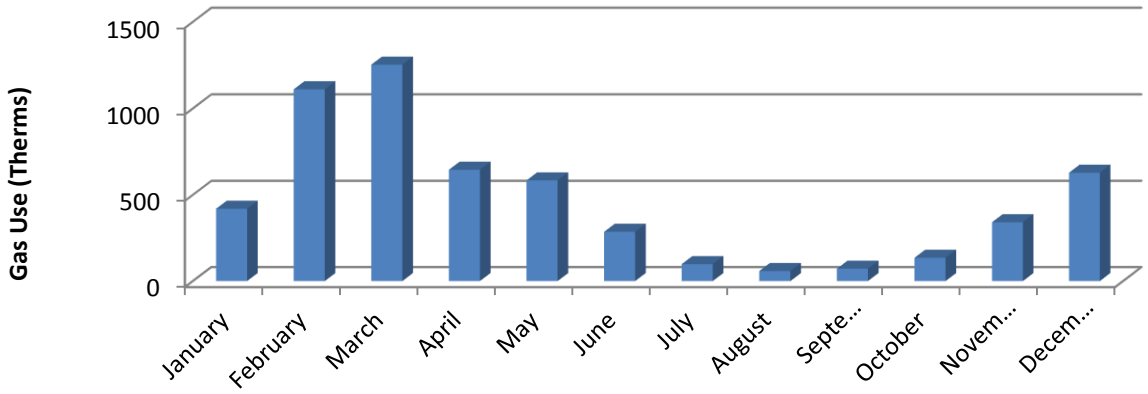


Figure 3-11 - Employee Facilities Building (No. 29) Gas Usage

3.2.11 Cogeneration/Sludge Drying Facility (No. 37)

Figure 3-12 the average monthly from January 2013 through September 2015.

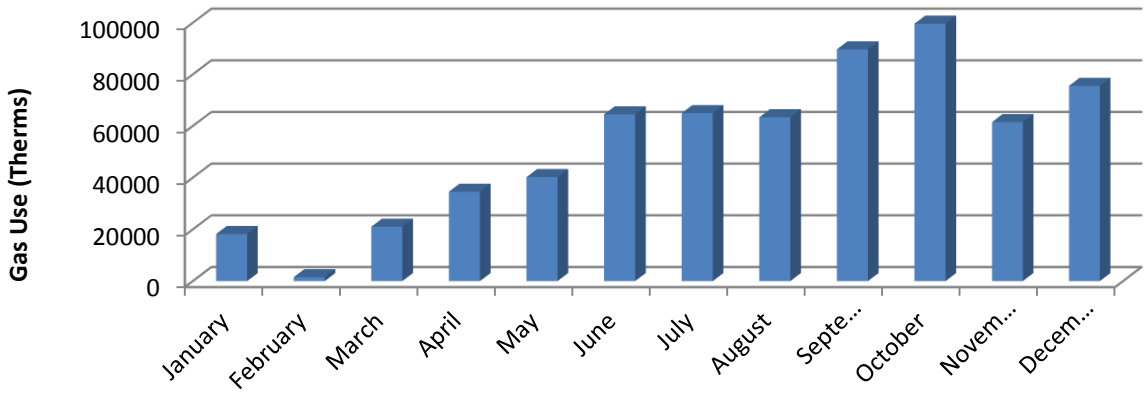


Figure 3-12 - Cogeneration/Sludge Drying Facility (No. 37) Gas Usage

3.2.12 Administration Annex (No. 39)

Figure 3-13 the average monthly January 2013 through November 2015.

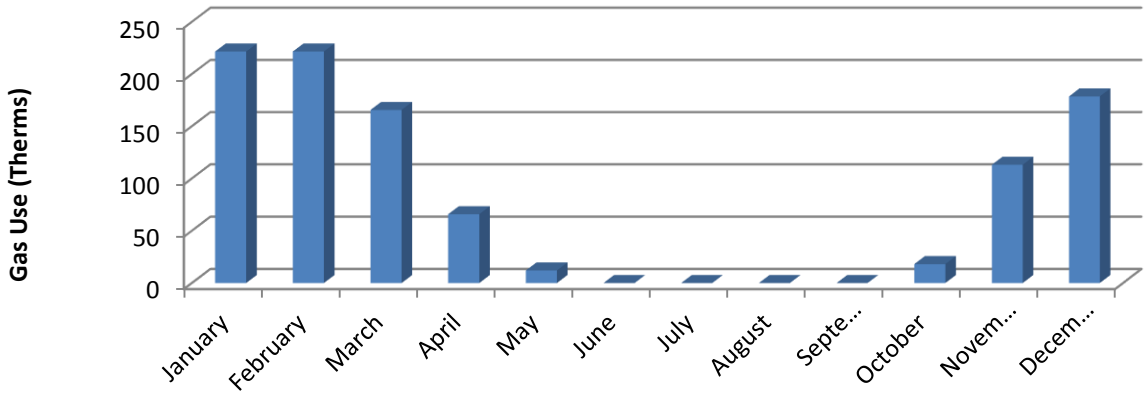


Figure 3-13 - Administration Annex (No. 39) Gas Usage

3.3 Aggregate Costs

For the purposes of computing energy savings for all identified energy conservation and retrofit measures, aggregate unit costs for electrical energy and fuel, in terms of cost/kWh and cost/therm, were determined for each service location and utilized in the simple payback analyses discussed in subsequent sections. The aggregate unit cost accounts for all distribution and supply charges for each location, unless otherwise noted.

Table 3-3 and Table 3-4 summarize the aggregate cost for electrical energy consumption and therms utilized, respectively.

Table 3-3 – Electrical Aggregate Unit Cost

Service Location	Aggregate $/kWh
Wastewater Treatment Facility	0.122

Table 3-4 - Natural Gas Aggregate Unit Costs

Service Location	Aggregate $ / therm
Service Building (No. 04)	1.00
Pump & Blower Building (No. 06)	52.56*
Laboratory Building (No. 20)	0.92
Administration Building (No. 21)	1.00
Utility Garage (No. 22)	1.09
Maintenance Shop (No. 25)	0.96
Sludge Dewatering Building (No. 27)	1.05
Employee Facilities Building (No. 29)	1.03
Cogeneration/Sludge Drying Facility (No. 37)	0.55
Administration Annex (No. 39)	1.28

*Pump and blower building has only 15 therms of usage and $4,800 in charges.

3.4 Portfolio Manager

3.4.1 Portfolio Manager Overview

Portfolio Manager is an interactive energy management tool that allows the Authority to track and assess energy consumption at the facilities in a secure online environment. Portfolio Manager can help the Authority set investment priorities, verify efficiency improvements, and receive EPA recognition for superior energy performance.

3.4.2 Energy Performance Rating

For many facilities, it is possible to rate energy performance on a scale of 1–100 relative to similar facilities nationwide. Statistically representative models are used to compare the facility against similar facilities from a national survey conducted by the Department of Energy's Energy Information Administration.

This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), is conducted every four years.

This survey gathers data on building characteristics and energy use from thousands of facilities across the United States. Your facility's peer group of comparison is those facilities in the CBECS survey that have similar facility and operating characteristics. A rating of 50 indicates that the facility, from an energy consumption standpoint, performs better than 50% of all similar facilities nationwide. A rating of 75 indicates that the facility performs better than 75% of all similar facilities nationwide.

3.4.3 Portfolio Manager Account Information

A Portfolio Manager account has been established for the Authority, and it includes a profile of the Wastewater Treatment Plant. Information entered into the profile, including electrical energy consumption and natural gas consumption, can be used to establish a performance baseline.

It is recommended that the information is continually updated to track the plant's energy usage. Ratings shown below are based on the periods for which utility data was available. Additional scoring can be generated if required utility data is entered into Portfolio Manager. The facility does not have a score because treatment plants are not scored. They are rated by plant MGD. Some of the buildings have too small a square footage to get a rating. The buildings that received a rating are listed below.

Service Building (No. 04): 100
Pump & Blower Building (No. 06): 100
Administration Building (No. 21): 99
Sludge Dewatering Building (No. 27): 100
Cogeneration/Sludge Drying Facility (No. 37): 73

CDM Smith has established account and building profiles for the Authority. The account has been shared with TRC and the request has been processed through the Energy Star website. The Authority is able to set up their own Portfolio Manager account on the Energy Star website. Once created, the data that CDM Smith has entered for the buildings can be accessed by the Authority.

The website link to access Portfolio Manager is as follows – (https://www.energystar.gov/istar/pmpam/)

The Statement of Energy Performance Score for each building, downloaded from the Portfolio Manager, is included in Appendix F.

3.5 Baseline Performance Assessment

3.5.1 Comparison to Industry Standards

Table 3-5 shows the average electricity used per influent volume by the plant from 2013 to 2015. This value is compared to industry standards published by the Electric Power Research Institute (EPRI) to gauge the plant's efficiency with similar plants around the country. These values vary depending on plant unit processes.

From the available references, the RSVA WWTP's kWh/MG is above the given range of published values from EPRI for activated sludge facilities (not advanced wastewater treatment or with nitrification), but just below the mean of 2,000 kWh/MG as found by S. Carlson in "Development of a Utility Energy Index", which was presented at the Water Environment Federation Conference in 2007.

Table 3-5 - Energy Consumption Comparison of RVSA to Industry Standards

Metric	RSVA (2013- 2015)	EPRI – 20 to 50 MGD (2010)
kWh/MG	1,963	1,051 – 1,114

Other metrics are shown below:

- 1,303 kWh/MG (Advanced Treatment Plant without Nitrification, 20 MGD plant)[1]
- 1,676 kWh/MG (Advanced Treatment Plant with Nitrification, 20 MGD plant)[1]
- 1,250 – 2,300 kWh/MG[2]
- 1,700 kWh/MG[3] (20 to 75 MGD)
- 1,400 kWh/MG[4] (20 to 75 MGD)

It should be noted that power consumption data provided from 3/14/15-10/31/15 showed a significant drop when compared to previous months. Cogeneration data during this time period could provide additional insight. As a result, data from 3/14/15-10/31/15 was excluded from average energy used per influent calculation.

[1] Energy Recovery from Wastewater Treatment Plants in the United Status: A Case Study of the Energy-Water Nexus, Sustainability 2010. Table A3. Energy Requirements.

[2] Energy Audit Manual for Water/Wastewater Facilities, CEC Report CR-104300. July 1994. Figure 3.1.

[3] ClearWaters, Spring 2008, NYSERDA, average kWh/MG for NYS municipal wastewater treatment facilities.

[4] ClearWaters, Winter 2015, NYSERDA, average kWh/MG for NYS municipal wastewater treatment facilities.

Section 4

Energy Conservation and Retrofit Measures

The following is a summary of how Annual Return on Investment (AROI), Internal Rate of Return (IRR), and Net Present Value (NPV) will be broken down in the cost analysis for all ECRMs recommended in this report.

Included in the simplified payback analysis summary table is the 'Annual Return on Investment' (AROI) values. This value is a performance measure used to evaluate the efficiency of an investment and is calculated using the following equation:

$$AROI = \frac{AECS + OCS}{NET\ ECM\ Cost} - \frac{1}{Lifetime}$$

Where OCS = Operating Cost Savings, and AECS = Annual Energy Cost Savings.

Also included in the table are net present values for each option. The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (DR) (assume bond rate of 3%). NPV is calculated using the following equation:

$$NPV = \sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$$

Where C_n=Annual cash flow, and N = number of years.

The Internal Rate of Return (IRR) expresses an annual rate that results in a break-even point for the investment. If the Authority is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the Authority to compare ECRM's against each other to determine the most appealing choices.

$$IRR \rightarrow 0 = \sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$$

Where C_n=Annual cash flow, and N = number of years.

The lifetime energy savings represents the cumulative energy savings over the assumed life of the ECRM. As noted in previous sections of this report, CDM Smith bases a recommendation solely on a measure's calculated simple payback. The metrics defined above (IRR, NPV, AROI) are included as part of the scope of this audit, and for the Authority's consideration as additional financial metrics to consider when deciding whether or not to pursue a specific measure that has been evaluated in this report.

Initial capital costs for measures are based on data gathered from RS Means 2015, in house construction services (CCI) and vendor quotes. A Simple Payback is determined by dividing a

measure's NET ECM Cost by the sum of its Operating Cost Savings and Annual Energy Cost Savings

4.1 Building Lighting Systems

The goal of this section is to present recommended lighting energy conservation measures. RVSA has installed some new LED fixtures (high bay, low bay, and area lighting) around the plant, such as on the first level of the pump and blower building. Further energy savings can be achieved through the replacement of other existing fixtures and lamps with either LED retrofit bulbs or completely new LED fixtures. All lighting upgrade recommendations and analyses are presented in Appendix B. Upgrade installation costs and overall savings are shown in Table 4-1.

The program ecoInsight was used to audit, analyze, and propose the lighting upgrades. The tool allows for a comprehensive account of energy savings and financial considerations; calculations made using ecoInsight comprise a majority of Appendix B.

The estimated probable construction costs presented are based on historic data from similar installations and engineering opinions. Further engineering and financial studies are required prior to implementing the conservation measures identified in this report. Installation design details and budget cost estimates should be confirmed before the coordination of project financing or the issuance of a Request for Proposal.

The strategy for upgrading the lighting efficiency at the plant focuses on maximizing safety by increasing light levels or maintaining them at or close to existing levels. Energy savings are maximized through the selection of luminaires with lower power draw. Installation costs are greatly decreased by selecting retrofit lamps which require minimal fixture modification. Maintenance costs are minimized through selection of LED lamps which are all rated for greater than 50,000 hours and through the elimination of ballasts which require periodic replacement.

There are many areas at the site which suffer from low light levels due to nonfunctioning luminaires and ballasts. It may be the case in multiple locations that fluorescent lamps are still functional but the ballast has exceeded its rated life. By choosing luminaires with long rated life and internal drivers, the need for maintenance is reduced and inspection is simplified as external ballasts would not need to be checked.

One of the major lighting upgrade recommendations is the replacement of both 2' and 4' T8, 32W linear fluorescent strip lights with new LED tubes. In general fixtures housing these lamps appear to be in reusable condition. There are several LED tube configurations which would serve this retrofit purpose.

"Plug and play" LED tubes can be retrofitted in existing fixtures very quickly, without having to decommission the ballast, which is normally required for power control during starting and continued operation. Since these lamps require the use of an existing ballast, they would suffer from compatibility issues and the maintenance costs associated with ballast use.

A second retrofit method for these strip lamps is the ballast bypass method. For this method, the fixture is reused but the existing ballast is removed, and minor rewiring is required to accommodate the new LED tubes. Ballast bypass LED tubes with internal drivers come in both

single-ended and double-ended power configurations, with the former currently being more common due to safety concerns associated with double-ended configurations.

The installation costs associated with installing a single-ended, internal driver LED T8 replacement involve ballast removal and rewiring of power. In addition, the LED tubes require non-shunted sockets at the power end, which may have to be installed depending on the configuration of the current fixture.

The installation described above is a common, quick, and simple procedure for an electrician. Although the ballast bypass method has slightly higher installation costs, the overall savings are greater due to less frequent maintenance and longer lamp life. Ballast bypass LED tubes are recommended for the upgrade of linear T8 fluorescent luminaires.

For safety reasons, occupancy sensors are not recommended for the lighting located in any of the areas containing process equipment. If the plant becomes interested in this option for certain spaces, the savings from installing occupancy sensors in areas with capable luminaires is approximately 20% of electrical usage costs associated with lighting based on typical occupancy schedules.

In general, the upgrade to more energy efficient luminaires will slightly decrease building cooling loads and slightly increase building heating loads, as the new lamps typically emit less heat than older bulbs. The overall effect is negligible for the purposes of this study.

Table 4-1 summarizes a simple payback analysis assuming the implementation of all recommended lighting system improvements at the plant. The upgrade of each fixture type is assumed to be implemented for all fixtures of that type site-wide at the wastewater treatment plant. For detailed analyses on upgrades in particular areas, refer to Appendix B. Note that incentive values are gathered from the New Jersey SmartStart Buildings program. All recommended lamps and fixtures are listed on the DesignLights Consortium (DLC) Qualified Products List (QPL).

Many of the lighting upgrades have simple paybacks of less than 10 years. An overview of Appendix B is highly recommended to understand the installation costs and lifetime savings associated with each upgrade. Appendix B also details and quantifies the applicable incentives per the Prescriptive Lighting Application as part of the New Jersey Clean Energy program.

Table 4-1 - Lighting Upgrades Analysis

Measure	Base Cost	Incentives	Annual Energy Savings (kWh)	Simple Payback (Yr)	IRR	NPV	20 Yr Savings*
60W Incandescent Bulbs - Upgrade to LED	$170	$170	466	no net cost	N/A	$1,066	$1,379
4', 3-Lamp Fluorescent T8s - Retain Fixture, Upgrade Lamps to LED	$8,271	$1,545	37,895	1.5	288%	$72,811	$110,078

Table 4-1 - Lighting Upgrades Analysis

Measure	Base Cost	Incentives	Annual Energy Savings (kWh)	Simple Payback (Yr)	IRR	NPV	20 Yr Savings*
4', 2-Lamp Fluorescent T8s - Retain Fixture, Upgrade Lamps to LED	$26,674	$3,940	96,640	1.9	712%	$208,105	$316,178
100W & 200W Incandescent Bulbs - Upgrade to LED	$135	$90	162	2.3	N/A	$325	$467
2', 3-Lamp Fluorescent T8s - Retain Fixture, Upgrade Lamps to LED	$3,014	$600	8,409	2.4	332%	$18,567	$29,159
8', 2-Lamp Fluorescent T12 Fixtures - Upgrade to LED	$8,283	$3,450	9,268	4.3	51%	$12,664	$22,614
Indoor 175W HID Fixtures - Upgrade to LED	$99,686	$29,400	96,149	6	45%	$136,138	$264,005
Outdoor 250W HID Floodlight Fixtures - Upgrade to LED	$8,497	$1,300	9,592	6.2	33%	$16,150	$30,204
Indoor Damp/Hazardous HID Susp. Fixtures - Upgrade to LED	$59,055	$9,300	53,439	7.6	14%	$34,200	$105,198
Outdoor 70W Wallpack Fixtures - Upgrade to LED	$14,877	$3,800	9,578	9.5	355%	$27,032	$47,805
Outdoor Stanchion Mounted HID Fixtures - Upgrade to LED	$19,144	$4,000	11,995	10.3	96%	$36,524	$65,189
2'x2' U-Bent Fluorescent Troffer Fixtures - Upgrade to LED	$26,859	$910	20,719	10.3	8%	$8,029	$42,728
Outdoor 250W Area & Roadway HID Fixtures - Upgrade to LED	$65,985	$6,500	36,461	13.4	16%	$58,757	$151,236
Total	**$340,650**	**$65,005**	**389,736**	**5.8**	**53%**	**$655,621**	**$1,186,245**

*Includes energy and maintenance savings

4.2 HVAC Systems

The goal of this section is to present any heating and cooling energy reduction and cost saving measures that may also be cost beneficial. Where possible, measures will be presented with a life-cycle cost analysis. This analysis displays a payback period based on weighing the capital cost of the measure against predicted annual fiscal savings. To do this, the buildings have been modeled as accurately as possible to predict energy usage for space heating and cooling, as well as domestic hot water use.

A detailed inventory of HVAC equipment observed at the facilities is included in Appendix E of this report. Along with basic equipment information such as manufacturers, model numbers, and estimated efficiencies, this inventory also seeks to provide an estimate of equipment remaining useful service life. For each piece of equipment, a known or estimated age is provided alongside the ASHRAE expected service life for that type of equipment. From this, an estimated remaining useful service life can be deduced. In some cases, service locations may have been estimated based on unit proximity. Additionally, in cases where a unit's manufacturer and/or model could not be determined due to an unreadable, faded, destroyed, or lost tag, manufacturer and model number information has been represented as "unknown".

Over several decades, ASHRAE has compiled data pertaining to service lives of most HVAC related equipment. From this, ASHRAE indicates a median service life (life until replacement) for HVAC related equipment that may be used as an estimate for the useful life of HVAC equipment currently in service. For example, ASHRAE indicates a window air conditioning unit has a median service life of 10 years. Therefore, if a window unit has been in service for more than 10 years, the owner may want to consider replacement. Not only will a replacement ensure minimal downtime between units (the unit is replaced before it ceases to function), but it will also maintain rated system efficiency, as efficiency tends to decrease with age.

Incentives included in HVAC ECRM analyses are taken from the New Jersey Clean Energy SmartStart program. These forms may also be downloaded directly from:

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/application-forms/regular-forms/regular-forms

Buildings that are used sporadically should be maintained at a mild temperature of approximately 55 degrees.

4.2.1 Space Heating Upgrades

Models were created for the Admin Annex, Administration Building and the Sludge Dewatering building. These models are Bin hour models which model the building energy usage as a function of outdoor temperature. Other variables which are not outdoor temperature dependent are normalized to an annual average. As stated above, the entire Wastewater Treatment Plant electricity is on one electric bill. These buildings all have separate gas bills.

The electrical usage for the building has been approximated in each model. The model has been calibrated to the metered usage of natural gas. The values of the lighting, non HVAC equipment, and occupancy have been approximated for these models. The values for the envelope areas and thermal resistance are based upon site observation.

Currently, these heating systems utilize gas fired hot water boilers. The administration building boiler is atmospheric. The other 2 boilers, in the administration annex and dewatering building, are forced draft. CDM Smith conservatively estimates these three boilers to be 80% efficient. For energy efficiency these boilers should be replaced with high-efficiency condensing boilers. The condensing boiler was sized according to the current boiler capacity. Condensing boilers are modeled with a full-load efficiency of ~93% and return water temperature of 100°F.

Fiscal savings from such an upgrade are then identified in Table 4-2 below. CDM Smith recommends that the administration building boiler be replaced. It's important to note that these are estimates based on building models, and further investigation is warranted before pursuing a boiler replacement.

Table 4-2 – Condensing Boiler Payback

Description	Administration Annex	Administration Building	Dewatering
Predicted Annual Savings (Therms)	76	1,097	1,733
Annual Savings	$97	$940	$940
Initial Capital Cost of Upgrade	$12,524	$12,462	$98,960
Incentives**	$1,000	$1,000	$6,590
Cost of Upgrade	$11,524	$11,462	$92,370
Annual Maintenance Cost Savings (AMCS)	$0	$0	$1,500
Simple Payback	**118.6**	**12.2**	**37.9**
Lifetime Energy Savings (24 years)*	$2,957	$28,605	$28,457
Annual Return on Investment (AROI)	-1.74%	0.05%	-1.74%
Internal Rate of Return (IRR)	-2.14%	1.84%	-1.86%
Net Present Value (NPV)	($1,971)	($1,199)	($11,008)
Annual Estimated Greenhouse Gas Reductions (Tons CO2)	0.4	6.4	10.1

*Assumes 2% yearly inflation on heating fuel costs

**Incentives, per New Jersey Clean Energy Program, are $1.75 per MBH

In place of replacing the existing boilers in these buildings, the heating hot water could be provided by the central hot water loop. The hot water loop is fed by the combined heat and power plant. The loop also has boilers to add to the hot water loop in the Service Building and the Pump and Blower building. These boilers are intended to add heat to the central loop to support the processes that require heating, like digestion.

The central hot water loop offers savings over the grid supplied natural gas because the hot water is a byproduct of the central heating plant electrical power production. Also the boilers connected to the hot water loop have the capacity to burn digester gas. Given these cost savings, the measure is an energy cost reduction.

This measure involves installing buried pre-insulated steel piping and pumping between the central hot water loop and the Administration Building, Administration Annex and the Dewatering Building. This will require a new controller for the building loops to circulate water when the building has a call for heating. This measure is recommended over the condensing boilers due to excess thermal in the central water loop is wasted.

Table 4-3 – Central Hot Water Loop Payback

Description	Admin, Annex, Dewatering
Predicted Annual Savings (Therms)	16,827
Central Water loop Usage (Therms)	16,827
Annual Savings**	$7,358
Initial Capital Cost of Upgrade	$82,492
Incentives	$0
Cost of Upgrade	$82,492
Annual Maintenance Cost Savings (AMCS)	$0
Simple Payback	**11.2**
Lifetime Energy Savings (24 years)*	$157,559
Annual Return on Investment (AROI)	4.75%
Internal Rate of Return (IRR)	9.17%
Net Present Value (NPV)	$71,117
Annual Estimated Greenhouse Gas Reductions (Tons CO2)	97.6

*Assumes 2% yearly inflation on heating fuel costs

**Annual Savings due to the

Models were created for the Employee facilities, Laboratory, and Utility Garage. These models are Bin hour models which model the building energy usage as a function of outdoor temperature. Other variables which are not outdoor temperature dependent are normalized to an annual average. As stated above, the entire Wastewater Treatment Plant electricity is on one electric bill. These buildings all have separate gas bills.

The electrical usage for the building has been approximated in each model. The model has been calibrated to the metered usage of natural gas. The values of the lighting, non HVAC equipment, and occupancy have been approximated for these models. The values for the envelope areas and thermal resistance are based upon site observation.

Currently, these heating systems utilize gas fired hot air equipment. The Employee facilities has a direct fired makeup air unit, gas furnace and gas unit heater. The Utility Garage has gas fired unit heaters. The Laboratory building is heated by a gas fired roof top unit. CDM Smith conservatively estimates this equipment to be 80% efficient. CDM Smith recommends replacing this boiler with a high-efficiency, condensing gas burning equipment. The condensing equipment capacity was sized according to the current equipment capacity. Condensing boilers are modeled with a full-load efficiency of ~93%.

Fiscal savings from such an upgrade are then identified in Table 4-4 below. It's important to note that these are estimates based on building models, and further investigation is warranted before pursuing a boiler replacement.

The estimated installed cost, projected energy and cost savings, and simple payback are included in Table 4-4. Savings are estimated to be 10% of the total ventilation, pump (if applicable), heating and cooling usage. It's important to note that these are estimates based on building models, and further investigation is warranted before pursuing a building management system. CDM recommends replacing the Utility Garage hot air equipment. The other buildings are not recommended based upon financials. When the equipment is being replaced, premium efficiency equipment should be evaluated.

Table 4-4 – Condensing Furnace Payback

Description	Employee Facilities	Laboratory	Utility Garage
Predicted Annual Savings (Therms)	926	1,754	1,537
Annual Savings	$960	$1,538	$1,557
Initial Capital Cost of Upgrade	$35,099	$267,016	$11,154
Incentives**	$1,100	$1,800	$800
Cost of Upgrade	$33,999	$265,216	$10,354
Annual Maintenance Cost Savings (AMCS)	$0	$0	$0
Simple Payback	**35.4**	**172.4**	**6.6**
Lifetime Energy Savings (24 years)*	$29,203	$46,787	$26,933
Annual Return on Investment (AROI)	-0.54%	1.22%	32.27%
Internal Rate of Return (IRR)	0.73%	3.95%	40.62%
Net Present Value (NPV)	($6,461)	$1,437	$17,202
Annual Estimated Greenhouse Gas Reductions (Tons CO2)	5.4	10.2	8.9

*Assumes 2% yearly inflation on heating fuel costs

**Incentives, per New Jersey Clean Energy Program

4.2.2 Thermal Oil to Process Hot Water Heat Exchanger

The Cogeneration equipment heats thermal oil that is typically used to heat the sludge dryer. The sludge dryer is not used during the weekends. This means that the energy recovered from the cogeneration process is just rejected to the atmosphere.

Installing a heat exchanger to take the energy from the thermal oil when there is additional capacity can add heat to the central loop for no cost. This is likely to occur when the sludge dryer is not in use. The process hot water loop is assumed to be able to use all the heat recovered when the outdoor air temperature is below 40°F. The additional capacity is assumed to be the weekend hours. This is being approximated by two-sevenths of the hours in the specified temperature range. Recovered energy is assumed to be saving natural gas at the CHP building rate.

This measure cost is based upon piping, heat exchanger, and control to all be located in the CHP building. This measure assumes that no additional pumping is required.

Table 4-5 – Process HW HX Payback

Description	Heat Exchanger
Predicted Annual Savings (Therms)*	30,361
Annual Savings	$14,877
Initial Capital Cost of Upgrade	$247,773
Incentives	$0
Cost of Upgrade	$247,773
Annual Maintenance Cost Savings (AMCS)	$0
Simple Payback	**16.7**
Lifetime Energy Savings (24 years)**	$361,472
Annual Return on Investment (AROI)	1.84%
Internal Rate of Return (IRR)	3.64%
Net Present Value (NPV)	$15,947
Annual Estimated Greenhouse Gas Reductions (Tons CO2)	176.1

*Calculations are included in Appendix O.

**Assumes 2% yearly inflation on heating fuel costs

4.2.3 Sludge Process Building

Additional energy savings may be available with the implementation of a solar thermal system. A transpired panel solar thermal system utilize solar energy to preheat incoming outdoor ventilation air. This technology is particularly advantageous for large process buildings with high ventilation air rates, such as the Sludge Process Building.

A transpired panel solar thermal system may be installed on existing building exterior walls or roofs respectively, and absorb heat from exposure to sunlight. The Sludge Process Building has large fiberglass windows making installation of a solar thermal system less feasible, but the roof can be used to install a solar thermal air heating system. Two-stage solar thermal air heating systems were evaluated for this ECRM. Outside air is drawn into the solar thermal system by the negative pressure provided by the HVAC system. This air is heated via the space between the glazing and collector and additional heating is provided via air drawn through the perforations along the collector on its way to the building HVAC system. Absorbed heat from solar energy is transferred to the incoming air as it travels through the solar thermal air heating system. The air then exits the duct at the opposite end, where it enters the building's ventilation supply system. The ventilation supply that could be used is the existing southernmost roof mounted Trane gas fired make-up air unit. As the air has been preheated by the solar thermal air heating system, less energy will be required by the gas fired make-up air unit to heat the air.

CDM Smith analyzed the feasibility of installing a solar thermal air heating system on the Southwest portion of the Sludge Process Building roof. This portion of the roof provides approximately 1,740 square feet of available roof area for a solar thermal air heating system installation. To calculate savings CDM Smith used RETScreen. A black solar thermal air heating

system collector was used for the savings calculation. A 50% shading factor was entered into the RETScreen software. It was assumed that the gas fired make-up air unit has a heating seasonal efficiency of 70%. Each solar thermal air heating system is six feet long by four feet deep and a maximum of eight solar thermal air heating systems can be mounted in one row. Five feet is required between the rows of solar thermal air heating systems. CDM Smith estimates that 29 solar thermal air heating systems can be mounted on the Sludge Processing Building roof according to the above assumptions and dimensions. Twenty-nine (29) solar thermal air heating systems allow for 6,264 cfm of air to be preheated. This is sufficient to pre-heat about 46% of the maximum make up air flow associated with the aforementioned make-up air unit (approximately 13,500 CFM). Electricity usage increase is a result of higher static pressure for the fan.

Table 4-6 – Sludge Process Building Solar Thermal Air Heating System

Description	Estimate
Predicted Annual Savings (Therms)	652
Predicted Annual Savings (kWh)	-700
Annual Savings	$ 829
Engineer's Opinion of Probable Cost	$ 33,750
Incentives**	$ 0
Cost of Upgrade	$ 33,750
Annual Maintenance Cost Savings (AMCS)	$ 0
Simple Payback (years)	**40.7**
Lifetime Energy Savings (30 years)*	$ 29,553
Annual Return on Investment (AROI)	-0.88%
Internal Rate of Return (IRR)	0.90%
Net Present Value (NPV)	$ -9,604
Description	**Estimate**
Annual Estimated Greenhouse Gas Reductions (Tons CO2)	3.0

*Assumes 2% yearly inflation on heating fuel costs

*30 year expected life provided by vendor representative

**No New Jersey Clean Energy Program incentives were noted for solar thermal air heating systems

The solar thermal air heating system analysis was based on estimated available roof area along with existing make-up air flow rates found in the gas fired make-up air unit. As installed conditions may not necessarily reflect observations found and assumptions made, it is recommended that a formal investigation and analysis be performed prior to pursuing this measure.

4.3 Alternative Energy Sources

4.3.1 On-Site Wind Power Generation

On-site wind power generation typically utilizes a form of turbine that is rotated with the flow of wind across its blades. This rotational force powers a generator, ultimately producing AC electricity, which can be used onsite or can be fed back into the power grid, reducing the overall

electric demand. A wind turbines power capacity is a function of the cube of the wind speed, so the higher the wind speed the greater the power production. The correlation between the wind speed and the power produced by a wind turbine is defined by that specific turbine's power curve. These power curves vary from manufacturer to manufacturer and from model to model.

CDM Smith's preliminary analysis of atmospheric conditions deemed on-site wind power generation not a viable option. The estimated wind speed average at this location is 5.5 m/s and is classified as a Class 2 Wind Power Class adjacent to Class 1 areas. See Appendix H for NREL based wind data.

4.3.2 Photovoltaic Solar Energy System Overview

Photovoltaic (PV) cells convert sunlight into electrical energy through the use of silicon semiconductors, diodes and collection grids. Several PV cells are linked in a single frame as a solar panel; panels are arranged in a grid to form a solar array. The amount of sunlight available, the orientation of the panels, the efficiency of the cells, and the total number of panels are all factors that affect the amount of electricity generated.

Calculations were performed with the assistance of PVWatts Calculator, a tool provided by the National Renewable Energy Laboratory (NREL) to estimate the energy production and installation cost of photovoltaic systems. For more information on PVWatts Calculator and NREL, see Appendix D.

Based on the current state of the site, three locations have been identified as candidates for PV installation. However, due to high installation cost and lack of available area, payback periods are long enough to conclude that solar array installation is not an immediately recommended conservation measure for the plant.

As part of this energy audit, a preliminary engineering feasibility study of candidate sites for solar generation facilities was completed consisting of the following tasks:

- Candidate location identification through analysis of site layout
- Design and construction cost estimation
- Determination for preliminary design the size and energy production of the solar system

Based on the estimated available roof and ground area, three locations have been identified as candidates for solar array installation. They are as follows:

- UV filter structure roof
- Maintenance/storage building roof
- Green space just east of headworks building

The total unobstructed available area with southern exposure was determined at each location. The structural integrity of the proposed locations was not confirmed during CDM Smith's site visit. Structural studies and reinforcement work may be required at each of the locations prior to solar system mounting. Specifically, installation on the UV filter roof would require a structural study beforehand, and installation may be costlier due to the roof's steel faced composition.

System size and kilowatt production values were calculated using azimuth angles derived from the orientation of the location. A 180 degree azimuth (South) was assumed for the ground installation. Based on the plant's latitude of 40.6° North, optimal panel tilt for energy gathering is approximately 34° from horizontal, but a tilt of 20° is chosen to maximize system size and reduce issues arising from wind.

The following is a preliminary study of the feasibility of installing PV systems at the three plant areas in order to offset the total electricity purchased. These systems are designed as additional generation options and shall not be used for the supply of backup or emergency power. An average aggregate electric rate was used based on previous billing data (Dec 2012-Nov 2015). Financial calculations were performed with assumed rates of inflation and system decay.

PV systems grid interconnection requires a modification or possible replacement of the service entrance equipment at the electrical substation. The PV feeder connections are made downstream of the main circuit breaker. Protective relaying is required, and all interconnections would have to be coordinated with and approved by the local utility.

Table 4-7 describes the candidate locations for solar installation.

Table 4-7 – Proposed Solar System Summary

Location	Area Type	Proposed PV Array Size (kW DC)
UV Filters Roof	Flat Roof	284.4
Maintenance Building Roof	Flat Roof	70.3
Space Adjacent to Headworks	Ground	80.0

4.3.2.1 Basis for Design and Calculations

The proposed photovoltaic power systems consist of the panels, combiner boxes, DC to AC inverters, disconnect switches, and all wiring and interconnection equipment. The array outputs feed the inverters, which convert the power to alternating current so that it can be used at the rest of the site. The AC outputs are connected to the main electrical service at the substation. The proposed locations are all at least 400 feet from the main electrical service – a distance which would increase installation cost significantly.

The most common PV system is a fixed tilt system typically mounted on a metal rack at a specific angle. Higher generation rates can be achieved through the use of one- or two-axis tracking arrays which change angle for optimal collection depending on the location of the sun. These systems have higher upfront costs and require more frequent maintenance than a fixed tilt system. The cost is prohibitive and fixed tilt panels are preferred in this case.

If photovoltaic systems are to be implemented, the type of panels and equipment used to mount the systems shall be determined based on the wind conditions and structural integrity of the chosen installation points.

4.3.2.2 Calculation of PV System Yield

Annual energy yield, based on geographical location, system size, and tilt was determined through the PVWatts software. Results of this calculation are summarized in Table 4-8.

Table 4-8 – Summary of Solar (PV) Systems

Building	Simple Pay-back	Array Size (kW DC)	Install Cost	Production (kWh/yr)	Annual Energy Savings	SREC* Value	AROI	IRR	NPV	Lifetime Savings (25 Years)
UV Filters Roof	17.5	284.4	$1,806,400	355,558	$43,378	$67,051	1.72%	3.30%	$55,304	$2,592,977
Storage Building Roof	20.2	70.3	$521,800	88,748	$10,827	$16,736	0.94%	1.90%	$(57,115)	$647,212
Adjacent to Headworks	19.6	80.0	$580,000	101,941	$12,436	$19,224	1.11%	2.21%	$(46,236)	$743,425

Notes

SREC factors based on average price from Dec 2014-Nov 2015

Includes 2% annual system degradation

Includes 3% Bond Rate

Due to high initial capital cost and long expected payback periods, photovoltaic system installation is not recommended as an energy conservation measure. The Authority may consult a Special Purpose Company (SPC) to fund the installation of these systems through a power purchase agreement (PPA). PPAs and SPCs are further discussed in Section 5.1.

Figures showing estimated power production and savings at each proposed array from PVWatts Calculator, along with further financial analysis, are presented in Appendix E.

4.3.3 Motor Upgrades and VFD Additions

The goal of this section is to present any energy conservation measures related to upgrading motors to premium efficiency models and adding variable frequency drives (VFD) for cost reduction.

Motor and VFDVariable frequency drive manufacturers were utilized to model the expected energy savings from upgrading motors to premium efficiency models and adding VFDs. Additional installation and labor costs were modeled using RSMeans Electrical Cost data 2014 and CDM Smith construction estimators. All VFDs 75hp and below were assumed to be 6 pulse drives with a 5% line reactor. A harmonic study will be required in a future design stage to determine drive requirements for compliance with IEEE 519 for harmonics.

The Additional bbenefits of removing traditional motor starters andwhen adding VFDs include being able to operate motors at more efficient setpoints, removal of traditional motor starters, lowering stress levels on the motor bearings and windings, and a decreasinge in stress and wear on the motor/pump.

Application of a VFD to a pump results in a cubic power reduction with speed, where a 1% reduction in pump speed will result in a 4% reduction in energy usage required to drive the

pump. We assumed a 25% decrease in energy usage for the pumps with added VFDs at the commission sites, by assuming a 6.25% reduction in motor speed (effective horsepower).

The Engineer's Estimate of Probable Construction Costs presented herein contains estimates based on historic data compiled from similar installations and engineering opinions. Additional engineering is required for each measure identified in this report. The fFinal scope of work and budget cost estimates need to be confirmed prior to the coordination of project financing.

VFDs are recommended on the aerated grit blowers and are discussed in 4.6.2. Refer to Appendix L for individual motor and VFD information and upgrade analysis.

A majority of the motors surveyed had unreadable nameplate data. CDM Smith has assumed standard NEMA efficiencies for these motors for analysis. Without actual nominal motor efficiencies, accurate cost savings and payback periods cannot be calculated. Many of the motors installed on site are relatively new with efficiencies that meet the NEMA Premium Efficiency standards. Due to lack of efficiency information on existing motors, no specific individual motor efficiency upgrade recommendations are being made.

If the Authority decides to upgrade motors to premium efficiency, consider the example of an existing 480 Volt, 50 horsepower, continuous duty, open mounted, 4 pole motor which operates with 93% efficiency. Assuming $0.122/kWh, upgrading that motor to the now mandated premium efficiency of 94.5% would result in an annual savings of $902 and a payback period of less than ten years. Upgrade of larger, older, more inefficient motors can result in even greater savings.

*Incentives for motors and VFDs will have to be reviewed by New Jersey Clean Energy program to provide customized rebates based on kwh saved per year

4.4 Other Measures

4.4.1 Smart Strips & Energy Star Appliances

It may be possible to reduce the plug load of the facilities even further with the implementation of smart strips. Smart Strips save energy by electronically unplugging all of the devices that are plugged into the "Automatically Switched outlets" when the device plugged into the control outlet is turned off. It is important to note that CDM Smith is not suggesting that computers be plugged into the automatically switched off outlets, as there would be potential for the computers to be shut off mid-operation. There are a vast amount of computer peripherals that are typically left on after a computer is shut off, including monitors, scanners, printers and DSL/Cable modems. These peripherals can be plugged into the automatic outlets.

A standard Smart Strip has one 'control' outlet, six (6) outlets that are automatically switched off when the control device is and three (3) outlets that are always hot. An example of how the Authority can implement the use of Smart Strips in office settings is to plug a computer into the control outlet, five (5) monitors and a personal printer (8 W in standby mode) into the automatic outlets and three (3) computers into the always hot outlets. An LCD monitor can use up to 34W; in standby mode the monitor utilizes 1 – 2W. A CRT monitor typically utilizes around 75W. The following Table 4-9 summarizes the payback of a Smart Strip, assuming 5 LCD monitors and 1

printer are automatically powered down that would otherwise been left on 8 hours/day and in standby mode 16 hours/day, 5 days/week for 9 months.

Table 4-9 – Smart Strip Simple Payback

Smart Strip Application Example	
Predicted Annual Savings – 5 LCD monitors, 1 printer (kWh)	308
*Total Annual Savings	$37
Initial Capital Cost	$40
Simple Payback (years)	1.1
Lifetime Energy Savings (15 years)	$688

*Based on the calculated aggregate cost of $.12/kWh

The following Table 4-10 summarizes other applications for the Smart Strip that may be applicable throughout the buildings:

Table 4-10 - Smart Strip - Other Applications

Control Outlet	Switched Outlets
Computer	Monitors, printers, scanners, lamps
TV	VCR, DVD player, cable box
Lamp	Space heater

It is recommended that RVSA continues to implement Energy Star appliances on an 'as-needed' basis.

The following two maintenance procedures can work to save the energy consumed by the refrigerators. One is cleaning dirty condenser coils, twice a year. A refrigerator's condenser coils and cooling fins are located either under the unit behind a grille in the front or on the back of the appliance. The coils can be cleaned with a brush or vacuum cleaner hose. The second source of wasted energy associated with a refrigerator is the door seal. Realigning the door or replacing a no longer airtight door seal will work to improve energy efficiency.

4.5 Water Systems

As a result of the National Energy Policy Act water use standards for commercial plumbing products were established. The standards required that toilets use no more than 1.6 gallons per flush, urinals were limited to 1 gallon per flush and faucets and shower heads were allowed a maximum flow of 1.5 gallons per minute (gpm) at 80 psi.

Prior to the National Energy Policy Act, originally passed in 1992, standard toilets used 3.5 – 5.5 gallons per flush, urinals required 2 to 3 gallons per flush and standard lavatory faucets has flow rates of 2.5 to 5 gpm.

In general, replacement of older water fixtures results in a 40 – 50% reduction in water consumption. Rough estimates of payback on common water system components are included in

Table 4-11 - Summary of Payback for Common Water System Components

Toilets					
Condition	Gals/Flush	Flushes/Yr	Gals/Yr	Cost/Gal	Cost Per Yr
Existing	3.5	2,100	7,350	$0.0067	$49.25
Proposed	1.3	2,100	2,730	$0.0067	$18.29
Savings/yr					$30.96
Cost of New Toilet - Installed					$500.00
Payback (yrs)					16.1
Urinals					
Condition	Gals/Flush	Flushes/Yr	Gals/Yr	Cost/Gal	Cost Per Yr
Existing	1.0	2,100	2,100	$0.0067	$14.07
Proposed	0.5	2,100	1,050	$0.0067	$7.04
Savings/yr					$7.03
Cost of New Urinal - Installed					$250.00
Payback (yrs)					35.6
Showerheads					
Condition	GPM	minutes/yr	Gals/Yr	Cost/Gal	Cost Per Yr
Existing	2.5	1,250	3,125	$0.0067	$20.94
Proposed	1.8	1,250	2,250	$0.0067	$15.08
Savings/yr					$5.86
Cost of New Showerhead - Installed					$125.00
Payback (yrs)					21.3
Faucet Aerators					
Condition	GPM	minutes/yr	Gals/Yr	Cost/Gal	Cost Per Yr
Existing	2.2	650	1,430	$0.0067	$9.58
Proposed	1.2	650	780	$0.0067	$5.23
Savings/yr					$4.35
Cost of New Faucet Aerator - Installed					$25.00
Payback (yrs)					5.7

Table 4-12 – Summary of Replacement of Common Water System Components

Component	Quantity	Total Cost	Total Savings	Payback (yrs)
Toilets	4	$2,000	$123.84	16.1
Urinals	10	$2,500	$70.30	35.6
Showerheads	14	$1,750	$82.04	21.3
Faucet Aerators	33	$825	$143.55	5.7
Total		**$7,075**	**$419.73**	**16.9**

4.6 Wastewater Process Upgrades

4.6.1 Primary Sludge Pump Operation

The existing five (5) primary sludge pumps convey settled sludge from the primary settling tanks to gravity thickeners. Each pump is powered by a 15 hp motor and is operated on average 19 hours per day (this average is based on plant data from 2013-2015, which includes periods of maintenance and intermittent use). However, RVSA notes that a primary sludge pump runs 24/7 when a tank is online.

CDM Smith recommends primary sludge pump operation be modified to run on an every other hour basis. Reduced operation to 12 hours per day would result in an estimated annual cost savings of $14,000 from the baseline of 19 hrs/day. The projected savings will increase if the actual operation is currently more than 19 hrs/day. An economic analysis of this operational change is shown below in Table 4-13. RVSA's SCADA system has the option to adjust pump operating hours, thus the proposed savings is due to operational change and has no associated baseline costs.

Table 4-13 - Primary Sludge Pump Operation

Description	Total
Engineer's Opinion of Probable Cost - Improvements Proposed as Energy Saving Measures**	No associated cost
Annual Electric Savings (kWh)***	113,000
Annual O&M Cost Savings***	$14,000
Simple Payback	**<1 years**
Description	**Total**
Annual Return on Investment (AROI)	-
Lifetime Electric Savings (kWh)***	2,260,000
Lifetime O&M Savings (20 years)****	$376,000
Internal Rate of Return (IRR)	-
Net Present Value (NPV)	$270,000

* See Appendix G for Engineer's Opinion on Probable Construction Costs.
** Additional incentives, based on eligibility, are discussed in Section 7.
*** See Appendix M for Electric and O&M cost assumptions.
**** 3% yearly inflation on costs.

4.6.2 Aerated Grit Blower Turndown

The existing four (4) aeration grit blowers are 20 hp each and operate at full capacity. Typically, two of the four aeration grit blowers operate at a given time. Each is rated for a maximum flow rate of 340 scfm at 7.0 psig discharge pressure based on blower curves at 2,026 rpm.

Typical air supply rates for aerated grit chambers per foot of basin length are 3 to 8 cfm/ft. Based on this and the equipment shop drawings, rates of 102 to 272 scfm are recommended for minimum and maximum air flow rates. The current estimated air flow rate well exceeds design guidelines and thus power consumption.

From our analysis, it was determined that the blowers could operate at a reduced capacity with the addition of VFDs and be able to maintain grit removal rates. The minimum blower flow rate

was estimated to be 145 scfm at 1,000 rpm. If the blower can be operated at a lower speed, further energy savings may be realized. Other operating conditions, such as a single blower (or 2 blowers with one as standby) were not considered since the existing blowers appeared in good working condition with remaining useful design life.

CDM Smith recommends installing VFDs on each of the aerated grit blowers. A VFD will allow the blowers to be operated at a reduced capacity, which could save an estimated $11,000 annually.

An economic analysis of this modification is shown below in Table 4-14.

Table 4-14 – Aerated Grit Blower VFD

Description	Total
Engineer's Opinion of Probable Cost - Improvements Proposed as Energy Saving Measures**	$26,000
Annual Electric Savings (kWh)***	88,000
Annual O&M Cost Savings***	$11,000
Simple Payback	**2.4 years**
Description	**Total**
Annual Return on Investment (AROI)	37.31%
Lifetime Electric Savings (kWh)***	1,800,000
Lifetime O&M Savings (20 years)****	$220,000
Internal Rate of Return (IRR)	45.3%
Net Present Value (NPV)	$190,000

* See Appendix G for Engineer's Opinion on Probable Construction Costs.
** Additional incentives, based on eligibility, are discussed in Section 7.
*** See Appendix M for Electric and O&M cost assumptions.
**** 3% yearly inflation on costs.

4.6.3 Aeration Tank Operation

The aeration tanks at RVSA were designed with the ability to nitrify, but RVSA is not currently required by permit to achieve this level of treatment. From the limited TKN and ammonia data received, CDM Smith believes nitrification may be occurring. If true, oxygen demand (and thus aeration blower power consumption) is increased beyond that required by permit.

With no effluent limits now or proposed for ammonia or TKN, RVSA could reduce the aerobic solids retention time (SRT) to approximately 4 days to reduce the extent of nitrification. Further and more frequent testing of primary effluent and plant effluent ammonia and TKN is necessary to confirm the target SRT, and degree of nitrification occurring.

RVSA is already operating the aeration tank process efficiently. However, any reduction in the SRT will lower the oxygen transfer required and result in less energy usage.

This alternative should be evaluated critically by RVSA. Running at an SRT in a range this low can be challenging with a young sludge, but is made possible for RVSA because there are effluent filters to polish any suspended solids carryover.

The analysis took into account a higher oxygen transfer rate for the baseline condition with partial nitrification taking place. This operational modification would result in an estimated annual cost savings of $9,000 by reducing oxygen demand and aeration blower power consumption. Further desktop analysis is necessary, as well as field checks to determine if there are any mixing limitations.

We have not proposed any modifications to existing equipment with this option. WAS pumping capacity should be confirmed and costs for additional pumping capacity incorporated as necessary. This operation change is recommended for further study immediately. Implementation can begin once design assumptions are confirmed.

Table 4-15 – Aeration Tank SRT Reduction

Description	Total
Engineer's Opinion of Probable Cost - Improvements Proposed as Energy Saving Measures**	No associated cost
Annual Electric Savings (kWh)***	74,000
Annual O&M Cost Savings***	$9,000
Simple Payback	**immediate**
Description	**Total**
Annual Return on Investment (AROI)	-
Lifetime Electric Savings (kWh)***	1,500,000
Lifetime O&M Savings (20 years)****	$242,000
Internal Rate of Return (IRR)	-
Net Present Value (NPV)	$175,000

* See Appendix G for Engineer's Opinion on Probable Construction Costs.

** Additional incentives, based on eligibility, are discussed in Section 7.

*** See Appendix M for Electric and O&M cost assumptions.

**** 3% yearly inflation on costs.

4.6.4 Post Aeration

The aeration blowers located in the Pump and Blower Building (No. 06) provide aeration to the aeration tanks and post aeration system located in the effluent filter channel. A manual butterfly valve controls the amount of air sent to the coarse bubble diffusers in the effluent filter channel. The flow meter associated with post aeration has not been operational for some time and the approximate amount of air delivered is not known.

Repair of the post aeration flow meter and DO sampling would allow RVSA to gather data on the effectiveness of this process. Since the average effluent DO is 7 mg/L which exceeds the effluent requirement of 3.0 mg/L, CDM Smith recommends further evaluation of this process to determine if post aeration can be reduced via valve throttling or closing the valve completely to conserve energy.

We note the most critical time for additional DO is assumed to be in the summer, when the water temperature is higher and oxygen not as soluble in solution. So, this recommendation could be implemented on a seasonal basis.

4.6.5 Disinfection Technology Alternatives

4.6.5.1 UV Disinfection

The existing treatment process at RVSA WWTP is low pressure, high intensity (output) UV light disinfection. The system is a WEDECO TAK-55M 9-13( )/143 x 2i2W model, installed downstream of the effluent filters in 2008, consists of four banks (two per channel, one active/one stand-by), with a total of 936 lamps.

The existing UV system has multiple mode options for operation, which include automatic and maintenance modes. In automatic mode, the number of banks online and power to lamps is controlled from UVT and flow sensor data, which minimizes energy consumption. Maintenance mode allows for manual operation of the system.

Currently, RVSA operates the UV system in maintenance mode, with four banks online and 100% power continuously. RVSA indicates they prefer to operate the UV system in maintenance mode due to higher kill ratios, operational issues with varying power, and longer bulb life.

As a result of energy and cost savings, CDM Smith recommends re-evaluating the UV system in automatic mode for normal operation. An economic analysis of utilizing automatic mode in comparison to maintenance mode is shown below in Table 4-16.

Table 4-16 - UV System Automatic Mode

Description	Total
Engineer's Opinion of Probable Cost - Improvements Proposed as Energy Saving Measures**	No associated cost
Annual Electric Savings (kWh)***	1,900,000
Annual O&M Cost Savings***	$320,000
Simple Payback	**immediate**
Description	**Total**
Annual Return on Investment (AROI)	-
Lifetime Electric Savings (kWh)***	38,000,000
Lifetime O&M Savings (20 years)****	$8,600,000
Internal Rate of Return (IRR)	-
Net Present Value (NPV)	$6,200,000

* See Appendix G for Engineer's Opinion on Probable Construction Costs.

** Additional incentives, based on eligibility, are discussed in Section 7.

*** See Appendix M for Electric and O&M cost assumptions.

**** 3% yearly inflation on costs.

As this proposal involves no modifications to existing equipment, this operational change is recommended to be implemented immediately.

4.6.5.2 Peracetic Acid

As part of this energy audit, peracetic acid (PAA) is proposed as an alternative disinfection technology once the existing UV system reaches the end of its useful life.

PAA is an equilibrium mixture of hydrogen peroxide and acetic acid that is reacted and stabilized using proprietary additives. While this chemical has been applied to the food, beverage, medical and pharmaceutical industries for decades, its use has recently expanded to include wastewater treatment facilities, mainly in Europe. More recently, both the United States Environmental Protection Agency (USEPA) and the Canadian authorities have approved PAA for use as a disinfectant to treat wastewater. PAA has been demonstrated to be an effective disinfectant, requiring low doses of chemical to achieve bacterial inactivation in wastewater effluent. Advantages of PAA include its fast kinetics, requiring very short contact times, lower capital cost and energy consumption when compared to UV technology.

There are two disadvantages of utilizing PAA. The first is its limited use when compared to other more mature disinfection technologies such as chlorination and UV disinfection. However, this is changing and new wastewater applications are evident throughout North America. Accordingly, we view this as a short term disadvantage. Until there are installations that are approved in individual states, pilot testing and regulatory coordination for permitting this relatively new technology may require additional time before the process can be implemented. The second disadvantage is PAA will add carbonaceous biochemical oxygen demand (CBOD) to the plant effluent. Because of the acetic acid component of the PAA solution, approximately 0.4 mg/L of CBOD is added per 1 mg/L of active PAA.

To determine feasibility of PAA at RVSA, effluent samples were collected upstream and downstream of effluent filters for dosage analysis by PeroxyChem. Preliminary analysis determined a PAA dose of 2 mg/L at average flows and 5 mg/L at max flows would meet disinfection requirements at RVSA. The Lab test report is included in Appendix N. In CDM Smith's experience, a 30% mixing factor should be added to bench PAA testing to account for mixing and related kinetics in order to achieve the same log inactivation at a full scale application.

Should disinfection utilizing PAA or a combination of PAA and the existing UV system be desired by RVSA, a pilot study needs to be performed in order to further evaluate the feasibility of PAA as a disinfection alternative. The "CT" (residual concentration times contact time) approach that is traditionally used for chlorine disinfection is not fully adequate to assess the effectiveness PAA disinfection because of differences in chemical half-lives. As a result, it is necessary to capture these kinetics and combine this information with a valid microbial inactivation model to describe the disinfection process using PAA.

If RVSA is interested in the use of PAA, we recommended a pilot study be performed for a 6-8 week period with sampling being conducted 5 days per week. Data will be collected during the pilot study and will support the analysis using this model to make recommendations on the design dose and contact times. Additionally, Whole Effluent Toxicity (WET) testing may be conducted at three target residual concentrations to determine if there is any need for residual quenching (the corollary to dechlorination for chlorine based disinfection).

With this information, the system may be sized and designed. The components of a PAA feed system are similar to typical sodium hypochlorite feed systems consisting primarily of bulk storage with secondary containment, suction and discharge piping, chemical metering pumps and controls, residual analyzers, and an injection point into a contact tank designed to provide contact time at peak flow. PAA does not require highly specialized equipment or instrumentation. Implementing PAA includes design and construction of a chemical feed and storage system along with any site improvements necessary to support the system, such as instrumentation and controls, electrical, site/civil upgrades (i.e., improving roads for access and providing dedicated chemical off-loading areas or providing adequate potable water), or control buildings where appropriate. We anticipate the PAA will be stored outdoors in new tanks for this option. Quotes, standard drawings of PAA bulk storage, pumps and associated piping are included in Appendix N.

Preliminary costs and energy savings based on sample analysis are shown below in Table 4-17. Pilot testing would be required to determine final lease costs and system design.

Table 4-17 - UV Replacement with PAA*

Description	Total
Engineer's Opinion of Probable Cost - Improvements Proposed as Energy Saving Measures**	$100,000
Annual O&M Cost Savings***	($1,007,000)
Simple Payback	**On implementation**
Description	**Total**
Annual Return on Investment (AROI)	(660.00%)
Lifetime O&M Savings (25 years)****	-
Internal Rate of Return (IRR)	-
Net Present Value (NPV)	($12,800,000)
* See Appendix G for Engineer's Opinion on Probable Construction Costs. ** Additional incentives, based on eligibility, are discussed in Section 7. *** See Appendix M for O&M cost assumptions. **** 3% yearly inflation on costs.	

Due to high O&M costs, this ECRM is not recommended as PAA would not result in cost savings when compared to the existing UV system. However, this option may become viable after the UV system reaches the end of its useful life. Also, if a PAA system was to be considered for implementation, a pilot test would be required.

4.6.6 WAS Pumps

Presently, RVSA operates two (2) mixed liquor pumps (duty/standby) located in the Pump & Blower Building (No. 6). Each unit is 30 hp, has a VFD, and has a rated capacity of 3,200 gpm at 25.3-ft of total dynamic head (TDH) The pumps convey mixed liquor from the aeration tanks to the gravity thickener tanks. The mixed liquor pumps were installed in the 1970s, and their remaining useful life is limited. Based on preliminary calculations, it is believed one pump operates at a higher total head and is less hydraulically efficient than the original pump, and thus explains why average flow is closer to 700 gpm at a speed of 660 rpm.

The Return Sludge Pumping Station (No. 62) houses three (3) WAS pumps with associated piping and controls. The WAS pumps were installed in 2006 and were intended to replace the mixed liquor pumps located in the Pump & Blower Building. Each pump is rated for 600 gpm at 55-ft TDH and has a VFD. WAS is conveyed by the pumps from the RAS wet well to the gravity thickener tanks or alternately to the rotary drum thickeners. Currently, the WAS pumps located in the Return Sludge Pumping Station (No. 62) are not used by RVSA due to lack of prime on startup and operational preference to waste mixed liquor

An analysis was performed which assumed the new WAS pumps run at approximately half the flow rate of the mixed liquor pumps. The resulting speed to achieve this flow was estimated to be 505 rpm. Based on affinity laws for centrifugal pumps, the energy usage was estimated to be approximately 9.5 kW less than the current operation of the mixed liquor pumps.

As a result of the newer pumps pumping a thicker sludge and potential energy savings, CDM Smith recommends further evaluation of the WAS pumps in the Return Sludge Pumping Station for wasting sludge to the gravity thickener tanks. An economic analysis is shown below in Table 4-18.

Table 4-18 – WAS Pumps

Description	Total
Engineer's Opinion of Probable Cost - Improvements Proposed as Energy Saving Measures**	No associated cost
Annual Electric Savings (kWh)***	80,000
Annual O&M Cost Savings***	$10,000
Simple Payback	**immediate**
Description	**Total**
Annual Return on Investment (AROI)	-
Lifetime Electric Savings (kWh)***	2,000,000
Lifetime O&M Savings (25 years)****	$269,000
Internal Rate of Return (IRR)	-
Net Present Value (NPV)	$194,000
* See Appendix G for Engineer's Opinion on Probable Construction Costs. ** Additional incentives, based on eligibility, are discussed in Section 7. *** See Appendix M for Electric and O&M cost assumptions. **** 3% yearly inflation on costs.	

The intent of the evaluation should be focused on confirming probable construction costs. None were identified as part of this analysis.

Section 5

Evaluation of Energy Purchasing and Procurement Strategies

5.1 Energy Deregulation

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, the deregulation of the market, allowed all consumers to shop for their electric supplier. The intent was to create a competitive market for electrical energy supply. As a result, utilities were allowed to charge Cost of Service and customers were given the ability to choose a third party supplier. Energy deregulation in New Jersey increased the energy buyers' options by separating the function of electricity distribution from that of electricity supply.

Authorized Third Party Electrical Suppliers can be found in Appendix R.

5.2 Demand Response Program

Demand Response is a program through which a business or Authority can make money by reducing their electricity use when wholesale electricity prices are high or when heavy demand causes instability on the electric grid, which can result in voltage fluctuations or grid failure. Demand Response is an energy management program that compensates the participant for reducing their energy consumption at critical times. Demand Response is a highly efficient and cost effective means of reducing the potential for electrical grid failure and price volatility and is one of the best solutions to the Mid-Atlantic region's current energy challenges.

The program provides at least two hours advance notice before curtailment is required. There is typically one event a year that lasts about three hours in the summer months, when demand for electricity is at its highest.

Participation in Demand Response is generally done through companies known as Curtailment Service Providers, or CSPs, who are members of PJM Interconnection. There is no cost to enroll in the program and participation is voluntary, for instance, you can choose when you want to participate. In most cases, there is no penalty for declining to reduce your electricity use when you are asked to do so. The event is managed remotely by notifying your staff of the curtailment request and then enacting curtailment through your Building Management System. CSPs will share in a percentage of your savings, which may differ among various CSPs, since there may be costs associated with the hardware and/or software required for participation, so it is recommended that a number of CSPs be contacted to review their offers.

Additional consideration must be given to emissions and air pollution permitting required to operating the onsite generator for extended periods of time.

5.3 Alternative Third Party Electrical Energy Supplier

5.3.1 Electricity

The Authority has been purchasing electrical power from PSE&G and a Third Party Supplier (TPS) for several years. The current TPS is Hudson Energy Services; the current contract in June 2016. Using a TPS has reduced the Authority's total electrical costs, and CDM Smith recommends the continuation of this practice. Usage rates and contract lengths should be compared when selecting a TPS.

5.3.2 Natural Gas

Elizabethtown Gas is the current distributor and Constellation Energy is the current supplier of natural gas for all of the Authority's facilities included in this report. The Authority is charged for the cost of the natural gas, a delivery charge and a customer charge, which covers gas administration charges.

5.3.3 Recommendation

A list of contact information for all Third Party Suppliers is included in Appendix R. These can be accessed at the following website:

http://www.bpu.state.nj.us/bpu/commercial/shopping.html#nbr1

RVSA is already taking advantage of third party suppliers for electricity and natural gas purchasing, so continued monitoring and comparison of alternative pricing offerings is recommended.

Section 6

Ranking of Energy Conservation and Retrofit Measures (ECRM)

6.1 ECRMs

The main objective of this energy audit is to identify potential Energy Conservation and Retrofit Measures and to determine whether or not the identified ECRM's are economically feasible to warrant the cost for planning and implementation of each measure. Economic feasibility of each identified measure was evaluated through a simple payback analysis. The simple payback analysis consists of establishing the Engineer's Opinion of Probable Construction Cost estimates; O&M cost savings estimates, projected annual energy savings estimates and the potential value of New Jersey Clean Energy Rebates or Renewable Energy Credits, if applicable. The simple payback period is then determined as the amount of time (years) until the energy savings associated with each measure amounts to the capital investment cost.

As discussed in Section 3, aggregate unit costs for electrical energy delivery and usage and natural gas delivery and usage, which accounts for all demand and tariff charges at each complex, was determined and utilized in the simple payback analyses.

In general, ECRMs having a payback period of 20 years or less are recommended for implementation or further study. Only ECRMs evaluated under Section 4 of this report are included herein. The most attractive rankings are those with the lowest simple payback period.

Ranking of ECRMs has been broken down into the following categories:

- Lighting Systems
- HVAC Systems
- Solar Systems
- Wind Systems
- Motor Upgrades and VFD Additions
- Wastewater process upgrades
- Geothermal Energy

6.1.1 Lighting Systems

This section includes the recommended ECRMs to provide energy savings for all site and building lighting systems, which include the installation of energy-efficient luminaires and occupancy sensors. A detailed discussion of building lighting systems is presented in Section 4.1; upgrade financials are summarized in Table 6-1.

Table 6-1 - Lighting Upgrades Summary

Base Cost	Incentives	Annual Energy Savings (kWh)	Simple Payback (Yr)	IRR	NPV	20 Yr Savings
$340,650	$65,005	389,736	5.8	53%	$639,643	$1,186,245

Refer to Section 4.1 and Appendix B for detailed analysis on recommended lighting system upgrades.

6.1.2 HVAC Systems

Table 6-2 includes the ECRMs to provide energy savings for the various building HVAC systems. A detailed discussion on building HVAC systems is presented in Section 4.2.

Table 6-2 - Ranking of Energy Savings Measures Summary – HVAC System Upgrade

Building Measure	Retrofit Cost	Incentives	Total Cost	Annual Fiscal Savings	Simple Payback (Years)
Utility Garage Condensing Furnace	$11,154	$800	$10,354	$ 1,557	6.6
Admin, Annex, Dewatering Central Water Loop	$82,492	$0	$82,492	$ 7,358	11.2
Administration Building Condensing Boilers	$12,462	$1,000	$11,462	$ 940	12.2
Employee Facility Condensing Furnace	$35,099	$1,100	$33,999	$ 960	35.4
Dewatering Condensing Boilers	$98,960	$6,590	$92,370	$ 2,440	37.9
Administration Annex Condensing Boilers	$12,524	$1,000	$11,524	$ 97	118.6
Laboratory Condensing Furnace	$267,016	$1,800	$265,216	$ 1,538	172.4

6.1.3 Solar Energy

Implementation of new solar energy systems has been evaluated to determine the economic feasibility for furnishing and installing such systems. Based on the simple payback modeling performed, it would not benefit the Authority to further investigate installing the solar energy systems. This is primarily based on the initial upfront capital investment required for a solar energy system installation and a payback period greater than 20 years. Table 6-3 includes a ranking of the solar energy ECRMs evaluated for the Authority.

Table 6-3 - Ranking of Energy Savings Measures Summary - Solar Energy Systems

Building	Simple Payback	Installation Cost	Annual Production (kWh)	Initial Annual Energy Savings	Initial Annual SREC Credit	Lifetime Savings (25 Years)
UV Filters Roof	17.5	$1,806,400	$355,558	$43,378.08	67,051.13	$2,592,977
Maintenance Building Roof	20.2	$521,800	$88,748	$10,827.26	$16,736.10	$647,212
Adjacent to Headworks	19.6	$580,000	$101,941	$12,436.80	$19,224.03	$743,425

Refer to Section 4.3.2 and Appendix D for detailed analysis on photovoltaic system installation.

6.1.4 Wind Energy

Implementation of new wind energy systems has been evaluated to determine the economic feasibility for furnishing and installing such systems. Based on the preliminary site analysis performed, it would not benefit the Authority to further investigate installing the wind energy systems. This is primarily based on the initial upfront capital investment required for a wind energy system installation and a payback period greater than 20 years.

6.1.5 Motor Upgrades and VFD Additions

Table 6-4 includes the recommended ECRM to provide energy savings by upgrading motors to premium efficiency models, and adding VFDs where deemed appropriate. A detailed discussion on motor upgrades and VFD additions is presented in Section 4.6.2.

Table 6-4 - Ranking of Motor Upgrades

Location	HP	Estimated Total Cost	Annual Fiscal Savings	Simple Payback (Years)
(4) Aerated Grit Blowers	20	$26,000	$21,000	1.3

6.1.6 Wastewater Process Upgrades

Table 6-5 includes the recommended ECRM to provide energy savings by upgrading the liquid and solids trains as discussed in Section 4. Supporting documentation can be found in Appendix C, G & M.

Table 6-5 - Ranking of Energy Savings Measures Summary – Wastewater Process Upgrades

Building & Measure	Annual Fiscal Savings	Simple Payback (Years)
UV System Automatic Mode – See Table 4-16	$320,000	<1
WAS Pump Operation – See Table 4-18	$10,000	<1
Aeration Tank SRT Reduction – See Table 4-15	$9,000	<1
Primary Sludge Pump Operation – See Table 4-13	$14,000	0.4

The Simple Payback calculations for primary sludge pump modifications are based on reduction in operation of the four motors. Only operational changes are associated with aeration tank SRT reduction and utilizing the existing UV system's automatic mode, therefore a payback period is not associated with these ECRMs as there are no capital modifications.

Section 7

Grants, Incentives and Funding Sources

7.1 Renewable Energy

7.1.1 Renewable Energy Certificates (NJ BPU)

As part of New Jersey's Renewable Portfolio Standards (RPS), electric suppliers are required to have an annually increasing percentage of their retail sales generated by renewable energy. Electric suppliers fulfill this obligation by purchasing renewable energy certificates (RECs) from the owners of solar generating systems. One REC is created for every 1,000 kWh (1 MWh) of renewable electricity generated. Although solar systems generate electricity and SRECs in tandem, the two are independent commodities and sold separately. The RPS, and the creation of RECs, is intended to provide additional revenue flow and financial support for renewable energy projects in New Jersey. RECs generated from solar electricity, or SRECs, currently trade at $200/MWh. The amounts paid for RECs can change over time and should be reviewed when appropriate for planning purposes.

NJ also offers RECs for biopower projects. To be eligible for incentives, projects must generate electricity (and thermal energy, if a CHP system is proposed) with sustainable Class I biomass resources as defined in N.J.A.C. 14:8-2.5. Projects designed to operate on any combination of sustainable biomass and any other feedstock not specifically designated as sustainable biomass in N.J.A.C. 14:8-2.5 are ineligible for this program but may be eligible for incentives under the NJCEP's Commercial and Industrial CHP/Fuel Cell Program or the New Jersey Energy Resilience Bank.

More information can be found here: http://www.njcleanenergy.com/renewable-energy/technologies/biopower/biopower

For more information on SRECS, please see http://www.njcleanenergy.com/renewable-energy/project-activity-reports/srec-pricing/srec-pricing

7.1.2 Clean Energy Solutions Capital Investment Loan/Grant (NJ EDA)

NJ EDA in cooperation with NJ DEP is offering interest-free loans and grants for energy efficiency, combined heat and power (CHP) and renewable energy projects with total project capital equipment costs of at least $1 million. The interest-free loans are available for up to $5 million, a portion of which may be issued as a grant.

For additional information, contact CESCI@njeda.com or call 866-534-7789.

7.1.3 Grid Connected Renewables Program (NJ BPU)

The New Jersey Grid Connected Renewables Program offers competitive incentives for wind and sustainable biomass electricity generation projects larger than 1 Megawatt (MW). Most of the incentives offered under this program will take the form of a payment for energy production ($/MWh) once the project is operating. Incentives range up to $58.49/MWh for publicly-owned wastewater biogas projects. Up to 10% of the incentive may be requested in the form of a lump

grant to cover up-front costs such as financing fees, interconnection fees, project design, permitting, and construction costs. For more information on the Grid Connected Renewable Program, please see www.njcleanenergy.com.

7.1.4 Utility Financing Programs

All four Electric Distribution Companies (EDCs) in New Jersey have developed long term contracting or financing programs for the development of solar energy systems. In all of the programs, Solar Renewable Energy Credits (SRECs) generated by the solar energy systems will be sold at auction to energy suppliers who are required to purchase a certain quantity of SRECs to meet their Renewable Portfolio Standard requirements.

7.1.5 Renewable Energy Manufacturing Incentive (NJ BPU)

New Jersey's Renewable Energy Manufacturing Incentive (REMI) program provides rebates to purchase and install solar panels, inverters, and racking systems manufactured in New Jersey. Rebates for panels start at $0.25 per watt and rebates for tracking systems and inverters start at $0.15 per watt for solar projects up to 500 kW in capacity. To be eligible for REMI, applicants must apply to either the Renewable Energy Incentive Program (REIP) or the SREC Registration Program (SRP).

7.1.6 Clean Renewable Energy Bonds (IRS)

The IRS is currently not accepting application for CREBs. For more information, please refer to http://www.irs.gov/pub/irs-drop/a-10-54.pdf.

7.1.7 Qualified Energy Conservation Bonds (IRS)

These IRS 0% interest bonds are very similar to CREBs except they are allocated based on state and county population. New Jersey was allocated $90 million as part of the ARRA stimulus fund. QECBs are typically distributed through municipal bond banks or state economic development agencies.

7.1.8 Private Tax-Exempt Financing

Similar to traditional municipal bond financing, there are many private financial service companies that offer a myriad of options for tax-exempt financing of municipal projects. The providers of these services suggest that this capital can be offered at competitive rates in an expedited timeframe and with fewer complications when compared to traditional municipal financing methods. Though these factors would need to be compared on a case-by-case basis, the one distinct advantage to private financing on the current project would likely be the flexibility to structure payments to meet budget needs with consideration given to the terms and conditions of existing loan and/or bond agreements. For example, this mechanism could be used to limit the initial debt payments when the current bond debt is the greatest and the operations savings of the project has yet to be fully realized. It should also be noted that, in many cases, the construction and long term financing can be rolled into a single private financing agreement. Also, in some instances, equipment manufacturers have the ability to offer competitive financing terms (e.g. Siemens Financial Services Corporation), though financing from these sources is generally contingent upon a substantial portion of the project cost (~20% to 30%) being for their respective equipment.

7.1.9 Performance Based Contracts (ESCOs)

A second financing alternative for a project of this nature would be to enter into a Performance Based Contract with an Energy Services Company (ESCO). The premise of this type of contract is that it requires no initial municipal capital contributions in order to implement the project - instead relying on future operations cost savings and/or energy production, to fund the annual payments. Prior to entering into an agreement for the funding of the project, an ESCO would perform an energy audit and/or conceptual studies to confirm future energy cost savings or energy production inherent with the projects implementation and operation. The contract would then be formulated based on some measurable parameter(s) (energy production, etc.) which would be verified by measurement throughout the contract duration. The savings in energy costs or energy production would then be used to pay back the capital investment of the project over the contract time period (typically on the order of 10-years or less). The ESCO would guarantee the agreed upon energy savings or energy production. If the project does not meet energy savings or production commitments, the ESCO pays the owner the equivalent difference.

With this funding alternative, the ownership and operation of the facility would be maintained by the original owner. A performance contract may also include ESCO operation and maintenance of the energy-related facilities if that were deemed appropriate. Significant ESCO's with experience in this area include Siemens Building Technologies, Chevron and Johnson Controls. CDM Smith has functioned in several roles on performance based contracts including being the owner's representative and, on different contracts, providing design-build services (as a subcontractor to the ESCO). CDM Smith can provide additional experience-based information upon request.

For more information on Performance Based Contracts or ESCOs , please see http://www.njcleanenergy.com/commercial-industrial/programs/energy-savings-improvement-program

7.1.10 Power Purchase Agreements (SPCs)

A Power Purchase Agreement (PPA) also delivers a project with no initial capital contribution by the original owner. In this model, a Special Purpose Company (SPC) created by a developer, would own the energy production facilities. Within the framework of a PPA, a SPC will typically lease property from the owners for construction and operation of the new facilities. The funding and construction of the new facilities would be performed by the SPC who would then own and operate the facilities for the duration of the contract (typically 20 to 30 years). Throughout that period of time, the original owner would purchase power from the SPC at a pre-negotiated rate which would take into account the initial capital cost, operation and maintenance of the constructed facility, ancillary benefits of the project and investor returns on investment. For renewable energy, financial incentives may enable this financing approach to compete favorably with utility power tariffs. Incentives include state and local tax credits, renewable energy credits, and Federal energy production tax credits or energy investment tax credits. It is expected that a number of experienced companies and developers may be interested in a PPA for New Jersey municipal renewable energy projects.

7.1.11 Energy Resiliency Bank (ERB)

The ERB is a new funding option for Wastewater Treatment Facilities in NJ. The ERB aims to strengthen the resilience of NJ by offering financially feasible distributed energy for critical

facilities affected by disasters. Financing through the Bank will be used to develop or enhance distributed energy resource ("DER") technologies at critical facilities that were directly or indirectly impacted by Superstorm Sandy or directly impacted by other eligible disasters.

The ERB may provide 100% of unmet funding needs for an eligible project (Eligible DER Systems and Projects vs. Ineligible Uses), after equity contribution applicable to for-profit owned projects, (i.e., the ERB may finance the entire funding gap, after applicable equity contribution is satisfied.) The amount of unmet need will be established through the federally required duplication of benefits/unmet need analysis.

For up to date information on the Energy Resiliency Bank, please see:

http://www.njeda.com/erb

7.2 Energy Efficiency

7.2.1 Introduction

New Jersey's Clean Energy Program (NJ CEP) promotes increased energy efficiency and the use of clean, renewable sources of energy including solar, wind, geothermal, and sustainable biomass. The results for New Jersey are a stronger economy, less pollution, lower costs, and reduced demand for electricity. NJCEP offers financial incentives, programs, and services for residential, commercial, and municipal customers.

NJCEP reduces the need to generate electricity and burn natural gas which eliminates the pollution that would have been caused by such electric generation or natural gas usage. The benefits of these programs continue for the life of the measures installed, which on average is about 15 years. Thus, the public receives substantial environmental and public health benefits from programs that also lower energy bills and benefit the economy.

7.2.2 New Jersey Smart Start Buildings Program (NJ BPU)

The New Jersey Smart Start Buildings Program offers rebate incentives for several qualifying equipment such as high efficient premium motors and lighting, and lighting controls.

Incentive information and incentive calculation worksheets are provided for the various new equipment installation identified in this report and are included in Appendix F.

For up to date information on the NJ Smart Start Building Program, please see:

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

7.2.3 Pay for Performance Program (NJ BPU)

Another program offered through the New Jersey Smart Start Program, is the Pay for Performance Program. Commercial, industrial and institutional buildings are eligible for participation if not already receiving Energy Efficiency and Conservation Block Grants.

Incentives are available for buildings that are able to present an Energy Reduction Plans that reduce the building's current energy consumption by 15% or more, in addition to incentives for

installing the recommended measures and incentives for presenting the energy savings in a post-construction benchmarking report. No more than 50% of the total energy savings may be derived from lighting retrofits. In addition, the total energy savings of 15% may not come from the implementation of one energy savings measure. The incentive structure is provided in Appendix F.

RVSA does not appear to be a good candidate for the Pay for Performance Program. The combined measures from the project only yield 11% savings. The demand requirements are met. For up to date information on the Pay for Performance program, please see:

http://www.njcleanenergy.com/P4P

7.2.4 Direct Install (NJ BPU)

Owners of existing small to mid-size commercial and industrial facilities with a peak electric demand that did not exceed 150 kW in any of the preceding 12 months are eligible to participate in Direct Install. Buildings must be located in New Jersey and served by one of the state's public, regulated electric or natural gas utility companies.

This program will cover up to 70% of the retro-fitting costs associated with the use of new energy efficient equipment. Lighting, HVAC, refrigeration, motors, natural gas systems, and variable frequency drives are covered under the Direct Install program.

The Direct Install Program is designed to fast-track project implementation so energy savings can be realized sooner rather than later. The steps for participation are to contact the contractor assigned and trained to provide Direct Install services in your County and schedule an Energy Assessment with this contractor. The contractor will assist in completing the Program Application and Participation Agreement.

The Energy Assessment with the participating contractor will work to determine which conservation measures qualify and the resulting project cost. Following this assessment, a scope of work will be finalized and installation will be arranged. Following completion of the installation a 'project completion form' must be submitted to the program representative assigned to the project.

Any additional information on the Direct Install Program can be obtained by calling 866-NJSMART or by e-mail to DirectInstall@trcsolutions.com.

Section 8

Action Item List

Several items were noted during the field inspection portion of this assignment. The following items have been compiled at the request of the LGEA and specifically include only the items noticed during the site inspection for the energy audit::

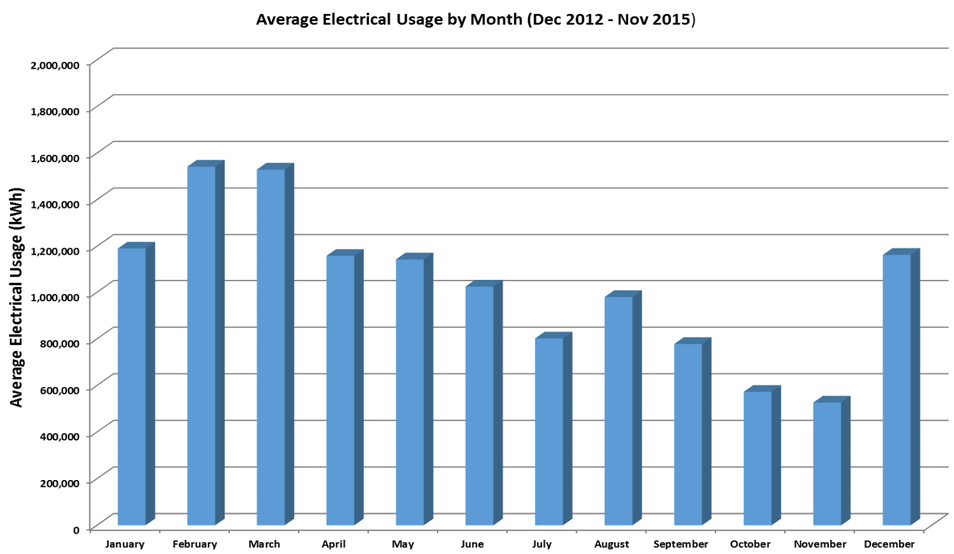
- Replace light bulbs as needed to maintain safe working environment.
- Perform maintenance as required on the boiler in the Sludge Dewatering Building.

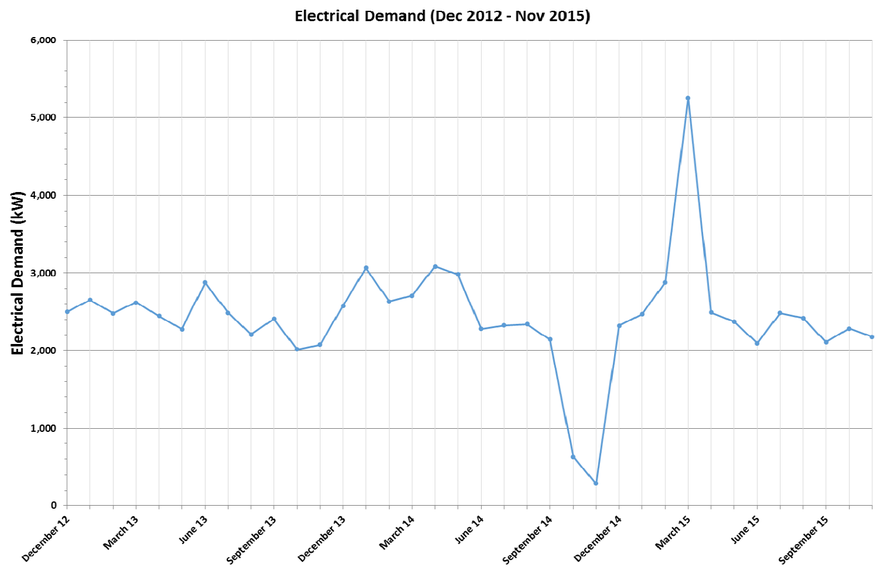
Appendix A
Utility Bill Information

Rahway Valley Sewerage Authority Wastewater Treatment Plant	
Service Provider	PSE&G and Third Party Suppliers
Account Number	42 004 579 03
Meter Number	778008870

Usage

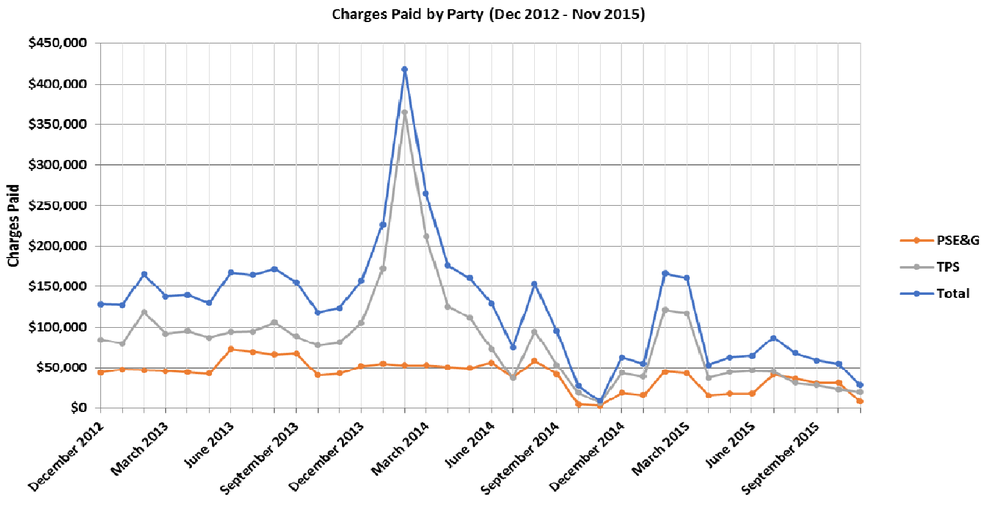
Month	Billing Days	Third Party Supplier (TPS)	Generation kW Capacity	Transmission kW Capacity	On Peak kWh	Off Peak kWh	Total kWh Usage	Peak kW Demand	Summer kW Demand	kWh Offset by Cogen
December 2012	33	Hess Electric (Acct #503721/503735)	2,115.30	1,949.03	565,956	791,317	1,357,273	2,497.30		
January 2013	31	Hess Electric	2,105.05	1,949.03	399,847	817,624	1,458,226	2,652.30		
February 2013	31	Hess Electric	2,105.05	1,949.03	392,978	865,831	1,452,744	2,477.20		
March 2013	30	Hess Electric	2,105.05	1,949.03	640,396	828,369	1,468,765	2,618.00		
April 2013	30	Hess Electric	2,105.05	1,949.03	621,613	810,796	1,432,409	2,444.40		
May 2013	31	Hess Electric	2,105.05	1,949.03	555,210	824,980	1,380,190	2,275.60		
June 2013	30	Hess Electric	1,994.91	1,949.03	373,165	815,420	1,434,785	2,879.10	2,806.00	
July 2013	30	NRG (Acct #9 818 213-2)	1,994.91	1,949.03	610,037	795,568	1,405,605	2,486.00	2,444.40	
August 2013	31	NRG	1,994.91	1,949.03	557,464	828,553	1,386,017	2,207.50	2,207.50	
September 2013	30	NRG	1,994.91	1,949.03	589,909	756,506	1,346,415	2,407.90	2,407.90	
October 2013	29	NRG	2,002.22	1,949.03	529,755	698,366	1,228,121	2,016.00		
November 2013	29	NRG	2,002.22	1,949.03	553,610	741,022	1,294,632	2,077.70		
December 2013	33	NRG	2,002.22	1,949.03	642,444	935,647	1,578,091	2,574.20		
January 2014	31	NRG	2,006.60	1,829.03	429,761	975,555	1,672,348	3,066.80		
February 2014	31	NRG	2,006.60	1,829.03	685,863	992,556	1,678,419	2,633.40		
March 2014	30	NRG	2,006.60	1,829.03	435,892	955,272	1,678,991	2,710.30		
April 2014	29	NRG	2,006.60	1,829.03	662,674	902,843	1,565,517	3,083.20		
May 2014	32	NRG	2,006.60	1,829.03	626,787	906,873	1,533,660	2,981.20		
June 2014	30	NRG	2,061.89	1,829.03	274,725	681,706	1,102,896	2,278.10	2,278.10	
July 2014	32	Hudson Energy Services	2,061.89	1,829.03	186,338	286,899	473,237	2,324.70	2,223.90	
August 2014	29	Hudson Energy Services	2,061.89	1,829.03	452,327	752,969	1,205,296	2,339.80	2,275.60	
September 2014	30	Hudson Energy Services	2,061.89	1,829.03	269,687	408,118	677,805	2,144.50	2,072.70	614,000
October 2014	29	Hudson Energy Services	2,064.11	1,829.03	96,230	147,145	243,375	630.00		999,220
November 2014	31	Hudson Energy Services	2,064.11	1,829.03	33,301	47,734	81,035	287.30		
December 2014	31	Hudson Energy Services	2,064.11	1,829.03	181,437	372,904	554,341	2,321.80		
January 2015	33	Hudson Energy Services	2,072.85	813.12	172,410	268,161	440,571	2,464.60		
February 2015	29	Hudson Energy Services	2,072.85	813.12	623,177	870,956	1,494,133	2,881.20		
March 2015	30	Hudson Energy Services	2,072.85	813.12	606,997	833,115	1,440,112	5,261.80		
April 2015	18	Hudson Energy Services	2,072.85	813.12	210,982	267,792	478,774	2,488.10		
May 2015	30	Hudson Energy Services	2,072.85	813.12	222,696	294,344	517,040	2,373.80		
June 2015	31	Hudson Energy Services	1,016.35	813.12	179,519	356,537	536,056	2,095.00		
July 2015	30	Hudson Energy Services	1,016.35	813.12	223,828	302,356	526,184	2,479.70	2,479.70	
August 2015	31	Hudson Energy Services	1,016.35	813.12	151,850	196,306	348,156	2,419.20	2,419.20	
September 2015	31	Hudson Energy Services	1,016.35	813.12	136,912	172,878	309,790	2,110.10	2,110.10	
October 2015	30	Hudson Energy Services	1,016.35	813.12	111,197	135,678	246,875	2,283.10	2,283.10	
November 2015	31	Hudson Energy Services	1,016.35	813.12	88,801	115,689	204,490	2,177.30		

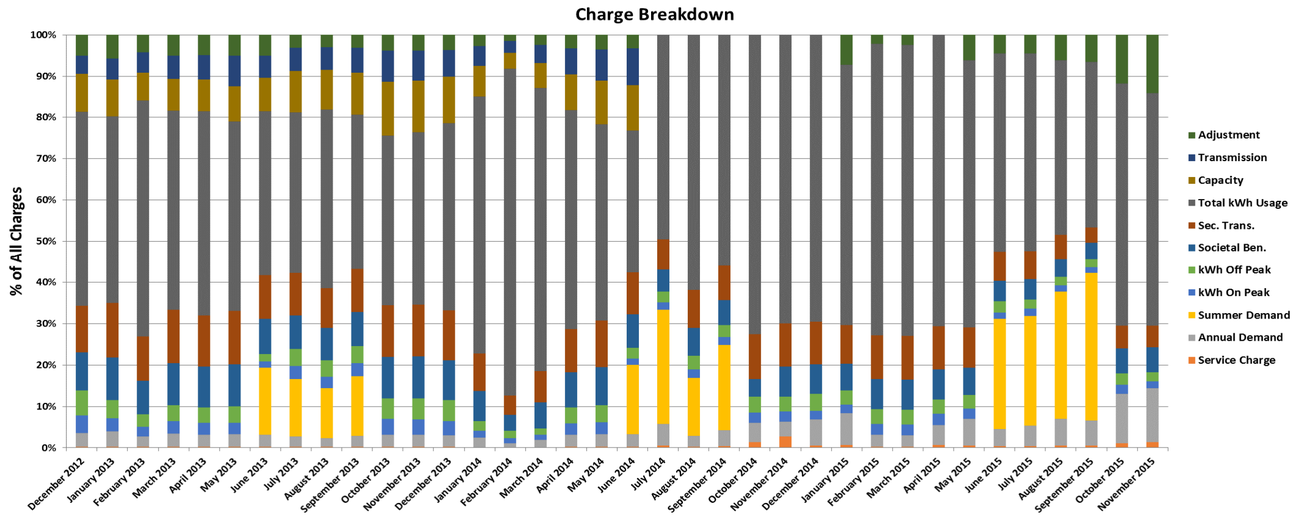




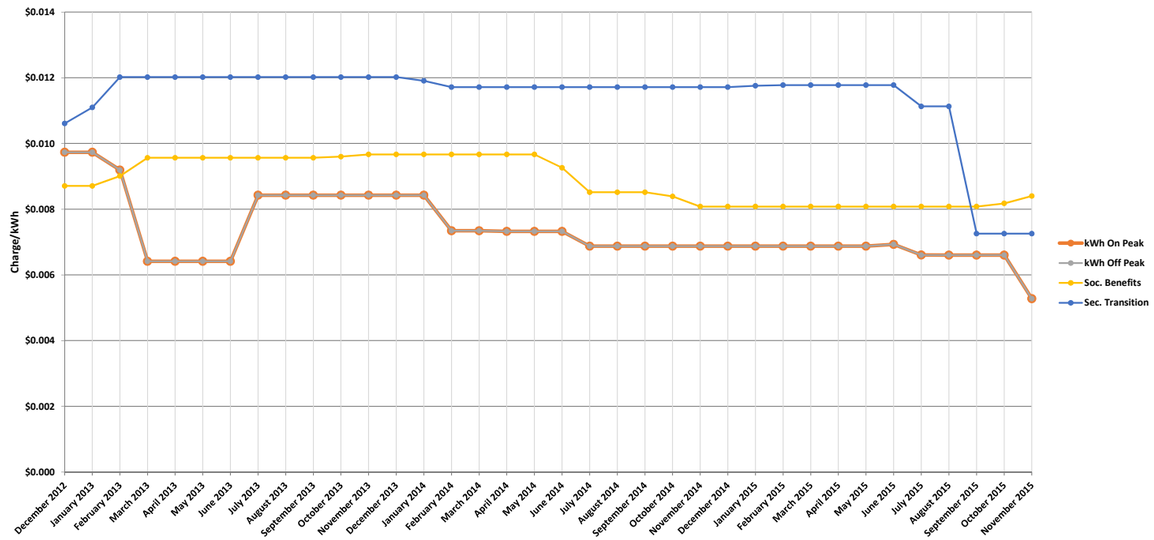
Rahway Valley Sewerage Authority Wastewater Treatment Plant	
Service Provider	PSE&G and Third Party Suppliers
Account Number	42 004 579 03
Meter Number	778008870

								Charges							
Month	**Billing Days**	**Service Charge**	**Annual Demand**	**Summer Demand**	**kWh - On Peak**	**kWh - Off Peak**	**Societal Benefits**	**Securitization Transition**	**Total PSE&G Charges**	**kWh Energy**	**Capacity**	**Transmission**	**Adder/Adjustment**	**Total TPS Charges**	**Total Electric Bill**
December 2012	33	$384.62	$4,136.53		$5,509.02	$7,702.68	$11,820.49	$14,399.31	$43,952.65	$60,332.14	$11,781.05	$5,659.17	$6,514.91	$84,300.62	$128,253.27
January 2013	31	$381.02	$4,416.61		$3,892.11	$5,399.51	$12,699.69	$16,182.01	$47,601.72	$55,638.61	$10,994.48	$6,229.80	$6,999.48	$79,931.08	$127,532.80
February 2013	31	$374.49	$4,164.67		$3,613.04	$5,040.12	$13,090.36	$17,464.89	$47,029.28	$92,804.19	$11,013.42	$7,910.14	$6,973.17	$118,700.88	$165,730.16
March 2013	30	$374.49	$4,401.38		$4,108.14	$5,313.99	$14,050.21	$17,657.49	$45,905.70	$66,618.77	$10,643.35	$7,644.34	$7,050.07	$91,956.88	$137,862.58
April 2013	30	$374.49	$4,109.53		$3,987.65	$5,201.26	$13,702.42	$17,220.42	$44,595.77	$69,120.90	$10,658.15	$8,292.13	$6,875.56	$94,946.33	$139,542.10
May 2013	31	$374.49	$3,825.74		$3,561.67	$5,292.25	$13,202.90	$16,592.64	$42,849.69	$59,781.55	$11,013.42	$9,556.11	$6,624.91	$86,976.29	$129,825.98
June 2013	30	$374.49	$4,840.35	$26,187.83	$2,393.85	$2,853.42	$13,725.15	$17,248.99	$72,821.98	$64,548.11	$13,119.75	$8,610.70	$8,186.88	$94,465.41	$167,287.39
July 2013	30	$374.49	$4,179.46	$22,813.10	$5,140.78	$6,704.25	$13,446.02	$16,898.18	$69,556.28	$63,989.60	$16,419.48	$9,247.83	$5,186.37	$94,843.27	$164,399.55
August 2013	31	$374.49	$3,711.25	$20,602.16	$4,697.75	$6,982.22	$13,258.64	$16,662.70	$66,289.21	$74,314.77	$16,422.96	$9,556.08	$5,115.90	$105,409.70	$171,698.91
September 2013	30	$374.49	$4,048.17	$22,472.45	$4,971.16	$6,375.08	$12,879.81	$16,186.60	$67,307.76	$58,278.29	$15,894.83	$9,247.83	$4,973.91	$88,394.86	$155,702.62
October 2013	29	$374.49	$3,389.30		$4,464.25	$5,885.13	$11,792.59	$14,764.47	$40,670.23	$48,574.49	$15,361.55	$8,939.56	$4,535.34	$77,410.94	$118,081.17
November 2013	29	$374.49	$3,493.03		$4,665.27	$6,244.59	$12,517.80	$15,564.07	$42,859.25	$51,931.96	$15,413.22	$8,939.56	$4,790.82	$81,075.56	$123,934.81
December 2013	33	$374.49	$4,327.75		$5,413.88	$7,884.70	$15,258.56	$18,971.81	$52,231.19	$71,381.55	$17,529.71	$10,172.61	$5,822.64	$104,906.51	$157,137.70
January 2014	31	$374.49	$5,155.90		$3,621.60	$5,285.98	$16,169.93	$19,917.29	$55,045.33	$138,655.24	$16,453.34	$10,638.90	$6,162.40	$171,909.88	$226,955.21
February 2014	31	$374.49	$4,427.27		$5,038.35	$7,291.32	$16,228.63	$19,666.04	$53,026.10	$330,631.58	$16,486.36	$11,831.62	$6,205.65	$365,155.21	$418,181.31
March 2014	30	$374.49	$4,556.56		$3,202.06	$3,972.96	$16,234.16	$19,672.74	$53,158.47	$177,791.03	$15,957.18	$11,416.15	$6,187.51	$211,351.87	$264,510.34
April 2014	29	$374.49	$5,183.48		$4,855.41	$6,615.13	$15,136.98	$18,343.16	$50,508.65	$93,364.94	$15,420.06	$10,992.88	$5,764.55	$125,542.43	$176,051.08
May 2014	32	$374.49	$5,011.99		$4,592.47	$6,644.66	$14,828.96	$17,969.89	$49,422.46	$76,779.72	$17,008.92	$12,130.08	$5,663.16	$111,581.88	$161,004.34
June 2014	30	$373.53	$3,820.20	$21,207.11	$2,012.91	$3,225.59	$10,217.00	$12,922.63	$56,446.05	$43,678.50	$13,986.65	$11,371.92	$4,082.86	$73,119.92	$129,565.97
July 2014	32	$372.11	$3,917.79	$20,806.18	$1,281.07	$1,972.44	$4,030.56	$5,544.92	$37,925.07	$37,267.41				$37,268.37	$75,193.44
August 2014	29	$374.49	$3,987.72	$21,530.13	$3,109.75	$5,176.66	$10,265.51	$14,122.45	$58,566.71	$94,917.06				$94,919.46	$153,486.17
September 2014	30	$372.11	$3,654.87	$19,610.43	$1,854.10	$2,805.81	$5,772.87	$7,941.84	$42,012.03	$53,377.14				$53,378.50	$95,390.53
October 2014	29	$372.11	$1,221.18		$661.58	$1,011.62	$1,126.57	$2,851.63	$4,576.90	$19,165.78				$19,166.27	$27,444.81
November 2014	31	$248.07	$326.43		$228.94	$328.17	$654.84	$949.49	$2,735.94	$6,381.51				$6,381.67	$9,117.61
December 2014	31	$372.11	$3,957.04		$1,247.38	$2,563.72	$4,479.63	$6,495.21	$19,115.09	$43,654.35				$43,655.45	$62,770.54
January 2015	33	$372.11	$4,200.42		$1,185.32	$1,843.61	$3,560.25	$5,180.96	$16,342.67	$34,694.97			$4,011.57	$38,707.41	$55,050.08
February 2015	29	$372.11	$4,910.43		$4,284.34	$5,987.82	$12,074.09	$17,599.39	$45,228.18	$117,662.97			$3,623.35	$121,289.31	$166,517.49
March 2015	30	$372.11	$4,486.12		$4,173.10	$5,727.67	$11,637.55	$16,963.08	$43,359.63	$113,411.71			$4,011.57	$117,423.28	$160,782.91
April 2015	18	$372.11	$2,547.27		$1,450.50	$1,841.07	$3,868.97	$5,639.48	$15,719.40	$37,704.41				$37,704.41	$53,423.81
May 2015	30	$372.11	$4,050.41		$1,531.04	$2,023.62	$4,178.20	$6,090.21	$18,245.59	$40,717.93			$3,882.16	$44,600.06	$62,845.65
June 2015	31	$372.11	$3,574.70	$23,488.96	$1,244.07	$2,470.79	$4,331.87	$6,314.20	$18,307.74	$42,215.48			$4,011.57	$46,227.05	$64,534.79
July 2015	30	$372.11	$4,245.35	$22,915.87	$1,478.39	$1,997.06	$4,252.09	$5,856.95	$41,703.31	$41,438.04			$3,882.16	$45,320.20	$87,023.51
August 2015	31	$372.11	$4,127.88	$19,987.92	$1,002.97	$1,296.60	$2,813.45	$3,875.32	$36,404.20	$27,417.98			$4,011.57	$31,429.55	$67,833.75
September 2015	31	$372.11	$3,600.46	$21,742.19	$904.30	$1,141.86	$2,503.41	$2,248.47	$30,758.53	$24,408.15			$4,011.57	$28,408.15	$59,166.68
October 2015	30	$372.11	$3,916.43		$734.46	$896.15	$2,018.70	$1,791.82	$31,471.86	$19,441.90			$3,882.16	$23,324.06	$54,795.92
November 2015	31	$372.11	$3,734.94		$468.60	$610.49	$1,718.12	$1,484.19	$8,388.45	$16,103.99			$4,011.57	$20,115.56	$28,504.01

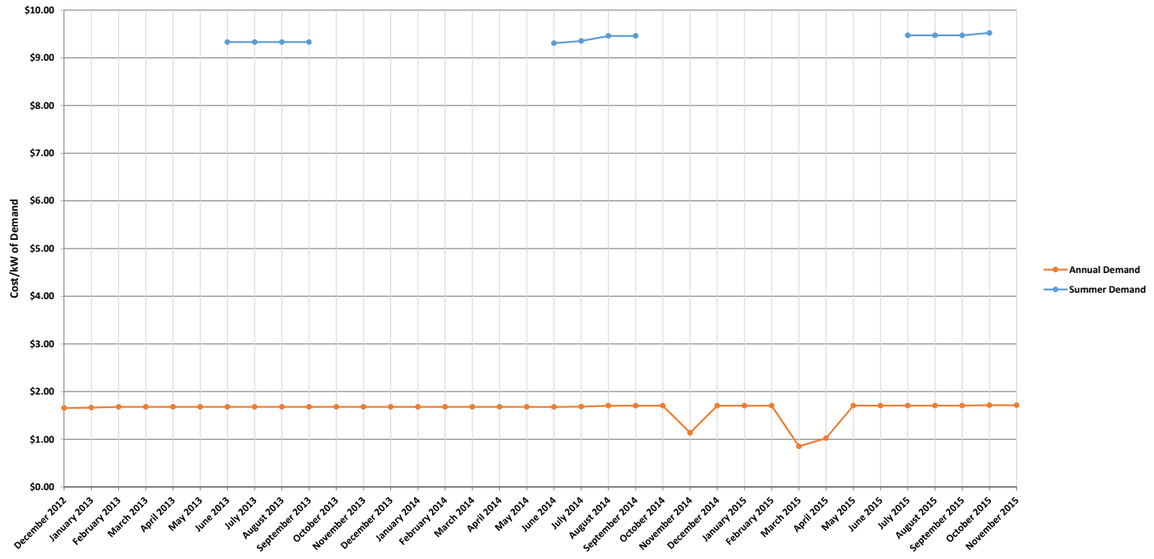




PSE&G Tariff Rates



PSE&G Demand Rates



Energy Audit Building	Service Building (No. 04)	Legend
Service Provider	Elizabeth Town Gas/Woodruff Energy/Constellation Energy	(Incomplete Data)
Account Number		
Meter Number		

2015

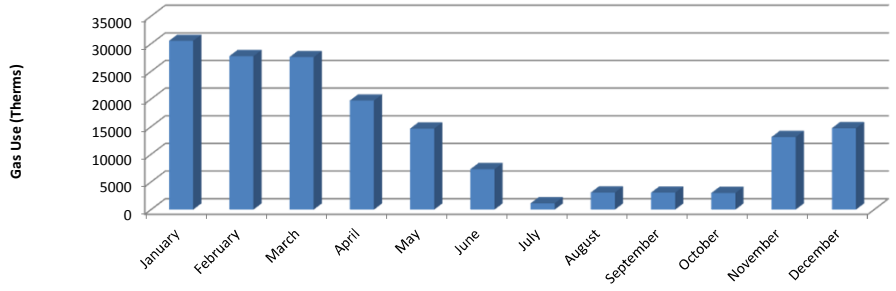
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	1	Feb	1					$ 10,841.94	11843.6		11844	
Feb	1	Mar	1					$ 13,407.69	15294.1		15294	
Mar	1	Apr	1					$ 10,161.15	11420.9		11421	
Apr	1	May	1					$ 5,950.35	5809.5		5810	
May	1	June	1					$ 3,318.93	2302.8		2303	
June	1	July	1					$ 2,620.63	1336.4		1336	
July	1	Aug	1					$ 1,921.73	444.6		445	
Aug	1	Sept	1					$ 1,621.72	41.4		41	
Sept	1	Oct	1					$ 1,759.71	227.9		228	
Oct	1	Nov	1					$ 1,629.74	51.5		52	
Nov	1	Dec	1									
Dec	1	Jan	1									

2014

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	1	Feb	1					$ 36,964.80	42072		42072	
Feb	1	Mar	1					$ 26,924.04	30130		30130	
Mar	1	Apr	1					$ 27,182.16	30,436.8		30,436.8	
Apr	1	May	1					$ 19,534.04	21,340.5		21,340.5	
May	1	June	1					$ 16,589.93	17,839.0		17,839.0	
June	1	July	1					$ 13,221.09	15,061.1		15,061.1	
July	1	Aug	1					$ 4,590.25	7794..4		0.0	
Aug	1	Sept	1					$ 5,253.16	4,742.6		4,742.6	
Sept	1	Oct	1					$ 2,325.50	951.3		951.30	
Oct	1	Nov	1					$ 1,590.91	0.0		0.00	
Nov	1	Dec	1					$ 4,885.99	4,243.5		4,243.50	
Dec	1	Jan	1					$ 2,892.54	1,666.4		1,666.40	

2013

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	1	Feb	1					$ 39,454.35	40611.2		40,611.20	
Feb	1	Mar	1					$ 36,778.55	37741.2		37,741.20	
Mar	1	Apr	1					$ 39,479.07	40637.7		40,637.70	
Apr	1	May	1					$ 30,827.24	31358		31,358.00	
May	1	June	1					$ 23,650.40	23306.4		23,306.40	
June	1	July	1					$ 5,976.30	4863.5		4863.50	
July	1	Aug	1					$ 3,848.86	2398.9		2398.90	
Aug	1	Sept	1					$ 6,043.20	4729.3		4729.30	
Sept	1	Oct	1					$ 9,226.52	8066		8066.0	
Oct	1	Nov	1					$ 10,307.38	8970.9		8970.9	
Nov	1	Dec	1					$ 23,568.23	22618.8		22619	
Dec	1	Jan	1					$ 24,866.45	27855		27855	



Energy Audit Building	Pump & Blower Building (No. 06)	Legend
Service Provider	Elizabeth Town Gas/Woodruff/Constellation	(Incomplete Data)
Account Number		
Meter Number		

2015

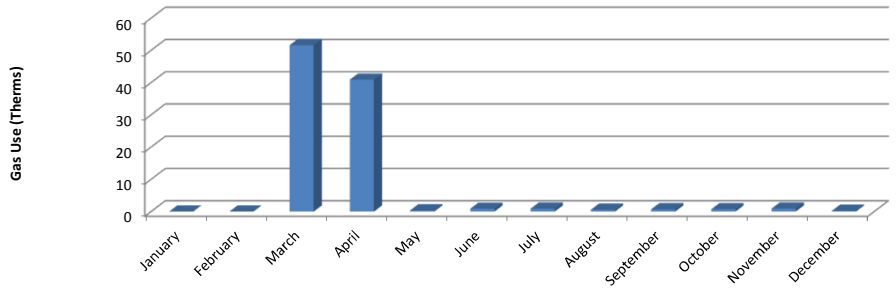
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	13	Jan	14					$ 440.94	0		0	
Jan	14	Feb	12					$ 434.42	0		0	
Feb	12	Mar	16					$ 434.42	0		0	
Mar	16	Apr	15					$ 435.25	1.1		1	
Apr	15	May	15					$ 435.24	1.1		1	
May	15	June	16					$ 437.78	4.4		4	
June	16	July	16					$ 435.25	1.1		1	
July	16	Aug	14					$ 436.05	2.2		2	
Aug	14	Sept	15					$ 435.24	1.1		1	
Sept	15	Oct	15					$ 435.91	2.2		2	
Oct	15	Nov	13					$ 436.05	2.2		2	

2014

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	16	Jan	15					$ 434.42	0		0	
Jan	15	Feb	14					$ 434.42	0		0	
Feb	14	Mar	17					$ 434.42	0		0.0	
Mar	17	Apr	15					$ 434.42	0		0.0	
Apr	15	May	15					$ 434.42	0		0.0	
May	15	June	16					$ 434.42	0		0.0	
June	16	July	16					$ 434.38	0		0.0	
July	16	Aug	15					$ 434.42	0		0.0	
Aug	15	Sept	16					$ 435.27	1.1		1.10	
Sept	16	Oct	15					$ 434.42	0		0.00	
Oct	15	Nov	13					$ 435.28	1.1		1.10	
Nov	13	Dec	13					$ 434.42	0		0.00	

2013

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	15	Jan	14					$ 434.42	0		0.00	
Jan	14	Feb	13					$ 434.42	0		0.00	
Feb	13	Mar	15					$ 697.51	277.1		277.10	
Mar	15	Apr	16					$ 434.42	0		0.00	
Apr	16	May	15					$ 434.42	0		0.00	
May	15	June	14					$ 434.42	0		0.00	
June	14	July	16					$ 435.44	0		0.00	
July	16	Aug	16					$ 434.42	0		0.00	
Aug	16	Sept	16					$ 434.42	0		0.0	
Sept	16	Oct	15					$ 434.42	0		0	
Oct	15	Nov	13					$ 434.42	0		0	
Nov	13	Dec	16					$ 434.42	0		0	



Energy Audit Building	Laboratory Building (No. 20)	Legend
Service Provider	Elizabeth Town Gas/Woodruff Energy/Constellation Energy	(Incomplete Data)
Account Number		
Meter Number		

2015

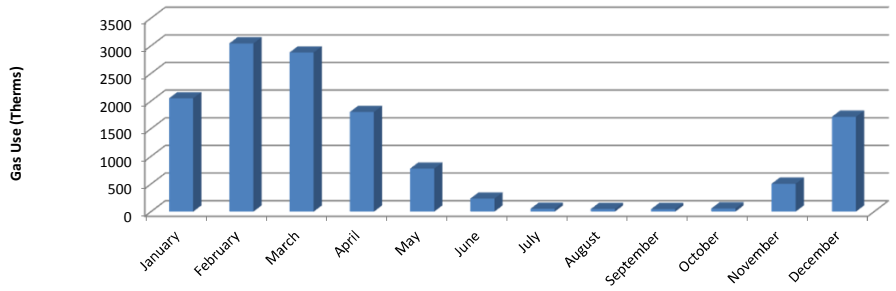
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	13	Jan	14					$ 2,588.14	3086.5		3087	
Jan	14	Feb	12					$ 2,565.39	3074.1		3074	
Feb	15	Mar	16					$ 2,201.16	2691.3		2691	
Mar	16	Apr	15					$ 872.22	1001.4		1001	
Apr	15	May	15					$ 507.69	527.8		528	
May	15	June	16					$ 159.06	62.2		62	
June	16	July	16					$ 151.72	53.1		53	
July	16	Aug	14					$ 145.36	45.3		45	
Aug	14	Sept	15					$ 148.63	49.8		50	
Sept	15	Oct	15					$ 173.55	83.9		84	
Oct	15	Nov	13					$ 629.59	780.1		780	

2014

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	16	Jan	15					$ 2,340.16	2624		2624	
Jan	15	Feb	14					$ 3,079.39	3477		3477	
Feb	14	Mar	17					$ 2,308.49	2,578.7		2,578.7	
Mar	17	Apr	15					$ 1,055.47	1,129.0		1,129.0	
Apr	15	May	15					$ 398.34	359.3		359.3	
May	15	June	16					$ 136.57	49.9		49.9	
June	16	July	16					$ 131.97	46.3		46.3	
July	16	Aug	15					$ 127.65	40.7		40.7	
Aug	15	Sept	16					$ 132.83	47.4		47.40	
Sept	16	Oct	15					$ 133.02	47.5		47.50	
Oct	15	Nov	13					$ 829.05	935.2		935.20	
Nov	13	Dec	13					$ 1,991.93	2,383.2		2,383.20	

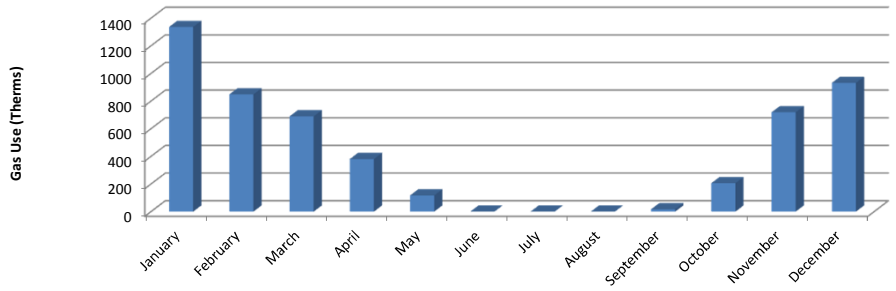
2013

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec		Jan										
Jan		Feb										
Feb		Mar										
Mar		Apr										
Apr		May										
May		June										
June		July										
July		Aug										
Aug		Sept										
Sept		Oct										
Oct	15	Nov	13					$ 1,145.90	1072.5		1073	
Nov	13	Dec	16					$ 2,128.19	2055.1		2055	



Energy Audit Building	Administration Building (No. 21)	Legend
Service Provider	Elizabeth Town Gas/Woodruff Energy/Constellation Energy	(Incomplete Data)
Account Number		
Meter Number		

2013												
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	25	Feb	22	$62.98		$0.00		$ 62.98	0		0.00	
Feb	23	Mar	26	$62.98		$0.00		$ 62.98	0		0.00	
Mar	27	Apr	25	$62.98		$0.00		$ 62.98	0		0.00	
Apr	26	May	24	$62.98		$0.00		$ 62.98	0		0.00	
May	25	June	25	$62.98		$0.00		$ 62.98	0		0.00	
June	26	July	25	$62.98		$0.00		$ 62.98	0		0.00	
July	26	Aug	23	$62.98		$0.00		$ 62.98	0		0.00	
Aug	24	Sept	25	$62.98		$0.00		$ 62.98	0		0.00	
Sept	26	Oct	25	$62.98		$0.00		$ 62.98	0		0.0	
Oct	26	Nov	25	$336.09		$446.03		$ 782.12	728.75		728.75	
Nov	26	Dec	26	$336.09		$446.03		$ 782.12	728.75		728.75	
Dec	27	Jan	24	$521.11		$572.63		$ 1,093.74	1203.0		1203	
2014												
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	25	Feb	25	$554.72		$612.90		$ 1,167.62	1287.6		1288	
Feb	26	Mar	26	$454.27		$487.71		$ 941.98	1024.6		1025	
Mar	27	Apr	28	$336.86		$354.33		$ 691.19	744.4		744.4	
Apr	29	May	28	$150.39		$114.05		$ 264.44	239.6		239.6	
May	29	June	26	$62.98		$0.00		$ 62.98	0.0		0.0	
June	27	July	28	$63.28		$0.48		$ 63.76	1.0		1.0	
July	29	Aug	27	$62.98		$0.00		$ 62.98	0.0		0.0	
Aug	28	Sept	25	$63.28		$0.48		$ 63.76	1.0		1.0	
Sept	26	Oct	24	$74.16		$17.75		$ 91.91	37.3		37.30	
Oct	25	Nov	24	$285.03		$337.48		$ 622.51	709.0		709.00	
Nov	25	Dec	23	$348.11		$422.69		$ 770.80	888.0		888.00	
Dec	24	Jan	23	$487.71		$627.46		$ 1,115.17	1318.2		1,318.20	
2015												
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	24	Feb	24	$598.42		$794.06		$ 1,392.48	1668.2		1668	
Feb	25	Mar	25	$383.05		$525.41		$ 908.46	1103.8		1104	
Mar	26	Apr	24	$225.00		$277.03		$ 502.03	582.0		582	
Apr	25	May	27	$105.86		$74.40		$ 180.26	156.3		156	
May	28	June	25	$63.27		$0.48		$ 63.75	1.0		1	
June	26	July	27	$62.98		$0.00		$ 62.98	0.0		0	
July	28	Aug	25	$63.24		$0.48		$ 63.72	1.0		1	
Aug	26	Sept	24	$62.98		$0.00		$ 62.98	0.0		0	
Sept	25	Oct	26	$124.38		$112.43		$ 236.81	236.2		236	
~~Oct~~	~~27~~	~~Nov~~	~~24~~	~~$213.02~~				~~$ 213.02~~	~~546.5~~		~~547~~	



Energy Audit Building	Utility Garage (No. 22)	Legend
Service Provider	Elizabeth Town Gas/Woodruff Energy/Constellation Energy	(Incomplete Data)
Account Number		
Meter Number		

2015

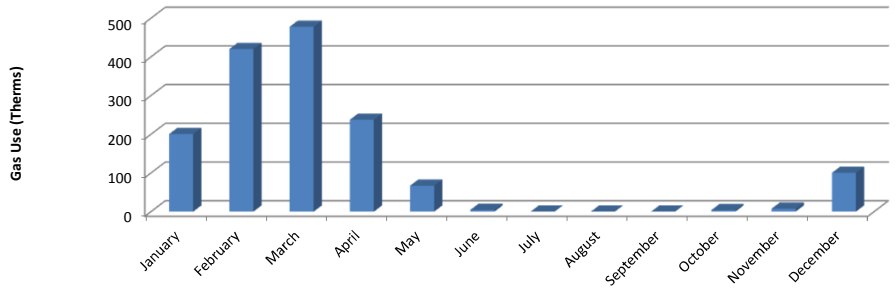
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	13	Jan	14			$ 214.60		$ 214.60	229		229	
Jan	14	Feb	12			$ 494.70		$ 494.70	581.5		582	
Feb	12	Mar	16			$ 336.83		$ 336.83	394.5		395	
Mar	16	Apr	15			$ 124.79		$ 124.79	124.1		124	
Apr	15	May	15			$ 37.59		$ 37.59	9.4		9	
May	15	June	16			$ 30.54		$ 30.54	0		0	
June	16	July	16			$ 30.54		$ 30.54	0		0	
July	16	Aug	14			$ 30.54		$ 30.54	0		0	
Aug	14	Sept	15			$ 30.54		$ 30.54	0		0	
Sept	15	Oct	15			$ 20.14		$ 20.14	14.5		15	
Oct	15	Nov	13			$ 42.06		$ 42.06	15.5		16	
								$ -			0	

2014

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
~~Dec~~	~~16~~	~~Jan~~	~~15~~									
~~Jan~~	~~15~~	~~Feb~~	~~14~~									
~~Feb~~	~~14~~	~~Mar~~	~~17~~									
~~Mar~~	~~17~~	~~Apr~~	~~15~~									
~~Apr~~	~~15~~	~~May~~	~~15~~									
~~May~~	~~15~~	~~June~~	~~16~~									
~~June~~	~~16~~	~~July~~	~~16~~									
July	16	Aug	15			$ 30.54		$ 30.54	0.0		0.0	
Aug	15	Sept	16			$ 30.54		$ 30.54	0.0		0.00	
Sept	16	Oct	15			$ 30.54		$ 30.54	0.0		0.00	
Oct	15	Nov	13			$ 30.54		$ 30.54	0.0		0.00	
Nov	13	Dec	13			$ 164.73		$ 164.73	168.7		168.70	

2013

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
~~Dec~~	~~14~~	~~Jan~~	~~14~~									
~~Jan~~	~~14~~	~~Feb~~	~~13~~									
~~Feb~~	~~13~~	~~Mar~~	~~15~~									
~~Mar~~	~~15~~	~~Apr~~	~~16~~									
~~Apr~~	~~16~~	~~May~~	~~15~~									
~~May~~	~~15~~	~~June~~	~~14~~									
~~June~~	~~14~~	~~July~~	~~16~~									
~~July~~	~~16~~	~~Aug~~	~~16~~									
~~Aug~~	~~16~~	~~Sept~~	~~16~~									
~~Sept~~	~~16~~	~~Oct~~	~~15~~									
~~Oct~~	~~15~~	~~Nov~~	~~13~~									
~~Nov~~	~~13~~	~~Dec~~	~~16~~									



Energy Audit Building	Maintenance Shop (No. 25)	Legend
Service Provider	Elizabeth Town Gas/Woodruff Energy/Constellation Energy	(Incomplete Data)
Account Number		
Meter Number		

2015

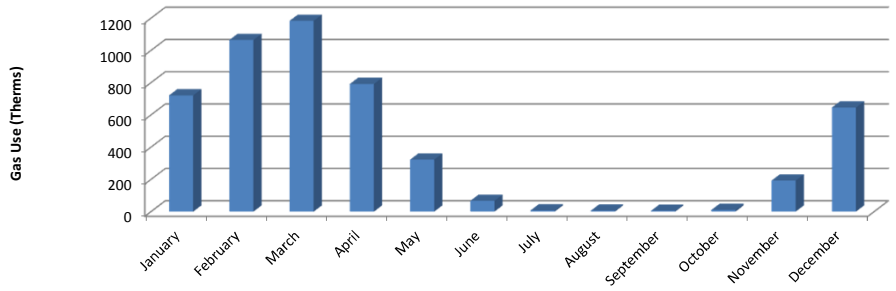
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	13	Jan	14					$ 851.10	994.8		995	
Jan	14	Feb	12					$ 1,023.04	1217		1217	
Feb	12	Mar	16					$ 1,155.51	1421.8		1422	
Mar	16	Apr	15					$ 562.55	627.7		628	
Apr	15	May	15					$ 137.71	114.7		115	
May	15	June	16					$ 57.18	7.3		7	
June	16	July	16					$ 55.56	5.2		5	
July	16	Aug	14					$ 54.68	4.1		4	
Aug	14	Sept	15					$ 55.49	5.2		5	
Sept	15	Oct	15					$ 56.20	6.2		6	
Oct	15	Nov	13					$ 235.09	284.7		285	
											0	

2014

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	16	Jan	15					$ 838.42	920		920	
Jan	15	Feb	14					$ 1,023.02	1132		1132	
Feb	14	Mar	17					$ 867.67	951.2		951.2	
Mar	17	Apr	15					$ 361.33	364.5		364.5	
Apr	15	May	15					$ 180.37	153.1		153.1	
May	15	June	16					$ 59.16	9.3		9.3	
June	16	July	16					$ 55.64	9.3		9.3	
July	16	Aug	15					$ 55.64	5.2		5.2	
Aug	15	Sept	16					$ 57.19	7.2		7.20	
Sept	16	Oct	15					$ 33.16	5.2		5.20	
Oct	15	Nov	13					$ 354.16	386.1		386.10	
Nov	13	Dec	13					$ 823.85	970.8		970.80	

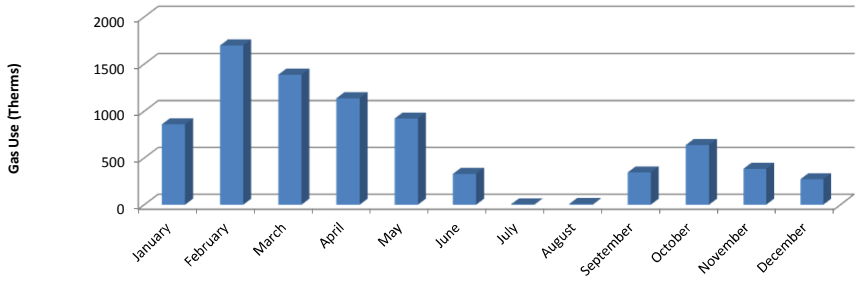
2013

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
~~Dec~~	~~14~~	~~Jan~~	~~14~~									
~~Jan~~	~~14~~	~~Feb~~	~~13~~									
~~Feb~~	~~13~~	~~Mar~~	~~15~~									
~~Mar~~	~~15~~	~~Apr~~	~~16~~									
~~Apr~~	~~16~~	~~May~~	~~15~~									
~~May~~	~~15~~	~~June~~	~~14~~									
~~June~~	~~14~~	~~July~~	~~16~~									
~~July~~	~~16~~	~~Aug~~	~~16~~						~~0~~		~~0.00~~	
Aug	16	Sept	16					$ 51.68	5.2		5.2	
Sept	16	Oct	15					$ 76.96	31.5		31.5	
Oct	15	Nov	13					$ 379.92	340.4		340	
Nov	13	Dec	16					$ 756.08	717.4		717	



Energy Audit Building	Sludge Dewatering Building (No. 27)	Legend
Service Provider	Elizabeth Town Gas/Woodruff/Constellation Energy	(Incomplete Data)
Account Number		
Meter Number		

2015												
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	13	Jan	14					$ 1,722.20	1948.1		1948	
Jan	14	Feb	12					$ 1,392.58	1767.3		1767	
Feb	12	Mar	16					$ 1,649.76	1916.3		1916	
Mar	16	Apr	15					$ 1,543.49	1819		1819	
Apr	15	May	15					$ 1,149.99	1316.7		1317	
May	15	June	16					$ 168.25	8.3		8	
June	16	July	16					$ 165.86	5.2		5	
July	16	Aug	14					$ 164.25	3.1		3	
Aug	14	Sept	15					$ 162.68	1		1	
Sept	15	Oct	15					$ 30.05	4.1		4	
Oct	15	Nov	13					$ 288.37	170.2		170	
2014												
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	16	Jan	15					$ 1,633.61	1721		1721	
Jan	15	Feb	14					$ 1,706.82	1801		1801	
Feb	14	Mar	17					$ 1,792.39	1,898.2		1,898.2	
Mar	17	Apr	15					$ 1,380.49	1,434.2		1,434.2	
Apr	15	May	15					$ 809.93	770.7		770.7	
May	15	June	16					$ 164.44	3.1		3.1	
June	16	July	16					$ 21.62	2.1		2.1	
July	16	Aug	15					$ 163.55	2.1		2.1	
Aug	15	Sept	16					$ 163.55	2.1		2.10	
Sept	16	Oct	15					$ 164.34	3.1		3.10	
Oct	15	Nov	13					$ 359.00	251.5		251.50	
Nov	13	Dec	13					$ 638.64	599.3		599.30	
2013												
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	15	Jan	10					$ 632.27	514.3		514.30	
Jan	11	Feb	6					$ 632.27	514.3		514.30	
Feb	6	Mar	7					$ 1,663.47	1730.85		1,730.85	
Mar	7	Apr	6					$ 1,663.47	1730.85		1,730.85	
Apr	6	May	15					$ 298.84	94.6		94.60	
May	15	June	14					$ 170.42	5.2		5.20	
June	14	July	16					$ 165.88	4.2		4.20	
July	16	Aug	16					$ 163.90	2.1		2.10	
Aug	16	Sept	16					$ 165.89	4.2		4.20	
Sept	16	Oct	15					$ 195.21	34.7		34.70	
Oct	15	Nov	13					$ 1,956.02	1833.1		1,833.10	
Nov	13	Dec	16					$ 2,140.32	2000.9		2,000.90	



Energy Audit Building	Employee Facilities Building (No. 29)	Legend
Service Provider	Elizabeth Town Gas/Woodruff Energy/Constellation Energy	(Incomplete Data)
Account Number		
Meter Number		

2015

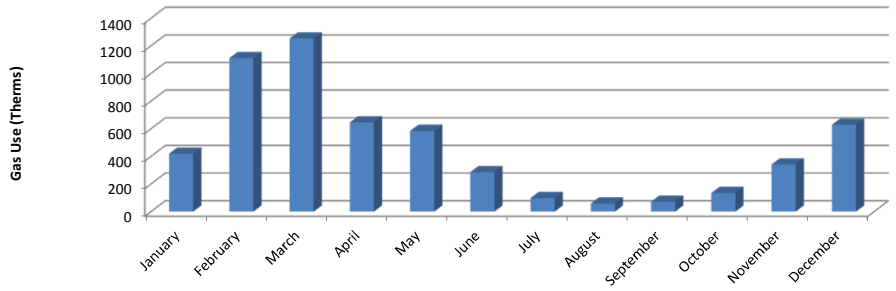
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	23	Jan	23					$ 1,025.69	1201		1201	
Jan	23	Feb	24					$ 1,262.41	1499.9		1500	
Feb	24	Mar	25					$ 919.75	113.2		113	
Mar	25	Apr	24					$ 572.18	669.6		670	
Apr	24	May	27					$ 242.26	233.5		234	
May	27	June	25					$ 104.62	48.7		49	
June	25	July	27					$ 101.68	46.5		47	
July	27	Aug	25					$ 97.85	41.4		41	
Aug	25	Sept	24					$ 100.85	45.6		46	
Sept	24	Oct	26					$ 325.88	351.7		352	
Oct	26	Nov	24					$ 156.38	325.4		325	

2014

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec	26	Jan	24					$ 928.58	1006		1006	
Jan	24	Feb	25					$ 1,192.28	1312		1312	
Feb	25	Mar	26					$ 937.03	1,041.1		1,041.1	
Mar	26	Apr	28					$ 610.94	644.5		644.5	
Apr	28	May	28					$ 352.66	339.7		339.7	
May	28	June	26					$ 181.00	145.8		145.8	
June	26	July	28					$ 143.48	99.0		99.0	
July	28	Aug	27					$ 164.18	125.8		125.8	
Aug	27	Sept	25					$ 181.95	148.8		148.80	
Sept	25	Oct	24					$ 332.69	342.5		342.50	
Oct	24	Nov	24					$ 754.82	871.5		871.50	
Nov	24	Dec	23					$ 840.06	969.8		969.80	

2013

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Dec		Jan										
Jan		Feb										
Feb	22	Mar	26					$ 993.03	975.3		975.30	
Mar	26	Apr	25					$ 602.22	571.9		571.90	
Apr	25	May	24					$ 471.21	431.4		431.40	
May	24	June	25					$ 173.13	113.01		113.01	
June	25	July	25					$ 98.38	33.3		33.30	
July	25	Aug	23					$ 100.46	35.5		35.50	
Aug	23	Sept	25					$ 126.61	63		63.0	
Sept	25	Oct	25					$ 210.00	147.9		147.9	
Oct	25	Nov	25					$ 688.01	630.5		631	
Nov	25	Dec	26					$ 918.44	861.1		861	



Energy Audit Building	Cogeneration/Sludge Drying Facility (No. 37)	Legend
Service Provider	Elizabeth Town Gas/Woodruff/Direct Energy	(Incomplete Data)
Account Number		
Meter Number		

2013

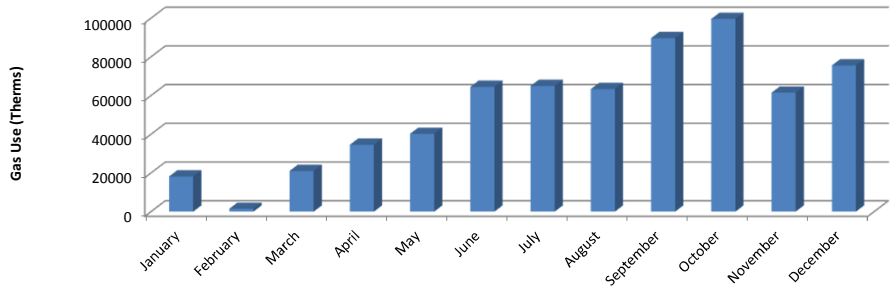
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	2	Feb	1					$ 3,129.35	0.00		0	
Feb	2	Mar	1					$ 3,129.35	0.00		0	
Mar	2	Apr	1					$ 3,129.35	0.00		0	
Apr	2	May	1					$ 3,129.35	0.00		0	
May	2	June	1					$ 3,129.35	0.00		0	
June	2	July	1					$ 3,129.35	0.00		0	
July	2	Aug	1					$ 3,129.35	0.00		0	
Aug	2	Sept	1					$ 3,129.35	0.00		0	
Sept	2	Oct	1					$ 3,129.35	0.00		0	
Oct	2	Nov	1					$ 3,129.35	0.00		0	
Nov	2	Dec	1					$ 3,734.69	759.00		759	
Dec	2	Jan	1					$ 6,073.10	3,797.00		3797	

2014

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	2	Feb	1					$ 4,347.50	470.00		470	
Feb	2	Mar	1					$ 6,670.25	2,944.00		2944	
Mar	2	Apr	1					$ 3,224.90	104.00		104.0	
Apr	2	May	1					$ 3,399.98	364.00		364.0	
May	2	June	1					$ 13,339.97	15,245.00		15,245.0	
June	2	July	1					$ 55,486.78	87,609.00		87,609.0	
July	2	Aug	1					$ 29,483.43	48,488.00		48,488.0	
Aug	2	Sept	1					$ 26,341.82	45,787.00		45,787.0	
Sept	2	Oct	1					$ 63,419.61	122,364.00		122,364.00	
Oct	2	Nov	1					$ 71,493.89	145,604.00		145,604.00	
Nov	2	Dec	1					$ 81,190.74	121,656.00		121,656.00	
Dec	2	Jan	1					$ 84,261.51	148,150.00		148,150.00	

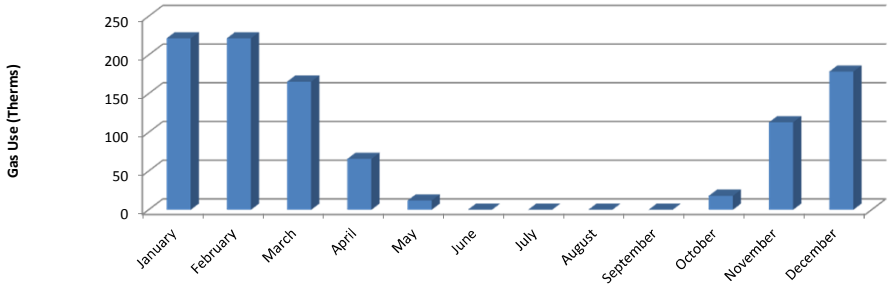
2015

Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	2	Feb	1					$ 41,843.75	50,862.00		50,862.00	
Feb	2	Mar	1					$ 3,204.29	52.00		52.00	
Mar	2	Apr	1					$ 40,035.80	65,021.00		65,021.00	
Apr	2	May	1					$ 49,567.93	104,696.00		104,696.00	
May	2	June	1					$ 48,780.08	105,867.00		105,867.00	
June	2	July	1					$ 47,201.61	108,542.00		108542.00	
July	2	Aug	1					$ 56,254.09	146,208.00		146208.00	
Aug	2	Sept	1					$ 57,399.60	144,217.00		144217.00	
Sept	2	Oct	1					$ 57,892.62	149,661.00		149661.0	
~~Oct~~	~~2~~	~~Nov~~	~~1~~						~~153,903.00~~		~~153903~~	
~~Nov~~	~~2~~	~~Dec~~	~~1~~						~~133,210.00~~		~~133210~~	



Energy Audit Building	Administration Annex (No. 39)	Legend
Service Provider	Elizabeth Town Gas/Woodruff Energy/Constellation Energy	(Incomplete Data)
Account Number		
Meter Number		

2013												
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	15	Feb	13	$130.97		$179.20		$ 310.17	292.8		292.80	
Feb	14	Mar	15	$109.51		$140.28		$ 249.79	229.2		229.20	
Mar	16	Apr	16	$64.97		$60.96		$ 125.93	99.6		99.60	
Apr	17	May	15	$32.84		$1.28		$ 34.12	2.1		2.10	
May	16	June	14	$32.17		$0.00		$ 32.17	0.0		0.00	
June	15	July	16	$32.17		$0.00		$ 32.17	0.0		0.00	
July	17	Aug	16	$32.17		$0.00		$ 32.17	0		0.00	
Aug	17	Sept	16	$32.17		$0.00		$ 32.17	0.0		0.00	
Sept	17	Oct	15	$32.17		$0.00		$ 32.17	0.0		0.0	
Oct	16	Nov	13	$55.26		$38.56		$ 93.82	63.0		63	
Nov	14	Dec	16	$97.09		$105.46		$ 202.55	172.3		172	
Dec	17	Jan	15	$117.76		$107.48		$ 225.24	225.8		226	
2014												
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	16	Feb	14	$145.04		$140.71		$ 285.75	295.6		296	
Feb	15	Mar	17	$131.72		$124.09		$ 255.81	260.7		261	
Mar	18	Apr	15	$89.01		$72.40		$ 161.41	152.1		152.1	
Apr	16	May	15	$56.87		$32.23		$ 89.10	67.7		67.7	
May	16	June	16	$32.17		$0.00		$ 32.17	0.0		0.0	
June	17	July	16	$32.17		$0.00		$ 32.17	0.0		0.0	
July	17	Aug	15	$32.17		$0.00		$ 32.17	0.0		0.0	
Aug	16	Sept	16	$32.17		$0.00		$ 32.17	0.0		0.0	
Sept	17	Oct	15	$32.17		$0.00		$ 32.17	0.0		0.00	
Oct	16	Nov	13	$38.23		$9.38		$ 47.61	19.7		19.70	
Nov	14	Dec	13	$88.70		$84.25		$ 172.95	177.0		177.00	
Dec	14	Jan	14	$81.57		$71.02		$ 152.59	149.2		149.20	
2015												
Month	Day	Month	Day	Delivery Charge (1)	Delivery Charge (2)	Supply Charge (1)	Supply Charge (2)	Total Charge	Therms (1)	Therms (2)	Total Therms	Supplier
Jan	15	Feb	12	$91.08		$87.01		$ 178.09	182.8		183	
Feb	13	Mar	16	$84.71		$83.25		$ 167.96	174.9		175	
Mar	17	Apr	15	$50.79		$31.27		$ 82.06	65.7		66	
Apr	16	May	15	$32.75		$1.00		$ 33.75	2.1		2	
May	16	June	16	$32.17		$0.00		$ 32.17	0.0		0	
June	17	July	16	$32.17		$0.00		$ 32.17	0.0		0	
July	17	Aug	14	$32.17		$0.00		$ 32.17	0.0		0	
Aug	15	Sept	15	$32.17		$0.00		$ 32.17	0.0		0	
Sept	16	Oct	15	$21.37		$0.00		$ 21.37	0.0		0	
Oct	16	Nov	13	$36.31		$7.38		$ 43.69	15.5		16	



Appendix B
Lighting Existing Conditions & Upgrade Analysis

Building Audit Inventory Report	
Audited By	Zachary M Barrett
Audit Date	1/21/2016
Building Name	Rahway Valley Sewerage Authority
Street Address	E Hazelwood Ave
City	Rahway
State/Province/Territory	NJ
Postal Code	07065
Description	Wastewater Treatment Plant
Utility	
Utility Name	PSE&G, Third Party Suppliers
Account Number	42 004 579 03
Average Electricity Rate ($/kWh)	0.1220

Schedule Name	Description	Hours/Year
Default Lighting Schedule		2,868
Continuous (24x7)		8,760
Night Time Photocell	Night Time Photocell	4,315
Occasional Task	These lights are switched on by occupant for occasional and task use.	100

Luminaire Type	Quantity	Input Wattage	Lamp Type	Lamp Sub-Type	Watts Per Lamp	Lamps Per Fixture
1000W Flood Wall Mounted Outdoor	2	1,090.0	Metal Halide – Ceramic		1,000.0	1
22EN-LD1-34-UNV-L840-CD1-U	12	34.8	LED		34.8	1
24EN-LD1-54-UNV-L840-CD1-U	16	54.4	LED		54.4	1
2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	55	60.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm U-Shaped)	32.0	2
2x2' 2-Lamp Fluorescent T8	36	62.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm U-Shaped)	31.0	2
2x2' Fluorescent 3-Lamp T8	40	51.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm)	17.0	3
2x4' Fluorescent Strip 2-Lamp T8	380	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2
2x4' Fluorescent Strip 3-Lamp T8	103	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3
2x4' Hazardous 2-Lamp T8	14	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2
8' 2-Lamp, F96 T12/T38 Strip	23	138.0	Fluorescent - Linear	T12/T38 (8 ft, 2400mm)	96.0	2
Compact Fluor 13W	10	13.0	Fluorescent – Compact, Integral Ballast		13.0	1
Hazardous 250W MH (285W)	55	285.0	Metal Halide – Ceramic		250.0	1
HBLED-LD3-24-W-CL-UNV-ED3-U	22	224.0	LED		224.0	1
Incandescent 200W	9	200.0	Incandescent		200.0	1
Incandescent 60W	17	60.0	Incandescent		60.0	1
Metal Halide 175W	196	195.0	Metal Halide – Ceramic		175.0	1
Metal Halide 250W (285W)	7	285.0	Metal Halide – Ceramic		250.0	1
Outdoor 175W Stanchion Mounted Metal Halide	10	175.0	Metal Halide – Ceramic		175.0	1
Outdoor 250W Flood	13	250.0	Metal Halide – Ceramic		250.0	1
Outdoor 250W Metal Halide	70	285.0	Metal Halide – Ceramic		250.0	1
Outdoor 250W Shoebox Pole Mounted Metal Halide	23	285.0	Metal Halide – Ceramic		250.0	1
Outdoor 70W Wallpack	38	75.0	Metal Halide – Ceramic		70.0	1
Outdoor MH 150W Stanchion	30	165.0	Metal Halide – Ceramic		150.0	1
QDCAST-1A Lumark 277V	19	56.0	LED		56.0	1
QDCAST-1A Luxmark QD Quadcast 120660-SSS	21	56.0	LED		56.0	1
XTOR-1A	31	8.0	LED		8.0	1
XTOR-2A	2	21.0	LED		21.0	1
XTOR-5A	6	50.0	LED		50.0	1

Area	Space	Luminaire Library	Luminaire Type	Notes	Quantity	Input Wattage	Lamp Type	Lamp Sub-Type	Watts Per Lamp	Lamps Per Fixture	Hours/Year
Admin Annex (39)	Basement Level (39)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	4	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Admin Annex (39)	Basement Level (39)	Strips	2x4' Fluorescent Strip 3-Lamp T8	0	6	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3	8760
Admin Annex (39)	First Floor (20)	Troffers	2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	0	13	60.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm U-Shaped)	32.0	2	8760
Admin Annex (39)	First Floor (20)	Troffers	2x2' Fluorescent 3-Lamp T8	0	12	51.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm)	17.0	3	8760
Admin Annex (39)	First Floor (39)	Troffers	2x2' Fluorescent 3-Lamp T8	0	1	51.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm)	17.0	3	8760
Administration Bldg (21)	Administration Bldg (21)	Troffers	22EN-LD1-34-UNV-L840-CD1-U	0	12	34.8	LED		34.8	1	8760
Administration Bldg (21)	Administration Bldg (21)	Troffers	24EN-LD1-54-UNV-L840-CD1-U	0	16	54.4	LED		54.4	1	8760
Aeration Tanks (07)	Aeration Gallery (07)	High Bays	Metal Halide 175W	1	19	195.0	Metal Halide – Ceramic		175.0	1	8760
Aeration Tanks (07)	Monitoring Building (07)	High Bays	Metal Halide 175W	0	5	195.0	Metal Halide – Ceramic		175.0	1	8760
Backwash Return PS (52)	Backwash Return PS (52)	Outdoor	Outdoor MH 150W Stanchion	0	2	165.0	Metal Halide – Ceramic		150.0	1	4315
Cascade Aeration (59)	Cascade Aeration (59)	Outdoor	Outdoor MH 150W Stanchion	0	2	165.0	Metal Halide – Ceramic		150.0	1	4315
Chem Handling & Feed System (72)	Sodium Hypo (72)	Strips	2x4' Fluorescent Strip 2-Lamp T8	2	8	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Cogen/Sludge Drying Fac (38)	Cogen Ctrl Room (38)	Troffers	2x2' Fluorescent 3-Lamp T8	1	14	51.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm)	17.0	3	8760
Cogen/Sludge Drying Fac (38)	Cogen Process Room (38)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	18	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Cogen/Sludge Drying Fac (38)	Cogen Process Room (38)	High Bays	Hazardous 250W MH (285W)	0	12	285.0	Metal Halide – Ceramic		250.0	1	8760
Cogen/Sludge Drying Fac (38)	Cogen/Sludge Drying Fac (38)	Strips	2x4' Fluorescent Strip 3-Lamp T8	0	10	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3	8760
Cogen/Sludge Drying Fac (38)	Cogen/Sludge Drying Fac (38)	High Bays	Metal Halide 175W	1	13	195.0	Metal Halide – Ceramic		175.0	1	8760
Cogen/Sludge Drying Fac (38)	Gas Compressor Room (38)	Strips	2x4' Hazardous 2-Lamp T8	0	7	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Cogen/Sludge Drying Fac (38)	Hallway (38)	Troffers	2x2' Fluorescent 3-Lamp T8	0	12	51.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm)	17.0	3	8760
Cogen/Sludge Drying Fac (38)	Mezzanine (38)	Outdoor	Outdoor 70W Wallpack	0	11	75.0	Metal Halide – Ceramic		70.0	1	8760
Cogen/Sludge Drying Fac (38)	Roof (38)	Outdoor	Outdoor 250W Metal Halide	0	22	285.0	Metal Halide – Ceramic		250.0	1	4315
Digester Ctrl Bldg (13)	Digester Ctrl Bldg 1st Flr (13)	High Bays	Metal Halide 175W	2	24	195.0	Metal Halide – Ceramic		175.0	1	8760
Digester Ctrl Bldg (13)	Digester Ctrl Bldg Bsmnt (13)	High Bays	Metal Halide 175W	1	23	195.0	Metal Halide – Ceramic		175.0	1	8760
Digester Ctrl Bldg (13)	Foam Separating Rm (13)	High Bays	Metal Halide 175W	1	12	195.0	Metal Halide – Ceramic		175.0	1	8760
Digester Ctrl Bldg (13)	Side Room (13)	High Bays	Metal Halide 175W	1	7	195.0	Metal Halide – Ceramic		175.0	1	8760
Digester Ctrl Bldg (13)	Stairs (13)	High Bays	Metal Halide 175W	0	2	195.0	Metal Halide – Ceramic		175.0	1	8760
Digester Ctrl Bldg (13)	Tanks (13)	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	3	285.0	Metal Halide – Ceramic		250.0	1	4315
Digester Ctrl Bldg (13)	Tanks (13)	Outdoor	Outdoor MH 150W Stanchion	0	3	165.0	Metal Halide – Ceramic		150.0	1	4315
DSN 001 Junction Chamber (60)	DSN 001 Junction Chamber (60)	Outdoor	Outdoor 250W Flood	0	2	250.0	Metal Halide – Ceramic		250.0	1	4315
DSN 001 Junction Chamber (60)	DSN 001 Junction Chamber (60)	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	1	285.0	Metal Halide – Ceramic		250.0	1	4315
Effl Filter & UV Ctrl Bldg (56)	Effl Filter & UV Ctrl Bldg (56)	Strips	2x4' Fluorescent Strip 2-Lamp T8	1	9	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Effl Filter & UV Ctrl Bldg (56)	Exterior (56)	Outdoor	XTOR-1A	0	3	8.0	LED		8.0	1	4315
Effluent Filters (53)	Effluent Filters (53)	Outdoor	QDCAST-1A Luxmark QD Quadcast 120660-SSS	0	21	56.0	LED		56.0	1	4315
Effluent Pump Station (58)	Effluent Pump Station (58)	Outdoor	Outdoor MH 150W Stanchion	0	2	165.0	Metal Halide – Ceramic		150.0	1	4315
Emerg Plant Prot Facility (33)	Emerg Plant Prot Facility (33)	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	1	285.0	Metal Halide – Ceramic		250.0	1	4315
Employee Facilities Bldg (29)	Lower Level (29)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	18	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Employee Facilities Bldg (29)	Main Level (29)	Troffers	2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	0	34	60.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm U-Shaped)	32.0	2	8760
Employee Facilities Bldg (29)	Main Level (29)	Industrials	Compact Fluor 13W	0	10	13.0	Fluorescent – Compact, Integral Ballast		13.0	1	100
Final Settling Tanks (16)	FST-1 (16)	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	1	285.0	Metal Halide – Ceramic		250.0	1	4315
Final Settling Tanks (16)	FST-1 (16)	Outdoor	Outdoor MH 150W Stanchion	0	3	165.0	Metal Halide – Ceramic		150.0	1	4315
Final Settling Tanks (16)	FST-2 (16)	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	1	285.0	Metal Halide – Ceramic		250.0	1	4315
Final Settling Tanks (16)	FST-2 (16)	Outdoor	Outdoor MH 150W Stanchion	0	3	165.0	Metal Halide – Ceramic		150.0	1	4315
Final Settling Tanks (16)	FST-3 (16)	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	1	285.0	Metal Halide – Ceramic		250.0	1	4315
Final Settling Tanks (16)	FST-3 (16)	Outdoor	Outdoor MH 150W Stanchion	0	3	165.0	Metal Halide – Ceramic		150.0	1	4315
Final Settling Tanks (16)	FST-4 (16)	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	1	285.0	Metal Halide – Ceramic		250.0	1	4315
Final Settling Tanks (16)	FST-4 (16)	Outdoor	Outdoor MH 150W Stanchion	0	3	165.0	Metal Halide – Ceramic		150.0	1	4315
Final Settling Tanks (16)	FST-5 (16)	Outdoor	Outdoor MH 150W Stanchion	0	3	165.0	Metal Halide – Ceramic		150.0	1	4315
Final Settling Tanks (16)	FST-6 (16)	Outdoor	Outdoor MH 150W Stanchion	0	3	165.0	Metal Halide – Ceramic		150.0	1	4315
General Site Area Lighting	General Site Area Lighting	Outdoor	Outdoor 250W Metal Halide	0	42	285.0	Metal Halide – Ceramic		250.0	1	4315
General Site Area Lighting	General Site Area Lighting	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	10	285.0	Metal Halide – Ceramic		250.0	1	4315
Headworks Building (44)	Caustic Soda (44)	Strips	2x4' Fluorescent Strip 3-Lamp T8	1	6	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3	8760
Headworks Building (44)	Conveyor/Open Process Area (44)	High Bays	QDCAST-1A Lumark 277V	1	16	56.0	LED		56.0	1	8760
Headworks Building (44)	Electrical Room (44)	Strips	2x4' Fluorescent Strip 3-Lamp T8	0	18	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3	8760
Headworks Building (44)	Exterior (44)	Outdoor	Outdoor 70W Wallpack	0	16	75.0	Metal Halide – Ceramic		70.0	1	4315
Headworks Building (44)	Exterior (44)	Outdoor	XTOR-2A	0	1	21.0	LED		21.0	1	2868
Headworks Building (44)	Grit Area (44)	High Bays	Hazardous 250W MH (285W)	0	11	285.0	Metal Halide – Ceramic		250.0	1	8760
Headworks Building (44)	Grit Area (44)	High Bays	QDCAST-1A Lumark 277V	0	3	56.0	LED		56.0	1	8760
Headworks Building (44)	HW Lower Level (44)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	5	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Headworks Building (44)	HW Lower Level (44)	High Bays	Hazardous 250W MH (285W)	1	10	285.0	Metal Halide – Ceramic		250.0	1	8760
Headworks Building (44)	Interm. Exterior (44)	Outdoor	Outdoor 175W Stanchion Mounted Metal Halide	0	4	175.0	Metal Halide – Ceramic		175.0	1	4315
Headworks Building (44)	Interm. Exterior (44)	Outdoor	Outdoor 250W Flood	0	2	250.0	Metal Halide – Ceramic		250.0	1	4315
Headworks Building (44)	Interm. Exterior (44)	Outdoor	Outdoor 70W Wallpack	0	3	75.0	Metal Halide – Ceramic		70.0	1	4315
Headworks Building (44)	Interm. Level (AHUs) (44)	Strips	2x4' Fluorescent Strip 3-Lamp T8	2	9	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3	8760
Headworks Building (44)	Interm. Level Elev. Room	Strips	2x4' Fluorescent Strip 3-Lamp T8	1	1	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3	8760
Headworks Building (44)	Loading Dock (44)	Strips	2x4' Fluorescent Strip 3-Lamp T8	1	3	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3	8760
Headworks Building (44)	Odor Control (44)	Strips	2x4' Fluorescent Strip 3-Lamp T8	2	6	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3	8760
Headworks Building (44)	Office, Bathroom, Hallway (44)	Strips	2x2' 2-Lamp Fluorescent T8	1	17	62.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm U-Shaped)	31.0	2	8760
Headworks Building (44)	Open Influent Channels (44)	High Bays	Hazardous 250W MH (285W)	1	22	285.0	Metal Halide – Ceramic		250.0	1	8760
Headworks Building (44)	Roof (44)	Outdoor	Outdoor 175W Stanchion Mounted Metal Halide	0	6	175.0	Metal Halide – Ceramic		175.0	1	4315
Headworks Building (44)	Stair 1 (44)	Strips	2x2' 2-Lamp Fluorescent T8	0	3	62.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm U-Shaped)	31.0	2	8760
Headworks Building (44)	Stair 1 (44)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	10	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760

Laboratory Building (20)	Exterior (21)	Outdoor	Outdoor 70W Wallpack	0	7	75.0	Metal Halide – Ceramic		70.0	1	4315
Laboratory Building (20)	Lab Bldg (20)	Strips	2x2' 2-Lamp Fluorescent T8	0	16	62.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm U-Shaped)	31.0	2	8760
Laboratory Building (20)	Lab Bldg (20)	Troffers	2x2' Fluorescent 3-Lamp T8	0	1	51.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm)	17.0	3	8760
Laboratory Building (20)	Lab Bldg (20)	Strips	2x4' Fluorescent Strip 3-Lamp T8	0	44	96.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	3	8760
Lime/Polymer Feed Station (28)	Lime/Polymer Feed Station (28)	High Bays	Metal Halide 175W	0	4	195.0	Metal Halide – Ceramic		175.0	1	8760
Maintenance Shop (25)	Floor (25)	High Bays	HBLED-LD3-24-W-CL-UNV-ED3-U	0	8	224.0	LED		224.0	1	8760
Maintenance Shop (25)	Lower Level (25)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	6	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Maintenance Shop (25)	Upper Level (25)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	4	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Maintenance Shop (25)	Upper Level (25)	Strips	8' 2-Lamp, F96 T12/T38 Strip	0	15	138.0	Fluorescent - Linear	T12/T38 (8 ft, 2400mm)	96.0	2	8760
Meter #28 (30)	Meter #28 (30)	Halogen/Incandescent	Incandescent 60W	1	3	60.0	Incandescent		60.0	1	100
Methane Filter Building (26)	Methane Filter Building (26)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	8	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Methane Filter Building (26)	Methane Filter Building (26)	Outdoor	Outdoor 70W Wallpack	0	1	75.0	Metal Halide – Ceramic		70.0	1	4315
Primary Settling Tanks (05)	Primary Settling Tanks (05)	Outdoor	Outdoor 250W Metal Halide	0	6	285.0	Metal Halide – Ceramic		250.0	1	4315
Primary Settling Tanks (05)	Primary Settling Tanks (05)	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	3	285.0	Metal Halide – Ceramic		250.0	1	4315
PS Valve Chamber (41)	PS Valve Chamber (41)	Outdoor	Outdoor MH 150W Stanchion	0	3	165.0	Metal Halide – Ceramic		150.0	1	4315
Pump & Blower Building (06)	Basement Level (06)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	57	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Pump & Blower Building (06)	Basement Level (06)	High Bays	Metal Halide 175W	0	4	195.0	Metal Halide – Ceramic		175.0	1	8760
Pump & Blower Building (06)	Blower Room (06)	Strips	2x4' Fluorescent Strip 2-Lamp T8	1	2	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Pump & Blower Building (06)	Blower Room (06)	High Bays	HBLED-LD3-24-W-CL-UNV-ED3-U	2	14	224.0	LED		224.0	1	8760
Pump & Blower Building (06)	Exterior (06)	Outdoor	1000W Flood Wall Mounted Outdoor	0	2	1,090.0	Metal Halide – Ceramic		1,000.0	1	4315
Pump & Blower Building (06)	Exterior (06)	Outdoor	Outdoor 250W Flood	0	3	250.0	Metal Halide – Ceramic		250.0	1	4315
Pump & Blower Building (06)	Exterior (06)	Outdoor	XTOR-1A	0	5	8.0	LED		8.0	1	4315
Pump & Blower Building (06)	Exterior (06)	Outdoor	XTOR-2A	0	1	21.0	LED		21.0	1	4315
Pump & Blower Building (06)	Office (06)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	9	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Pump & Blower Building (06)	Old Generator Room (06)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	3	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Pump & Blower Building (06)	Unit Substation (06)	Strips	2x4' Fluorescent Strip 2-Lamp T8	1	16	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Return Sludge PS (62)	Electrical Room (62)	Strips	2x4' Fluorescent Strip 2-Lamp T8	2	10	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Return Sludge PS (62)	Exterior (62)	Outdoor	XTOR-1A	0	5	8.0	LED		8.0	1	4315
Return Sludge PS (62)	RAS/WAS Room (62)	High Bays	Metal Halide 175W	2	10	195.0	Metal Halide – Ceramic		175.0	1	8760
Rotary Drum Thick Fac (34)	Electrical Room (34)	Strips	2x4' Fluorescent Strip 2-Lamp T8	1	8	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Rotary Drum Thick Fac (34)	Exterior (34)	Outdoor	XTOR-1A	0	6	8.0	LED		8.0	1	4315
Rotary Drum Thick Fac (34)	OCS Room (34)	Strips	2x4' Hazardous 2-Lamp T8	1	7	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Rotary Drum Thick Fac (34)	Washwater Room (34)	High Bays	Metal Halide 175W	1	19	195.0	Metal Halide – Ceramic		175.0	1	8760
Service Building (04)	Boiler, Old & New Chlorine Rms.	Strips	2x4' Fluorescent Strip 2-Lamp T8	1	12	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Service Building (04)	Chlorine Room (04)	Strips	8' 2-Lamp, F96 T12/T38 Strip	1	2	138.0	Fluorescent - Linear	T12/T38 (8 ft, 2400mm)	96.0	2	8760
Service Building (04)	Corridor & Open Well (04)	Strips	2x4' Fluorescent Strip 2-Lamp T8	3	14	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Service Building (04)	Electrical Room (04)	Strips	2x4' Fluorescent Strip 2-Lamp T8	3	4	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Service Building (04)	Exterior	Outdoor	Outdoor 250W Flood	0	5	250.0	Metal Halide – Ceramic		250.0	1	4315
Service Building (04)	Exterior	Outdoor	XTOR-1A	0	5	8.0	LED		8.0	1	4315
Service Building (04)	Lower Level Classified Area (04)	Halogen/Incandescent	Incandescent 60W	0	5	60.0	Incandescent		60.0	1	100
Service Building (04)	Lower Level Classified Area (04)	High Bays	Metal Halide 250W (285W)	2	7	285.0	Metal Halide – Ceramic		250.0	1	8760
Service Building (04)	Upper Level Screen Room (04)	Halogen/Incandescent	Incandescent 60W	0	3	60.0	Incandescent		60.0	1	100
Service Building (04)	Upper Level Screen Room (04)	High Bays	Metal Halide 175W	2	2	195.0	Metal Halide – Ceramic		175.0	1	8760
Sludge Dewatering Bldg (27)	2nd Flr Centrifuge Rm (27)	Strips	2x4' Fluorescent Strip 2-Lamp T8	3	54	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Sludge Dewatering Bldg (27)	2nd Flr Centrifuge Rm (27)	Halogen/Incandescent	Incandescent 200W	0	4	200.0	Incandescent		200.0	1	100
Sludge Dewatering Bldg (27)	Electrical Room (27)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	10	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Sludge Dewatering Bldg (27)	Hallway (27)	Troffers	2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	2	8	60.0	Fluorescent - Linear	T8/T26 (2 ft, 600 mm U-Shaped)	32.0	2	8760
Sludge Dewatering Bldg (27)	Mechanical Room (27)	Strips	2x4' Fluorescent Strip 2-Lamp T8	1	6	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Sludge Dewatering Bldg (27)	NE Pump Room (27)	Strips	2x4' Fluorescent Strip 2-Lamp T8	1	20	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Sludge Dewatering Bldg (27)	Polymer Pump Room (27)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	16	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Sludge Dewatering Bldg (27)	Stairs (27)	Outdoor	XTOR-1A	0	6	8.0	LED		8.0	1	4315
Sludge Dewatering Bldg (27)	Storage Room (27)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	5	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Sludge Dewatering Bldg (27)	Truck Loading (27)	Strips	2x4' Fluorescent Strip 2-Lamp T8	1	15	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Sludge Dewatering Bldg (27)	Truck Loading (27)	Halogen/Incandescent	Incandescent 200W	0	5	200.0	Incandescent		200.0	1	100
Sludge Pumping Station (09)	Exterior	Outdoor	XTOR-1A	0	1	8.0	LED		8.0	1	4315
Sludge Pumping Station (09)	Sludge Pumping Station (09)	High Bays	Metal Halide 175W	1	7	195.0	Metal Halide – Ceramic		175.0	1	8760
Sludge Storage Ctrl Bldg (15)	Sludge Storage Ctrl Bldg (15)	Outdoor	Outdoor 250W Flood	0	1	250.0	Metal Halide – Ceramic		250.0	1	4315
Sludge Storage Ctrl Bldg (15)	Sludge Storage Ctrl Bldg (15)	Outdoor	Outdoor 250W Shoebox Pole Mounted Metal Halide	0	1	285.0	Metal Halide – Ceramic		250.0	1	4315
Sludge Thickening Bldg (11)	2nd Floor (11)	High Bays	Metal Halide 175W	1	10	195.0	Metal Halide – Ceramic		175.0	1	8760
Sludge Thickening Bldg (11)	Ground Floor (11)	Halogen/Incandescent	Incandescent 60W	0	1	60.0	Incandescent		60.0	1	8760
Sludge Thickening Bldg (11)	Lower Level (11)	High Bays	Metal Halide 175W	1	28	195.0	Metal Halide – Ceramic		175.0	1	8760
Sludge Thickening Bldg (11)	Stair & Ground Floor (11)	High Bays	Metal Halide 175W	1	7	195.0	Metal Halide – Ceramic		175.0	1	8760
South Complex Exterior	South Complex Exterior	Outdoor	XTOR-5A	0	6	50.0	LED		50.0	1	2868
Tunnels (35)	Tunnels (35)	Strips	2x4' Fluorescent Strip 2-Lamp T8	0	29	64.0	Fluorescent - Linear	T8/T26 (4 ft, 1200 mm)	32.0	2	8760
Utility Garage (22)	Utility Garage (22)	Strips	8' 2-Lamp, F96 T12/T38 Strip	0	6	138.0	Fluorescent - Linear	T12/T38 (8 ft, 2400mm)	96.0	2	8760
UV Disinfection (54)	UV Disinfection (54)	Halogen/Incandescent	Incandescent 60W	1	5	60.0	Incandescent		60.0	1	100

Company Part Number	Manufacturer Name	Manufacturer Part Number	Description	Total Quantity	Unit Price ($)	Total Price ($)
15A21/2700-WHT DIM	Philips Brand Lighting	15A21/2700-WHT DIM	15A21/2700-WHT DIM	17	5.00	85.00
19A21/2700-WHT DIM	Philips Brand Lighting	19A21/2700-WHT DIM	19A21/2700-WHT DIM	9	10.00	90.00
22EN-LD1-34-UNV-L840-CD1-U	Cooper Industries	22EN-LD1-34-UNV-L840-CD1-U	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	91	200.00	18,200.00
70884	OSRAM Sylvania	70884	Wall pack,LED Fixture,30W,70CRI,4500K	38	240.00	9,120.00
ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	65	760.00	49,400.00
FXLED78SF	RAB Lighting	FXLED78SF	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	13	500.00	6,500.00
HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	196	330.00	64,680.00
HPLED 70 700 4K AS UN L5	Holophane	HPLED 70 700 4K AS UN L5	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	62	720.00	44,640.00
PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	40	350.00	14,000.00
PQL LED 18WT8/40K/FR (90537)	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 1915 LUMENS	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	309	10.50	3,244.50
PQL LED 18WT8/40K/FR (90537)	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	788	10.50	8,274.00
PQL LED 9WT8/40K/FR (90541)	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	120	8.85	1,062.00
PTNSL8 AD2 LP835 DNA EPL PLR1 V…	Acuity Brands Lighting	PTNSL8 AD2 LP835 DNA EPL PLR1 V…	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	23	270.00	6,210.00

Area	Space	Original Luminaire Type	Original Luminaire Quantity	Status	Company Part Numer	Manufacturer Name	Manufacturer Part Number	Description	Quantity Per Space
Admin Annex (39)	Basement Level (39)	2x4' Fluorescent Strip 3-Lamp T8	6	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	18
Admin Annex (39)	Basement Level (39)	2x4' Fluorescent Strip 2-Lamp T8	4	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	8
Admin Annex (39)	First Floor (20)	2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	13	Upgrade	22EN-LD1-34-UNV-L840-CD1-U	Cooper Industries	22EN-LD1-34-UNV-L840-CD1-U	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	13
Admin Annex (39)	First Floor (20)	2x2' Fluorescent 3-Lamp T8	12	Upgrade	PQL LED 9WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	PQL LED 9WT8/40K/FR	36
Admin Annex (39)	First Floor (39)	2x2' Fluorescent 3-Lamp T8	1	Upgrade	PQL LED 9WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	PQL LED 9WT8/40K/FR	3
Administration Bldg (21)	Administration Bldg (21)	24EN-LD1-54-UNV-L840-CD1-U	16	Keep					
Administration Bldg (21)	Administration Bldg (21)	22EN-LD1-34-UNV-L840-CD1-U	12	Keep					
Aeration Tanks (07)	Aeration Gallery (07)	Metal Halide 175W	19	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	19
Aeration Tanks (07)	Monitoring Building (07)	Metal Halide 175W	5	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	5
Backwash Return PS (52)	Backwash Return PS (52)	Outdoor MH 150W Stanchion	2	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	2
Cascade Aeration (59)	Cascade Aeration (59)	Outdoor MH 150W Stanchion	2	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	2
Chem Handling & Feed System (72)	Sodium Hypo (72)	2x4' Fluorescent Strip 2-Lamp T8	8	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	16
Cogen/Sludge Drying Fac (38)	Cogen Ctrl Room (38)	2x2' Fluorescent 3-Lamp T8	14	Upgrade	PQL LED 9WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	PQL LED 9WT8/40K/FR	42
Cogen/Sludge Drying Fac (38)	Cogen Process Room (38)	Hazardous 250W MH (285W)	12	Upgrade	HPLED 70 700 4K AS UN L5	Holophane	HPLED 70 700 4K AS UN L5	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	12
Cogen/Sludge Drying Fac (38)	Cogen Process Room (38)	2x4' Fluorescent Strip 2-Lamp T8	18	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	36
Cogen/Sludge Drying Fac (38)	Cogen/Sludge Drying Fac (38)	Metal Halide 175W	13	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	13
Cogen/Sludge Drying Fac (38)	Cogen/Sludge Drying Fac (38)	2x4' Fluorescent Strip 3-Lamp T8	10	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	30
Cogen/Sludge Drying Fac (38)	Gas Compressor Room (38)	2x4' Hazardous 2-Lamp T8	7	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	14
Cogen/Sludge Drying Fac (38)	Hallway (38)	2x2' Fluorescent 3-Lamp T8	12	Upgrade	PQL LED 9WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	PQL LED 9WT8/40K/FR	36
Cogen/Sludge Drying Fac (38)	Mezzanine (38)	Outdoor 70W Wallpack	11	Upgrade	70884	OSRAM Sylvania	70884	Wall pack,LED Fixture,30W,70CRI,4500K	11
Cogen/Sludge Drying Fac (38)	Roof (38)	Outdoor 250W Metal Halide	22	Upgrade	HPLED 70 700 4K AS UN L5	Holophane	HPLED 70 700 4K AS UN L5	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	22
Digester Ctrl Bldg (13)	Digester Ctrl Bldg 1st Flr (13)	Metal Halide 175W	24	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	24
Digester Ctrl Bldg (13)	Digester Ctrl Bldg Bsmnt (13)	Metal Halide 175W	23	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	23
Digester Ctrl Bldg (13)	Foam Separating Rm (13)	Metal Halide 175W	12	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	12
Digester Ctrl Bldg (13)	Side Room (13)	Metal Halide 175W	7	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	7
Digester Ctrl Bldg (13)	Stairs (13)	Metal Halide 175W	2	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	2
Digester Ctrl Bldg (13)	Tanks (13)	Outdoor 250W Shoebox Pole Mounted Metal Halide	3	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	3
Digester Ctrl Bldg (13)	Tanks (13)	Outdoor MH 150W Stanchion	3	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	3
DSN 001 Junction Chamber (60)	DSN 001 Junction Chamber (60)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1
DSN 001 Junction Chamber (60)	DSN 001 Junction Chamber (60)	Outdoor 250W Flood	2	Upgrade	FXLED78SF	RAB Lighting	FXLED78SF	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	2
Effl Filter & UV Ctrl Bldg (56)	Effl Filter & UV Ctrl Bldg (56)	2x4' Fluorescent Strip 2-Lamp T8	9	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	18
Effl Filter & UV Ctrl Bldg (56)	Exterior (56)	XTOR-1A	3	Keep					
Effluent Filters (53)	Effluent Filters (53)	QDCAST-1A Luxmark QD Quadcast 120660-SSS	21	Keep					
Effluent Pump Station (58)	Effluent Pump Station (58)	Outdoor MH 150W Stanchion	2	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	2
Emerg Plant Prot Facility (33)	Emerg Plant Prot Facility (33)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1
Employee Facilities Bldg (29)	Lower Level (29)	2x4' Fluorescent Strip 2-Lamp T8	18	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	36
Employee Facilities Bldg (29)	Main Level (29)	Compact Fluor 13W	10	Keep					
Employee Facilities Bldg (29)	Main Level (29)	2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	34	Upgrade	22EN-LD1-34-UNV-L840-CD1-U	Cooper Industries	22EN-LD1-34-UNV-L840-CD1-U	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	34
Final Settling Tanks (16)	FST-1 (16)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1
Final Settling Tanks (16)	FST-1 (16)	Outdoor MH 150W Stanchion	3	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	3
Final Settling Tanks (16)	FST-2 (16)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1
Final Settling Tanks (16)	FST-2 (16)	Outdoor MH 150W Stanchion	3	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	3
Final Settling Tanks (16)	FST-3 (16)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1
Final Settling Tanks (16)	FST-3 (16)	Outdoor MH 150W Stanchion	3	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	3
Final Settling Tanks (16)	FST-4 (16)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1
Final Settling Tanks (16)	FST-4 (16)	Outdoor MH 150W Stanchion	3	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	3
Final Settling Tanks (16)	FST-5 (16)	Outdoor MH 150W Stanchion	3	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	3
Final Settling Tanks (16)	FST-6 (16)	Outdoor MH 150W Stanchion	3	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	3
General Site Area Lighting	General Site Area Lighting	Outdoor 250W Shoebox Pole Mounted Metal Halide	10	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	10
General Site Area Lighting	General Site Area Lighting	Outdoor 250W Metal Halide	42	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	42
Headworks Building (44)	Caustic Soda (44)	2x4' Fluorescent Strip 3-Lamp T8	6	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	18
Headworks Building (44)	Conveyor/Open Process Area (44)	QDCAST-1A Lumark 277V	16	Keep					
Headworks Building (44)	Electrical Room (44)	2x4' Fluorescent Strip 3-Lamp T8	18	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 1915 LUMENS	PQL LED 18WT8/40K/FR	54
Headworks Building (44)	Exterior (44)	XTOR-2A	1	Keep					
Headworks Building (44)	Exterior (44)	Outdoor 70W Wallpack	16	Upgrade	70884	OSRAM Sylvania	70884	Wall pack,LED Fixture,30W,70CRI,4500K	16
Headworks Building (44)	Grit Area (44)	QDCAST-1A Lumark 277V	3	Keep					
Headworks Building (44)	Grit Area (44)	Hazardous 250W MH (285W)	11	Upgrade	HPLED 70 700 4K AS UN L5	Holophane	HPLED 70 700 4K AS UN L5	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	11
Headworks Building (44)	HW Lower Level (44)	Hazardous 250W MH (285W)	10	Upgrade	HPLED 70 700 4K AS UN L5	Holophane	HPLED 70 700 4K AS UN L5	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	10
Headworks Building (44)	HW Lower Level (44)	2x4' Fluorescent Strip 2-Lamp T8	5	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	10
Headworks Building (44)	Interm. Exterior (44)	Outdoor 70W Wallpack	3	Upgrade	70884	OSRAM Sylvania	70884	Wall pack,LED Fixture,30W,70CRI,4500K	3
Headworks Building (44)	Interm. Exterior (44)	Outdoor 250W Flood	2	Upgrade	FXLED78SF	RAB Lighting	FXLED78SF	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	2
Headworks Building (44)	Interm. Exterior (44)	Outdoor 175W Stanchion Mounted Metal Halide	4	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	4
Headworks Building (44)	Interm. Level (AHUs) (44)	2x4' Fluorescent Strip 3-Lamp T8	9	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	27
Headworks Building (44)	Interm. Level Elev. Room	2x4' Fluorescent Strip 3-Lamp T8	1	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	3
Headworks Building (44)	Loading Dock (44)	2x4' Fluorescent Strip 3-Lamp T8	3	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	9
Headworks Building (44)	Odor Control (44)	2x4' Fluorescent Strip 3-Lamp T8	6	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	18
Headworks Building (44)	Office, Bathroom, Hallway (44)	2x2' 2-Lamp Fluorescent T8	17	Upgrade	22EN-LD1-34-UNV-L840-CD1-U	Cooper Industries	22EN-LD1-34-UNV-L840-CD1-U	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	17
Headworks Building (44)	Open Influent Channels (44)	Hazardous 250W MH (285W)	22	Keep					
Headworks Building (44)	Roof (44)	Outdoor 175W Stanchion Mounted Metal Halide	6	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	6
Headworks Building (44)	Stair 1 (44)	2x2' 2-Lamp Fluorescent T8	3	Upgrade	22EN-LD1-34-UNV-L840-CD1-U	Cooper Industries	22EN-LD1-34-UNV-L840-CD1-U	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	3
Headworks Building (44)	Stair 1 (44)	2x4' Fluorescent Strip 2-Lamp T8	10	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	20
Laboratory Building (20)	Exterior (21)	Outdoor 70W Wallpack	7	Upgrade	70884	OSRAM Sylvania	70884	Wall pack,LED Fixture,30W,70CRI,4500K	7
Laboratory Building (20)	Lab Bldg (20)	2x2' 2-Lamp Fluorescent T8	16	Upgrade	22EN-LD1-34-UNV-L840-CD1-U	Cooper Industries	22EN-LD1-34-UNV-L840-CD1-U	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	16
Laboratory Building (20)	Lab Bldg (20)	2x4' Fluorescent Strip 3-Lamp T8	44	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	132
Laboratory Building (20)	Lab Bldg (20)	2x2' Fluorescent 3-Lamp T8	1	Upgrade	PQL LED 9WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	PQL LED 9WT8/40K/FR	3
Lime/Polymer Feed Station (28)	Lime/Polymer Feed Station (28)	Metal Halide 175W	4	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	4
Maintenance Shop (25)	Floor (25)	HBLED-LD3-24-W-CL-UNV-ED3-U	8	Keep					
Maintenance Shop (25)	Lower Level (25)	2x4' Fluorescent Strip 2-Lamp T8	6	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	12
Maintenance Shop (25)	Upper Level (25)	2x4' Fluorescent Strip 2-Lamp T8	4	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	8
Maintenance Shop (25)	Upper Level (25)	8' 2-Lamp, F96 T12/T38 Strip	15	Upgrade	PTNSL8 AD2 LP835 DNA EPL PLR1 V...	Acuity Brands Lighting	PTNSL8 AD2 LP835 DNA EPL PLR1 V...	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	15
Meter #28 (30)	Meter #28 (30)	Incandescent 60W	3	Upgrade	15A21/2700-WHT DIM		15A21/2700-WHT DIM	15A21/2700-WHT DIM	3
Methane Filter Building (26)	Methane Filter Building (26)	Outdoor 70W Wallpack	1	Upgrade	70884	OSRAM Sylvania	70884	Wall pack,LED Fixture,30W,70CRI,4500K	1
Methane Filter Building (26)	Methane Filter Building (26)	2x4' Fluorescent Strip 2-Lamp T8	8	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	16
Primary Settling Tanks (05)	Primary Settling Tanks (05)	Outdoor 250W Metal Halide	6	Keep					
Primary Settling Tanks (05)	Primary Settling Tanks (05)	Outdoor 250W Shoebox Pole Mounted Metal Halide	3	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	3
PS Valve Chamber (41)	PS Valve Chamber (41)	Outdoor MH 150W Stanchion	3	Upgrade	PLED2 10L 4K AS UN CRW L5 BP	Holophane	PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	3
Pump & Blower Building (06)	Basement Level (06)	Metal Halide 175W	4	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	4
Pump & Blower Building (06)	Basement Level (06)	2x4' Fluorescent Strip 2-Lamp T8	57	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	114
Pump & Blower Building (06)	Blower Room (06)	HBLED-LD3-24-W-CL-UNV-ED3-U	14	Keep					

Pump & Blower Building (06)	Blower Room (06)	2x4' Fluorescent Strip 2-Lamp T8	2	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	4
Pump & Blower Building (06)	Exterior (06)	1000W Flood Wall Mounted Outdoor	2	Keep					
Pump & Blower Building (06)	Exterior (06)	XTOR-2A	1	Keep					
Pump & Blower Building (06)	Exterior (06)	XTOR-1A	5	Keep					
Pump & Blower Building (06)	Exterior (06)	Outdoor 250W Flood	3	Upgrade	FXLED78SF	RAB Lighting	FXLED78SF	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	3
Pump & Blower Building (06)	Office (06)	2x4' Fluorescent Strip 2-Lamp T8	9	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	18
Pump & Blower Building (06)	Old Generator Room (06)	2x4' Fluorescent Strip 2-Lamp T8	3	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	6
Pump & Blower Building (06)	Unit Substation (06)	2x4' Fluorescent Strip 2-Lamp T8	16	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	32
Return Sludge PS (62)	Electrical Room (62)	2x4' Fluorescent Strip 2-Lamp T8	10	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	20
Return Sludge PS (62)	Exterior (62)	XTOR-1A	5	Keep					
Return Sludge PS (62)	RAS/WAS Room (62)	Metal Halide 175W	10	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	10
Rotary Drum Thick Fac (34)	Electrical Room (34)	2x4' Fluorescent Strip 2-Lamp T8	8	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	16
Rotary Drum Thick Fac (34)	Exterior (34)	XTOR-1A	6	Keep					
Rotary Drum Thick Fac (34)	OCS Room (34)	2x4' Hazardous 2-Lamp T8	7	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	14
Rotary Drum Thick Fac (34)	Washwater Room (34)	Metal Halide 175W	19	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	19
Service Building (04)	Boiler, Old & New Chlorine Rms.	2x4' Fluorescent Strip 2-Lamp T8	12	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	24
Service Building (04)	Chlorine Room (04)	8' 2-Lamp, F96 T12/T38 Strip	2	Upgrade	PTNSL8 AD2 LP835 DNA EPL PLR1 V...	Acuity Brands Lighting	PTNSL8 AD2 LP835 DNA EPL PLR1 V...	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	2
Service Building (04)	Corridor & Open Well (04)	2x4' Fluorescent Strip 2-Lamp T8	14	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	28
Service Building (04)	Electrical Room (04)	2x4' Fluorescent Strip 2-Lamp T8	4	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	8
Service Building (04)	Exterior	XTOR-1A	5	Keep					
Service Building (04)	Exterior	Outdoor 250W Flood	5	Upgrade	FXLED78SF	RAB Lighting	FXLED78SF	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	5
Service Building (04)	Lower Level Classified Area (04)	Incandescent 60W	5	Upgrade	15A21/2700-WHT DIM		15A21/2700-WHT DIM	15A21/2700-WHT DIM	5
Service Building (04)	Lower Level Classified Area (04)	Metal Halide 250W (285W)	7	Upgrade	HPLED 70 700 4K AS UN L5	Holophane	HPLED 70 700 4K AS UN L5	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	7
Service Building (04)	Upper Level Screen Room (04)	Incandescent 60W	3	Upgrade	15A21/2700-WHT DIM		15A21/2700-WHT DIM	15A21/2700-WHT DIM	3
Service Building (04)	Upper Level Screen Room (04)	Metal Halide 175W	2	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	2
Sludge Dewatering Bldg (27)	2nd Flr Centrifuge Rm (27)	Incandescent 200W	4	Upgrade	19A21/2700-WHT DIM		19A21/2700-WHT DIM	19A21/2700-WHT DIM	4
Sludge Dewatering Bldg (27)	2nd Flr Centrifuge Rm (27)	2x4' Fluorescent Strip 2-Lamp T8	54	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	108
Sludge Dewatering Bldg (27)	Electrical Room (27)	2x4' Fluorescent Strip 2-Lamp T8	10	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	20
Sludge Dewatering Bldg (27)	Hallway (27)	2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	8	Upgrade	22EN-LD1-34-UNV-L840-CD1-U	Cooper Industries	22EN-LD1-34-UNV-L840-CD1-U	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	8
Sludge Dewatering Bldg (27)	Mechanical Room (27)	2x4' Fluorescent Strip 2-Lamp T8	6	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	12
Sludge Dewatering Bldg (27)	NE Pump Room (27)	2x4' Fluorescent Strip 2-Lamp T8	20	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	40
Sludge Dewatering Bldg (27)	Polymer Pump Room (27)	2x4' Fluorescent Strip 2-Lamp T8	16	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	32
Sludge Dewatering Bldg (27)	Stairs (27)	XTOR-1A	6	Keep					
Sludge Dewatering Bldg (27)	Storage Room (27)	2x4' Fluorescent Strip 2-Lamp T8	5	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	10
Sludge Dewatering Bldg (27)	Truck Loading (27)	Incandescent 200W	5	Upgrade	19A21/2700-WHT DIM		19A21/2700-WHT DIM	19A21/2700-WHT DIM	5
Sludge Dewatering Bldg (27)	Truck Loading (27)	2x4' Fluorescent Strip 2-Lamp T8	15	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	30
Sludge Pumping Station (09)	Exterior	XTOR-1A	1	Keep					
Sludge Pumping Station (09)	Sludge Pumping Station (09)	Metal Halide 175W	7	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	7
Sludge Storage Ctrl Bldg (15)	Sludge Storage Ctrl Bldg (15)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	Upgrade	ALED3T150RG	RAB Lighting	ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1
Sludge Storage Ctrl Bldg (15)	Sludge Storage Ctrl Bldg (15)	Outdoor 250W Flood	1	Upgrade	FXLED78SF	RAB Lighting	FXLED78SF	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	1
Sludge Thickening Bldg (11)	2nd Floor (11)	Metal Halide 175W	10	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	10
Sludge Thickening Bldg (11)	Ground Floor (11)	Incandescent 60W	1	Upgrade	15A21/2700-WHT DIM		15A21/2700-WHT DIM	15A21/2700-WHT DIM	1
Sludge Thickening Bldg (11)	Lower Level (11)	Metal Halide 175W	28	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	28
Sludge Thickening Bldg (11)	Stair & Ground Floor (11)	Metal Halide 175W	7	Upgrade	HBL-72LU-5K-A-070-WH	Hubbell Industrial Lighting	HBL-72LU-5K-A-070-WH	LED Highbay,HBL Series,72L,169W,120-277V,LED,15319Lumens,5000K	7
South Complex Exterior	South Complex Exterior	XTOR-5A	6	Keep					
Tunnels (35)	Tunnels (35)	2x4' Fluorescent Strip 2-Lamp T8	29	Upgrade	PQL LED 18WT8/40K/FR	Premium Quality Lighting	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL LED 18WT8/40K/FR	58
Utility Garage (22)	Utility Garage (22)	8' 2-Lamp, F96 T12/T38 Strip	6	Upgrade	PTNSL8 AD2 LP835 DNA EPL PLR1 V...	Acuity Brands Lighting	PTNSL8 AD2 LP835 DNA EPL PLR1 V...	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	6
UV Disinfection (54)	UV Disinfection (54)	Incandescent 60W	5	Upgrade	15A21/2700-WHT DIM		15A21/2700-WHT DIM	15A21/2700-WHT DIM	5

Efficiency Measure	Associated Incentive Category	Incentive	Quantity	Total Incentive
4', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED	LED Linear Replacement Lamps (2'&4' Only)	$5/lamp	315	$1,545
2', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED	LED Linear Replacement Lamps (2'&4' Only)	$5/lamp	120	$600
4', 2-Lamp T8s - Retain Fixture, Upgrade Lamps to LED	LED Linear Replacement Lamps (2'&4' Only)	$5/lamp	788	$3,940
2'x2' U-Bent Troffer Fixtures - Upgrade to LED	LED Replacement of 32W T8 System	$5/lamp	182	$910
60W Incandescent Bulbs - Upgrade to LED	Energy Screw Bulbs A15	$10/lamp	17	$170
100W & 200W Incandescent Bulbs - Upgrade to LED	Energy Screw Bulbs A19	$10/lamp	9	$90
Indoor Damp/Haz 250W HID Pend Fixt - Upgrade to LED	LED High Bay & Low Bay Fixtures for Commercial & Industrial Bldg	$150/fixture	62	$9,300
8', 2-Lamp T12 Fixtures - Upgrade to LED	LED High Bay & Low Bay Fixtures for Commercial & Industrial Bldg	$150/fixture	23	$3,450
Indoor 175W HID Fixtures - Upgrade to LED	LED High Bay & Low Bay Fixtures for Commercial & Industrial Bldg	$150/fixture	196	$29,400
Outdoor 250W Area & Roadway HID Fixt - Upgrade to LED	LED Outdoor Pole/Arm-Mounted Area & Rdwy Luminaires	$100/fixture	65	$6,500
Outdoor Stanchion Mounted HID Fixtures - Upgrade to LED	LED Outdoor Pole/Arm-Mounted Area & Rdwy Luminaires	$100/fixture	40	$4,000
Outdoor 70W Wallpack Fixtures - Upgrade to LED	LED Outdoor Wall-Mounted Area Luminaires	$100/fixture	38	$3,800
Outdoor 250W HID Floodlight Fixtures - Upgrade to LED	LED Outdoor Wall-Mounted Area Luminaires	$100/fixture	13	$1,300
			Total	**$65,005**

Recommended Lighting Energy Conservation Measures

For:

Rahway Valley Sewerage Authority

Rahway Valley Sewerage Authority
1050 E Hazelwood Ave

Rahway, NJ 07065

RVSA
E Hazelwood Ave
Rahway NJ 07065

Thursday, March 31, 2016

Prepared By:

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Introduction

The cost and energy savings detailed in this proposal are calculated based on the implementation of all recommended lighting energy conservation measures. The measures are assumed to be taken for all applicable fixtures and lamps at the RVSA Wastewater Treatment Plant.

Prior to the implementation of any of the recommendations, additional studies should be performed. All lamps and ballasts should be suitably rated for the voltage of the local system and for the operating environment; luminaires in classified areas shall be rated appropriately. Fixtures and lamps in a condition that creates a hazard to personnel should be removed and replaced.

Executive Summary

Project Overview

Cost of Project	
Total Material Cost ($)	225,506
Total Labor Cost ($)	115,144
Less Rebates and Incentives ($)	(65,005)
Net Cost of Project ($)	**275,645**
Annual Operating Savings	
Energy Savings ($)[1, 2]	47,675
Maintenance Savings ($)[3]	11,764
Total Annual Operating Savings ($)	**59,439**
Operating Savings Over 20 Years	
Energy Savings ($)[1, 2]	953,500
Maintenance Savings ($)	235,289
Total Operating Savings Over 20 Years ($)	**1,188,789**
Payback Period (years)	5.8
Net Present Value ($)[4]	655,621
Internal Rate of Return (%)	52.65

1. Energy cost ($) = 0.1220/kWh; Annual energy cost escalation (%) = 0.00
2. Energy savings are averaged over 20 year analysis period
3. Maintenance costs are averaged over 20 year analysis period
4. Assumed cost of capital (%) = 3.00
5. Product Tax Rate (%) = 0.00
6. Service Tax Rate (%) = 0.00

Financial Summary

Total Project Cost ($)	Net Project Cost ($)	20 Yr Operating Savings ($)[1, 2]	Payback Period (yrs)	NPV ($)[3]	IRR (%)
340,650	275,645	1,188,789	5.8	655,621	52.65

1. Energy cost ($) = 0.1220/kWh; Annual energy cost escalation (%) = 0.00
2. Operating Savings equals the energy cost savings plus the maintenance savings averaged over the analysis period
3. Assumed Cost of capital (%) = 3.00
4. Product Tax Rate (%) = 0.00

5. Service Tax Rate (%) = 0.00

Upgrade Summary

Total Cost ($)	Total Incentives ($)	Net Cost ($)	Total Energy Savings ($) [1, 2]	Maintenance Savings ($)	20 Yr NPV ($)[3]	Payback Period (yrs)
340,650	65,005	275,645	953,500	235,289	655,621	5.8

1. Energy cost ($) = 0.1220/kWh; Annual energy cost escalation (%) = 0.00
2. Energy savings are for the 20-year analysis period
3. Assumed Cost of capital (%) = 3.00
4. Product Tax Rate (%) = 0.00
5. Service Tax Rate (%) = 0.00

Financial Analysis by Efficiency Measures (EM)

EM Name	EM Type[1]	kWh/yr Savings	Operating Savings ($)[2,3]	Total Cost ($)	Net Cost ($)	Payback Period (yrs)
4', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED	ALU	37,895	110,078	8,271	6,726	1.5
Outdoor 70W Wallpack Fixtures - Upgrade to LED	ALU	9,578	50,349	14,877	11,077	9.5
Outdoor 250W HID Floodlight Fixtures - Upgrade to LED	ALU	9,592	30,204	8,497	7,197	6.2
Outdoor Stanchion Mounted HID Fixtures - Upgrade to LED	ALU	11,995	65,189	19,144	15,144	10.3
2'x2' U-Bent Troffer Fixtures - Upgrade to LED	ALU	20,719	42,728	26,859	25,949	10.3
Indoor Damp/Hazardous 250W HID Susp. Fixture - Upgrade to LED	ALU	53,439	105,198	59,055	49,755	7.6
Outdoor 250W	ALU	36,461	151,236	65,985	59,485	13.4

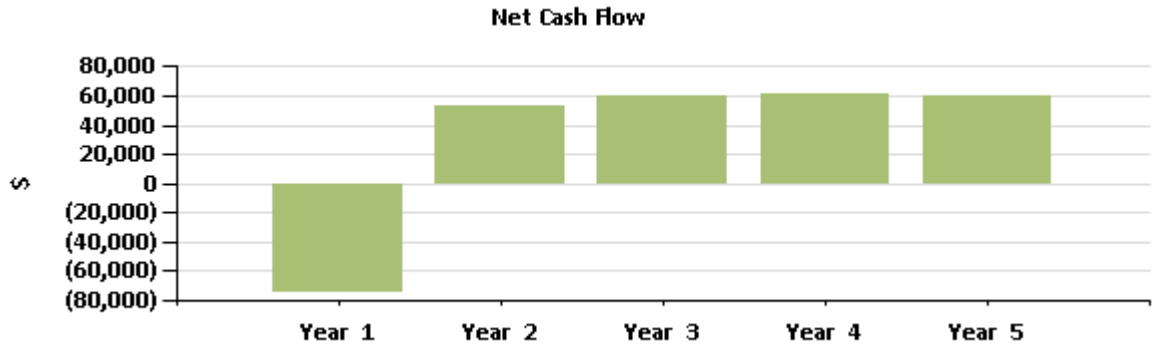
Area & Roadway HID Fixtures - Upgrade to LED						
2', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED	ALU	8,409	29,159	3,014	2,414	2.4
100W & 200W Incandescent Bulbs - Upgrade to LED	ALU	162	467	135	45	2.3
8', 2-Lamp T12 Fixtures - Upgrade to LED	ALU	9,268	22,614	8,283	4,833	4.3
Indoor 175W HID Fixtures - Upgrade to LED	ALU	96,149	264,005	99,686	70,286	6.0
60W Incandescent Bulbs - Upgrade to LED	ALU	466	1,379	170	0	0.0
4', 2-Lamp T8s - Retain Fixture, Upgrade Lamps to LED	ALU	96,640	316,178	26,674	22,734	1.9

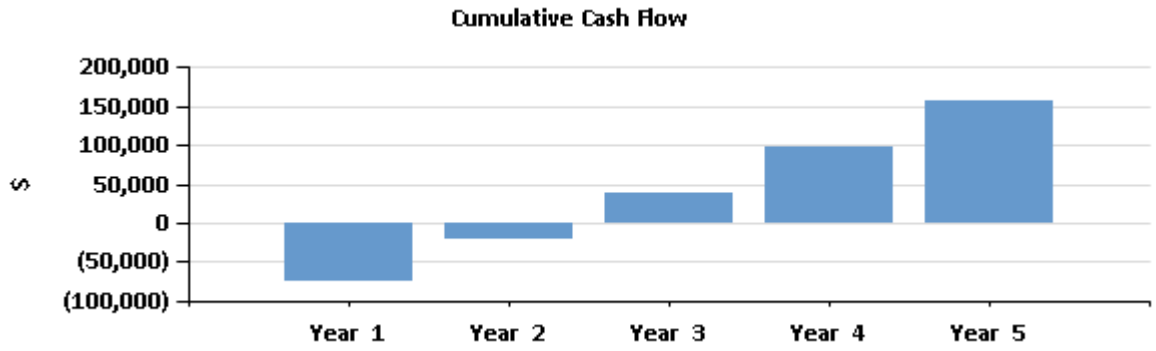
1. *ILC=Integrated Lighting and Controls, ALU=Advanced Lighting Upgrade, ALC=Advanced Local Controls, LC=Local Control*
2. *Operating savings includes energy savings and maintenance savings*
3. *Energy cost ($) = 0.1220/kWh; Annual energy cost escalation (%) = 0.00*
4. *Product Tax Rate (%) = 0.00*
5. *Service Tax Rate (%) = 0.00*

Cash Flow Analysis

20 Year Cash Flow Analysis ($)

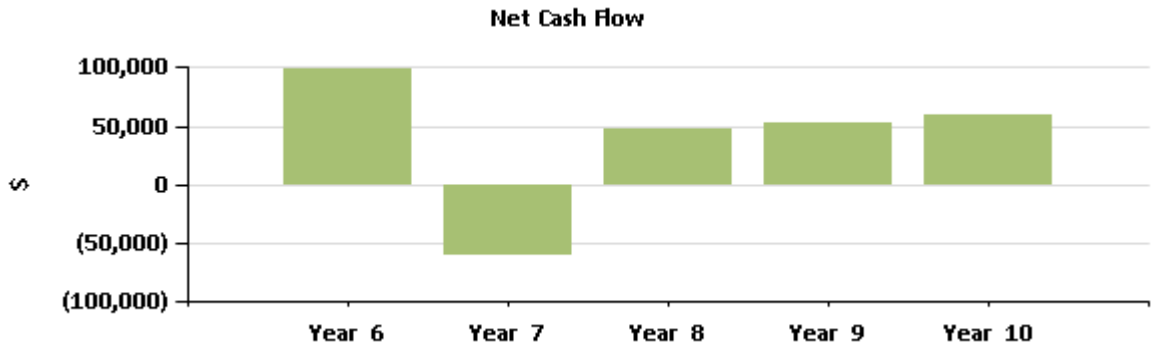
	Year 1	Year 2	Year 3	Year 4	Year 5
Product Costs	225,506	-	-	-	-
Installation Services	115,144	-	-	-	-
Incentives	65,005	-	-	-	-
Energy Savings	47,675	47,675	47,675	47,675	47,675
Maintenance Savings	153,694	4,952	11,654	13,667	11,658
Net Cash Flow	**(74,276)**	**52,627**	**59,329**	**61,342**	**59,333**
Cumulative Cash Flow	**(74,276)**	**(21,649)**	**37,680**	**99,022**	**158,355**

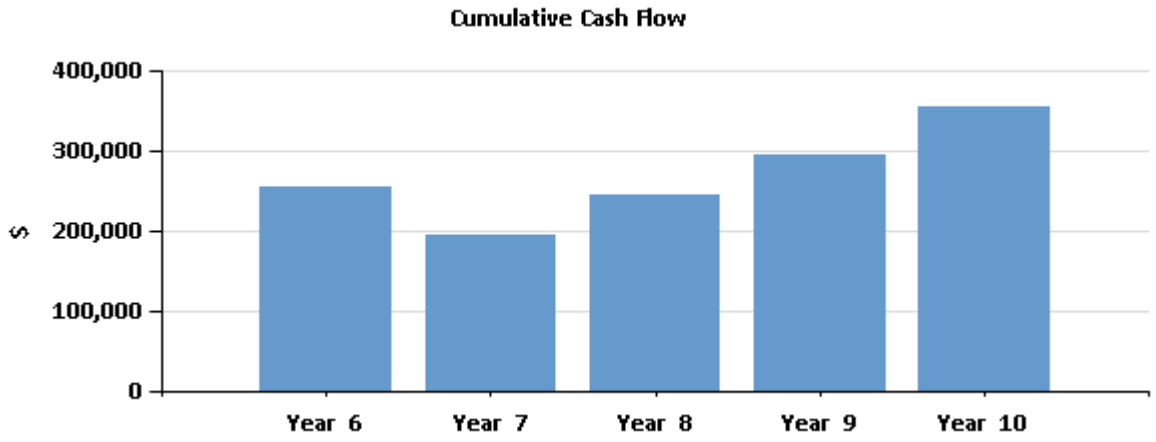




20 Year Cash Flow Analysis ($)

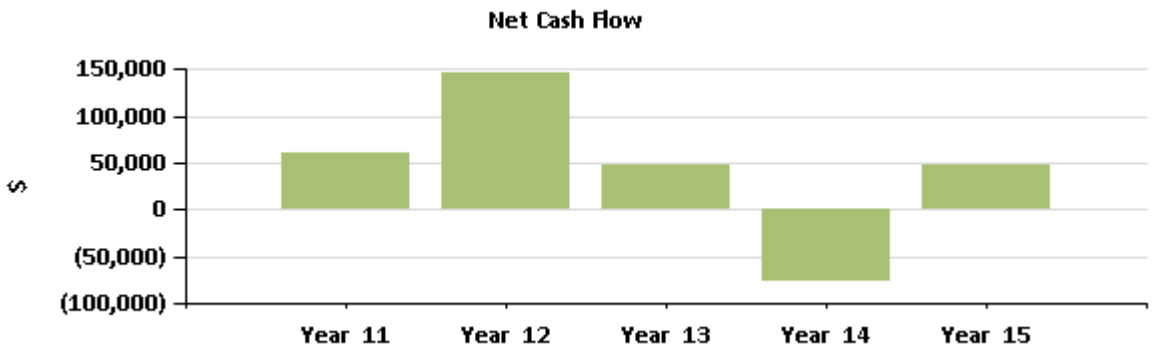
	Year 6	Year 7	Year 8	Year 9	Year 10
Product Costs	-	-	-	-	-
Installation Services	-	-	-	-	-
Incentives	-	-	-	-	-
Energy Savings	47,675	47,675	47,675	47,675	47,675
Maintenance Savings	50,574	(107,886)	12	4,936	11,664
Net Cash Flow	**98,249**	**(60,211)**	**47,687**	**52,611**	**59,339**
Cumulative Cash Flow	**256,604**	**196,393**	**244,080**	**296,691**	**356,030**

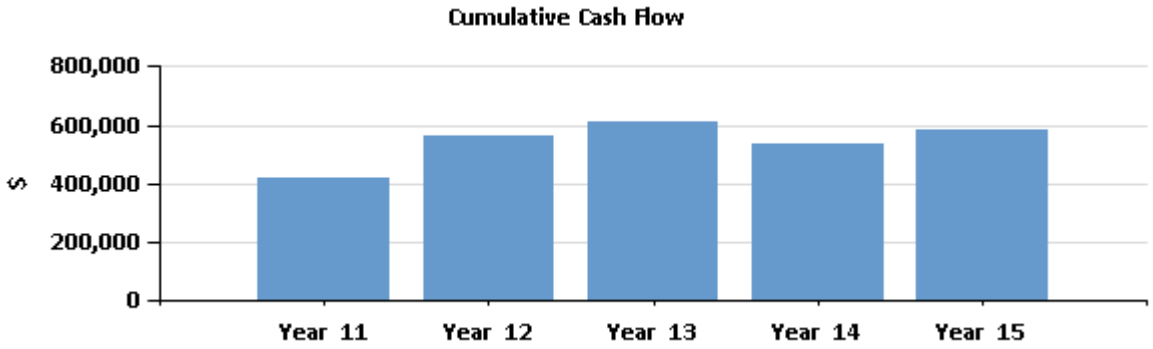




20 Year Cash Flow Analysis ($)

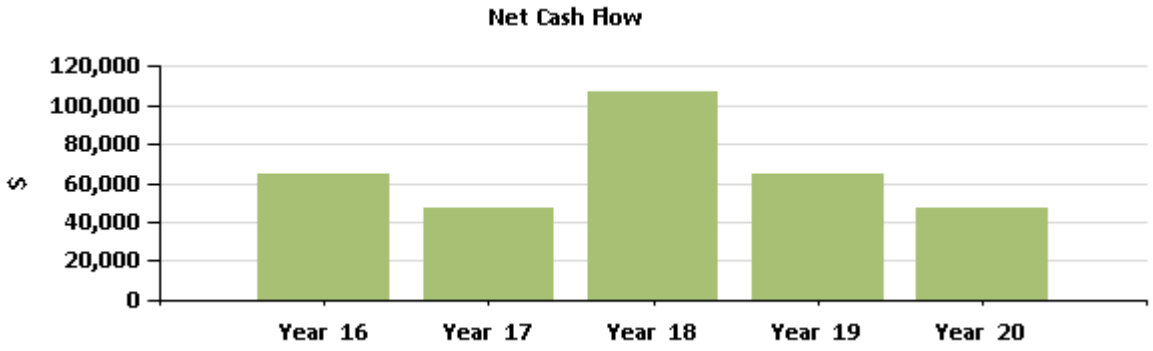
	Year 11	Year 12	Year 13	Year 14	Year 15
Product Costs	-	-	-	-	-
Installation Services	-	-	-	-	-
Incentives	-	-	-	-	-
Energy Savings	47,675	47,675	47,675	47,675	47,675
Maintenance Savings	13,667	99,011	6	(124,826)	2
Net Cash Flow	**61,342**	**146,686**	**47,681**	**(77,151)**	**47,677**
Cumulative Cash Flow	**417,372**	**564,058**	**611,739**	**534,588**	**582,265**

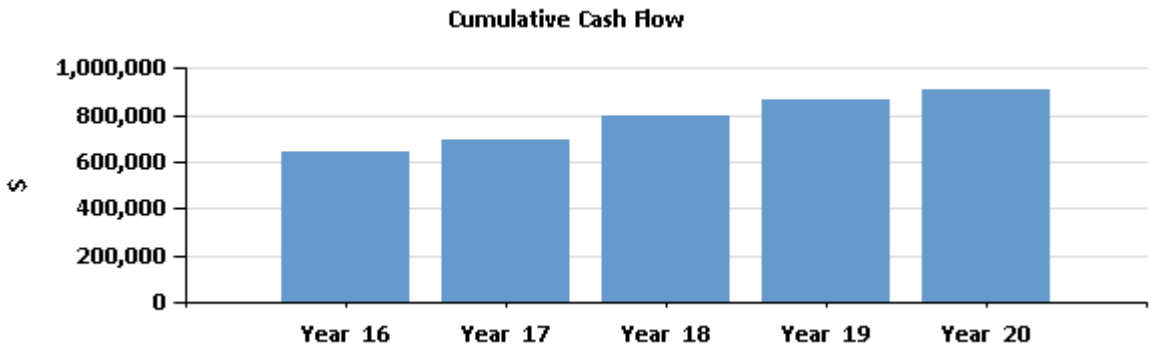




20 Year Cash Flow Analysis ($)

	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Product Costs	-	-	-	-	-	**225,506**
Installation Services	-	-	-	-	-	**115,144**
Incentives	-	-	-	-	-	**65,005**
Energy Savings	47,675	47,675	47,675	47,675	47,675	**953,501**
Maintenance Savings	16,604	6	59,289	16,604	2	**235,289**
Net Cash Flow	**64,279**	**47,681**	**106,964**	**64,279**	**47,677**	**913,145**
Cumulative Cash Flow	**646,544**	**694,226**	**801,189**	**865,468**	**913,145**	**913,145**





20 Year Cash Flow Analysis ($)

	Year 1	Year 2	Year 3	Year 4	Year 5
Product Costs	225,506	-	-	-	-
Installation Services	115,144	-	-	-	-
Incentives	65,005	-	-	-	-
Energy Savings	47,675	47,675	47,675	47,675	47,675
Maintenance Savings	153,694	4,952	11,654	13,667	11,658
Net Cash Flow	**(74,276)**	**52,627**	**59,329**	**61,342**	**59,333**
Cumulative Cash Flow	**(74,276)**	**(21,649)**	**37,680**	**99,022**	**158,355**

20 Year Cash Flow Analysis ($)

	Year 6	Year 7	Year 8	Year 9	Year 10
Product Costs	-	-	-	-	-
Installation Services	-	-	-	-	-
Incentives	-	-	-	-	-
Energy Savings	47,675	47,675	47,675	47,675	47,675
Maintenance Savings	50,574	(107,886)	12	4,936	11,664
Net Cash Flow	**98,249**	**(60,211)**	**47,687**	**52,611**	**59,339**
Cumulative Cash Flow	**256,604**	**196,393**	**244,080**	**296,691**	**356,030**

20 Year Cash Flow Analysis ($)

	Year 11	Year 12	Year 13	Year 14	Year 15
Product Costs	-	-	-	-	-
Installation Services	-	-	-	-	-
Incentives	-	-	-	-	-
Energy Savings	47,675	47,675	47,675	47,675	47,675
Maintenance Savings	13,667	99,011	6	(124,826)	2
Net Cash Flow	**61,342**	**146,686**	**47,681**	**(77,151)**	**47,677**
Cumulative Cash Flow	**417,372**	**564,058**	**611,739**	**534,588**	**582,265**

20 Year Cash Flow Analysis ($)

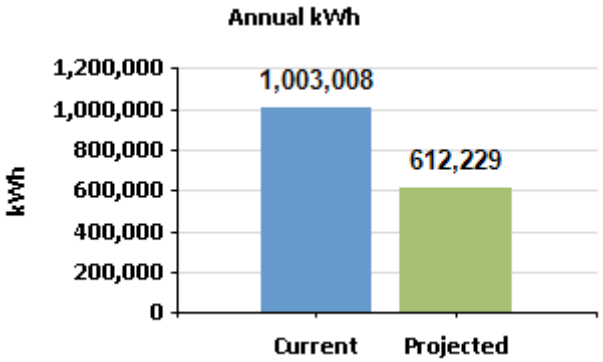
	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Product Costs	-	-	-	-	-	**225,506**
Installation Services	-	-	-	-	-	**115,144**
Incentives	-	-	-	-	-	**65,005**
Energy Savings	47,675	47,675	47,675	47,675	47,675	**953,501**
Maintenance Savings	16,604	6	59,289	16,604	2	**235,289**
Net Cash Flow	**64,279**	**47,681**	**106,964**	**64,279**	**47,677**	**913,145**
Cumulative Cash Flow	**646,544**	**694,226**	**801,189**	**865,468**	**913,145**	**913,145**

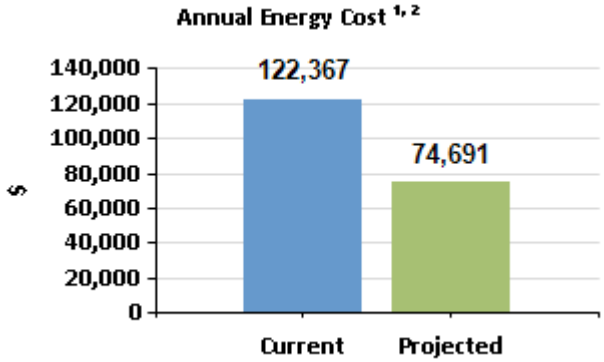
Energy Usages and Costs

Annual Energy Usage Reduction

Current Usage (kWh)	Projected Usage (kWh)	Reduction (kWh)	Reduction (%)
1,003,008	612,229	390,779	39

Energy Comparison





1. Energy Cost ($) = 0.1220/kWh; Annual energy cost escalation (%) = 0.00
2. Energy costs are averaged over 20 year analysis period

Watts Summary

Existing Watts[1]	Proposed Watts[1]	Reduced Watts	Reduction (%)
135,885	80,180	55,705	39

1. The watts calculations in this table take into account existing fixtures that are being replaced, upgraded, and/or have new lighting controls being proposed for them

Lighting Wattage Comparison

Area :								
Space	Existing Fixture	Qty	Watts	Total Watts	Proposed Solution	Qty	Watts	Total Watts

Sludge Dewatering Bldg (27) :								
2nd Flr Centrifuge Rm (27)	Incandescent 200W	4	200	800	19A21/2700-WHT DIM	4	20	80
Sludge Dewatering Bldg (27) :								
Truck Loading (27)	Incandescent 200W	5	200	1,000	19A21/2700-WHT DIM	5	20	100
Cogen/Sludge Drying Fac (38) :								
Cogen Ctrl Room (38)	2x2' Fluorescent 3-Lamp T8	14	51	714	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	42	9	378
Admin Annex (39) :								
First Floor (20)	2x2' Fluorescent 3-Lamp T8	12	51	612	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	36	9	324
Admin Annex (39) :								
First Floor (39)	2x2' Fluorescent 3-Lamp T8	1	51	51	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	3	9	27
Cogen/Sludge Drying Fac (38) :								
Hallway (38)	2x2' Fluorescent 3-Lamp T8	12	51	612	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	36	9	324
Laboratory Building (20) :								
Lab Bldg (20)	2x2' Fluorescent	1	51	51	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950	3	9	27

	3-Lamp T8				LUMENS			
Admin Annex (39) :								
First Floor (20)	2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	13	60	780	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	13	35	455
Sludge Dewatering Bldg (27) :								
Hallway (27)	2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	8	60	480	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	8	35	280
Laboratory Building (20) :								
Lab Bldg (20)	2x2' 2-Lamp Fluorescent T8	16	62	992	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	16	35	560
Employee Facilities Bldg (29) :								
Main Level (29)	2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	34	60	2,040	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	34	35	1,190
Headworks Building (44) :								
Office, Bathroom, Hallway (44)	2x2' 2-Lamp Fluorescent T8	17	62	1,054	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	17	35	595
Headworks Building (44) :								
Stair 1 (44)	2x2' 2-Lamp Fluorescent T8	3	62	186	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	3	35	105
Sludge Dewatering								

Bldg (27) :								
2nd Flr Centrifuge Rm (27)	2x4' Fluorescent Strip 2-Lamp T8	54	64	3,456	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	108	18	1,944
Pump & Blower Building (06) :								
Basement Level (06)	2x4' Fluorescent Strip 2-Lamp T8	57	64	3,648	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	114	18	2,052
Admin Annex (39) :								
Basement Level (39)	2x4' Fluorescent Strip 2-Lamp T8	4	64	256	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	8	18	144
Pump & Blower Building (06) :								
Blower Room (06)	2x4' Fluorescent Strip 2-Lamp T8	2	64	128	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	4	18	72
Service Building (04) :								
Boiler, Old & New Chlorine Rms.	2x4' Fluorescent Strip 2-Lamp T8	12	64	768	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	24	18	432
Cogen/Sludge Drying Fac (38) :								
Cogen Process Room (38)	2x4' Fluorescent Strip 2-Lamp T8	18	64	1,152	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	36	18	648

Service Building (04) :								
Corridor & Open Well (04)	2x4' Fluorescent Strip 2-Lamp T8	14	64	896	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	28	18	504
Effl Filter & UV Ctrl Bldg (56) :								
Effl Filter & UV Ctrl Bldg (56)	2x4' Fluorescent Strip 2-Lamp T8	9	64	576	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	18	324
Service Building (04) :								
Electrical Room (04)	2x4' Fluorescent Strip 2-Lamp T8	4	64	256	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	8	18	144
Sludge Dewatering Bldg (27) :								
Electrical Room (27)	2x4' Fluorescent Strip 2-Lamp T8	10	64	640	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	20	18	360
Rotary Drum Thick Fac (34) :								
Electrical Room (34)	2x4' Fluorescent Strip 2-Lamp T8	8	64	512	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	16	18	288
Return Sludge PS (62) :								
Electrical Room (62)	2x4' Fluorescent Strip 2-Lamp	10	64	640	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	20	18	360

	T8							
Cogen/Sludge Drying Fac (38) :								
Gas Compressor Room (38)	2x4' Hazardous 2-Lamp T8	7	64	448	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	14	18	252
Headworks Building (44) :								
HW Lower Level (44)	2x4' Fluorescent Strip 2-Lamp T8	5	64	320	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	10	18	180
Maintenance Shop (25) :								
Lower Level (25)	2x4' Fluorescent Strip 2-Lamp T8	6	64	384	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	12	18	216
Employee Facilities Bldg (29) :								
Lower Level (29)	2x4' Fluorescent Strip 2-Lamp T8	18	64	1,152	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	36	18	648
Sludge Dewatering Bldg (27) :								
Mechanical Room (27)	2x4' Fluorescent Strip 2-Lamp T8	6	64	384	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	12	18	216
Methane Filter Building (26) :								
Methane Filter Building	2x4' Fluorescent	8	64	512	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915	16	18	288

(26)	Strip 2-Lamp T8				LUMENS			
Sludge Dewatering Bldg (27) :								
NE Pump Room (27)	2x4' Fluorescent Strip 2-Lamp T8	20	64	1,280	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	40	18	720
Rotary Drum Thick Fac (34) :								
OCS Room (34)	2x4' Hazardous 2-Lamp T8	7	64	448	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	14	18	252
Pump & Blower Building (06) :								
Office (06)	2x4' Fluorescent Strip 2-Lamp T8	9	64	576	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	18	324
Pump & Blower Building (06) :								
Old Generator Room (06)	2x4' Fluorescent Strip 2-Lamp T8	3	64	192	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	6	18	108
Sludge Dewatering Bldg (27) :								
Polymer Pump Room (27)	2x4' Fluorescent Strip 2-Lamp T8	16	64	1,024	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	32	18	576
Chem Handling & Feed System								

(72) :								
Sodium Hypo (72)	2x4' Fluorescent Strip 2-Lamp T8	8	64	512	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	16	18	288
Headworks Building (44) :								
Stair 1 (44)	2x4' Fluorescent Strip 2-Lamp T8	10	64	640	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	20	18	360
Sludge Dewatering Bldg (27) :								
Storage Room (27)	2x4' Fluorescent Strip 2-Lamp T8	5	64	320	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	10	18	180
Sludge Dewatering Bldg (27) :								
Truck Loading (27)	2x4' Fluorescent Strip 2-Lamp T8	15	64	960	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	30	18	540
Tunnels (35) :								
Tunnels (35)	2x4' Fluorescent Strip 2-Lamp T8	29	64	1,856	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	58	18	1,044
Pump & Blower Building (06) :								
Unit Substation (06)	2x4' Fluorescent Strip 2-Lamp T8	16	64	1,024	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	32	18	576
Maintenance								

Shop (25) :								
Upper Level (25)	2x4' Fluorescent Strip 2-Lamp T8	4	64	256	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	8	18	144
Admin Annex (39) :								
Basement Level (39)	2x4' Fluorescent Strip 3-Lamp T8	6	96	576	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	18	324
Headworks Building (44) :								
Caustic Soda (44)	2x4' Fluorescent Strip 3-Lamp T8	6	96	576	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	18	324
Cogen/Sludge Drying Fac (38) :								
Cogen/Sludge Drying Fac (38)	2x4' Fluorescent Strip 3-Lamp T8	10	96	960	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	30	18	540
Headworks Building (44) :								
Electrical Room (44)	2x4' Fluorescent Strip 3-Lamp T8	18	96	1,728	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	54	18	972
Headworks Building (44) :								
Interm. Level (AHUs) (44)	2x4' Fluorescent Strip 3-Lamp T8	9	96	864	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	27	18	486
Headworks Building (44) :								

Interm. Level Elev. Room	2x4' Fluorescent Strip 3-Lamp T8	1	96	96	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	3	18	54
Laboratory Building (20) :								
Lab Bldg (20)	2x4' Fluorescent Strip 3-Lamp T8	44	96	4,224	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	132	18	2,376
Headworks Building (44) :								
Loading Dock (44)	2x4' Fluorescent Strip 3-Lamp T8	3	96	288	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	9	18	162
Headworks Building (44) :								
Odor Control (44)	2x4' Fluorescent Strip 3-Lamp T8	6	96	576	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	18	324
Sludge Thickening Bldg (11) :								
Ground Floor (11)	Incandescent 60W	1	60	60	15A21/2700-WHT DIM	1	15	15
Service Building (04) :								
Lower Level Classified Area (04)	Incandescent 60W	5	60	300	15A21/2700-WHT DIM	5	15	75
Meter #28 (30) :								
Meter #28 (30)	Incandescent 60W	3	60	180	15A21/2700-WHT DIM	3	15	45

Service Building (04) :								
Upper Level Screen Room (04)	Incandescent 60W	3	60	180	15A21/2700-WHT DIM	3	15	45
UV Disinfection (54) :								
UV Disinfection (54)	Incandescent 60W	5	60	300	15A21/2700-WHT DIM	5	15	75
Service Building (04) :								
Chlorine Room (04)	8' 2-Lamp, F96 T12/T38 Strip	2	138	276	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	2	92	184
Maintenance Shop (25) :								
Upper Level (25)	8' 2-Lamp, F96 T12/T38 Strip	15	138	2,070	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	15	92	1,380
Utility Garage (22) :								
Utility Garage (22)	8' 2-Lamp, F96 T12/T38 Strip	6	138	828	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	6	92	552
Sludge Thickening Bldg (11) :								
2nd Floor (11)	Metal Halide 175W	10	195	1,950	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	10	139	1,390
Aeration Tanks (07) :								
Aeration Gallery (07)	Metal Halide 175W	19	195	3,705	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	19	139	2,641
Pump &								

Blower Building (06) :								
Basement Level (06)	Metal Halide 175W	4	195	780	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	4	139	556
Cogen/Sludge Drying Fac (38) :								
Cogen/Sludge Drying Fac (38)	Metal Halide 175W	13	195	2,535	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	13	139	1,807
Digester Ctrl Bldg (13) :								
Digester Ctrl Bldg 1st Flr (13)	Metal Halide 175W	24	195	4,680	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	24	139	3,336
Digester Ctrl Bldg (13) :								
Digester Ctrl Bldg Bsmnt (13)	Metal Halide 175W	23	195	4,485	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	23	139	3,197
Digester Ctrl Bldg (13) :								
Foam Separating Rm (13)	Metal Halide 175W	12	195	2,340	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	12	139	1,668
Lime/Polymer Feed Station (28) :								
Lime/Polymer Feed Station (28)	Metal Halide 175W	4	195	780	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	4	139	556
Sludge Thickening Bldg (11) :								
Lower Level (11)	Metal Halide 175W	28	195	5,460	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	28	139	3,892

Aeration Tanks (07) :								
Monitoring Building (07)	Metal Halide 175W	5	195	975	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	5	139	695
Return Sludge PS (62) :								
RAS/WAS Room (62)	Metal Halide 175W	10	195	1,950	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	10	139	1,390
Digester Ctrl Bldg (13) :								
Side Room (13)	Metal Halide 175W	7	195	1,365	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	7	139	973
Sludge Pumping Station (09) :								
Sludge Pumping Station (09)	Metal Halide 175W	7	195	1,365	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	7	139	973
Sludge Thickening Bldg (11) :								
Stair & Ground Floor (11)	Metal Halide 175W	7	195	1,365	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	7	139	973
Digester Ctrl Bldg (13) :								
Stairs (13)	Metal Halide 175W	2	195	390	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	2	139	278
Service Building (04) :								
Upper Level Screen Room (04)	Metal Halide 175W	2	195	390	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	2	139	278
Rotary Drum Thick Fac (34) :								

Washwater Room (34)	Metal Halide 175W	19	195	3,705	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	19	139	2,641
Cogen/Sludge Drying Fac (38) :								
Cogen Process Room (38)	Hazardous 250W MH (285W)	12	285	3,420	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	12	165	1,980
Headworks Building (44) :								
Grit Area (44)	Hazardous 250W MH (285W)	11	285	3,135	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	11	165	1,815
Headworks Building (44) :								
HW Lower Level (44)	Hazardous 250W MH (285W)	10	285	2,850	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	10	165	1,650
Service Building (04) :								
Lower Level Classified Area (04)	Metal Halide 250W (285W)	7	285	1,995	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	7	165	1,155
Cogen/Sludge Drying Fac (38) :								
Roof (38)	Outdoor 250W Metal Halide	22	285	6,270	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	22	165	3,630
DSN 001 Junction Chamber (60) :								
DSN 001 Junction Chamber (60)	Outdoor 250W Shoebox Pole Mounted	1	285	285	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1	155	155

	Metal Halide							
Emerg Plant Prot Facility (33) :								
Emerg Plant Prot Facility (33)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	285	285	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1	155	155
Final Settling Tanks (16) :								
FST-1 (16)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	285	285	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1	155	155
Final Settling Tanks (16) :								
FST-2 (16)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	285	285	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1	155	155
Final Settling Tanks (16) :								
FST-3 (16)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	285	285	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1	155	155
Final Settling Tanks (16) :								
FST-4 (16)	Outdoor 250W Shoebox Pole	1	285	285	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1	155	155

	Mounted Metal Halide							
General Site Area Lighting :								
General Site Area Lighting	Outdoor 250W Shoebox Pole Mounted Metal Halide	10	285	2,850	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	10	155	1,550
General Site Area Lighting :								
General Site Area Lighting	Outdoor 250W Metal Halide	42	285	11,970	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	42	155	6,510
Primary Settling Tanks (05) :								
Primary Settling Tanks (05)	Outdoor 250W Shoebox Pole Mounted Metal Halide	3	285	855	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	3	155	465
Sludge Storage Ctrl Bldg (15) :								
Sludge Storage Ctrl Bldg (15)	Outdoor 250W Shoebox Pole Mounted Metal Halide	1	285	285	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	1	155	155
Digester Ctrl Bldg (13) :								
Tanks (13)	Outdoor 250W Shoebox	3	285	855	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	3	155	465

	Pole Mounted Metal Halide							
DSN 001 Junction Chamber (60) :								
DSN 001 Junction Chamber (60)	Outdoor 250W Flood	2	250	500	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	2	79	158
Service Building (04) :								
Exterior	Outdoor 250W Flood	5	250	1,250	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	5	79	395
Pump & Blower Building (06) :								
Exterior (06)	Outdoor 250W Flood	3	250	750	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	3	79	237
Headworks Building (44) :								
Interm. Exterior (44)	Outdoor 250W Flood	2	250	500	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	2	79	158
Sludge Storage Ctrl Bldg (15) :								
Sludge Storage Ctrl Bldg (15)	Outdoor 250W Flood	1	250	250	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	1	79	79
Laboratory Building (20) :								
Exterior (21)	Outdoor 70W Wallpack	7	75	525	NWP L 030 7 40 T4 UNV BZ	7	30	210
Headworks Building (44) :								

Exterior (44)	Outdoor 70W Wallpack	16	75	1,200	NWP L 030 7 40 T4 UNV BZ	16	30	480
Headworks Building (44) :								
Interm. Exterior (44)	Outdoor 70W Wallpack	3	75	225	NWP L 030 7 40 T4 UNV BZ	3	30	90
Methane Filter Building (26) :								
Methane Filter Building (26)	Outdoor 70W Wallpack	1	75	75	NWP L 030 7 40 T4 UNV BZ	1	30	30
Cogen/Sludge Drying Fac (38) :								
Mezzanine (38)	Outdoor 70W Wallpack	11	75	825	NWP L 030 7 40 T4 UNV BZ	11	30	330
Backwash Return PS (52) :								
Backwash Return PS (52)	Outdoor MH 150W Stanchion	2	165	330	PLED2 10L 4K AS UN CRW L5 BP	2	98	196
Cascade Aeration (59) :								
Cascade Aeration (59)	Outdoor MH 150W Stanchion	2	165	330	PLED2 10L 4K AS UN CRW L5 BP	2	98	196
Effluent Pump Station (58) :								
Effluent Pump Station (58)	Outdoor MH 150W Stanchion	2	165	330	PLED2 10L 4K AS UN CRW L5 BP	2	98	196

Final Settling Tanks (16) :								
FST-1 (16)	Outdoor MH 150W Stanchion	3	165	495	PLED2 10L 4K AS UN CRW L5 BP	3	98	294
Final Settling Tanks (16) :								
FST-2 (16)	Outdoor MH 150W Stanchion	3	165	495	PLED2 10L 4K AS UN CRW L5 BP	3	98	294
Final Settling Tanks (16) :								
FST-3 (16)	Outdoor MH 150W Stanchion	3	165	495	PLED2 10L 4K AS UN CRW L5 BP	3	98	294
Final Settling Tanks (16) :								
FST-4 (16)	Outdoor MH 150W Stanchion	3	165	495	PLED2 10L 4K AS UN CRW L5 BP	3	98	294
Final Settling Tanks (16) :								
FST-5 (16)	Outdoor MH 150W Stanchion	3	165	495	PLED2 10L 4K AS UN CRW L5 BP	3	98	294
Final Settling Tanks (16) :								
FST-6 (16)	Outdoor MH 150W Stanchion	3	165	495	PLED2 10L 4K AS UN CRW L5 BP	3	98	294
Headworks Building (44) :								
Interm. Exterior (44)	Outdoor 175W Stanchion Mounted Metal Halide	4	175	700	PLED2 10L 4K AS UN CRW L5 BP	4	98	392

PS Valve Chamber (41) :								
PS Valve Chamber (41)	Outdoor MH 150W Stanchion	3	165	495	PLED2 10L 4K AS UN CRW L5 BP	3	98	294
Headworks Building (44) :								
Roof (44)	Outdoor 175W Stanchion Mounted Metal Halide	6	175	1,050	PLED2 10L 4K AS UN CRW L5 BP	6	98	588
Digester Ctrl Bldg (13) :								
Tanks (13)	Outdoor MH 150W Stanchion	3	165	495	PLED2 10L 4K AS UN CRW L5 BP	3	98	294
Total			**16184**	**135,885**			**8060**	**80,198**

Operational Overview

Operational Savings Summary

Operational Area	Current Annual ($)	Projected Annual ($)	Reduction (%)	Current 20 Year ($)	Projected 20 Year ($)	Reduction (%)
Energy [1, 2]	122,367	74,691	39	2,447,340	1,493,839	39
Maintenance [3]	32,424	20,660	36	648,489	413,200	36
Total	**154,791**	**95,351**	**38**	**3,095,829**	**1,907,039**	**38**

1. *Energy cost ($) = 0.1220/kWh; Annual energy cost escalation (%) = 0.00*
2. *Energy costs are averaged over 20 year analysis period*
3. *Maintenance costs are averaged over 20 year analysis period*

Upgrade Analysis

Fixture Replacement Summary

Existing Fixture	Qty	Proposed Fixture	Qty
2x2' 2 Lamp, U Tube F32 T8/T26 Parabolic	55	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	55
2x2' 2-Lamp Fluorescent T8	36	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	36
8' 2-Lamp, F96 T12/T38 Strip	23	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	23
Hazardous 250W MH (285W)	33	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	33
Incandescent 200W	9	19A21/2700-WHT DIM	9
Incandescent 60W	17	15A21/2700-WHT DIM	17
Metal Halide 175W	196	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	196
Metal Halide 250W (285W)	7	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	7
Outdoor 175W Stanchion Mounted Metal Halide	10	PLED2 10L 4K AS UN CRW L5 BP	10
Outdoor 250W Flood	13	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	13
Outdoor 250W Metal Halide	22	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	22
Outdoor 250W Metal Halide	42	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	42
Outdoor 250W Shoebox Pole Mounted Metal Halide	23	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	23
Outdoor 70W Wallpack	38	NWP L 030 7 40 T4 UNV BZ	38
Outdoor MH 150W Stanchion	30	PLED2 10L 4K AS UN CRW L5 BP	30
Total	**554**		**554**

Component Upgrade Summary

Existing Fixture	Qty	Proposed Upgrade	Qty
2x2' Fluorescent 3-Lamp T8	40	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	120
2x4' Fluorescent Strip 2-Lamp T8	380	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	760

2x4' Fluorescent Strip 3-Lamp T8	103	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	309
2x4' Hazardous 2-Lamp T8	14	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	28
Total Fixtures:	**537**	**Total Lamps:**	**1217**

Component Upgrade by Space

Area	Space	Existing Fixture	Qty	Proposed Upgrade	Qty	Scheduled Hours
Admin Annex (39)	Basement Level (39)	2x4' Fluorescent Strip 2-Lamp T8	4	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	8	8,760
Admin Annex (39)	Basement Level (39)	2x4' Fluorescent Strip 3-Lamp T8	6	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	8,760
Admin Annex (39)	First Floor (20)	2x2' Fluorescent 3-Lamp T8	12	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	36	8,760
Admin Annex (39)	First Floor (39)	2x2' Fluorescent 3-Lamp T8	1	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	3	8,760
Chem Handling & Feed System (72)	Sodium Hypo (72)	2x4' Fluorescent Strip 2-Lamp T8	8	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	16	8,760
Cogen/Sludge Drying Fac (38)	Cogen Ctrl Room (38)	2x2' Fluorescent 3-Lamp T8	14	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	42	8,760
Cogen/Sludge Drying Fac	Cogen Process	2x4' Fluorescent Strip 2-Lamp T8	18	Lamps: 2 PQL/SUPERIOR LIFE DLC	36	8,760

(38)	Room (38)			4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS		
Cogen/Sludge Drying Fac (38)	Cogen/Sludge Drying Fac (38)	2x4' Fluorescent Strip 3-Lamp T8	10	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	30	8,760
Cogen/Sludge Drying Fac (38)	Gas Compressor Room (38)	2x4' Hazardous 2-Lamp T8	7	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	14	8,760
Cogen/Sludge Drying Fac (38)	Hallway (38)	2x2' Fluorescent 3-Lamp T8	12	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	36	8,760
Effl Filter & UV Ctrl Bldg (56)	Effl Filter & UV Ctrl Bldg (56)	2x4' Fluorescent Strip 2-Lamp T8	9	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	8,760
Employee Facilities Bldg (29)	Lower Level (29)	2x4' Fluorescent Strip 2-Lamp T8	18	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	36	8,760
Headworks Building (44)	Caustic Soda (44)	2x4' Fluorescent Strip 3-Lamp T8	6	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	8,760
Headworks Building (44)	Electrical Room (44)	2x4' Fluorescent Strip 3-Lamp T8	18	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	54	8,760
Headworks Building (44)	HW Lower Level (44)	2x4' Fluorescent Strip 2-Lamp T8	5	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	10	8,760
Headworks	Interm. Level	2x4' Fluorescent Strip	9	Lamps: 3	27	8,760

Building (44)	(AHUs) (44)	3-Lamp T8		PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS		
Headworks Building (44)	Interm. Level Elev. Room	2x4' Fluorescent Strip 3-Lamp T8	1	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	3	8,760
Headworks Building (44)	Loading Dock (44)	2x4' Fluorescent Strip 3-Lamp T8	3	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	9	8,760
Headworks Building (44)	Odor Control (44)	2x4' Fluorescent Strip 3-Lamp T8	6	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	8,760
Headworks Building (44)	Stair 1 (44)	2x4' Fluorescent Strip 2-Lamp T8	10	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	20	8,760
Laboratory Building (20)	Lab Bldg (20)	2x2' Fluorescent 3-Lamp T8	1	Lamps: 3 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	3	8,760
Laboratory Building (20)	Lab Bldg (20)	2x4' Fluorescent Strip 3-Lamp T8	44	Lamps: 3 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	132	8,760
Maintenance Shop (25)	Lower Level (25)	2x4' Fluorescent Strip 2-Lamp T8	6	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	12	8,760
Maintenance Shop (25)	Upper Level (25)	2x4' Fluorescent Strip 2-Lamp T8	4	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	8	8,760

Methane Filter Building (26)	Methane Filter Building (26)	2x4' Fluorescent Strip 2-Lamp T8	8	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	16	8,760
Pump & Blower Building (06)	Basement Level (06)	2x4' Fluorescent Strip 2-Lamp T8	57	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	114	8,760
Pump & Blower Building (06)	Blower Room (06)	2x4' Fluorescent Strip 2-Lamp T8	2	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	4	8,760
Pump & Blower Building (06)	Office (06)	2x4' Fluorescent Strip 2-Lamp T8	9	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	18	8,760
Pump & Blower Building (06)	Old Generator Room (06)	2x4' Fluorescent Strip 2-Lamp T8	3	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	6	8,760
Pump & Blower Building (06)	Unit Substation (06)	2x4' Fluorescent Strip 2-Lamp T8	16	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	32	8,760
Return Sludge PS (62)	Electrical Room (62)	2x4' Fluorescent Strip 2-Lamp T8	10	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	20	8,760
Rotary Drum Thick Fac (34)	Electrical Room (34)	2x4' Fluorescent Strip 2-Lamp T8	8	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	16	8,760
Rotary Drum Thick Fac (34)	OCS Room (34)	2x4' Hazardous 2-Lamp T8	7	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	14	8,760

Service Building (04)	Boiler, Old & New Chlorine Rms.	2x4' Fluorescent Strip 2-Lamp T8	12	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	24	8,760
Service Building (04)	Corridor & Open Well (04)	2x4' Fluorescent Strip 2-Lamp T8	14	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	28	8,760
Service Building (04)	Electrical Room (04)	2x4' Fluorescent Strip 2-Lamp T8	4	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	8	8,760
Sludge Dewatering Bldg (27)	2nd Flr Centrifuge Rm (27)	2x4' Fluorescent Strip 2-Lamp T8	54	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	108	8,760
Sludge Dewatering Bldg (27)	Electrical Room (27)	2x4' Fluorescent Strip 2-Lamp T8	10	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	20	8,760
Sludge Dewatering Bldg (27)	Mechanical Room (27)	2x4' Fluorescent Strip 2-Lamp T8	6	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	12	8,760
Sludge Dewatering Bldg (27)	NE Pump Room (27)	2x4' Fluorescent Strip 2-Lamp T8	20	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	40	8,760
Sludge Dewatering Bldg (27)	Polymer Pump Room (27)	2x4' Fluorescent Strip 2-Lamp T8	16	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	32	8,760
Sludge Dewatering Bldg (27)	Storage Room (27)	2x4' Fluorescent Strip 2-Lamp T8	5	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	10	8,760

Sludge Dewatering Bldg (27)	Truck Loading (27)	2x4' Fluorescent Strip 2-Lamp T8	15	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	30	8,760
Tunnels (35)	Tunnels (35)	2x4' Fluorescent Strip 2-Lamp T8	29	Lamps: 2 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	58	8,760
		Total Fixtures:	**537**	**Total Lamps:**	**1,217**	

Bill of Materials

Products

Fixtures

Part Number	Short Description	Qty	Cost ($)	Extended ($)
ALED3T150RG	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	65	760.00	49,400.00
HPLED 70 700 4K AS UN L5	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	62	720.00	44,640.00
22EN-LD1-34-UNV-L840-CD1-U	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	91	200.00	18,200.00
FXLED78SF	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	13	500.00	6,500.00
HBL-60LU-5K-W-070-WH	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	196	330.00	64,680.00
15A21/2700-WHT DIM	15A21/2700-WHT DIM	17	5.00	85.00
19A21/2700-WHT DIM	19A21/2700-WHT DIM	9	10.00	90.00
PTNSL8 AD2 LP835 DNA EPL PLR1 V…	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	23	270.00	6,210.00
NWP L 030 7 40 T4 UNV BZ	NWP L 030 7 40 T4 UNV BZ	38	240.00	9,120.00
PLED2 10L 4K AS UN CRW L5 BP	PLED2 10L 4K AS UN CRW L5 BP	40	350.00	14,000.00
Total				**212,925.00**

Lamps

Part Number	Short Description	Qty	Cost ($)	Extended ($)
PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	1,097	10.50	11,518.50
PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	120	8.85	1,062.00
Total				**12,580.50**

Installation

Description	Qty	Cost ($)	Extended ($)
Existing Lamp Demo	309	2.10	648.90
Wiring/Contact Rework	103	25.00	2,575.00
Existing Ballast Demo	103	17.50	1,802.50
New LED WP Installation	38	105.00	3,990.00
Existing HID Demo	38	46.50	1,767.00
LED Installation	13	105.00	1,365.00
Existing Ballast/Fixture Demo	13	42.50	552.50
Existing Lamp Demo	13	6.15	79.95
Metal Halide Ballast Demo	40	17.45	698.00
LED Installation	40	105.00	4,200.00
Metal Halide Lamp Demo	40	6.15	246.00
LED Installation	91	73.50	6,688.50
Troffer Ballast Demo	91	17.45	1,587.95
Troffer Lamp Demo	182	2.10	382.20
LED C1D2 Installation Lamp & mounting Hardware	62	155.00	9,610.00
Hazardous (C1D2) Metal Halide Demolition	62	77.50	4,805.00
LED Installation	65	155.00	10,075.00
Metal Halide Ballast & Fixture Demo	42	155.00	6,510.00
Ballast Removal	40	17.50	700.00
Wiring/Contact Rework	40	25.00	1,000.00
Existing Lamp Demo	120	2.10	252.00
LED Installation	9	5.00	45.00
Fluorescent lamp demo	46	2.10	96.60
Fluorescent ballast demo	23	17.45	401.35
LED Installation	23	68.50	1,575.50
Existing Ballast Demo	196	17.45	3,420.20
Existing Lamp Demo	196	6.15	1,205.40
LED Installation	196	155.00	30,380.00
LED Installation	17	5.00	85.00
Existing Ballast Demo	394	17.50	6,895.00
Wiring/Contact Rework	394	25.00	9,850.00
Existing Lamp Demo	788	2.10	1,654.80

Total			**115,144.35**

Bill of Materials By Efficiency Measures

100W & 200W Incandescent Bulbs - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
19A21/2700-WHT DIM	Fixture	19A21/2700-WHT DIM	9	10.00	90.00
LED Installation	Services	LED Installation	9	5.00	45.00
Total					**135.00**

2', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	Lamp	PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS	120	8.85	1,062.00
Ballast Removal	Services	Ballast Removal	40	17.50	700.00
Wiring/Contact Rework	Services	Wiring/Contact Rework	40	25.00	1,000.00
Existing Lamp Demo	Services	Existing Lamp Demo	120	2.10	252.00
Total					**3,014.00**

2'x2' U-Bent Troffer Fixtures - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
22EN-LD1-34-UNV-L840-CD1-U	Fixture	22EN Series,2x2 Troffer LED,34.8W,3400Lm,4000K,Dimming,Unit Pack	91	200.00	18,200.00
LED Installation	Services	LED Installation	91	73.50	6,688.50
Troffer Ballast Demo	Services	Troffer Ballast Demo	91	17.45	1,587.95
Troffer Lamp Demo	Services	Troffer Lamp Demo	182	2.10	382.20
Total					**26,858.65**

4', 2-Lamp T8s - Retain Fixture, Upgrade Lamps to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)

PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	Lamp	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	788	10.50	8,274.00
Existing Ballast Demo	Services	Existing Ballast Demo	394	17.50	6,895.00
Wiring/Contact Rework	Services	Wiring/Contact Rework	394	25.00	9,850.00
Existing Lamp Demo	Services	Existing Lamp Demo	788	2.10	1,654.80
Total					**26,673.80**

4', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	Lamp	PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS	309	10.50	3,244.50
Existing Lamp Demo	Services	Existing Lamp Demo	309	2.10	648.90
Wiring/Contact Rework	Services	Wiring/Contact Rework	103	25.00	2,575.00
Existing Ballast Demo	Services	Existing Ballast Demo	103	17.50	1,802.50
Total					**8,270.90**

60W Incandescent Bulbs - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
15A21/2700-WHT DIM	Fixture	15A21/2700-WHT DIM	17	5.00	85.00
LED Installation	Services	LED Installation	17	5.00	85.00
Total					**170.00**

8', 2-Lamp T12 Fixtures - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)

PTNSL8 AD2 LP835 DNA EPL PLR1 V...	Fixture	PTNSL8 Series, 8' Strip for HighBay,LED,92W,3500K,120-277V	23	270.00	6,210.00
Fluorescent lamp demo	Services	Fluorescent lamp demo	46	2.10	96.60
Fluorescent ballast demo	Services	Fluorescent ballast demo	23	17.45	401.35
LED Installation	Services	LED Installation	23	68.50	1,575.50
Total					**8,283.45**

Indoor 175W HID Fixtures - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
HBL-60LU-5K-W-070-WH	Fixture	LED Highbay,HBL Series,60L,139W,120-277V,LED,13472Lumens,5000K	196	330.00	64,680.00
Existing Ballast Demo	Services	Existing Ballast Demo	196	17.45	3,420.20
Existing Lamp Demo	Services	Existing Lamp Demo	196	6.15	1,205.40
LED Installation	Services	LED Installation	196	155.00	30,380.00
Total					**99,685.60**

Indoor Damp/Hazardous 250W HID Susp. Fixture - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
HPLED 70 700 4K AS UN L5	Fixture	HPLED 70 700 4K AS UN L5 Class 1 Div 2 LED	62	720.00	44,640.00
LED C1D2 Installation Lamp & mounting Hardware	Services	LED C1D2 Installation Lamp & mounting Hardware	62	155.00	9,610.00
Hazardous (C1D2) Metal Halide Demolition	Services	Hazardous (C1D2) Metal Halide Demolition	62	77.50	4,805.00
Total					**59,055.00**

Outdoor 250W Area & Roadway HID Fixtures - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
ALED3T150RG	Fixture	ALED3T150RG-150W-LED AreaLight-12526Lm-5000K-DLC	65	760.00	49,400.00

LED Installation	Services	LED Installation	65	155.00	10,075.00
Metal Halide Ballast & Fixture Demo	Services	Metal Halide Ballast & Fixture Demo	42	155.00	6,510.00
Total					**65,985.00**

Outdoor 250W HID Floodlight Fixtures - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
FXLED78SF	Fixture	FXLED Sries-78W-LED-Floodlight-7597Lm-5100K-DLC	13	500.00	6,500.00
LED Installation	Services	LED Installation	13	105.00	1,365.00
Existing Ballast/Fixture Demo	Services	Existing Ballast/Fixture Demo	13	42.50	552.50
Existing Lamp Demo	Services	Existing Lamp Demo	13	6.15	79.95
Total					**8,497.45**

Outdoor 70W Wallpack Fixtures - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
NWP L 030 7 40 T4 UNV BZ	Fixture	NWP L 030 7 40 T4 UNV BZ	38	240.00	9,120.00
New LED WP Installation	Services	New LED WP Installation	38	105.00	3,990.00
Existing HID Demo	Services	Existing HID Demo	38	46.50	1,767.00
Total					**14,877.00**

Outdoor Stanchion Mounted HID Fixtures - Upgrade to LED

Part Number	Type	Short Description	Qty	Cost ($)	Extended ($)
PLED2 10L 4K AS UN CRW L5 BP	Fixture	PLED2 10L 4K AS UN CRW L5 BP	40	350.00	14,000.00
Metal Halide Ballast Demo	Services	Metal Halide Ballast Demo	40	17.45	698.00
LED Installation	Services	LED Installation	40	105.00	4,200.00
Metal Halide Lamp Demo	Services	Metal Halide Lamp Demo	40	6.15	246.00

Total					**19,144.00**

Appendix

Incentives

Part Number Description	Incentive Description	Amount ($)	Est. Receipt Date
Custom	EnergyStar Screw Bulbs A15	170.00	Immediate
Custom	EnergyStar Screw Bulbs A19	90.00	Immediate
Custom	LED High Bay & Low Bay Fixtures for Commercial & Industrial Bldg	9,300.00	Immediate
Custom	LED High Bay & Low Bay Fixtures for Commercial & Industrial Bldg	3,450.00	Immediate
Custom	LED High Bay & Low Bay Fixtures for Commercial & Industrial Bldg	29,400.00	Immediate
Custom	LED Linear Replacement Lamps (2'&4' Only)	1,545.00	Immediate
Custom	LED Linear Replacement Lamps (2'&4' Only)	600.00	Immediate
Custom	LED Linear Replacement Lamps (2'&4' Only)	3,940.00	Immediate
Custom	LED Outdoor Pole/Arm-Mounted Area & Rdwy Luminaires	6,500.00	Immediate
Custom	LED Outdoor Pole/Arm-Mounted Area and Rdwy Luminaires	4,000.00	Immediate
Custom	LED Outdoor Wall-Mounted Area Luminaires	3,800.00	Immediate
Custom	LED Outdoor Wall-Mounted Area Luminaires	1,300.00	Immediate
Custom	LED Replacement of 32W T8 System	910.00	Immediate
Total		**65,005.00**	

Financial Assumptions

Cost of Capital (%)	Analysis Period (yrs)	Energy Cost ($/kWh)
3.0	20	0.1220

Efficiency Measure Assumptions

100W & 200W Incandescent Bulbs - Upgrade to LED Assumptions

Replacement of 100W & 200W incandescents with LED bulbs.New LEDs are rated for 25,000 hours.

2', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED Assumptions

Existing lamps in 3-lamp 2' T8s to be replaced with linear LEDs. Lamp life is over doubled and wattage is halved. Ballast is to be removed and wiring rework may be required if shunted tombstones are existing.

2'x2' U-Bent Troffer Fixtures - Upgrade to LED Assumptions

2x2 U-Bent troffers replaced with LED fixtures of comparable lumen output.New LEDs have 60,000 hour life. Plug and play LEDs not recommended for U-bent lamps.

4', 2-Lamp T8s - Retain Fixture, Upgrade Lamps to LED Assumptions

LED tubes to replace fluorescent T8 lamps in existing 2-lamp fixtures. Lamp life is over doubled and wattage almost halved. Lamps are to be replaced in pendant mounted as well as recessed fixtures. Ballast is to be removed and rewiring is required.

4', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED Assumptions

In existing 3-lamp T8 fixtures, lamps are to be replaced with LED tubes. Lamp life is over doubled and wattage nearly halved. Lamps are to be replaced in pendant mounted as well as recessed fixtures. Ballast is to be removed, and contacts in fixture may need to be reworked to non-shunted tombstones if shunted tombstones are present.

60W Incandescent Bulbs - Upgrade to LED Assumptions

Replacement of 60W incandescent bulbs with LEDs.New bulbs are rated for 25,000 hours.

8', 2-Lamp T12 Fixtures - Upgrade to LED Assumptions

8' 2-lamp T12s replaced with LEDs of 60,000 hr life.

Indoor 175W HID Fixtures - Upgrade to LED Assumptions

Indoor 175W metal halide fixtures replaced with LED fixture of comparable lumen output.Care should be taken to order proper voltage, housing, and mounting options.

Indoor Damp/Hazardous 250W HID Susp. Fixture - Upgrade to LED Assumptions

Replacement of Class 1 Div 2 250W MH with LED.Proposed fixtures are rated for 100,000 hours.

Outdoor 250W Area & Roadway HID Fixtures - Upgrade to LED Assumptions

Replacement of pole mounted site lighting with LEDs.Some current roadway and area lighting is at 208V.Proposed LED fixtures are rated for 100,000 hours. Payback period will be much more favorable two years from now as LED fixture price drops.

Outdoor 250W HID Floodlight Fixtures - Upgrade to LED Assumptions

Medium outdoor floodlights replaced with LEDs of comparable output.Proposed LEDs are rated for 100,000 hours.

Outdoor 70W Wallpack Fixtures - Upgrade to LED Assumptions

70W wall packs replaced with LEDs of comparable lumen output.New LEDs are rated for 100,000 hours.

Outdoor Stanchion Mounted HID Fixtures - Upgrade to LED Assumptions

Outdoor 150W and 175W metal halides replaced with LEDs of comparable output.Proposed LEDs rated for 100,000 hours.

Installation Assumptions

100W & 200W Incandescent Bulbs - Upgrade to LED Installation Assumptions

LED Installation :

2', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED Installation Assumptions

Ballast Removal : RSMEANS 26 05 05.50 5000

Wiring/Contact Rework : Assume 30 min at $50/hr.

Existing Lamp Demo : RSMEANS 26 05 05.50 6010

2'x2' U-Bent Troffer Fixtures - Upgrade to LED Installation Assumptions

LED Installation : RSMEANS 26 51 13.55 1200

Troffer Ballast Demo : RSMEANS 26 05 05.50 5000

Troffer Lamp Demo : RSMEANS 26 05 05.50 6010

4', 2-Lamp T8s - Retain Fixture, Upgrade Lamps to LED Installation Assumptions

Existing Ballast Demo : RSMEANS 26 05 05.50 5000

Wiring/Contact Rework : 30 min at $50/hr

Existing Lamp Demo : RSMEANS 26 05 05.50 6010

4', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED Installation Assumptions

Existing Lamp Demo : RSMEANS 26 05 05.50 6010

Wiring/Contact Rework : 30 min at $50/hr.

Existing Ballast Demo : RSMEANS 26 05 05.50 5000

60W Incandescent Bulbs - Upgrade to LED Installation Assumptions

LED Installation :

8', 2-Lamp T12 Fixtures - Upgrade to LED Installation Assumptions

Fluorescent lamp demo : RSMEANS 26 05 05.50 6010

Fluorescent ballast demo : RSMEANS 26 05 05.50 5000

LED Installation : RSMEANS 26 51 13.55 3010

Indoor 175W HID Fixtures - Upgrade to LED Installation Assumptions

Existing Ballast Demo : RSMEANS 26 05 05.50 5040

Existing Lamp Demo : RSMEANS 26 05 05.50 6030

LED Installation : RSMEANS 26 51 13.55 4000

Indoor Damp/Hazardous 250W HID Susp. Fixture - Upgrade to LED Installation Assumptions

LED C1D2 Installation Lamp & mounting Hardware : RSMEANS 26 51 13.55 4010

Hazardous (C1D2) Metal Halide Demolition : RSMEANS 26 05 05.50 4020

Outdoor 250W Area & Roadway HID Fixtures - Upgrade to LED Installation Assumptions

LED Installation : RSMEANS 26 56 23.10 0160

Metal Halide Ballast & Fixture Demo : Assume same labor as installation.

Outdoor 250W HID Floodlight Fixtures - Upgrade to LED Installation Assumptions

LED Installation :

Existing Ballast/Fixture Demo : RSMEANS 26 05 05.50 5040

Existing Lamp Demo : RSMEANS 26 0505.50 6030

Outdoor 70W Wallpack Fixtures - Upgrade to LED Installation Assumptions

New LED WP Installation : RSMEANS 26 56 23.55 0410

Existing HID Demo : RSMEANS 26 05 05.50 4050

Outdoor Stanchion Mounted HID Fixtures - Upgrade to LED Installation Assumptions

Metal Halide Ballast Demo : RSMEANS 26 05 05.50 5040

LED Installation : RSMEANS 26 56 23.55

Metal Halide Lamp Demo : RSMEANS 26 05 05.50 6030

Maintenance Assumptions

100W & 200W Incandescent Bulbs - Upgrade to LED Maintenance Assumptions

Proposed Maintenance : Material cost from bulbs.com.

2', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED Maintenance Assumptions

Existing Maintenance :Assume 6 minutes at $50/hr for lamp replacement. Ballast values from RSMEANS 26 51 13.50 7520.

2'x2' U-Bent Troffer Fixtures - Upgrade to LED Maintenance Assumptions

Existing Maintenance :Lamp labor based on 5 minutes at $50/hr. Ballast cost and labor based on RSMEANS 26 51 13.50 7520.

4', 2-Lamp T8s - Retain Fixture, Upgrade Lamps to LED Maintenance Assumptions

Existing Maintenance :Labor based on 6 minutes at $50/hr. Ballast values based on RSMEANS 26 51 13.50 7520.

4', 3-Lamp T8s - Retain Fixture, Upgrade Lamps to LED Maintenance Assumptions

Existing Maintenance :Assume six minutes to install lamp at $50/hr. Ballast values based on RSMEANS 26 51 13.50 7520.

60W Incandescent Bulbs - Upgrade to LED Maintenance Assumptions

There are no maintenance assumptions to be presented.

8', 2-Lamp T12 Fixtures - Upgrade to LED Maintenance Assumptions

Existing Maintenance :Ballast cost and labor RSMEANS 26 51 13.50 7520.
Proposed Maintenance : Assume 30 min installation at $50/hr.

Indoor 175W HID Fixtures - Upgrade to LED Maintenance Assumptions

Existing Maintenance :Assume six minutes for replacement at $50/hr. Ballast values based on RSMEANS 26 51 13.90 7610.

Indoor Damp/Hazardous 250W HID Susp. Fixture - Upgrade to LED Maintenance Assumptions

Existing Maintenance :RSMEANS 26 51 13.90 7580 for ballast cost and labor. Bulbs.com for lamp replacement. Assume 5 minutes at $50/hr for bulb replacement.
Proposed Maintenance : 1 hour replacement labor at $50/hr.

Outdoor 250W Area & Roadway HID Fixtures - Upgrade to LED Maintenance Assumptions

Existing Maintenance :Assume 1 hr for pole mounted lamp replacement and 2 hours for pole mounted ballast replacement. Ballast cost based on RSMEANS.

Outdoor 250W HID Floodlight Fixtures - Upgrade to LED Maintenance Assumptions

Existing Maintenance :Ballast values based on RSMEANS 26 51 13.90 7620.
Proposed Maintenance : Assume 1 hour LED replacement at $50/hr.

Outdoor 70W Wallpack Fixtures - Upgrade to LED Maintenance Assumptions

Existing Maintenance :Ballast cost and labor RSMEANS 26 56 23.10 1160.
Proposed Maintenance : RSMEANS 26 56 23.55 410

Outdoor Stanchion Mounted HID Fixtures - Upgrade to LED Maintenance Assumptions

Existing Maintenance :Replacement cost and labor based on RSMEANS 26 56 23.90 1180, RSMEANS 26 51 13.90 7610.
Proposed Maintenance : RSMEANS 26 56 23.55

LIGHTWORX LED & ELECTRIC SUPPLY, LLC
382 E. WESTFIELD AVE
ROSELLE PARK, NJ 07204 US
(732) 900-7519
lightworxled@gmail.com
www.worxled.net

ADDRESS
ZACHERY BARRETT
CDM SMITH
75 STATES ST, SUITE 701
BOSTON, MA 02109

SHIP TO
ZACHERY BARRETT
CDM SMITH
75 STATES ST, SUITE 701
BOSTON, MA 02109

QUOTE 1187

DATE 03/29/2016

P.O. NUMBER
RAHWAY

ACTIVITY	QTY	RATE	AMOUNT
90537 PQL/SUPERIOR LIFE DLC 4FT LED 18 WATT T8 TUBE 4000K 1915 LUMENS 120-277V	1,124	10.50	11,802.00T
90541 PQL/SUPERIOR LIFE DLC 2FT LED 9 WATT T8 TUBE 4000K 950 LUMENS 120-277V	120	8.85	1,062.00T

TERMS IN ADVANCE
BANK TT OR CHECK
CREDIT CARD CHARGES SUBJECT TO 4% SERVICE FEE
IF YOU HAVE A TAX EXEMPT FORM TAXES WILL BE WAIVED
FREE SHIPPING
ATTACHED ARE SPECS AND DLC LISTING

SUBTOTAL	12,864.00
TAX (7%)	900.48
TOTAL	**$13,764.48**

Accepted By

Accepted Date

Please make checks payable to:
LightWORX LED & Electric Supply, LLC
382 E. Westfield Ave.
Roselle Pk, NJ 07204

PREMIUM QUALITY LIGHTING

90537
LINEAR LED T8
TECHNICAL DATA SHEET

FEATURES

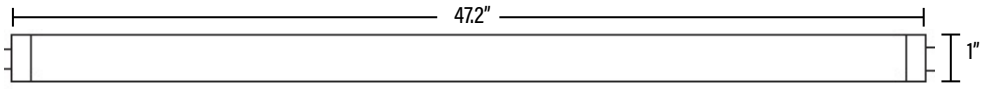


T8 LED tube lamp provides exceptional LED lighting with reduced energy and maintenance costs. The linear LED does not require a ballast to work and offers a built-in universal line voltage driver, making it a top-of-the-line replacement for standard fluorescent lamps.

- Simple rewiring installation allows lamps to run off main
- Wide beam design - 240° light emitting area
- Exceptional efficacy
- No flickering

SPECIFICATIONS	
Power Consumption	**18W**
Input Voltage	120-277V
Input Current	82-200
Power Factor	0.9
Lumens	1915
Luminous Efficiency	106 Lm/W
Color Temperature	4000K
CRI	82
LED Quantity	120
Beam Angle	240°
Average Life	50,000
Dimension (Inches)	47.2"(L) x 1"(DIA)

DIMENSIONS



ORDERING

ITEM#	DESCRIPTION	WATT	LED	LED QTY	COLOR	LUMENS	CRI	VOLT	HOURS	CASE
90537	LED SMD 4' 18WT8/40K/FR/V4 - SUPERIOR LIFE® **DLC**	18	SMD	120	4000K	1915	82	120-277V	50,000	25

Please check DLC website for the most current list of approved items • www.designlights.org
Published lumens on LED products are approximate and may vary slightly.

P.Q.L., INC. • 2285 WARD AVENUE • SIMI VALLEY, CA 93065 • 800.323.8107 • FAX: 877.619.7053
www.PQLighting.com

PREMIUM QUALITY LIGHTING

90541
LINEAR LED T8
TECHNICAL DATA SHEET

Superior Life®

FEATURES

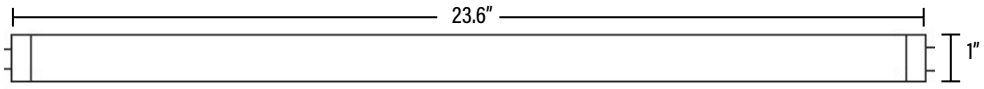


T8 LED tube lamp provides exceptional LED lighting with reduced energy and maintenance costs. The linear LED does not require a ballast to work and offers a built-in universal line voltage driver, making it a top-of-the-line replacement for standard fluorescent lamps.

- Simple rewiring installation allows lamps to run off main
- Wide beam design - 240° light emitting area
- Exceptional efficacy
- No flickering

SPECIFICATIONS	
Power Consumption	**9W**
Input Voltage	120-277V
Input Current	41-100
Power Factor	0.9
Lumens	950
Luminous Efficiency	105 Lm/W
Color Temperature	4000K
CRI	82
LED Quantity	60
Beam Angle	240°
Average Life	50,000
Dimension (Inches)	23.6"(L) x 1"(DIA)

DIMENSIONS



ORDERING

ITEM#	DESCRIPTION	WATT	LED	LED QTY	COLOR	LUMENS	CRI	VOLT	HOURS	CASE
90541	LED SMD 2' 9WT8/40K/FR/V4 - SUPERIOR LIFE® **DLC**	9	SMD	60	4000K	950	82	120-277V	50,000	25

Please check DLC website for the most current list of approved items • www.designlights.org
Published lumens on LED products are approximate and may vary slightly.

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www.PQLighting.com

Appendix C
Engineer's Opinion of Probable Construction Cost

11 British American Blvd
Latham, NY 12110
Phone (518) 782-4500
Fax (518) 786-3810

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Created By **C. Dowd**
Reviewed By **B. McLean**

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
	Central Hot Water Loop Connection									
1	4" Burried Insulated Steel Pipe	200	L.F.	$ 42.00	$ 8,400.00	200	L.F.	$ 6.20	$ 1,240.00	$ 9,640.00
2	2" Burried Insulated Steel Pipe	400	L.F.	$ 39.00	$ 15,600.00	400	L.F.	$ 3.49	$ 1,396.00	$ 16,996.00
3	Pump, 4" connection, 10 HP	2	Ea	$ 2,900.00	$ 5,800.00	2	Ea	$ 480.00	$ 960.00	$ 6,760.00
4	Pump, 2" connection, 3 HP	2	Ea	$ 5,225.00	$ 10,450.00	2	Ea	$ 695.00	$ 1,390.00	$ 11,840.00
5	Digital Controller	2	Ea	$ 6,075.00	$ 12,150.00	2	Ea	$ -	$ -	$ 12,150.00
	Subtotal				52,400.00				4,986.00	

Cost data obtained from RSMeans CostWorks 2015 and vendor pricing.

SUBTOTAL =	$	57,386.00
MARKUP % =	$	0.15
MARKUP =	$	8,607.90
SUB-TOTAL w/ OH & P =	$	65,993.90
CONTINGENCY % =		0.25
CONTINGENCY =	$	16,498.48
BUDGET COST ESTIMATE =	$	82,492.38

Notes:
1. Bonds not included in estimate.
2. Escalation not included in estimate.
3. CDM has no control over the cost of labor, materials, equipment, services furnished or market conditions.
4. CDM does not guarantee that this opinion will not vary from actual cost, or contractor's bids.
5. Estimates do not include site conditions that may be required as part of the project. These may include abatement, remediation, or structural work.
6. Estimate assumes associated systems are available and in good working order. This includes existing chimney and venting, combustion air, floor drains, electrical and local controls.

o "This is an Opinion of Probable Construction Cost only. CDM has no control over the cost of labor, materials, equipment, or services furnished, over schedules, over contractor's methods of determining prices, competitive bidding, market conditions or negotiating terms. CDM does not guarantee that this opinion will not vary from actual cost, or contractor's bids. There are not any costs provided for: Change Orders, Design Engineering, Construction Oversight, Client Costs, Finance or Funding Costs, Legal Fees, Land Acquisition or temporary/permanent Easements, Operations, or any other costs associated with this project that are not specifically part of the bidding contractor's proposed scope.

11 British American Blvd
Latham, NY 12110
Phone (518) 782-4500
Fax (518) 786-3810

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Created By **C. Dowd**
Reviewed By **B. McLean**

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
	Admin. Annex: Condensing Boiler									
1	Gas Boiler Removal (199 MBH)	1	Ea			1	Ea	$ 2,950.00	$ 2,950.00	$ 2,950.00
2	Condensing Boiler (199 MBH)	1	Ea	$ 3,025.00	$ 3,025.00	1	Ea	$ 1,450.00	$ 1,450.00	$ 4,475.00
3	1" Steel Gas Pipe (10')	10	L.F.	$ 4.30	$ 43.00	10	L.F.	$ 15.95	$ 159.50	$ 202.50
4	1" Hot Water Pipe (20')	20	L.F.	$ 4.30	$ 86.00	20	L.F.	$ 15.95	$ 319.00	$ 405.00
5	3" PVC (20')	20	L.F.	$ 13.00	$ 260.00	20	L.F.	$ 21.00	$ 420.00	$ 680.00
	Subtotal				3,154.00				4,878.50	

Cost data obtained from RSMeans CostWorks 2015 and vendor pricing.

SUBTOTAL =	$ 8,712.50
MARKUP % =	$ 0.15
MARKUP =	$ 1,306.88
SUB-TOTAL w/ OH & P =	$ 10,019.38
CONTINGENCY % =	0.25
CONTINGENCY =	$ 2,504.84
BUDGET COST ESTIMATE =	$ 12,524.22

Notes:
1. Bonds not included in estimate.
2. Escalation not included in estimate.
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4. CDM does not guarantee that this opinion will not vary from actual cost, or contractor's bids.
5. Estimates do not include site conditions that may be required as part of the project. These may include abatement, remediation, or structural work.
6. Estimate assumes associated systems are available and in good working order. This includes existing chimney and venting, combustion air, floor drains, electrical and local controls.

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11 British American Blvd
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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Created By **C. Dowd**
Reviewed By **B. McLean**

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
	Admin.: Condensing Boiler									
1	Gas Boiler Removal (400 MBH)	1	1.00			1	Ea	$ 2,950.00	$ 2,950.00	$ 2,950.00
2	Condensing Boiler (400 MBH)	1	Ea	$ 3,025.00	$ 3,025.00	1	Ea	$ 1,450.00	$ 1,450.00	$ 4,475.00
3	1" Steel Gas Pipe (10')	10	L.F.	$ 4.30	$ 43.00	10	L.F.	$ 15.95	$ 159.50	$ 202.50
4	1" Hot Water Pipe (20')	20	L.F.	$ 4.30	$ 43.00	20	L.F.	$ 15.95	$ 319.00	$ 362.00
5	3" PVC (20')	20	L.F.	$ 13.00	$ 260.00	20	L.F.	$ 21.00	$ 420.00	$ 680.00
	Subtotal				3,111.00				4,878.50	

Cost data obtained from RSMeans CostWorks 2015 and vendor pricing.

SUBTOTAL =	$	8,669.50
MARKUP % =	$	0.15
MARKUP =	$	1,300.43
SUB-TOTAL w/ OH & P =	$	9,969.93
CONTINGENCY % =		0.25
CONTINGENCY =	$	2,492.48
BUDGET COST ESTIMATE =	$	12,462.41

Notes:
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6. Estimate assumes associated systems are available and in good working order. This includes existing chimney and venting, combustion air, floor drains, electrical and local controls.

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ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
	Dewatering: Condensing Boiler									
1	Gas Boiler Removal (3295 MBH)	1	1.00			1	Ea	$ 2,950.00	$ 2,950.00	$ 2,950.00
2	Condensing Boiler (3295 MBH)	1	Ea	$ 53,000.00	$ 53,000.00	1	Ea	$ 11,300.00	$ 11,300.00	$ 64,300.00
3	2" Steel Gas Pipe (10')	10	L.F.	$ 8.30	$ 83.00	10	L.F.	$ 30.95	$ 309.50	$ 392.50
4	3" Hot Water Pipe (20')	20	L.F.	$ 4.30	$ 86.00	20	L.F.	$ 11.65	$ 233.00	$ 319.00
5	6" Stainless Steel (20')	20	L.F.	$ 23.00	$ 460.00	20	L.F.	$ 21.00	$ 420.00	$ 880.00
	Subtotal				53,169.00				15,212.50	

Cost data obtained from RSMeans CostWorks 2015 and vendor pricing.

SUBTOTAL =	$	68,841.50
MARKUP % =	$	0.15
MARKUP =	$	10,326.23
SUB-TOTAL w/ OH & P =	$	79,167.73
CONTINGENCY % =		0.25
CONTINGENCY =	$	19,791.93
BUDGET COST ESTIMATE =	$	98,959.66

Notes:
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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Created By **C. Dowd**
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ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
	Employee Facilities: Furnace									
1	Removal of Existing Furnace	1	Ea	$ -	$ -	1	Ea	$ 355.00	$ 355.00	$ 355.00
2	Removal of Existing Unit Heaters	1	Ea	$ -	$ -	1	Ea	$ 355.00	$ 355.00	$ 355.00
3	Removal of Existing Make up Air Unit Burner	1	Ea	$ -	$ -	1	Ea	$ 375.00	$ 375.00	$ 375.00
4	Condensing Boiler 500 MBH	1	Ea	$ 14,000.00	$ 14,000.00	1	Ea	$ 405.00	$ 405.00	$ 14,405.00
5	Water coils for MAU	1	Ea	$ 1,600.00	$ 1,600.00	1	Ea	$ 405.00	$ 405.00	$ 2,005.00
6	Condensing Furnace, 100 MBH	1	Ea	$ 5,750.00	$ 5,750.00	1	Ea	$ 310.00	$ 310.00	$ 6,060.00
7	New hot water Heater (85 MBH)	1	Ea	$ 690.00	$ 690.00	1	Ea	$ 172.00	$ 172.00	$ 862.00
	Subtotal				22,040.00				2,377.00	

Cost data obtained from RSMeans CostWorks 2015 and vendor pricing.

SUBTOTAL =	$	24,417.00
MARKUP % =	$	0.15
MARKUP =	$	3,662.55
SUB-TOTAL w/ OH & P =	$	28,079.55
CONTINGENCY % =		0.25
CONTINGENCY =	$	7,019.89
BUDGET COST ESTIMATE =	$	35,099.44

Notes:
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Created By **C. Dowd**
Reviewed By **B. McLean**

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
	Laboratory: Heating System Upgrade									
1	Removal of RTU Furnace (1150 MBH)	1	Ea		$ -	1	Ea	$ 2,950.00	$ 2,950.00	$ 2,950.00
2	New Rooftop Unit (1150 MBH)	1	Ea	$ 168,000.00	$ 168,000.00	1	Ea	$14,800.00	$ 14,800.00	$ 182,800.00
	Subtotal				168,000.00				17,750.00	

Cost data obtained from RSMeans CostWorks 2015 and vendor pricing.

SUBTOTAL =	$	185,750.00
MARKUP % =	$	0.15
MARKUP =	$	27,862.50
SUB-TOTAL w/ OH & P =	$	213,612.50
CONTINGENCY % =		0.25
CONTINGENCY =	$	53,403.13
BUDGET COST ESTIMATE =	$	267,015.63

Notes:
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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Created By **C. Dowd**
Reviewed By **B. McLean**

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
	Utility Garage: Furnace									
1	Removal of Existing Unit Heater (150 MBH)	1	Ea			1	Ea	$ 355.00	$ 355.00	$ 355.00
2	Removal of Existing Unit Heater (250 MBH)	1	Ea			1	Ea	$ 355.00	$ 355.00	$ 355.00
3	New Unit Heater (150 MBH)	1	Ea	$ 2,700.00	$ 2,700.00	1	Ea	$ 525.00	$ 525.00	$ 3,225.00
4	New Unit Heater (250 MBH)	1	Ea	$ 3,299.00	$ 3,299.00	1	Ea	$ 525.00	$ 525.00	$ 3,824.00
	Subtotal				5,999.00				1,760.00	

Cost data obtained from RSMeans CostWorks 2015 and vendor pricing.

SUBTOTAL =	$	7,759.00
MARKUP % =	$	0.15
MARKUP =	$	1,163.85
SUB-TOTAL w/ OH & P =	$	8,922.85
CONTINGENCY % =		0.25
CONTINGENCY =	$	2,230.71
BUDGET COST ESTIMATE =	$	11,153.56

Notes:
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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Created By **C. Dowd**
Reviewed By **B. McLean**

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
	Building 69: Electric Heat Conversion									
1	Electric Heat Removal	1	Ea		$ -	1	Ea	$ 670.00	$ 670.00	$ 670.00
2	New Galvanized Duct	100	LBS	$ 0.57	$ 57.00	100	LBS	$ 7.00	$ 700.00	$ 757.00
3	New Gas Furnace (60 MBH)	1	Ea	$ 925.00	$ 925.00	1	Ea	$ 112.00	$ 112.00	$ 1,037.00
4	1" Steel Gas Pipe (40')	40	L.F.	$ 4.30	$ 172.00	40	L.F.	$ 15.95	$ 638.00	$ 810.00
5	Thermostat & Power Wiring	1	Ea	$ 50.00	$ 50.00	1	Ea	$ 125.00	$ 125.00	$ 175.00
	Subtotal				1,204.00				2,245.00	

Cost data obtained from RSMeans CostWorks 2015
Cost does not include construction of a structure to hold the turbine, excessive lengths of piping, air permitting, new meter connections or heating system modifications that may be required.

SUBTOTAL =	$	3,449.00
MARKUP % =	$	0.15
MARKUP =	$	517.35
SUB-TOTAL w/ OH & P =	$	3,966.35
CONTINGENCY % =		0.25
CONTINGENCY =	$	991.59
BUDGET COST ESTIMATE =	$	4,957.94

Notes:
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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Created By **M. Rowlinson**
Reviewed By **B. McLean**

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
	Thermal Oil Heat Exchanger									
1	Heat Exchanger, Plate and Frame, Oil to Water, 800 GPM	1	Ea	$ 66,000.00	$ 66,000.00	1	Ea	$ 3,500.00	$ 3,500.00	$ 69,500.00
2	Pipe, Steel, 6" dia, Welded, Sch 40	800	L.F.	$ 46.00	$ 36,800.00	800	L.F.	$ 49.58	$ 39,664.00	$ 76,464.00
3	Valves, Steel, Flanged, 6" 150 lbs	8	Ea	$ 1,800.00	$ 565.00	8	Ea	$ 480.00	$ 3,840.00	$ 4,405.00
4	Pipe Insulation, 3" wall, 6" pipe diameter	800	Ea	$ 7.55	$ 6,040.00	800	Ea	$ 12.35	$ 9,880.00	$ 15,920.00
5	Digital Controller and programming	1	Ea	$ 6,075.00	$ 6,075.00	1	Ea	$ -	$ -	$ 6,075.00
	Subtotal				115,480.00				56,884.00	

Cost data obtained from RSMeans CostWorks 2015 and vendor pricing.

SUBTOTAL =	$	172,364.00
MARKUP % =	$	0.15
MARKUP =	$	25,854.60
SUB-TOTAL w/ OH & P =	$	198,218.60
CONTINGENCY % =		0.25
CONTINGENCY =	$	49,554.65
BUDGET COST ESTIMATE =	$	247,773.25

Notes:
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5. Estimates do not include site conditions that may be required as part of the project. These may include abatement, remediation, or structural work.
6. Estimate assumes associated systems are available and in good working order. This includes existing chimney and venting, combustion air, floor drains, electrical and local controls.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Created By **E. Moody**
Reviewed By **V. Apa** 3/30/2016
Revision

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL UNIT COST	MATERIAL SUBTOTAL	QTY	UNIT	LABOR COST	LABOR SUBTOTAL	TOTAL
1	**Aerated Grit Blowers** Provide VFD with controls and dedicated enclosure	4	Ea	$ 2,900.00	$ 11,600.00	4	Ea	$ 940.00	$ 3,760.00	$ 15,360.00
	Subtotal				$ 11,600.00				$ 3,760.00	

Cost data obtained from RSMeans 2015 & engineering knowledge

SUBTOTAL =	$ 15,360.00
MARKUP % =	$ 0.15
MARKUP =	$ 2,304.00
SUB-TOTAL w/ OH & P =	$ 17,664.00
CONTINGENCY % =	0.25
CONTINGENCY =	$ 4,416.00
SUBTOTAL =	$ 22,080.00
ENGINEERING, PERMITTING & CONSTRUCTION ADMIN % =	0.20
ENGINEERING, PERMITTING & CONSTRUCTION ADMIN =	$ 4,416.00
BUDGET COST ESTIMATE =	$ 26,496.00

Notes:
1. Bonds not included in estimate.
2. Escalation not included in estimate.
3. CDM Smith has no control over the cost of labor, materials, equipment, services furnished or market conditions.
4. CDM Smith does not guarantee that this opinion will not vary from actual cost, or contractor's bids.

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Appendix D
Solar Financial Calculations

SUMMARY DATA

Building Name	Aggregate Utility Cost ($/kWh)	Square Footage	Usable Square Footage	First Year Production (kWh)
Effluent Filters Roof	0.122	23625	20000	355558
Maintenance Building Roof	0.122	5175	5000	88748
Adjacent to Headworks	0.122	5600	5600	101941

Summary Data Over 25 Yr

Total kWh generated	12,867,368
Utility Savings	$2,271,929
SRECS	$1,969,033
Installation	-$2,908,200
Maintenance	-$257,347
Net	$1,075,415

Building Name	AROI	IRR	NPV	Lifetime Savings	Simple Payback	Energy Savings	SRECS
UV Filters Roof	1.720%	3.296%	$55,304.24	$2,592,977.34	17.5	$43,378.08	$67,051.13
Storage Building Roof	0.942%	1.900%	($57,114.83)	$647,212.42	20.2	$10,827.26	$16,736.10
Adjacent to Headworks	1.107%	2.206%	($46,236.19)	$743,424.99	19.6	$12,436.80	$19,224.03

UV Filters Roof

Solar Rating for 07065 (kWh/sq m/day)	4.41
Current Utility Price ($/kWh)	0.122
Usable Roof Space (sq ft)	20000
PV System Size (kWdc)	284.4

Costs

Electrical Service Modification	100000
System Installation ($6/Wdc)	1706400
Materials	1194480
Labor	511920
Total Cost	1806400

Assumptions

Annual System Degradation	0.50%
Annual Utility Inflation	3.00%
Annual SREC Inflation	3.00%
Annual Maintenance Costs	2.00%

Year	Utility Price	Solar kWh	Utility Savings	SRECS	Maintenance Costs	Annual Cash Flow	Cumulative Cash Flow	SREC Factor* ($/kWh)	REC Factor ($/kWh)
1	$0.122	355558	$43,378.08	$67,051.13	($7,111.16)	$103,318.04	$103,318.04	0.189	
2	$0.126	353780	$44,456.02	$68,717.35	($7,075.60)	$106,097.77	$209,415.81	0.194	
3	$0.129	352011	$45,560.75	$70,424.97	($7,040.23)	$108,945.50	$318,361.31	0.200	
4	$0.133	350251	$46,692.94	$72,175.03	($7,005.03)	$111,862.95	$430,224.26	0.206	
5	$0.137	348500	$47,853.26	$73,968.58	($6,970.00)	$114,851.84	$545,076.10	0.212	
6	$0.141	346757	$49,042.41	$75,806.70	($6,935.15)	$117,913.96	$662,990.07	0.219	
7	$0.146	345024	$50,261.11	$77,690.50	($6,900.47)	$121,051.14	$784,041.21	0.225	
8	$0.150	343299	$51,510.10	$79,621.11	($6,865.97)	$124,265.24	$908,306.45	0.232	
9	$0.155	341582	$52,790.13	$81,599.69	($6,831.64)	$127,558.18	$1,035,864.63	0.239	
10	$0.159	339874	$54,101.96	$83,627.45	($6,797.48)	$130,931.93	$1,166,796.56	0.246	
11	$0.164	338175	$55,446.40	$85,705.59	($6,763.50)	$134,388.49	$1,301,185.05	0.253	
12	$0.169	336484	$56,824.24	$87,835.37	($6,729.68)	$137,929.93	$1,439,114.98	0.261	
13	$0.174	334802	$58,236.32	$90,018.08	($6,696.03)	$141,558.37	$1,580,673.36	0.269	
14	$0.179	333128	$59,683.50	$92,255.03	($6,662.55)	$145,275.98	$1,725,949.33	0.277	
15	$0.185	331462	$61,166.63	$94,547.57	($6,629.24)	$149,084.96	$1,875,034.29	0.285	
16	$0.190	329805	$62,686.62	$8,245.11	($6,596.09)	$64,335.64	$1,939,369.94		0.025
17	$0.196	328156	$64,244.38	$8,203.89	($6,563.11)	$65,885.16	$2,005,255.10		0.025
18	$0.202	326515	$65,840.86	$8,162.87	($6,530.30)	$67,473.43	$2,072,728.53		0.025
19	$0.208	324882	$67,477.00	$8,122.05	($6,497.64)	$69,101.41	$2,141,829.95		0.025
20	$0.214	323258	$69,153.81	$8,081.44	($6,465.16)	$70,770.10	$2,212,600.04		0.025
21	$0.220	321641	$70,872.28	$8,041.04	($6,432.83)	$72,480.49	$2,285,080.53		0.025
22	$0.227	320033	$72,633.45	$8,000.83	($6,400.67)	$74,233.62	$2,359,314.15		0.025
23	$0.234	318433	$74,438.40	$7,960.83	($6,368.66)	$76,030.56	$2,435,344.71		0.025
24	$0.241	316841	$76,288.19	$7,921.02	($6,336.82)	$77,872.39	$2,513,217.10		0.025
25	$0.248	315257	$78,183.95	$7,881.42	($6,305.13)	$79,760.24	$2,592,977.34		0.025

*SREC Factor is based on average data from Dec 2014-Nov 2015

Storage Building Roof

Solar Rating for 07065 (kWh/sq m/day)	4.41
Current Utility Price ($/kWh)	0.122
Usable Roof Space (sq ft)	5000
PV System Size (kWdc)	70.3

Costs

Electrical Service Modification	100000
System Installation ($6/Wdc)	421800
Materials	295260
Labor	126540
Total Cost	521800

Assumptions

Annual System Degradation	0.50%
Annual Utility Inflation	3.00%
Annual SREC Inflation	3.00%
Annual Maintenance Costs	2.00%

Year	Utility Price	Solar kWh	Utility Savings	SRECS	Maintenance Costs	Annual Cash Flow	Cumulative Cash Flow	SREC Factor* ($/kWh)	REC Factor ($/kWh)
1	$0.122	88748	$10,827.26	$16,736.10	($1,774.96)	$25,788.39	$25,788.39	0.189	
2	$0.126	88304	$11,096.31	$17,151.99	($1,766.09)	$26,482.22	$52,270.61	0.194	
3	$0.129	87863	$11,372.06	$17,578.22	($1,757.25)	$27,193.02	$79,463.63	0.200	
4	$0.133	87423	$11,654.65	$18,015.04	($1,748.47)	$27,921.22	$107,384.85	0.206	
5	$0.137	86986	$11,944.27	$18,462.71	($1,739.73)	$28,667.25	$136,052.10	0.212	
6	$0.141	86551	$12,241.09	$18,921.51	($1,731.03)	$29,431.57	$165,483.67	0.219	
7	$0.146	86119	$12,545.28	$19,391.71	($1,722.37)	$30,214.61	$195,698.28	0.225	
8	$0.150	85688	$12,857.03	$19,873.59	($1,713.76)	$31,016.86	$226,715.14	0.232	
9	$0.155	85260	$13,176.52	$20,367.45	($1,705.19)	$31,838.78	$258,553.92	0.239	
10	$0.159	84833	$13,503.96	$20,873.58	($1,696.67)	$32,680.88	$291,234.79	0.246	
11	$0.164	84409	$13,839.53	$21,392.29	($1,688.18)	$33,543.64	$324,778.43	0.253	
12	$0.169	83987	$14,183.45	$21,923.89	($1,679.74)	$34,427.59	$359,206.03	0.261	
13	$0.174	83567	$14,535.90	$22,468.70	($1,671.34)	$35,333.26	$394,539.28	0.269	
14	$0.179	83149	$14,897.12	$23,027.04	($1,662.99)	$36,261.18	$430,800.46	0.277	
15	$0.185	82734	$15,267.32	$23,599.27	($1,654.67)	$37,211.91	$468,012.37	0.285	
16	$0.190	82320	$15,646.71	$2,058.00	($1,646.40)	$16,058.31	$484,070.68		0.025
17	$0.196	81908	$16,035.53	$2,047.71	($1,638.17)	$16,445.07	$500,515.75		0.025
18	$0.202	81499	$16,434.01	$2,037.47	($1,629.97)	$16,841.51	$517,357.26		0.025
19	$0.208	81091	$16,842.40	$2,027.28	($1,621.83)	$17,247.85	$534,605.11		0.025
20	$0.214	80686	$17,260.93	$2,017.14	($1,613.72)	$17,664.36	$552,269.47		0.025
21	$0.220	80282	$17,689.86	$2,007.06	($1,605.65)	$18,091.28	$570,360.75		0.025
22	$0.227	79881	$18,129.46	$1,997.02	($1,597.62)	$18,528.86	$588,889.61		0.025
23	$0.234	79482	$18,579.97	$1,987.04	($1,589.63)	$18,977.38	$607,866.99		0.025
24	$0.241	79084	$19,041.69	$1,977.10	($1,581.68)	$19,437.11	$627,304.10		0.025
25	$0.248	78689	$19,514.87	$1,967.22	($1,573.77)	$19,908.32	$647,212.42		0.025

*SREC Factor is based on average data from Dec 2014-Nov 2015

Adjacent to Headworks

Solar Rating for 07065 (kWh/sq m/day)	4.41
Current Utility Price ($/kWh)	0.122
Usable Roof Space (sq ft)	5600
PV System Size (kWdc)	80

Costs

Electrical Service Modification	100000
System Installation ($6/Wdc)	480000
Materials	336000
Labor	144000
Total Cost	580000

Assumptions

Annual System Degradation	0.50%
Annual Utility Inflation	3.00%
Annual SREC Inflation	3.00%
Annual Maintenance Costs	2.00%

Year	Utility Price	Solar kWh	Utility Savings	SRECS	Maintenance Costs	Annual Cash Flow	Cumulative Cash Flow	SREC Factor* ($/kWh)	REC Factor ($/kWh)
1	$0.122	101941	$12,436.80	$19,224.03	($2,038.82)	$29,622.02	$29,622.02	0.189	
2	$0.126	101431	$12,745.86	$19,701.75	($2,028.63)	$30,418.98	$60,041.00	0.194	
3	$0.129	100924	$13,062.59	$20,191.34	($2,018.48)	$31,235.45	$91,276.45	0.200	
4	$0.133	100420	$13,387.20	$20,693.09	($2,008.39)	$32,071.90	$123,348.35	0.206	
5	$0.137	99917	$13,719.87	$21,207.32	($1,998.35)	$32,928.84	$156,277.18	0.212	
6	$0.141	99418	$14,060.81	$21,734.32	($1,988.36)	$33,806.77	$190,083.95	0.219	
7	$0.146	98921	$14,410.22	$22,274.42	($1,978.41)	$34,706.22	$224,790.17	0.225	
8	$0.150	98426	$14,768.31	$22,827.94	($1,968.52)	$35,627.73	$260,417.90	0.232	
9	$0.155	97934	$15,135.30	$23,395.21	($1,958.68)	$36,571.84	$296,989.73	0.239	
10	$0.159	97444	$15,511.42	$23,976.58	($1,948.89)	$37,539.11	$334,528.85	0.246	
11	$0.164	96957	$15,896.88	$24,572.40	($1,939.14)	$38,530.13	$373,058.98	0.253	
12	$0.169	96472	$16,291.91	$25,183.02	($1,929.45)	$39,545.49	$412,604.47	0.261	
13	$0.174	95990	$16,696.77	$25,808.82	($1,919.80)	$40,585.79	$453,190.26	0.269	
14	$0.179	95510	$17,111.68	$26,450.17	($1,910.20)	$41,651.65	$494,841.91	0.277	
15	$0.185	95032	$17,536.91	$27,107.46	($1,900.65)	$42,743.72	$537,585.63	0.285	
16	$0.190	94557	$17,972.70	$2,363.93	($1,891.15)	$18,445.49	$556,031.11		0.025
17	$0.196	94085	$18,419.32	$2,352.11	($1,881.69)	$18,889.74	$574,920.86		0.025
18	$0.202	93614	$18,877.04	$2,340.35	($1,872.28)	$19,345.11	$594,265.97		0.025
19	$0.208	93146	$19,346.14	$2,328.65	($1,862.92)	$19,811.87	$614,077.83		0.025
20	$0.214	92680	$19,826.89	$2,317.01	($1,853.61)	$20,290.29	$634,368.12		0.025
21	$0.220	92217	$20,319.58	$2,305.42	($1,844.34)	$20,780.67	$655,148.79		0.025
22	$0.227	91756	$20,824.53	$2,293.90	($1,835.12)	$21,283.31	$676,432.10		0.025
23	$0.234	91297	$21,342.02	$2,282.43	($1,825.94)	$21,798.50	$698,230.60		0.025
24	$0.241	90841	$21,872.37	$2,271.01	($1,816.81)	$22,326.57	$720,557.17		0.025
25	$0.248	90386	$22,415.89	$2,259.66	($1,807.73)	$22,867.83	$743,424.99		0.025

*SREC Factor is based on average data from Dec 2014-Nov 2015

IRR, NPV, AROI - PV Solar Energy Systems

Financial Assumptions

Inflation	3.00%
O&M Inflation	3.00%

Effluent Filters Roof

Year	Energy Savings	SREC Sales	Maintenance Cost	Cash Flow
0				($1,806,400.00)
1	$43,378.08	$67,051.13	($7,111.16)	$103,318.04
2	$44,456.02	$68,717.35	($7,075.60)	$106,097.77
3	$45,560.75	$70,424.97	($7,040.23)	$108,945.50
4	$46,692.94	$72,175.03	($7,005.03)	$111,862.95
5	$47,853.26	$73,968.58	($6,970.00)	$114,851.84
6	$49,042.41	$75,806.70	($6,935.15)	$117,913.96
7	$50,261.11	$77,690.50	($6,900.47)	$121,051.14
8	$51,510.10	$79,621.11	($6,865.97)	$124,265.24
9	$52,790.13	$81,599.69	($6,831.64)	$127,558.18
10	$54,101.96	$83,627.45	($6,797.48)	$130,931.93
11	$55,446.40	$85,705.59	($6,763.50)	$134,388.49
12	$56,824.24	$87,835.37	($6,729.68)	$137,929.93
13	$58,236.32	$90,018.08	($6,696.03)	$141,558.37
14	$59,683.50	$92,255.03	($6,662.55)	$145,275.98
15	$61,166.63	$94,547.57	($6,629.24)	$149,084.96
16	$62,686.62	$8,245.11	($6,596.09)	$64,335.64
17	$64,244.38	$8,203.89	($6,563.11)	$65,885.16
18	$65,840.86	$8,162.87	($6,530.30)	$67,473.43
19	$67,477.00	$8,122.05	($6,497.64)	$69,101.41
20	$69,153.81	$8,081.44	($6,465.16)	$70,770.10
21	$70,872.28	$8,041.04	($6,432.83)	$72,480.49
22	$72,633.45	$8,000.83	($6,400.67)	$74,233.62
23	$74,438.40	$7,960.83	($6,368.66)	$76,030.56
24	$76,288.19	$7,921.02	($6,336.82)	$77,872.39
25	$78,183.95	$7,881.42	($6,305.13)	$79,760.24
			IRR	3.296%
			NPV	$55,304.24
			AROI	1.720%

Maintenance Building Roof

Year	Energy Savings	SREC Sales	Maintenance Cost	Cash Flow
0				($521,800.00)
1	$10,827.26	$16,736.10	($1,774.96)	$25,788.39
2	$11,096.31	$17,151.99	($1,766.09)	$26,482.22
3	$11,372.06	$17,578.22	($1,757.25)	$27,193.02
4	$11,654.65	$18,015.04	($1,748.47)	$27,921.22
5	$11,944.27	$18,462.71	($1,739.73)	$28,667.25
6	$12,241.09	$18,921.51	($1,731.03)	$29,431.57
7	$12,545.28	$19,391.71	($1,722.37)	$30,214.61
8	$12,857.03	$19,873.59	($1,713.76)	$31,016.86
9	$13,176.52	$20,367.45	($1,705.19)	$31,838.78
10	$13,503.96	$20,873.58	($1,696.67)	$32,680.88
11	$13,839.53	$21,392.29	($1,688.18)	$33,543.64
12	$14,183.45	$21,923.89	($1,679.74)	$34,427.59
13	$14,535.90	$22,468.70	($1,671.34)	$35,333.26
14	$14,897.12	$23,027.04	($1,662.99)	$36,261.18
15	$15,267.32	$23,599.27	($1,654.67)	$37,211.91
16	$15,646.71	$2,058.00	($1,646.40)	$16,058.31
17	$16,035.53	$2,047.71	($1,638.17)	$16,445.07
18	$16,434.01	$2,037.47	($1,629.97)	$16,841.51
19	$16,842.40	$2,027.28	($1,621.83)	$17,247.85
20	$17,260.93	$2,017.14	($1,613.72)	$17,664.36
21	$17,689.86	$2,007.06	($1,605.65)	$18,091.28
22	$18,129.46	$1,997.02	($1,597.62)	$18,528.86
23	$18,579.97	$1,987.04	($1,589.63)	$18,977.38
24	$19,041.69	$1,977.10	($1,581.68)	$19,437.11
25	$19,514.87	$1,967.22	($1,573.77)	$19,908.32
			IRR	1.900%
			NPV	($57,114.83)
			AROI	0.942%

Adjacent to Headworks

Year	Energy Savings	SREC Sales	Maintenance Cost	Cash Flow
0				($580,000.00)
1	$12,436.80	$19,224.03	($2,038.82)	$29,622.02
2	$12,745.86	$19,701.75	($2,028.63)	$30,418.98
3	$13,062.59	$20,191.34	($2,018.48)	$31,235.45
4	$13,387.20	$20,693.09	($2,008.39)	$32,071.90
5	$13,719.87	$21,207.32	($1,998.35)	$32,928.84
6	$14,060.81	$21,734.32	($1,988.36)	$33,806.77
7	$14,410.22	$22,274.42	($1,978.41)	$34,706.22
8	$14,768.31	$22,827.94	($1,968.52)	$35,627.73
9	$15,135.30	$23,395.21	($1,958.68)	$36,571.84
10	$15,511.42	$23,976.58	($1,948.89)	$37,539.11
11	$15,896.88	$24,572.40	($1,939.14)	$38,530.13
12	$16,291.91	$25,183.02	($1,929.45)	$39,545.49
13	$16,696.77	$25,808.82	($1,919.80)	$40,585.79
14	$17,111.68	$26,450.17	($1,910.20)	$41,651.65
15	$17,536.91	$27,107.46	($1,900.65)	$42,743.72
16	$17,972.70	$2,363.93	($1,891.15)	$18,445.49
17	$18,419.32	$2,352.11	($1,881.69)	$18,889.74
18	$18,877.04	$2,340.35	($1,872.28)	$19,345.11
19	$19,346.14	$2,328.65	($1,862.92)	$19,811.87
20	$19,826.89	$2,317.01	($1,853.61)	$20,290.29
21	$20,319.58	$2,305.42	($1,844.34)	$20,780.67
22	$20,824.53	$2,293.90	($1,835.12)	$21,283.31
23	$21,342.02	$2,282.43	($1,825.94)	$21,798.50
24	$21,872.37	$2,271.01	($1,816.81)	$22,326.57
25	$22,415.89	$2,259.66	($1,807.73)	$22,867.83
			IRR	2.206%
			NPV	($46,236.19)
			AROI	1.107%

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The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

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The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

355,558 kWh per Year *

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	2.74	20,956	2,557
February	3.47	23,615	2,881
March	4.29	31,546	3,849
April	4.92	33,756	4,118
May	5.68	39,078	4,768
June	5.84	37,893	4,623
July	5.73	38,005	4,637
August	5.44	35,708	4,356
September	4.86	31,782	3,877
October	3.93	27,447	3,348
November	2.60	18,458	2,252
December	2.30	17,314	2,112
Annual	4.32	355,558	$ 43,378

Location and Station Identification

Requested Location	07065
Weather Data Source	(TMY2) NEWARK, NJ 9.4 mi
Latitude	40.7° N
Longitude	74.17° W

PV System Specifications *(Commercial)*

DC System Size	284.4 kW
Module Type	Standard
Array Type	Fixed (roof mount)
Array Tilt	20°
Array Azimuth	200°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Initial Economic Comparison

Average Cost of Electricity Purchased from Utility	0.12 $/kWh
Initial Cost	6.00 $/Wdc
Cost of Electricity Generated by System	0.29 $/kWh

These values can be compared to get an idea of the cost-effectiveness of this system. However, system costs, system financing options (including 3rd party ownership) and complex utility rates can significantly change the relative value of the PV system.

UV Filters Roof

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The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

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The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

88,748 kWh per Year *

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	2.77	5,242	640
February	3.52	5,939	725
March	4.34	7,897	963
April	4.95	8,396	1,024
May	5.70	9,688	1,182
June	5.87	9,411	1,148
July	5.73	9,382	1,145
August	5.47	8,872	1,082
September	4.90	7,934	968
October	3.99	6,902	842
November	2.68	4,710	575
December	2.35	4,375	534
Annual	4.36	88,748	$ 10,828

Location and Station Identification

Requested Location	07065
Weather Data Source	(TMY2) NEWARK, NJ 9.4 mi
Latitude	40.7° N
Longitude	74.17° W

PV System Specifications *(Commercial)*

DC System Size	70.3 kW
Module Type	Standard
Array Type	Fixed (roof mount)
Array Tilt	20°
Array Azimuth	175°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Initial Economic Comparison

Average Cost of Electricity Purchased from Utility	0.12 $/kWh
Initial Cost	6.00 $/Wdc
Cost of Electricity Generated by System	0.29 $/kWh

These values can be compared to get an idea of the cost-effectiveness of this system. However, system costs, system financing options (including 3rd party ownership) and complex utility rates can significantly change the relative value of the PV system.

Maintenance/Storage Building Roof

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at http://sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

Disclaimer: The PVWatts® Model ("Model") is provided by the National Renewable Energy Laboratory ("NREL"), which is operated by the Alliance for Sustainable Energy, LLC ("Alliance") for the U.S. Department Of Energy ("DOE") and may be used for any purpose whatsoever.

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The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

101,941 kWh per Year *

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	2.78	6,019	734
February	3.52	6,811	831
March	4.34	9,057	1,105
April	4.95	9,649	1,177
May	5.69	11,134	1,358
June	5.86	10,814	1,319
July	5.73	10,796	1,317
August	5.47	10,217	1,246
September	4.91	9,126	1,113
October	3.99	7,926	967
November	2.68	5,385	657
December	2.35	5,007	611
Annual	4.36	101,941	$ 12,435

Location and Station Identification

Requested Location	07065
Weather Data Source	(TMY2) NEWARK, NJ 9.4 mi
Latitude	40.7° N
Longitude	74.17° W

PV System Specifications *(Commercial)*

DC System Size	80.0 kW
Module Type	Standard
Array Type	Fixed (open rack)
Array Tilt	20°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Initial Economic Comparison

Average Cost of Electricity Purchased from Utility	0.12 $/kWh
Initial Cost	6.00 $/Wdc
Cost of Electricity Generated by System	0.28 $/kWh

These values can be compared to get an idea of the cost-effectiveness of this system. However, system costs, system financing options (including 3rd party ownership) and complex utility rates can significantly change the relative value of the PV system.

Ground Mount

Appendix E
HVAC Equipment Inventory

Designation	Building	Location	Manufacturer/ Model/Type	Date	Efficiency	Capacity	Serves	Operating Hours/Year	Quantity	ASHRAE Expected Life (Years)	Remarks
AHU	Cogen	Control Room	Unknown	1990	100%	3 ton	Control Room	5000	1	15	electric heat in control room
Evaporative Cooler	Cogen	Engine Room	Hunt Air	1990	100%	24 fan array @ 3hp each	engine room	5000	1	20	electric heat in engine room
Domestic Water Heater	Cogen	Janitors Closet	Ruud/model E120A-18-G	2005	98.00%	119 gal., 18kw	Bathrooms	2000	1	15	
HV Unit	Sludge Thickening	Process pump gallery	Unknown	1990-1995	unknown	unknown	Pump gallery	0	1	20	Disconnected from HW system
Pump	Sludge Thickening	Process pump gallery	Unknown	1995-2000	unknown	unknown	Pump gallery	0	1	20	Disconnected from HW system
Electric Unit Heater	Maintenance	Breakroom	TPI/Model 43UH10C0T04	2000	100%	10 kw	Breakroom	5000	1	13	wall tstat
Window AC	Maintenance	Breakroom	Freidrich	2012	10.1 SEER	1.5 ton	Breakroom	2000	1	10	Model # unknown
Electric Unit Heater	Maintenance	Shower Room	Dayton	2010	100%	10 kw	Shower area	5000	1	13	Model # unknown, wall tstat
Electric Unit Heater	Maintenance	Locker Room	TPI/Model 43UH10C0T04	2000	100%	10 kw	Locker Room	5000	1	13	wall tstat
Radiant Heater	Maintenance	Garage	Superior	2005-2010	80%	100 MBH	Garage	5000	1	13	35' long, wall tstat
Gas water Heater	Maintenance	Shower Room	AO Smith/Model GDV 40 200	2012	84%	40 gal., 38 MBH	Shower area	2000	1	15	
Compressor	Maintenance	Oil Room	Westward/Model 523997C	2003	84%	80 gal, 5 HP	Oil Room	2000	1	20	
AC-1	UV	Roof	Trane/Model TFD181C40ACA	2006	10.8 EER	15 tons, 54 kw electric heat	Mech./Elec. Rooms	5000	1	15	
AC-2	UV	Roof	Trane/Model TFD181C40ACA	2006	10.8 EER	15 tons, 54 kw electric heat	Mech./Elec. Rooms	5000	1	15	
Compressor	UV	Mechanical Room	Ingersol Rand/Model 2475	2012	88%	80 gal. capacity, 5 HP	Mech./Elec. Rooms	5000	1	20	has air leaks
Wall Heater	Headworks	Stairs	Trane/Model UHWA053A2AT	2005	100%	5 kw	Stairway	5000	1	13	
AC-1	Headworks	Roof	McQuay/Model RPS020CSY	2005	unknown	20 tons	MCC	2000	1	20	Programmable tstat, hw coils
AHU-5	Headworks	Roof	Xetex/Heat Exchanger	2005	unknown	unknown	unknown	5000	1	20	Programmable tstat, hw coils
AHU-4	Headworks	Roof	Xetex/Model XHS-40H-72RTBP	2005	unknown	unknown	unknown	5000	1	20	Programmable tstat, hw coils
AHU-3	Headworks	Roof	Xetex/Model XHS-80M-84RTBP	2005	unknown	unknown	unknown	5000	1	20	Programmable tstat, hw coils
AHU-2	Headworks	Roof	Xetex/Model XHS-80M-84RTBP	2005	unknown	unknown	unknown	5000	1	20	Programmable tstat, hw coils
AHU-1	Headworks	Roof	Xetex/Model XHS-80M-84RTBPHWEX	2005	unknown	unknown	unknown	5000	1	20	Programmable tstat, hw coils
Pump 1	Headworks	Gallery	Taco	2009	91.70%	10 HP, 1770 RPM	Hot water	5000	1	20	on VFD
Pump 1	Headworks	Gallery	Taco	2009	91.70%	10 HP, 1770 RPM	Hot water	5000	1	20	on VFD
Domestic Water Heater	Headworks	Gallery	Ruud/model E120A-30-G	2009	100%	120 gal., 30 kw	bathroom/control room sink	5000	1	15	
UH	Sludge Pumping Station	Sludge Pumping Station	unknown	1990-1995	unknown	unknown	unknown	5000	2	20	Controlled with tstat
HV Unit	Digester Building	Digester Building	44F/Model H-25 LPHVFYA	1990-1995	unknown	10 HP, 1750 RPM	Digester Building	5000	1	20	on HW loop, tstat
Domestic Water Heater	Digester Building	Main	Bradford/Model M240T6DS5	2005-2010	unknown	40 gal., 4.5kw	unknown	5000	1	15	
Compressor	Digester Building	unknown	Quilncy/Model 2225	1971	86.50%	80 gal., 7.5 HP, 1745 RPM	unknown	5000	1	20	

Designation	Building	Location	Manufacturer/ Model/Type	Date	Efficiency	Capacity	Serves	Operating Hours/Year	Quantity	ASHRAE Expected Life (Years)	Remarks
AHU	Employee Facilities Building	Mechanical Room	Weather Rite	2005-2010	unknown	unknown	Locker Room	5000	1	18	Gas fired, 48"x48" OA louver
AHU	Employee Facilities Building	Mechanical Room	Coleman/Model TG8S100C16MP	2005-2010	unknown	4 ton	Breakroom	5000	1	20	dx split, TI 87 tstat
Gas UH	Employee Facilities Building	Mechanical Room	Dayton/Model 3E 2280	1996	80%	100 MBH	Mechanical Room	5000	1	13	
Condensing Unit	Employee Facilities Building	Outdoors?	Coleman/Model HABA-W048SG	2002	unknown	4 ton	Breakroom	2000	1	20	
Gas water Heater	Employee Facilities Building	Mechanical Room	AO Smith/Model BTR-197	2003	unknown	100 gal, 199 MBH	Locker Room	5000	1	15	stack damper
Electric water Heater	Employee Facilities Building	IPP	Bradford White/M180R6DS13	1996	unknown	80 gal., 4.5 kw	unknown	5000	1	15	
PTAC	Rotary Drum	MCC Room	Bard/Model WA484-C09	2005-2010	unknown	unknown	MCC Room	2000	1	15	cooling only
UH	Rotary Drum	Odor Control	Trane	2005	unknown	unknown	Odor Control	5000	2	20	Hot water, too high to see model number
UH	Rotary Drum	Centrifuge	Trane	2005	unknown	unknown	Centrifuge	5000	7	20	Hot water, too high to see model number
RTU	Rotary Drum	Roof	Trane	2005	unknown	unknown	unknown	5000	1	20	Hot water heat, no other information
Condensing Unit	Pump and Blower	Outdoors?	Fujitsu/Model AOU36RMLI	2011	unknown	unknown	unknown	2000	1	20	
Ductless AC	Pump and Blower	unknown	Fujitsu/Model ASU18	2011	unknown	unknown	unknown	2000	2	20	
Gas Fired Boiler	Pump and Blower	unknown	Buderus	2008	unknown	4835 MBH input	unknown	5000	1	35	
Burner	Pump and Blower	unknown	Industrial Combuster	2008	unknown	unknown	unknown	unknown	unknown	21	
Pump 1 and 2	Pump and Blower	unknown	Muller	1995-2000	85.50%	5 HP, 1735 RPM	unknown	5000	2	20	HW pump
Air Handling Unit	Pump and Blower	unknown	unknown	2005-2010	unknown	unknown	unknown	5000	1	20	
Pump SHHP	Pump and Blower	unknown	Bell and Gossett	2000-2005	87.50%	5 HP, 1750 RPM	unknown	5000	2	20	HW pump
Pump HWSP	Pump and Blower	unknown	Taco	2005-2010	94%	30 HP, 1770 RPM	unknown	5000	2	20	HW pump
Electric Unit Heater	Pump and Blower	Switchgear	unknown	1980	100%	5 kw	Switchgear	5000	1	13	
Electric Unit Heater	Pump and Blower	Electrical Supply	Dayton	2000	100%	5 kw	Electrical Supply	5000	1	13	
HW Unit Heater	Pump and Blower	Electrical Room	Modine	1990-1995	unknown	unknown	unknown	5000	2	20	
HW Unit Heater	Pump and Blower	unknown	unknown	1990-1995	unknown	unknown	unknown	5000	1	20	
Window AC	Pump and Blower	unknown	Frigidare	2005-2010	unknown	18,000 Btu	unknown	2000	1	10	
HV Unit	Pump and Blower	Non HCL	unknown	2010-2015	unknown	unknown	unknown	5000	1	20	OA blocked, fan on, coil pump hw
Electric Water Heater	Pump and Blower	Blower Janitors Cl.	Bradford/Model M12OU61SS	2000	100%	19 gal, 1500 W	Janitors Closet	5000	1	15	
AHU-3	Admin.	unknown	unknown	2010-2015	unknown	unknown	Heat/AC Offices	5000	1	20	tstat, Hot water/dx split w/ 2 condensers
AHU-2	Admin.	unknown	Goodman/Model AR120	2011	unknown	10 tons cooling	Heat/AC Offices	5000	1	20	tstat, Uses 2 condensers
AHU-1	Admin.	unknown	Goodman/Model ARUF4860168B	2011	unknown	4 tons cooling	Heat/AC Boardroom	5000	1	20	tstat, Uses 1 condenser
Condensing Units	Admin.	Roof	Goodman/Model GSC130603CB, GSC130603AC, GSX130613AA	2010-2015	unknown	5 tons	All AHUs	2000	5	20	
Carbon Filter	Admin.	AHU-2	Barneby Satcliffe/Model SS351	1989	unknown	unknown	unknown	unknown	2	1	carbon filters

Designation	Building	Location	Manufacturer/ Model/Type	Date	Efficiency	Capacity	Serves	Operating Hours/Year	Quantity	ASHRAE Expected Life (Years)	Remarks
Gas Fired Boiler	Admin.	Boiler Room	Weil McClain/Model EGH115	2005	80%	500 MBH in, 400 MBH out	Heat	5000	1	35	Perimeter radiation, 3 way mixing valves on AHUs
Condensing Unit	Admin.	Roof	Sanyo/Model CLI271	2009	17 EER	1 ton	Server Room	5000	1	20	
AC unit	Admin.	Server Room	LG/Model LSU186HE	2009	17 EER	17,800 Btuh	Server Room	5000	1	20	
Electric Water Heater	Admin.	Boiler Room	Bradford White/M24056D3-1NCWW	2011	unknown	40 gal, 4.5 kw	Bathrooms, Locker Rms, Brkrm	5000	1	15	
Gas Unit Heater	Utility Shop Garage	Garage	Modine/ Model PD150AE0130	2005-2010	80%	150 MBH in, 120 MBH out	Garage	5000	1	13	Wall mtd. Tstat
Gas Unit Heater	Utility Shop Garage	Breakroom	Modine/Model PD250AE0136	2005-2010	80%	250 MBH in, 200 MBH out	Breakroom	5000	1	13	Wall mtd. Tstat
Window AC	Utility Shop Garage	Breakroom	GE/Model ASM10AKSI	2007	10.8 EER	10,500 Btuh	Breakroom	2000	1	10	
Compressor	Utility Shop Garage	Shop	Quincy	1995-2000	87%	5 HP, 1750 RPM, 80 gal	Shop	5000	1	20	
Window AC	Primary	MCC Room	GE/Model AGL18DSQ1	2005-2010	unknown	unknown	MCC Room	2000	1	10	
Boiler 1	Primary	Boiler Room	Cleaver Brooks/Model FLX-700-600	2007	unknown	6000 MBH input	Heat	5000	1	35	
Burner 1	Primary	Boiler Room	Powerflame/Model LNICRS-G-30	2007	87.50%	3000 to 6000 MBH, 3600 RPM, 7.5 HP	Heat	5000	2	21	
Boiler 2	Primary	Boiler Room	Cleaver Brooks/Model FLX-700-600-160HW	2005-2010	unknown	6000 MBH input	Heat	5000	1	35	Digester gas or natural gas
Burner 2	Primary	Boiler Room	Powerflame/Model LNICRS-G-30	2005-2010	88.50%	3000 to 6000 MBH, 3450 RPM, 7.5 HP	Heat	5000	1	21	
HWP-3	Primary	Boiler Room	Taco	2005-2010	91.70%	7.5 HP, 1770 RPM	Heat	5000	1	20	Running
HWP-4	Primary	Boiler Room	Taco	2005-2010	91.70%	7.5 HP, 1770 RPM	Heat	5000	1	20	
HWP-5	Primary	Boiler Room	Taco	2005-2010	91.70%	7.5 HP, 1760 RPM	Heat	5000	1	20	
Boiler	Admin. Annex	Basement	RayPak/Serial #0801277350	1990-1995	unknown	199 MBH input	Heat	5000	1	25	HW heat with local programmable tstats and zone valves, 72° setpoint
Unit Heater	Admin. Annex	unknown	Trane	1995-2000	unknown	unknown	unknown	5000	1	20	
RTU	Admin. Annex	Roof	Circulaine/Model R-304SP	1990-1995	unknown	5 HP	unknown	5000	1	15	AC and Heat, split system
Condensing Unit	Admin. Annex	Roof	Carrier/Model 38AUZA12AC	2005-2010	unknown	unknown	unknown	2000	1	20	
Window AC	Admin. Annex	unknown	unknown	2000-2005	unknown	unknown	unknown	2000	1	10	unknown
Electric water Heater	Admin. Annex	Basement	AO Smith/Model DSE30	2000-2005	unknown	30 gal, 6.0 kw	unknown	5000	1	15	
Electric Unit Heater	Return Sludge Bldg.	unknown	Trane/Model UHRA103DAT	2005-2010	100%	10 kw	Heating	5000	2	13	
AHU	Return Sludge Bldg.	unknown	Trane/M Series	2005-2010	unknown	unknown	Heating	5000	1	20	tstat on BMS
EDH	Return Sludge Bldg.	unknown	Unknown	2005-2010	100%	unknown	Heating	5000	1	15	Duct Heater
RTU	Return Sludge Bldg.	Roof	Trane/ Model THC120A4R6A2	2005-2010	unknown	10 tons	MCC	2000	1	15	cooling only, 70° setpoint, 60° factual
Electric Unit Heater	Lab	Dock	Berko	2005-2010	100%	5 kw	Heat	5000	1	13	

Designation	Building	Location	Manufacturer/ Model/Type	Date	Efficiency	Capacity	Serves	Operating Hours/Year	Quantity	ASHRAE Expected Life (Years)	Remarks
Electric Unit Heater	Lab	Mechanical Room	Berko	2005-2010	100%	5 kw	Heat	5000	1	13	
RTU	Lab	roof	Octogon/Model OAS-055T-16C-1150	1998-2005	unknown	1150 MBH input gas	Lab & office	5000	1	15	tstats, with evaporative condensor
Cooling Tower	Lab	Roof	Recold	1998-2005	unknown	unknown	RTU	5000	1	20	
Gas water Heater	Lab	Mechanical Room	AO Smith/Model BTP139A104	2012	80%	78 gal, 140 MBH	Restrooms, lab, Jan.	5000	1	15	
Air compressor	Lab	Mechanical Room	EMSE/Model 3DOX3T120	2000-2005	89.50%	3 HP, 120 gal	lab	5000	2	20	
Vacuum pump	Lab	Mechanical Room	EMSE/Model 1DWSC3T120	1998-2005	unknown	3 HP, 120 gal	lab	5000	2	15	
Gas Fired Boiler	Dewatering	Boiler Room	HB Smith/Model 28-5	1981	80%	3295 MBH	heat	5000	1	35	
Pump 1	Dewatering	Boiler Room	Aurora	1995-2000	84%	1.5 HP, 1750 RPM	unknown	5000	1	20	
Pump 2	Dewatering	Boiler Room	Bell and Gossett	1995-2000	84%	1.5 HP, 1740 RPM	unknown	5000	1	20	
AC Unit	Dewatering	Control Room	LG	2005-2010	unknown	unknown	Control Room	5000	1	20	Ductless split
Electric Unit Heater	Dewatering	Control Room	TPI/Model P3PUH10CA1-MC	2014	100%	10 kw	Control Room	5000	1	13	
HW Unit Heater	Dewatering	Stairwell	Airtherm	1995-2000	unknown	unknown	Stairway	5000	1	20	
RTU	Dewatering	Roof	unknown	1995-2000	unknown	unknown	unknown	5000	1	15	Local electric controls
ERU-1	Dewatering	Roof	Clean Air/Model Jekw950V	1995-2000	unknown	8100 CFM	unknown	5000	1	15	
ERU-2	Dewatering	Roof	Clean Air/Model Jekw1500V	1995-2000	unknown	14800 CFM	unknown	5000	1	15	
Gas water Heater	Dewatering	Boiler Room	Bradford Whit/Model M140T6FBN	2006	80%	40 gal, 40 MBH, no stack	Restrooms, utility	5000	1	15	

Appendix F
NJ Smart Start Incentives Program Worksheets

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Electric Chillers Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	Doing Business as (if applicable)	Installation Start Date:	
		Installation Completion Date:	

Facility Address	City	State	Zip Code
		NJ	

Electric Utility Serving Applicant	Electric Account Number*	NAICS Code

Building Type (Office, Retail, Hospital, School, etc).	Building Type (if "Other")	How did you hear about the program? (See above)

Project Type (New Construction, Renovation, Replacement)	Size of Building

Company Mailing Address	City	State	Zip Code

Contact Person (name/title)	E-mail Address	Telephone Number	Fax Number

Incorporated (Yes, No, Other)	Customer Federal Tax ID #	Incentive Payment To (Customer, Contractor or Other)	Customer Signature (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor / Information

Company	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Electric Chillers Application - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this page with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program
c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Visit our website: NJCleanEnergy.com/ssb

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Electric Chillers Application - July 1, 2015 through June 30, 2016

Specific Program Requirements* (these requirements are in addition to the Program Terms and Conditions)

1. Please submit manufacturer's certified AHRI performance sheet with the application package and mail or fax directly to the Commercial/ Industrial Market Manager.

2. Units are eligible for the Base $/ton incentive by meeting both the incentive program minimum and qualifying efficiency levels listed in the table below for Path A (constant speed chillers) or Path B (variable speed chillers).

3. An additional $/ton Performance incentive applies for each 0.1 EER above the Incentive Minimum EER or for each 0.01 kW/ton below the Incentive Minimum kW/ton.
The performance incentive rate in column C of the Equipment Information table should be calculated by:

- **Water Cooled Chiller Performance Incentive**
  $/ton = (minimum kW/ton – installed unit kW/ton) * (Performance $/ton)/0.01
- **Air Cooled Chiller Performance Incentive**
  $/ton = (installed unit EER - min EER) * (Performance $/ton)/0.1

4. Constant speed chillers (Path A) must meet or exceed the ASHRAE Standard 90.1-2013 IPLV efficiency to qualify for the incentive program and will receive an incentive based on meeting or exceeding the Program Incentive Minimum full load efficiency. Variable speed chillers (Path B) must meet or exceed the ASHRAE Standard 90.1-2013 full load efficiency to qualify for the program and will receive an incentive based on meeting or exceeding the Program Incentive Minimum IPLV efficiency.

5. All water cooled chillers must be submitted at AHRI conditions of:

- Evaporator - 54 °F entering water temperature (EWT) and 44 °F leaving water temperature (LWT)
- Condenser - 85 °F EWT and 95 °F LWT

6. The incentive for air-cooled chillers is based on the unit's compressor kW per capacity (tons) at AHRI conditions.

7. For water cooled centrifugal chillers that are designed to operate at other than the AHRI standard conditions the procedure in ASHRAE Standard 90.1-2013, Section 6.4.1.2.1 can be used by the applicant to adjust the manufacturer's published efficiency at non-AHRI conditions to the efficiency at AHRI standard conditions. The applicant will need to provide the manufacturer's non-AHRI ratings as well as the calculations for the chiller efficiency at AHRI conditions.

8. Prescriptive incentives are limited to comfort cooling chiller applications only. Non-comfort cooling chillers (manufacturing, process use, et cetera) will be evaluated through the Custom measures path.

Electric Chiller Equipment Information

Incentives are for comfort chillers ONLY. Non-comfort (process chillers) must go through custom measures.

Reason **N-** New **R -** Replaced	Type **AC -** Air Cooled **WCC -** Water Cooled, Centrifugal **WCP -** Water Cooled, Positive Displacement	Variable Speed? Yes/No	Manufacturer	Model	Location (Building/Room Name)	Full Load Efficiency **AC -** EER **WCC/WCP -** kW/ton	Part Load Efficiency **AC -** EER **WCC/WCP -** kW/ton	A Unit Size (Tons)	B Base Incentive $/ton *See Incentive Rates & Efficiencies page*	C Performance Incentive $/ton *See Requirement #3 above for Performance Incentive Per Ton Calculation*	D # of Units	Total Incentives =A*(B+C)*D
(Example) N	AC	No	ACME	RRC1957	Mech Room #4	10.4 EER	16 EER	130	$20.00	$3.50	1	$3,055.00
(Example) N	WCC	Yes	ACME	RRC1958	Mech Room #5	0.633 kW/Ton	0.328 kW/ton	290	$30.00	$15.00	1	$13,050.00
										Total:		

Mail or fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program c/o TRC Energy Services
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095
Phone: 866-657-6278 • Fax: 732-855-0422

Electric Chillers Application - July 1, 2015 through June 30, 2016

Minimum Qualifying Efficiency Levels

Type	Capacity	Path A (Constant Speed)		Path B (Variable Speed)		Path A (Constant Speed)		Path B (Variable Speed)	
		Incentive Minimum Full Load kW/ton	Qualifying IPLV kW/ton	Qualifying Full Load kW/ton	Incentive Minimum IPLV kW/ton	Incentive Minimum Full Load EER	Qualifying IPLV EER	Qualifying Full Load EER	Incentive Minimum IPLV EER
Air Cooled	tons < 150					10.3	13.7	9.7	16.12
Air Cooled	tons ≥ 150					10.3	14	9.7	16.42
Water Cooled, Positive Displacement	tons < 75	0.735	0.6	0.78	0.49				
Water Cooled, Positive Displacement	75 ≤ tons < 150	0.706	0.56	0.75	0.48				
Water Cooled, Positive Displacement	150 ≤ tons < 300	0.647	0.54	0.68	0.431				
Water Cooled, Positive Displacement	300 ≤ tons < 600	0.598	0.52	0.625	0.402				
Water Cooled, Positive Displacement	tons ≥ 600	0.549	0.5	0.585	0.372				
Water Cooled, Centrifugal	tons < 150	0.598	0.55	0.695	0.431				
Water Cooled, Centrifugal	150 ≤ tons < 300	0.598	0.55	0.635	0.392				
Water Cooled, Centrifugal	300 ≤ tons < 400	0.549	0.52	0.595	0.382				
Water Cooled, Centrifugal	400 ≤ tons < 600	0.549	0.5	0.585	0.372				
Water Cooled, Centrifugal	tons ≥ 600	0.549	0.5	0.585	0.372				

Incentives*

Type	Capacity	Constant Speed		Variable Speed	
		Base $/ton	Performance* $/ton	Base $/ton	Performance* $/ton
Air Cooled	tons < 150	$20.00	$3.50	$90.00	$4.00
Air Cooled	tons ≥ 150	$20.00	$2.75	$92.00	$4.00
Water Cooled, Positive Displacement	tons < 75	$13.00	$2.25	$40.00	$2.50
Water Cooled, Positive Displacement	75 ≤ tons < 150	$20.00	$2.00	$43.00	$2.00
Water Cooled, Positive Displacement	150 ≤ tons < 300	$17.00	$2.00	$43.00	$2.00
Water Cooled, Positive Displacement	300 ≤ tons < 600	$15.00	$2.25	$37.00	$2.00
Water Cooled, Positive Displacement	tons ≥ 600	$30.00	$2.00	$44.00	$2.00
Water Cooled, Centrifugal	tons < 150	$24.00	$2.25	$12.00	$4.00
Water Cooled, Centrifugal	150 ≤ tons < 300	$10.00	$2.00	$30.00	$2.50
Water Cooled, Centrifugal	300 ≤ tons < 400	$8.00	$2.00	$20.00	$2.00
Water Cooled, Centrifugal	400 ≤ tons < 600	$8.00	$2.00	$25.00	$2.00
Water Cooled, Centrifugal	tons ≥ 600	$8.00	$2.00	$25.00	$2.00

* Performance Incentives apply for each 0.1 EER above the Incentive Minimum EER or for each 0.01 kW/ton below the Incentive Minimum kW/ton.

Mail or fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program c/o TRC Energy Services
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NJ SmartStart Buildings®

Program Terms and Conditions

Definitions:

Energy-Efficient Measures – Any device eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings).

New Jersey Utilities – The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under "Incentive Amount" heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

Eligibility: In order to be eligible for program incentives, a customer, or an agent (contractor/vendor) authorized by a customer, must submit a properly completed application package. A complete application package should include:

- Completed application forms signed by the customer.
- Manufacturer specification sheets and supporting documentation of qualifications.
- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
    - Name of the customer listed on the application must match the name of the customer listed on the utility bill.
    - For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.
- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

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Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Electric Unitary HVAC Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	Doing Business as (if applicable)	Installation Start Date:	
		Installation Completion Date:	

Facility Address	City	State	Zip Code
		NJ	

Electric Utility Serving Applicant	Electric Account Number*	NAICS Code

Building Type (Office, Retail, Hospital, School, etc).	Building Type (if "Other")	How did you hear about the program? (See above

Project Type (New Construction, Renovation, Equipment Replacement)	Size of Building

Mailing Address	City	State	Zip Code

Contact Person	E-mail Address	Telephone Number	Fax Number

Incorporated (Yes, No, Other)	Federal Tax ID #	Incentive Payment To (Customer, Contractor or Other)	Customer Signature (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	Contact Person

Mailing Address	City	State	Zip Code

Contact Email Address	Federal Tax ID #	Telephone Number	Fax Number

Contractor Information

Company	Contact Person

Mailing Address	City	State	Zip Code

Contact Email Address	Federal Tax ID #	Telephone Number	Fax Number

Electric Unitary HVAC Application - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

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Visit our website: NJCleanEnergy.com/ssb

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited. *Incentives/Requirements subject to change.

Specific Program Requirements*

(these requirements are in addition to the Program Terms and Conditions

1. Include the manufacturer's specification sheet and AHRI Certified Net Capacity with the application package and mail or fax directly to the Commercial/Industrial Market Manager.
2. Both indoor and outdoor components of a split system must be replaced to qualify for an incentive.
3. Incentive calculation is based on the Electric Unitary HVAC equipment capacity at AHRI Certified Net Capacity and Rating at operating conditions; it is not based on the nominal Electric Unitary HVAC equipment capacity.
4. Dual Enthalpy Economizer Control incentive is available with new installation on qualifying Electric Unitary HVAC equipment.
5. Efficiency requirements to comply with ASHRAE 90.1-2007.
6. Incentives for qualifying Central DX AC Systems >63 tons for existing buildings only. New construction ineligible.
7. A/C economizing controls incentive available for both retrofits and new units without a current economizing control installed.
8. All A/C economizing controls must be listed by UL or other OSHA approved Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable US standards.
9. Eligible measure types for occupancy controlled thermostats include (All require installation of a new thermostat):
   - In-room occupancy sensors (single or dual technology)
   - Keycard-based system
   - Check-in/check-out system – requires door switch and in-room occupancy sensor

Electric Unitary HVAC Efficiency Levels and Incentives*

Unitary HVAC/Split Systems	
<5.4 tons	14.0 SEER $92/ton
≥5.4 to <11.25 tons	11.5 EER $73/ton
≥11.25 to <20 tons	11.5 EER $79/ton
≥20 to 30 tons	10.5 EER $79/ton
Air-to-Air Heat Pump Systems	
<5.4 tons	14 SEER & 7.8 HSPF $92/ton
≥5.4 to <11.25 tons	11.5 EER $73/ton
≥11.25 to <20 tons	11.5 EER $79/ton
≥20 to 30 tons	10.5 EER $79/ton
Packaged Terminal Systems	
<9,000 BTUH	12.0 EER $65/ton
≥9,000 to 12,000 BTUH	11.0 EER $65/ton
>12,000 BTUH	10.0 EER $65/ton

Water Source Heat Pumps	
≤5.4 tons	14.0 EER $81/ton
>5.4 tons	14.0 EER $81/ton
Central DX AC Systems	
>30 to 63 tons	≥9.5 EER $40/ton
> 63 tons	≥9.5 EER $72/ton
Dual Enthalpy Economizer Controls	
All	$250/unit
Occupancy Controlled Thermostats for Hospitality/Institutional Facilities	
All	$75/unit
A/C Economizing Controls	
≤5 tons	$85/unit
>5 tons	$170/unit

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Electric Unitary HVAC Equipment Information

Reason N–New R–Replaced	**Type** **A**–ASHP **D**-DXAC **P**–PTS **S**–Split* **U**–Unitary **W**–WSHP	**Manuf.**	**Model**	**A** Unit Size Cooling** (Btuh)	**B** **Cooling Efficiency** (EER or SEER)	**C** **Has Dual Enthalpy Economizer? 0-No 1-Yes**	**D** **Incentive $/ton (Table)**	**ASHP or WSHP**		**E** **Quantity**	**F** **Total Incentives** (A*D*E)+C*E*250 12,000
								Unit Size Heating (Btuh)	Heating Efficiency (COP or HSPF)		
(Example) - N	U	ACME	HV1011	120,000	11.5	1	$ 73.00	N/A	N/A	2	$ 1,960.00
											$ -
											$ -
											$ -
											$ -
											$ -
											$ -
											$ -
											$ -
											$ -
											$ -
											$ -
*Split Systems: List matching Indoor and Outdoor Components **AHRI Certified Net Capacity and Rating as listed on AHRI Certification Sheet										**Total**	$ -

Occupancy Controlled Thermostats

Heating Type E – Electric Heating (Heat Pump) G – Gas Heating (Occ. Cont. T-Stat Only)	**T_h Heating Season Facility Temp. (ºF)**	**T_c Cooling Season Facility Temp. (ºF)**	**Weekly Occupied Hours**	**Occupancy Sensor Type** 1 - In room occupancy sensors 2 - Key card-based system 3 - Check in/check-out system	**Cap_{hp}=** Connected load capacity of heat pump/AC (Tons)	**Cap_h=** Connected heating Load capacity (Btu/hr)	**$AFUE_h$=** Heating Equipment Efficiency	**EER =** Heat Pump/ AC Equipment Efficiency	**Number of OCC. Controlled Thermostats**	**Total Incentives - $75/OCT x # of units**
(Example) - E	72 deg F	70 deg F	56		N/A	200,000 btu	95%	12 EER	10	$75 * 10 = $750
										$ -
										$ -
										$ -
									Total	$ -

A/C Economizing Controls

A/C Manuf.	**Model**	**Unit Size Cooling (Btuh)**	**Cooling Efficiency** (EER or SEER)	**(A) Quantity**	**(B) Incentive**	**(A x B) Total Incentives**
(Example) - Acme	HV1011	120,000 Btuh	11.5	3	$170	3*$170=$510
						$ -
						$ -
						$ -
					Total	$ -

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- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Food Service Equipment Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	Doing Business as (if applicable)	Installation Start Date:	
		Installation Completion Date:	

Facility Address	City	State	Zip Code
		NJ	

Electric Utility	Electric Account Number	Gas Utility	Gas Account Number	NAICS Code

Building Type (Office, Retail, Hospital, School, etc).	Building Type (if "Other")	How did you hear about the program? (See above

Project Type (New Construction, Renovation, Replacement)	Size of Building

Mailing Address	City	State	Zip Code

Contact Person	E-mail Address	Telephone Number	Fax Number

Incorporated (Yes, No, Other)	Federal Tax ID #	Incentive Payment To (Customer, Contractor or Other)	Customer Signature (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company Name	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor Information

Company Name	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Food Service Equipment Application - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program
c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Food Service Equipment Application - July 1, 2015 through June 30, 2016

Specific Program Requirements* (these requirements are in addition to the Program Terms and Conditions)

1. Please refer to the table below for specific technical requirements.
2. Include the manufacturer's specification sheet with the application package and mail or fax directly to the Commercial/Industrial Market Manager.
3. Incentives must be applied towards the purchase of new or replacement energy-efficient equipment only. Equipment that is used or rebuilt is not eligible.
4. Equipment must meet the performance requirements as defined in the incentives table below or be listed on the current Energy Star qualified product list or Consortium of Energy Efficiency (CEE).

ENERGY STAR Commercial Kitchen Package:
http://www.energystar.gov/products

CEE Program Resources:
http://www.cee1.org/content/cee-program-resources

Commercial Combination Oven/Steamer Information

Fuel Use (Electric or Gas)	**# of Steamer Pans**	**Convection Mode Idle Energy Rate** (kW or Btu/h)	**Steam Mode Idle Energy Rate** (kW or Btu/h)	**Convection Mode Efficiency** (%)	**Steam Mode Efficiency** (%)	Manufacturer Name	Model Number	**A** # of Units	**B** Incentive (see below)	**Total Incentive** = A*B
Electric	15	2 kW	5 kW	75%	55%			1	$1,000	$1,000
								Total:		

Commercial Combination Oven/Steamer (Electric) Requirements and Incentives*

REQUIREMENTS -
Equipment must meet either of the following criteria:
• Be listed on the current Energy Star qualified product list; or
• Must have a cooking energy efficiency of 50 percent or greater in steam
• CEE qualified; or
• ASTM:
• Must have a cooking energy efficiency of 50 percent or greater in steam mode and 70 percent cooking energy efficiency or greater in convection mode, utilizing American Society for Testing and Materials (ASTM) F2861.
• Must meet the idle energy rate requirements in the Electric Combination Oven/Steamer Table, utilizing ASTM F2861.

Pan Capacity	**Steam Mode - Idle Energy Rate**	**Convection Mode - Idle Energy Rate**
Less than 15 pans*	5.0 kW or less	2.0 kW or less
15 - 28 pans*	6.0 kW or less	2.5 kW or less
Greater than 28 pans*	9.0 kW or less	3.5 kW or less

* Combination oven/steamer pan capacity on based on the maximum capacity of full-size 2 1/2-inch deep hotel pans. This must be consistent with the number of pans used to meet the energy-efficiency qualifications per ASTM F2861.

Description	**Incentive/Unit**
Commercial Combination Oven/Steamer (Electric)	$1,000/oven

Commercial Combination Oven/Steamer (Natural Gas) Requirements and Incentives*

REQUIREMENTS -
Equipment must meet either of the following criteria:
• Be listed on the current Energy Star qualified product list; or
• Must have a cooking energy efficiency of 50 percent or greater in steam
• CEE qualified; or
• ASTM:
• Must have a cooking energy efficiency of 38 percent or greater in steam mode and 44 percent or greater in convection mode, utilizing ASTM F2861.
• Must meet the idle energy rate requirements in the Gas Commercial Combination Oven/Steamer Table, utilizing ASTM F2861.

Pan Capacity	**Steam Mode - Idle Energy Rate**	**Convection Mode - Idle Energy Rate**
Less than 15 pans*	15,000 Btuh or less	9,000 Btuh or less
15 - 28 pans*	18,000 Btuh or less	11,000 Btuh or less
Greater than 28 pans*	28,000 Btuh or less	17,000 Btuh or less

* Combination oven/steamer pan capacity on based on the maximum capacity of full-size 2 1/2-inch deep hotel pans. This must be consistent with the number of pans used to meet the energy-efficiency qualifications per ASTM F2861.

Description	**Incentive/Unit**
Commercial Combination Oven/Steamer (Natural Gas)	$750/oven

Food Service Equipment Application - July 1, 2015 through June 30, 2016

Commercial Refrigeration & Freezer Information

Equipment Type (Glass or Solid Door; Refrigerator or Freezer)	**Internal Volume** (ft^3)	**Daily Energy Rate** (kWh/day)	**Manufacturer Name**	**Model Number**	**A** # of Units	**B** Incentive Amount From Table	**Total Incentive** =A*B
Solid Door Refrigerator	41.8 ft^3	3.7 kWh			2	$125	$250
						Total	

Commercial Refrigeration REQUIREMENTS -
• The refrigeration system must be built-in (packaged) and be listed on the current Energy Star qualified product list.

Commercial Refrigeration Exclusions -
• Cases with remote refrigeration systems do not qualify.

EnergyStar® Commercial Refrigerator Incentives*

Description	**Glass Door Incentive/unit**	**Solid Door Incentive/unit**
ENERGY STAR Refrigerators - Internal volume less than 15 ft^3	$75/unit	$50/unit
ENERGY STAR Refrigerators - Internal volume 15 ft^3–29.9 ft^3	$100/unit	$75/unit
ENERGY STAR Refrigerators - Internal volume 30 ft^3–49.9 ft^3	$125/unit	$125/unit
ENERGY STAR Refrigerators - Internal volume 50 ft^3 or greater	$150/unit	$200/unit

EnergyStar® Commercial Freezer Incentives*

Description	**Glass Door Incentive/unit**	**Solid Door Incentive/unit**
ENERGY STAR Freezers - Internal volume less than 15 ft^3	$200/unit	$100/unit
ENERGY STAR Freezers - Internal volume 15 ft^3–29.9 ft^3	$250/unit	$150/unit
ENERGY STAR Freezers - Internal volume 30 ft^3–49.9 ft^3	$500/unit	$300/unit
ENERGY STAR Freezers - Internal volume 50 ft^3 or greater	$1,000/unit	$600/unit

Commercial Ice Machine Information

Equipment Type (Ice Making Heads, Remote Condenser, Self-Contained)	**Daily Ice Harvest Rate** (lbs @70°F Water, 90°	**Energy Rate** (kWh/100 lbs ice @70°F Water, 90° Ambient)	**Manufacturer Name**	**Model Number**	**A** # of Units	**B** Incentive Amount From Table	**Total Incentive** =A*B
Self-Contained	846 lbs	5.1 kWh			5	$250	$1,250
						Total	

EnergyStar® Ice Machine Incentives*

• Proposed equipment MUST be on one of these two lists. A list of qualifying ENERGY STAR Ice Machines can be found by visiting the ENERGY STAR Commercial Kitchens Package Page. For Super-Efficient qualified products, please reference the Fisher-Nickel Qualified Products List at http://fishnick.com/saveenergy/rebates/icemakers.pdf.
• Includes machines generating ice cubes that are 60 grams (2 oz.) or lighter. It also includes flaked, crushed and fragmented ice makers.
• Only air-cooled machines (self-contained, ice making heads, or remote condensing).
• The entire ARI tested ice making system must be purchased.
• Remote machines must be purchased with qualifying remote condenser or remote condenser/compressor unit.
• Ice machines must be tested in accordance with the Air Conditioning and Refrigeration Institute (ARI) Standard 810. Visit www.ari.org for product information and testing procedures.

Additional Details:
• The efficiency specifications for the two qualifying tiers are equivalent to ENERGY STAR or Super-Efficient.
• Specifications are available at www.energystar.gov/cfs and www.fishnick.com/saveenergy/rebates.

Description	**Incentive/unit**
ENERGY STAR Ice Machine (101–200 lbs/day)	$50/unit
ENERGY STAR Ice Machine (201–300 lbs/day)	$50/unit
ENERGY STAR Ice Machine (301–400 lbs/day)	$75/unit
ENERGY STAR Ice Machine (401–500 lbs/day)	$75/unit
ENERGY STAR Ice Machine (501–1000 lbs/day)	$125/unit
ENERGY STAR Ice Machine (1001–1500 lbs/day)	$200/unit
ENERGY STAR Ice Machine (greater than 1500 lbs/day)	$250/unit
Description	**Incentive/unit**
Super-Efficient Ice Machine (101–200 lbs/day)	$100/unit
Super-Efficient Ice Machine (201–300 lbs/day)	$100/unit
Super-Efficient Ice Machine (301–400 lbs/day)	$150/unit
Super-Efficient Ice Machine (401–500 lbs/day)	$150/unit
Super-Efficient Ice Machine (501–1000 lbs/day)	$250/unit
Super-Efficient Ice Machine (1001–1500 lbs/day)	$400/unit
Super-Efficient Ice Machine (greater than 1500 lbs/day)	$500/unit

Food Service Equipment Application - July 1, 2015 through June 30, 2016

Commercial Ovens, Steamers, Fryers and Griddles Information

Fuel Use (Electric or Gas)	**Type** Convection Oven, Conveyor Oven, Rack Oven, Fryer, Large Vat Fryer, Griddle, or Steamer	**Sizing** (See Below for sizing Guide)	**Idle Energy Rate** (kW or Btu/h)	**Heavy Load Efficiency** (%)	**Manufacturer Name**	**Model Number**	**A** # of Units	**B** Incentive Amount From Table	**Total Incentive** =A*B
Electric	Large Vat Fryer	N/A	0.8 kW	90%			4	$200	$800
								Total:	

Sizing Guide	
Convection Ovens	Enter Half-Size or Full-Size
Conveyor Ovens	Enter Small (Conveyor width 25-in. or less) or Large (Conveyor width greater than 25-in.)
Rack Ovens	Enter Single-Rack or Double-Rack
Steamers	Enter # of Pans
Fryers and Large Vat Fryers	No Input Required
Griddles	Enter Griddle Width in Feet (2, 3, 4, 5 or 6 Feet)

Commercial Convection Oven (Electric) Requirements and Incentives*

REQUIREMENTS -
Equipment must meet either of the following criteria:
• Be listed on the current Energy Star qualified product list; or
• CEE qualified; or
• ASTM:
• Must have a tested heavy load (potato) cooking energy efficiency of 70 percent or more, utilizing ASTM F1496.
• Full-size electric ovens must have a tested idle energy rate of 1.6 kW or less, utilizing ASTM F1496.
• Half-size electric ovens must have a tested idle energy rate of 1.0 kW or less, utilizing ASTM F1496.

Description	Incentive/Unit
Commercial Convection Oven (Electric)	$350/oven

Commercial Convection Oven (Natural Gas) Requirements and Incentives*

REQUIREMENTS -
Equipment must meet either of the following criteria:
• Be listed on the current Energy Star qualified product list; or
• CEE qualified; or
• ASTM:
• Must have a tested heavy load (potato) cooking energy efficiency of 44 percent or greater and an idle energy rate of 13,000 Btu/h or less, utilizing ASTM F1496.

Description	Incentive/Unit
Commercial Convection Oven (Natural Gas)	$500/oven

Commercial Rack Oven (Natural Gas) Requirements and Incentives*

REQUIREMENTS -
Equipment must meet either of the following criteria:
• Be listed on the current Energy Star qualified product list; or
• CEE qualified; or
• ASTM:
• Must have a tested baking energy efficiency of 50 percent or greater, utilizing ASTM F2093.

Description	Incentive/Unit
Commercial Rack Oven Single (Natural Gas)	$1,000/single oven
Commercial Rack Oven Double (Natural Gas)	$2,000/double oven

Commercial Conveyor Oven (Natural Gas)

REQUIREMENTS -
Equipment must meet either of the following criteria:
• Be listed on the current Energy Star qualified product list; or CEE qualified; or
• ASTM:
  • Must have a tested baking energy efficiency of 42 percent or greater, utilizing ASTM F1817.
  • Small conveyor ovens with total conveyor width 25 inches or less must have a tested idle energy rate that is 29,000 Btu/h or less, utilizing ASTM F1817.
  • Large conveyor ovens with total conveyor width greater than 25 inches must have a tested idle energy rate that is 57,000 Btu/h or less, utilizing ASTM F1817.

ADDITIONAL DETAILS:
• Multiple-deck oven configurations are paid per qualifying oven deck

Description	Incentive/Unit
Commercial Conveyor Oven — Small (Conveyor width 25-in. or less) (Natural Gas)	$500/deck
Commercial Conveyor Oven — Large (Conveyor width greater than 25-in) (Natural Gas)	$750/deck

Commercial Fryer (Electric) Requirements and Incentives*	
REQUIREMENTS - Equipment must meet either of the following criteria: • Be listed on the current Energy Star qualified product list; • or CEE qualified; or	• ASTM: • Must have a tested heavy load cooking energy efficiency of 80 percent or greater and an idle energy rate of 1.0 kW or less, utilizing ASTM F1361. ADDITIONAL DETAILS: • Multiple-deck oven configurations are paid per qualifying vat
Description	**Incentive/Unit**
Commercial Fryer (Electric)	$200/vat

Commercial Fryer (Natural Gas) Requirements and Incentives*	
REQUIREMENTS - Equipment must meet either of the following criteria: • Be listed on the current Energy Star qualified product list; • or CEE qualified; or	• ASTM: • Must meet a tested heavy load cooking energy efficiency of 50 percent or greater and an idle energy rate of 9,000 Btu/h or less, utilizing ASTM F1361. ADDITIONAL DETAILS: • Multiple-deck oven configurations are paid per qualifying vat
Description	**Incentive/Unit**
Commercial Fryer (Natural Gas)	$749/vat

Commercial Large Vat Fryer (Electric) Requirements and Incentives*	
REQUIREMENTS - Equipment must meet either of the following criteria: • Be listed on the current Energy Star qualified product list; • or CEE qualified; or	• ASTM: • Must have a tested heavy load (French fry) cooking energy efficiency of 80 percent or greater, utilizing ASTM F2144. ADDITIONAL DETAILS: • Multiple-deck oven configurations are paid per qualifying vat
Description	**Incentive/Unit**
Commercial Large Vat Fryer (Electric)	$200/vat

Commercial Large Vat Fryer (Natural Gas) Requirements and Incentives*	
REQUIREMENTS - Equipment must meet either of the following criteria: • Be listed on the current Energy Star qualified product list; • or CEE qualified; or	• ASTM: • Must have a tested heavy load (French fry) cooking energy efficiency of 50 percent or greater, utilizing ASTM F2144. ADDITIONAL DETAILS: • Multiple-deck oven configurations are paid per qualifying vat
Description	**Incentive/Unit**
Commercial Large Vat Fryer (Natural Gas)	$500/vat

Commercial Griddle (Electric) Requirements and Incentives*	
REQUIREMENTS - Equipment must meet either of the following criteria: • Be listed on the current Energy Star qualified product list; • or CEE qualified; or	• ASTM: • Must have a tested heavy load cooking energy efficiency of 70 percent or greater and an idle energy rate of 355 watts per square foot of cooking surface or less, utilizing ASTM F1275. ADDITIONAL DETAILS: • Multiple-deck oven configurations are paid per qualifying vat
Description	**Incentive/Unit**
Commercial Griddle (Electric)	$300/griddle

Commercial Griddle (Natural Gas) Requirements and Incentives*	
REQUIREMENTS - Equipment must meet either of the following criteria: • Be listed on the current Energy Star qualified product list; • or CEE qualified; or	• ASTM: • Must have a tested heavy load cooking energy efficiency of 38 percent or greater and an idle energy rate of 2,650 Btu/h per square foot of cooking surface or less, utilizing ASTM F1275. ADDITIONAL DETAILS: • Multiple-deck oven configurations are paid per qualifying vat
Description	**Incentive/Unit**
Commercial Griddle (Natural Gas)	$125/griddle

Commercial Steam Cooker (Electric) Requirements and Incentives*	
REQUIREMENTS - Equipment must meet either of the following criteria: • Be listed on the current Energy Star qualified product list; • or CEE qualified; or	• ASTM: • Must have a tested heavy load (potato) cooking energy efficiency of 50 percent or greater, utilizing ASTM F1484.
Description	**Incentive/Unit**
Commercial Steam Cooker (Electric)	$1,250/steamer

Commercial Steam Cooker (Electric) Requirements and Incentives*	
REQUIREMENTS - Equipment must meet either of the following criteria: • Be listed on the current Energy Star qualified product list; • or CEE qualified; or	• ASTM: • Must have a tested heavy load (potato) cooking energy efficiency of 38 percent or greater, utilizing ASTM F1484.
Description	**Incentive/Unit**
Commercial Steam Cooker (Natural Gas)	$2,000/steamer

Food Service Equipment Application - July 1, 2015 through June 30, 2016

Insulated Hood Holding Cabinet Information

Fuel Use (Electric or Gas)	**Cabinet Size** (1/2, 3/4, or Full-Size)	**Idle Energy Rate** (kW or Btu/h)	**Manufacturer Name**	**Model Number**	**A** # of Units	**B** Incentive Amount From Table	**Total Incentive** =A*B
Electric	Full-size	0.28 kW			4	$300	$1,200
						Total:	

Insulated Holding Cabinets Requirements and Incentives*	
REQUIREMENTS - • Must meet CEE Tier II specification • All measures must be electric hot food holding cabinets that are fully insulated and have solid doors.	**Exclusions:** • Does not include cook and hold equipment.
Description	**Incentive/Unit**
Insulated Holding Cabinets, Full-size	$300/unit
Insulated Holding Cabinets, 3/4 size	$250/unit
Insulated Holding Cabinets, 1/2 size	$200/unit

Commercial Dishwasher Information

Equipment Type (Under Counter, Door Type, Single Tank Conveyor, Double Tank Conveyor)	**Cleaning Temperature** (Low-Temp or High-Temp)	**Hot Water Fuel Type** (Electric or Gas)	**Booster Hot Water Fuel Type** (Electric or Gas if applicable)	**Manufacturer Name**	**Model Number**	**A** # of Units	**B** Incentive Amount From Table	**Total Incentive** =A*B
Single Tank Conveyor	High-temp	Gas	Gas			2	$1,000	$2,000
							Total:	

Commercial Dishwasher Requirements and Incentives*	
REQUIREMENTS - Equipment must meet either of the following criteria: • Be listed on the current Energy Star qualified product list; or • CEE qualified	
Description	**Incentive/Unit**
Under Counter Dishwasher	$400/unit
Door Type Dishwasher	$700/unit
Single Tank Conveyor Dishwasher	$1,000/unit
Multiple Tank Conveyor Dishwasher	$1,500/unit

NJ SmartStart Buildings®

Program Terms and Conditions

Definitions:

Energy-Efficient Measures – Any device eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings).

New Jersey Utilities – The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under "Incentive Amount" heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

Eligibility: In order to be eligible for program incentives, a customer, or an agent (contractor/vendor) authorized by a customer, must submit a properly completed application package. A complete application package should include:

- Completed application forms signed by the customer.
- Manufacturer specification sheets and supporting documentation of qualifications.
- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
    - Name of the customer listed on the application must match the name of the customer listed on the utility bill.
    - For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.
- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities' service territory and designated on the Participating Customer's incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Gas Cooling Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	Doing Business as (if applicable)	Installation Start Date:	
		Installation Completion Date:	

Facility Address	City	State	Zip Code
		NJ	

Gas Utility Serving Applicant	Gas Account Number*	NAICS Code

Building Type (Office, Retail, Hospital, School, etc).	Building Type (if "Other")	How did you hear about the program? (See above

Project Type (New Construction, Renovation, Replacement)	Size of Building

Mailing Address	City	State	Zip Code

Contact Person	E-mail Address	Telephone Number	Fax Number

Incorporated (Yes, No, Other)	Federal Tax ID #	Incentive Payment To (Customer, Contractor or Other)	Customer Signature (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	Contact Person

Mailing Address	City	State	Zip Code

Contact Email Address	Federal Tax ID #	Telephone Number	Fax Number

Contractor Information

Company	Contact Person

Mailing Address	City	State	Zip Code

Contact Email Address	Federal Tax ID #	Telephone Number	Fax Number

Gas Cooling Application - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent gas bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program
c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Visit our website: NJCleanEnergy.com/ssb

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited. *Incentives/Requirements subject to change.

Specific Program Requirements*

(these requirements are in addition to the Program Terms and Conditions

1. Please refer to the program guide for additional applicable technical requirements.
2. Include the manufacturer's specification sheet with the application package and mail or fax directly to the Commercial/Industrial Market Manager.
3. Chiller full and part-load efficiencies are determined in accordance with AHRI Standard 550/590/2003.
4. Efficiency requirements to comply with ASHRAE 90.1-2007.

Gas Cooling Equipment Efficiency Levels and Incentives*

Gas Absorption Chillers

Size Range	Indirect-Fired (Incentive & Efficiency Threshold)	Direct-Fired (Incentive & Efficiency Threshold)
< 100 tons	≥ 1.1 F.L. COP $450/ton	> 1.1 F.L. COP $450/ton
100 to 400 tons	> 1.1 F.L. COP $230/ton	> 1.1 F.L. COP $230/ton
> 400 tons (only two-stage chillers)	>1.1 F.L. COP $185/ton	> 1.1 F.L. COP $185/Ton

Regenerative Desiccant Units

Incentive per CFM (based on process airflow)
$1.00 per CFM Eligible when matched with core gas or electric cooling equipment

Gas Cooling Equipment Information

Reason N- New R- Replaced	Type A- Absorption D- Dessicant	Manufacturer & Model	Vacuum Boiler Efficiency %	Boiler Input Rating Therms/hour	Parasitic Load (kW/Ton)	A Unit Size (Tons)	B Unit Efficiency (C.O.P.)	C Incentive $/ton (see table)	D Quantity	E Total Incentives (A * C * D)
(Example) N	A	ACME/GF1011	80%	100	0.1	10	1.1	$450	1	10*$450*1 = $4,500
								Total:		

Mail or fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program c/o TRC Energy Services
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095
Phone: 866-657-6278 • Fax: 732-855-0422

NJ SmartStart Buildings®

Program Terms and Conditions

Definitions:

Energy-Efficient Measures – Any device eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings).

New Jersey Utilities – The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under "Incentive Amount" heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

Eligibility: In order to be eligible for program incentives, a customer, or an agent (contractor/vendor) authorized by a customer, must submit a properly completed application package. A complete application package should include:

- Completed application forms signed by the customer.
- Manufacturer specification sheets and supporting documentation of qualifications.
- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
    - Name of the customer listed on the application must match the name of the customer listed on the utility bill.
    - For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.
- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities' service territory and designated on the Participating Customer's incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

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Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Gas Heating Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	Doing Business as (if applicable)	Installation Start Date:	
		Installation Completion Date:	

Facility Address	City	State	Zip Code
		NJ	

Gas Utility Serving Applicant	Gas Account Number*	NAICS Code

Building Type (see legend below)	Building Location (select closest city - see legend below)	How did you hear about the program?

Project Type (New Construction, Renovation, Replacement)	Size of Building

Mailing Address	City	State	Zip Code

Contact Person	E-mail Address	Telephone Number	Fax Number

Incorporated (Yes, No, Other)	Federal Tax ID #	Incentive Payment To (Customer, Contractor or Other)	Customer Signature (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Building Type Legend

Education; Food Sales; Food Service; Health Care; Lodging; Retail; Office; Public Assembly; Public Order/Safety; Religious Worship; Service; Warehouse/Storage; Multi-Family; Other

Building Location Legend *(select city closest to building site)*

Atlantic City, NJ; Newark, NJ; Philadelphia, PA; Monticello, NY

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor Information

Company	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Gas Heating Application - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent gas bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program
c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Gas Heating Application - July 1, 2015 through June 30, 2016

Specific Program Requirements* (these requirements are in addition to the Program Terms and Conditions)

1. Include the manufacturer's specification sheet with the application package and mail or fax directly to the Commercial/Industrial Market Manager.
2. Equipment efficiency information must be provided on manufacturer specification documents.
3. Boiler economizing controls incentive available for both retrofits and new units without a current economizing control installed.
4. The incentive for boilers, furnaces and infrared equipment is calculated using the input capacity of the new unit(s).
5. Equipment must meet or exceed the applicable efficiencies levels listed in the table in this form to be eligible for an incentive.
6. Gas Fired Boilers - The equipment efficiency published under one of the sources listed below must meet or exceed the applicable efficiency levels listed in the table in this form to be eligible for an incentive.

- AHRI certificate for the proposed make and model of equipment (www.ahridirectory.org).
- Federal Trade Commission EnergyGuide label.
- Manufacturer efficiency rating using the test procedure for the equipment listed in ASHRAE Standard 90.1-2013 Table 6.8.

Provide a copy of the AHRI certificate if it is available. Otherwise provide either a copy of the manufacturer's FTC EnergyLabel showing the efficiency of the proposed equipment or a copy of the manufacturer's cutsheet showing either the efficiency or the input and output ratings of the proposed equipment.
7. All boiler economizing controls and infrared heaters must be listed by UL or other OSHA approved Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable U.S. Standards.
8. Incentives for infrared heating equipment are for indoor installations only.

Gas Heating Equipment Information

Replacement Type N - New R - Replaced	**Type** Boiler; Furnace; Infrared Heater; Econ. Controls	**Boiler Type** (if applicable, per table below)	**Location**	**Manufacturer**	**Model Number**	**A** **Unit Size Installed** (MBh Input)	**Exiting Unit Size Mbh Input** (For boiler & furnace replacements only)	**Unit Efficiency** (see table below for required type)	**B** **Incentive $/Unit** (See Table Below)	**C** **# of units**	**Total Incentives** Boiler/Furnace = A*B*C Infrared/Econ =B*C
(ex) R	Boiler	Hot water: non-condensing	Mech Room #1	ACME	B1500	1,500	1,500 Mbh	85%	$1.75	2	1500*$1.75*2 = $5,250
(ex) N	Boiler	Steam: natural draft	Mech Room #2	ACME	B1200	1,200	n/a	80%	$1.00	1	1200*$1.00*1 =$1200
(ex) R	Infrared	n/a	Warehouse	ACME	I120	120	n/a	87%	$300	10	$300*10 =$3,000
										Total	

Gas Fired Boilers

Boiler Type	**Size Category (MBh Input)**	**Non-Condensing**		**Condensing**	
		Efficiency Requirement	**Incentive***	**Efficiency Requirement**	**Incentive***
Hot Water	< 300	85% AFUE	$0.95/MBh; Min $400/unit	93% AFUE	$2.00/MBh; Min $1000/unit
Hot Water	≥ 300 to 1,500	85% Et	$1.75/MBh	91% Et	$2.20/MBh; Min $1000/unit
Hot Water	> 1,500 to 2,500	85% Et	$1.50/MBh	91% Et	$2.20/MBh
Hot Water	> 2500 to 4,000	85% Ec	$1.30/MBh	93% Ec	$2.00/MBh
Steam, all except natural draft	< 300	82% AFUE	$1.40/MBh; Min $400/unit		
Steam, all except natural draft	≥ 300 to 1,500	81% Et	$1.20/MBh		
Steam, all except natural draft	> 1,500 to 2,500	81% Et	$1.20/MBh		
Steam, all except natural draft	> 2,500 to 4,000	81% Et	$1.00/MBh		
Steam, natural draft	< 300	82% AFUE	$1.40/MBh; Min $300/unit		
Steam, natural draft	≥ 300 to 1,500	79% Et	$1.00/MBh		
Steam, natural draft	> 1500 to 2,500	79% Et	$0.90/MBh		
Steam, natural draft	> 2,500 to 4,000	79% Et	$0.70/MBh		
All types	> 4,000	Evaluated through the Custom measures path			

Et = Thermal Efficiency Ec= Combustion Efficiency MBh = 1,000 Btuh

Gas Furnaces – Minimum Efficiency ≥ 95% AFUE, ≥ 2.0% Fan Efficiency, ENERGY STAR®	
Capacity	**Incentive***
No size/capacity limiation	$400 per furnace
Low Intensity Infrared Heating	
Capacity	**Incentive***
≤100 MBh	$500/unit
>100 MBh	$300/unit

Boiler Economizing Controls	
Capacity	**Incentive***
≤ 800 MBh	$1,200
>800 MBh - <1,600 MBh	$1,500
≥1,600 MBh- <3,000 MBh	$1,800
≥3,000 MBh- <3,500 MBh	$2,100
≥3,500 MBh- < 4,000 MBh	$2,400
≥ 4,000 MBh	$2,700

NJ SmartStart Buildings®

Program Terms and Conditions

Definitions:

Energy-Efficient Measures – Any device eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings).

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Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under "Incentive Amount" heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

Eligibility: In order to be eligible for program incentives, a customer, or an agent (contractor/vendor) authorized by a customer, must submit a properly completed application package. A complete application package should include:

- Completed application forms signed by the customer.
- Manufacturer specification sheets and supporting documentation of qualifications.
- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
    - Name of the customer listed on the application must match the name of the customer listed on the utility bill.
    - For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.
- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities' service territory and designated on the Participating Customer's incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

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Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Gas Water Heating Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	Doing Business as (if applicable)	Installation Start Date:	
		Installation Completion Date:	

Facility Address	City	State	Zip Code
		NJ	

Gas Utility Serving Applicant	Gas Account Number*	NAICS Code

Building Type (see legend below)	Building Location (select closest city - see legend below)	How did you hear about the program?

Project Type (New Construction, Renovation, Replacement)	Size of Building

Mailing Address	City	State	Zip Code

Contact Person	E-mail Address	Telephone Number	Fax Number

Incorporated (Yes, No, Other)	Federal Tax ID #	Incentive Payment To (Customer, Contractor or Other)	Customer Signature (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Building Type Legend

Education; Food Sales; Food Service; Health Care; Lodging; Retail; Office; Public Assembly; Public Order/Safety; Religious Worship; Service; Warehouse/Storage; Multi-Family; Other

Building Location Legend *(select city closest to building site)*

Atlantic City, NJ; Newark, NJ; Philadelphia, PA; Monticello, NY

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor Information

Company	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Gas Water Heating Application - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent gas bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

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Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program
c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Visit our website: NJCleanEnergy.com/ssb

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited. *Incentives/Requirements subject to change.

Gas Water Heating Efficiency Levels and Incentives*

Gas-Fired Water Booster Heaters	
Capacity - MBH	**Incentive**
≤ 100 MBH	$35 per MBH
> MBH	$17 per MBH

Gas Water Heaters ≤ 50 gallons	
Capacity - MBH	**Incentive**
0.67 or better Energy Factor Size Limit: ≤ 50 gallons	$50 per water heater

Gas Water Heaters > 50 gallons		
Capacity - MBH	**Minimum Efficiency**	**Incentive**
> 50 gallons - < 300 MBH	85% AFUE	$2.00 per MBH but not less than $50 unit
≥ 300 MBH - 1500 MBH	85% AFUE	$1.75 per MBH
> 1500 - ≤ 4000 MBH	84% AFUE	$1.00 per MBH

Tankless Water Heater	
Minimum Efficiency	**Incentive**
≥ 82% Energy Factor, 90% thermal efficiency	$300 per tankless water heater

This incentive is only available for the replacement of existing, free-standing water heaters.

Gas Water Heating Equipment Information

Reason R-Replaced	**Type** 0 - Booster Heater, 1 - Water Heater, 2 - Tankless Water Heater	**Manufacturer**	**Model**	**Area Served By Heater** (1-13 - see legend)	**Unit Size** **Gallons**	**A** **Unit Capacity** **MBH Input**	**B** **Efficiency (EF or AFUE)**	**C** **Incentive (Table)**	**D** **Quantity**	**Total Incentive** Booster = A*C*D WH ≤ 50 gal = C*D WH > 50 gal = A*C*D Tankless = C*D
(Example) R	1 - Water Heater	**ACME**	**DHW1500**	**1**	**100 gallons**	**250 MBH**	**92%**	**$2.00**	**2**	**250 * $2.00 * 2 = $1,000**
(Example) R	2 - Tankless Water Heater	**ACME**	**BWH50**	**7**	**10 gallons**	**1000 MBH**	**96%**	**$ 300.00**	**1**	**$300 * 1 = $300**
								Total:		

Area Legend

1 - Education	6 - Retail (other than mall)	11 - Service
2 - Food Sales	7 - Office	12 - Warehouse and Storage
3 - Food Service	8 - Public Assembly	13 - Other
4 - Health Care	9 - Public Order and Safety	
5 - Lodging	10 - Religious Worship	

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1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
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Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Ground Source Heat Pump - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	Doing Business as (if applicable)	Installation Start Date:	
		Installation Completion Date:	

Facility Address	City	State	Zip Code
		NJ	

Electric Utility Serving Applicant	Electric Account Number*	NAICS Code

Building Type (Office, Retail, Hospital, School, etc).	Building Type (if "Other")	How did you hear about the program? (See above

Project Type (New Construction, Renovation, Equipment Replacement)	Size of Building

Mailing Address	City	State	Zip Code

Contact Person	E-mail Address	Telephone Number	Fax Number

Incorporated (Yes, No, Other)	Federal Tax ID #	Incentive Payment To (Customer, Contractor or Other)	Customer Signature (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	Contact Person

Mailing Address	City	State	Zip Code

Contact Email Address	Federal Tax ID #	Telephone Number	Fax Number

Contractor Information

Company	Contact Person

Mailing Address	City	State	Zip Code

Contact Email Address	Federal Tax ID #	Telephone Number	Fax Number

Ground Source Heat Pump - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program
c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Visit our website: NJCleanEnergy.com/ssb

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited. *Incentives/Requirements subject to change.

Specific Program Requirements

1. Include the manufacturer's specification sheet with the application package and mail or fax directly to the Commercial/Industrial Market Manager

2. Performance ratings (EER, Btuh) for qualifying closed loop Ground Source Heat Pump equipment are calculated at 77 degrees Fahrenheit entering water temperature per test procedure ISO-13256-1.

3. No incentives are available for open loop Ground Source Heat Pump equipment.

4. Efficiency requirements to comply with ASHRAE 90.1-2007.

Ground Source Heat Pump Equipment Information

Manufacturer	**Model**	**A** Unit Size Cooling (Btuh)	**B** Cooling Efficiency (EER)	**C** Incentive $/ton (Table)	**D** Unit Heating Size (Btuh)	**E** Heat Efficiency (COP or HSPF)	**F** Quantity	**G** Equipment Incentive = A*C*F / 12,000
(Example) - Acme	HV1011	51,000	16	$450.00	45,000	3.5	4	51,000 * $450 * 4 / 12,000 = $7650
							Total:	

Ground Source Heat Pump Equipment Efficiency Levels and Incentives*

Ground Loop & Ground Water Heat Pumps		
Type	**Qualifying Efficiency Level**	**Incentive**
Closed Loop ≥ 16 EER	≥ 16 EER	Up to $450 per ton
	≥ 18 EER	Up to $600 per ton
	≥ 20 EER	Up to $750 per ton

*Incentives/Requirements subject to change.

NJ SmartStart Buildings®

Program Terms and Conditions

Definitions:

Energy-Efficient Measures – Any device eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings).

New Jersey Utilities – The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under "Incentive Amount" heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

Eligibility: In order to be eligible for program incentives, a customer, or an agent (contractor/vendor) authorized by a customer, must submit a properly completed application package. A complete application package should include:

- Completed application forms signed by the customer.
- Manufacturer specification sheets and supporting documentation of qualifications.
- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
    - Name of the customer listed on the application must match the name of the customer listed on the utility bill.
    - For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.
- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities' service territory and designated on the Participating Customer's incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

Pre-approval prior to installation is required.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Lighting Controls Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	**Doing Business as (if applicable)**	**Anticipation Installation Date:** (cannot begin prior to approval by Market Manager	
Facility Address	**City**	**State**	**Zip Code**
		NJ	
Electric Utility Serving Applicant	**Electric Account Number***	**NAICS Code**	
Building Type (Hospital, Industrial, Municipality, Office, Retail, School, State, Other)		**Building Type (if "Other")**	
Project Type (New Construction, Renovation or Equipment Replacement)		**How did you hear about the program?** (See above)	
Mailing Address	**City**	**State**	**Zip Code**
Contact Person	**E-mail Address**	**Telephone Number**	**Fax Number**
Incorporated (Yes, No, Other)	**Federal Tax ID #**	**Incentive Payment To** (Customer, Contractor or Other)	**Customer Signature** (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company Name		**Contact Person**	
Mailing Address:	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor Information

Company Name		**Contact Person**	
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Lighting Controls Incentive

_____ total incentive (per attached worksheet calculations)

Note: Lighting Controls Worksheet must accompany this application.

Pre-approval prior to installation is required.

Lighting Controls Application - July 1, 2015 through June 30, 2016

Specific Program Requirements * (These requirements are in addition to the Program Terms and Conditions)

1. Include the manufacturer's specification sheet with the application package and mail or fax directly to the Commercial/Industrial Market Manager.

2. All lighting controls must be listed by UL or other OSHA approved Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable US standards.

3. If more than one eligible lighting control device is associated with the same eligible fixture, the incentive paid will be for the lighting control device that yields the largest incentive only.

4. Occupancy Sensor Controls/wireless or hard wired (existing facilities only):
■ There is no incentive available for occupancy sensors installed in a space where they are prohibited by state or local building or safety code.
■ Additionally, no incentive is eligible for occupancy sensors in the following specific spaces in all cases: stairways, restrooms (remote mounted only allowed), elevators, corridors/ hallways, lobbies, and closets/storage areas.
■ Incentives will only be paid for eligible occupancy sensors (OSW & OSR) controlling at least 2 eligible lighting fixtures and, for OSR installations, a minimum total connected load of 180 watts.
■ Incentives will only be paid for eligible OSRH occupancy sensors controlling eligible fixtures when the controlled wattage is greater than 180 watts.
■ Occupancy sensors with manual override to the "ON" position are ineligible for incentive.

5. High-Low Controls/wireless or hard wired (OHLC):
■ Incentives will not be paid for high- low controls on eligible fixtures where daylight dimming controls can be effectively employed.
■ Incentives will not be paid for spaces smaller than 250 square feet.
■ Incentives available only when "low level" is no more than 60% of "high level."
■ Incentives are not available for the following spaces: stairways, elevators, corridors/hallways, or lobbies.
■ Each sensor must control at least 180W.
■ For T8 4' systems, dimming ballasts must be qualified by CEE to qualify.

6. Daylight Dimming Controls /wireless or hard wired for eligible fixtures:
■ Incentives will only be paid for eligible daylight dimming controls operating at least 4 eligible fixtures with a minimum total connected load of 240 watts.
■ Dimming shall be continuous or stepped at 4 or more levels.
■ Incentives will be paid only for eligible daylight dimming control systems designed in accordance with IESNA practice as delineated in "RP-5-99, IESNA Recommended Practice of Daylighting."
■ For T8 4' systems, dimming ballasts must be qualified by CEE to qualify.

7. In addition to the requirements listed above, lighting control incentives are only available for control of eligible energy efficient lighting fixtures that meet Prescriptive Lighting program requirements. See the Prescriptive Lighting form for a list of eligible fixture types and requirements.

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Acknowledgement

Submit a printed, signed copy of this tab with application

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Visit our website: NJCleanEnergy.com/ssb

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*Incentives/Requirements subject to change.

Pre-approval prior to installation is required.

Lighting Controls Application - July 1, 2015 through June 30, 2016

For larger projects, please use large project spreadsheet available at NJCleanEnergy.com/Forms

Customer Information

Company Name:		**Facility Address:**			
Indicate Yes/No if multiple worksheets are being submitted for 1 project/building:			**Date Submitted:**		

Lighting Controls Prescriptive Incentives*

Control Device Type (wireless & hardwired units)	Incentive Per Unit
OSW - Occupancy Sensor Wall Mounted *(Existing facilities only)*	$20 per control
OSR - Occupancy Sensor Remote Mounted *(Existing facilities only)*	$35 per control
DDC - Daylight Dimming Controls	$45 per fixture controlled
OHLC - Occupancy-Based High-Low Dimming Control	$35 per fixture controlled
OSRH - Occupancy Sensor Remote Fixture Mounted High-Bay *(Existing facilities only)*	$35 per control

Lighting Controls Information

	Upgrade Type **N-** New **R-** Replaced	Device Type: OSW OSR OSRH DDC OHLC	Location (Room name/number) *Please be as descriptive as possible.*	Fixture Type Controlled *(ex: Fluorescent, LED. Provide configuration)*	A # of Control Units	B # of fixtures controlled per unit	C Total Wattage Controlled Per Device	D Incentive Rate	E Total Incentives For OSW, OSR, OSRH = A*D For DDC, OHLC = A*B*D
ex	N	OSW	Office 101	4L F32T8	4	2	224	$20.00	$80.00
ex	N	OSR	Conference Room A	2L F32T8	2	6	354	$35.00	$70.00
ex	N	DDC	Large Office #400	2L 18w LED tube	1	8	288	$45.00	$360.00
ex	N	OHLC	Warehouse	220w LED high bay	4	3	660	$35.00	$420.00
ex	N	OSRH	Warehouse	220w LED high bay	5	1	220	$35.00	$175.00
1									
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								Total:	

Mail or fax your application package Directly to the Commercial/Industrial Market Manager:

New Jersey's Clean Energy Program c/o TRC Energy Services
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095
Phone: 866-657-6278 • Fax: 732-855-0422

Visit our website: NJCleanEnergy.com

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NJ SmartStart Buildings®

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Definitions:

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Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

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- Completed application forms signed by the customer.
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- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
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- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities' service territory and designated on the Participating Customer's incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

Pre-approval prior to installation is required.







How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Performance Lighting Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	**Doing Business as (if applicable)**	**Anticipation Installation Date:** (cannot begin prior to approval by Market Manager	
Facility Address	**City**	**State**	**Zip Code**
		NJ	
Electric Utility Serving Applicant	**Electric Account Number***	**NAICS Code**	
Building Type (Office, Retail, Hospital, School, etc).	**Building Type** (if "Other")	**How did you hear about the program?** (See above	
Project Type (New Construction or Renovation of Existing Building)		**Size of Building**	
Mailing Address	**City**	**State**	**Zip Code**
Contact Person	**E-mail Address**	**Telephone Number**	**Fax Number**

Incorporated (Yes, No, Other)	**Federal Tax ID #**	**Incentive Payment To** (Customer, Contractor or Other)	**Customer Signature** (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	**Contact Person**		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor Information

Company	**Contact Person**		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Pre-approval prior to installation is required.

Performance Lighting Application - July 1, 2015 through June 30, 2016

Specific Program Requirements * (These requirements are in addition to the Program Terms and Conditions)

1. All proposed fixtures, ballasts, and lamp equipment must meet or exceed all guidelines listed on the Prescriptive Lighting application where applicable See the Prescriptive Lighting requirements for a full list of current requirements.
2. Include the manufacturer's specification sheet with the application package. Please label specification sheets according to luminaire tag, if possible.
3. Incentives for T-5 and T-8 fluorescent lighting fixtures with electronic ballasts are available only for fixtures with a Total Harmonic Distortion of ≤ 20%.
4. All eligible lighting devices must be UL or other OSHA approved Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable US standards.
5. New construction additions (add-ons) to an existing building are eligible for Performance incentives.
6. Spaces within existing buildings are eligible for Performance Lighting incentives. Proposed space where work is to be performed must have ALL lighting removed confirmed by a pre inspection.
7. Only new fixtures are eligible for incentives. Retrofit of existing fixtures are not eligible.
8. Customer may submit multiple applications for phased projects

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program
c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Visit our website: NJCleanEnergy.com/ssb

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited.
*Incentives/Requirements subject to change.

Pre-approval prior to installation is required.

Performance Lighting Application - July 1, 2015 through June 30, 2016

Performance Lighting Incentive Worksheet - Instructions

This worksheet is intended for use in assessing incentives that may be available for meeting Performance Lighting criteria of the New Jersey SmartStart Buildings® Program. It is modeled after the lighting worksheets/forms in ASHRAE 90.1-2007 User's Manual and is intended to be used in conjunction with ASHRAE standard 90.1-2007 for Lighting Power Densities by building area (Table 9.5.1 – page 62) and space type (Table 9.6.1 – pages 63-64).

1. Pre-approval prior to installation is required for Performance Lighting projects.
2. Applicants must select building types from Table 9.5.1 or space types from Table 9.6.1 from ASHRAE 90.1-2007 User's Manual.
3. Each space type must be listed separately on the worksheet with a corresponding Area Name/Description of sufficient detail for an inspector to find the associated luminaires. Pre-inspection is required for all gut-rehab projects of existing buildings.
4. For each area with multiple luminaire types (i.e. 2x4 3L T8 and 2x2 2U T8), list each luminaire type on a separate line.
5. Interior lighting and exterior lighting must appear on separate lines.
6. Incentives are available for both ground-up new construction, ground-up additions to existing buildings and for major renovations of an entire existing building OR a room where all lighting in the area is to be removed and replaced.
7. **PLEASE NOTE: An Excel Worksheet is available for large projects on our website at www.NJcleanenergy.com which may be submitted in place of this worksheet.**

Performance Lighting Incentive Worksheet - Table 1

1) Calculate the Program Maximum Wattage (sum of column D).

- List each unique room type in its own row. If more rows are needed, copy this sheet or use the Excel Worksheet available on online.
- The Program Maximum Wattage for incentive eligibility is 95% of the maximum allowed wattage per ASHRAE 90.1-2007 as calculated using the space-by-space method.
- Note: Columns C and D will self-populate as columns A and B are entered

Area Name/Description	A Area Square Footage	ASHRAE Building-Specific Space Type *(select from ASHRAE 90.1-2007 Table 9.5.1 or 9.6.1)*	B Space type LPD Allowed *(select from ASHRAE 90.1-2007 Table 9.5.1 or 9.6.1)*	C Maximum Allowed Wattage per ASHRAE = A * B	D Program Wattage Maximum = 0.95 * C
Conference Room #5	*300 ft^2*	*Conference/Meeting/Multipurpose*	*1.3 Watts/ft^2*	*390 watts*	*313.5 watts*
				Program Maximum Wattage = ∑ D	

Pre-approval prior to installation is required.

Performance Lighting Application - July 1, 2015 through June 30, 2016

Performance Lighting Incentive Worksheet - Table 2

2) Calculate the proposed design wattage (sum of column E) by finding wattage of all light fixtures to be installed in the areas identified in Table-1.

- List each unique fixture type found in each room/area in its own row.
- **Individual areas with design wattage exceeding the Program Wattage Maximum should be removed from both Table-1 and Table-2 for correct incentive calculation.**
- Please attach specification sheets for each fixture (with accompanying components e.g. lamps/ballasts) labeled according to the Luminaire Tag, if available. Justification for fixture wattages must be provided.
- **Eligible Fixtures:** All proposed fixtures, ballasts, and lamp equipment must meet or exceed all guidelines listed on the Prescriptive Lighting application where applicable. See the Prescriptive Lighting requirements for a full list of current requirements.

Area Name/Description	**Gross Lighted Area** *(For areas with multiple fixture types, list area only once)*	**Luminaire Tag** (if available)	**Luminaire Description**	**Watts Per Luminaire** *(As rated by DLC or EnergyStar®, if applicable)*	**Total Number of Luminaires**	**E Total Wattage**	**Eligible Fixture?**
Conference Room #5	*300 ft^2*	*A*	*2x2 LED*	*45*	*5*	*225*	*Yes*
Conference Room #5	*-*	*B1*	*Incandescent 65 watt bulb*	*60*	*1*	*60*	*No*

Pre-approval prior to installation is required.

Performance Lighting Application - July 1, 2015 through June 30, 2016

Performance Lighting Incentive Worksheet - Table 3	
F **Total quantity of <u>eligible</u> fixtures to be installed** (*See Prescriptive Lighting application for requirements)*	
G **Fixture Incentive Cap** = F * $30	
H **Wattage Incentive Cap** $1 * (Program Maximum Wattage (sum of column D) – Design Wattage (sum of column E))	
ESTIMATED INCENTIVE **Lesser of G and H**	

Performance Lighting Incentives*	
Indoor Lighting Outdoor Lighting (attached to building only)	$1.00 per watt per square foot below program incentive threshold
Maximum Incentive	$30 per qualified fixture
Baseline	New Jersey Code (ASHRAE 90.1-2007)
Incentive Threshold	5% more energy-efficient than ASHRAE 90.1-2007
Minimum Lighting Levels – Applicant shall be responsible for confirming light levels	Lighting installed under the performance incentive path should comply with the following minimum lighting levels: ■ Lighting level requirements as specified by New Jersey's non-residential construction code, or ■ For publicly supported schools, minimum lighting levels as specified in the New Jersey Administrative Code Title 6-NJAC 6:22-5.4, g1-h1.

Mail or fax your application package Directly to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program c/o TRC Energy Services
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095
Phone: 866-657-6278 • Fax: 732-855-0422

Visit our website: NJCleanEnergy.com

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*Incentives/Requirements subject to change.

NJ SmartStart Buildings®

Program Terms and Conditions

Definitions:

Energy-Efficient Measures – Any device eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings).

New Jersey Utilities – The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under "Incentive Amount" heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

Eligibility: In order to be eligible for program incentives, a customer, or an agent (contractor/vendor) authorized by a customer, must submit a properly completed application package. A complete application package should include:

- Completed application forms signed by the customer.
- Manufacturer specification sheets and supporting documentation of qualifications.
- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
    - Name of the customer listed on the application must match the name of the customer listed on the utility bill.
    - For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.
- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

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Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

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- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

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Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

Pre-approval prior to installation is required.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Prescriptive Lighting Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	**Doing Business as (if applicable)**	**Anticipation Installation Date:** (cannot begin prior to approval by Market Manager	
Facility Address	**City**	**State**	**Zip Code**
		NJ	
Electric Utility Serving Applicant	**Electric Account Number***	**NAICS Code**	
Building Type (Hospital, Industrial, Municipality, Office, Retail, School, State, Other)		**Building Type (if "Other")**	
Project Type (Renovation or Equipment Replacement)		**How did you hear about the program?** (See above)	
Mailing Address	**City**	**State**	**Zip Code**
Contact Person	**E-mail Address**	**Telephone Number**	**Fax Number**

Incorporated (Yes, No, Other)	**Federal Tax ID #**	**Incentive Payment To** (Customer, Contractor or Other)	**Customer Signature** (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company Name		**Contact Person**	
Mailing Address:	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor Information

Company Name		**Contact Person**	
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Prescriptive Lighting Incentive

_____ total incentive (per attached worksheet calculations)

Note: Prescriptive Lighting Worksheet must accompany this application.

Pre-approval prior to installation is required.

Prescriptive Lighting Application - July 1, 2015 through June 30, 2016

Specific Program Requirements * (These requirements are in addition to the Program Terms and Conditions)

1. The prescriptive lighting incentive is a 1:1 replacement program.

2. Include the manufacturer's specification sheet with the application package and mail or fax directly to the Commercial/Industrial Market Manager.

3. Incentives for T-5 and T-8 lamps with electronic ballasts are available only for fixtures with a Total Harmonic Distortion of 20%.

4. Incentives for retrofits/replacement of existing fixtures <250W to T-8 lighting requires high performance or reduced wattage lamps (4' only) and ballasts qualified by most current CEE qualified product list.
http://library.cee1.org/content/commercial-lighting-qualifying-products-lists

- Incentives for delamped T-8 lamps with new reflectors are available only for fixtures with a total Harmonic Distortion of <20%. Electronic ballast replacement required for all eligible de-lamped fixtures. Eligible de-lamping can include reduction in linear lamp feet from existing conditions. For example, 1-8' linear fluorescent lamp can be considered as 2-4' linear lamps. U-bend lamps 4' in total length can be considered as 2-F17/T8 lamps.
- Electronic ballast replacement is necessary for all eligible de-lamped fixtures.
- New T8 fixture (with reduced wattage lamps 28w/25w 4') (1-4 lamps) new electronic ballast required.
- Reduced wattage T8 (28W/25W 4') (1-4 lamps) retrofit requires lamp and ballast replacement.

5. For all eligible lighting devices, fixture or lamp must be listed by UL or other OSHA approved Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable US standards.

6. T-5 or T-8 Fixtures replacing an HID fixture of 250 watts or greater shall comply as follows:

- T-5 fixtures replacing an HID fixture of 250 watts or greater shall have a ballast factor greater than or equal to 1.0; have reflectivity greater than or equal to 91%; have a minimum 2 lamps; and be designated as F54T5 HO.
- T-8 fixtures replacing an HID fixture of 250 watts or greater shall have a ballast factor greater than or equal to 1.14; have reflectivity greater than or equal to 91%; have a minimum of 4 lamps; and be designated as F32T8, minimum 32 watts.

7. Incentive requirements for LED fixtures and lamps (excluding LED Exit Signs)

- LED fixture or lamp must be listed on most current ENERGY STAR® or Design Lights Consortium (DLC) Product Lists and be designated as per the description noted on the qualifying LED list. To qualify, the model number of the LED must be an exact match to the qualified product list.
- The approved category for the LED must match its application (for example, outdoor wall mounted fixtures proposed for interior use will not qualify)
- Incentives for LED screw-in/plug-in (Integral Lamps) only available for incandescent and halogen replacement. CFL or HID to LED will not be eligible.
- Incentives for LED fixtures only available for HID incandescent/halogen and fluorescent (excluding T-12's) replacements or retrofits. T-12 to LED is not eligible.
- Incentives will not be provided for the installation of screw-in/plug-in lighting measures in non-permanent and non-/hard-wired fixtures (Example - refrigerator, oven, floor/desk lamps, etc).
- Watts of new fixture (LED only) each line in the scope of work must have wattage reduction to qualify for an incentive.
- LEDs categories not listed by most current ENERGY STAR®(1)(2) or DLC(3) qualified products will not be evaluated through Custom for incentive eligibility.
  - o (1) http://www.energystar.gov/products/lighting_fans/commercial_light_fixtures
  - o (2) http://www.energystar.gov/products/lighting_fans/light_bulbs
  - o (3) http://www.designlights.org/

Application Checklist Before submitting your application, please make sure you have signed in the space below and completed the following items.

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Acknowledgement Submit a printed, signed copy of this tab with application

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Visit our website: NJCleanEnergy.com/ssb

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited.
*Incentives/Requirements subject to change.

Pre-approval prior to installation is required.

Prescriptive Lighting Application - July 1, 2015 through June 30, 2016

Prescriptive Lighting Measures and Incentives

Linear Fluorescent Lighting - New Fixture			
Type of Existing Fixture	**Wattage of Existing Fixture**	**Proposed Fixture**	**Incentive**
HID	> 750 Watts	T-5, T-8	$150/fixture
HID	400 - 750 Watts	T-5, T-8	$100/fixture
HID	250 - 399 Watts	T-5, T-8	$50/fixture
HID	< 250 Watts	T-5, T-8	$25/fixture

Linear Fluorescent Lighting - Retrofit of Existing Fixture	
Measure	**Incentive**
For retrofit or replacement of T-8 fixtures by permanent de-lamping & new reflectors - Electronic ballast replacement required for all eligible de-lamped fixtures. - Incentives for replacement/retrofit of T12 systems are not available	$10 per fixture
Retrofit or replacement of existing 32 watt T-8 system to reduced wattage (28w/25w 4') (new or retrofit) - Requires lamp and ballast replacement. - Incentives for replacement/retrofit of T12 systems are not available	$5 per fixture (1-4 lamps)

Induction Lighting Incentives	
Measure	**Incentive**
HID (≥100w) fixture replaced with a new induction fixture. - Replacement unit must use 30% less wattage per fixture than existing HID system.	$70 per fixture
HID (≥100w) fixture retrofitted with induction lamp power coupler and generator - Replacement unit must use 30% less wattage per fixture than existing HID system.	$50 per fixture

LED LIGHTING INCENTIVES	
LED Fixture Categories ***Incentive rate is determined by the approved fixture category per DLC or EnergyStar ®. See Specific Program Requirement #7.***	
LED Architectural Flood and Spot luminaires	$50 per fixture
LED Bollard Fixtures	$50 per fixture
LED display case lighting	$30 per display case
LED Fuel Pump canopy	$100 per fixture
LED High-Bay and low-Bay Fixtures for commercial & industrial Buildings	$150 per fixture
LED High-Bay-Aisle lighting	$150 per fixture
LED linear Ambient luminaires (indirect, indirect/direct, direct/indirect, direct)	2' fixtures - $20/fixture
	3' fixtures - $30/fixture
	4' fixtures - $45/fixture
	6' fixtures - $60/fixture
	8' fixtures - $75/fixture
LED Linear Replacement Lamps (2’ & 4’ only)	$5 per lamp
LED Luminaires for Ambient lighting of interior commercial Spaces (1x4, 2x2, 2x4) - Incentive rates apply to both New fixtures and Retrofit Kits	1x4 LED (new or retrofit kit) - $15/fixture
	2x2 LED (new or retrofit kit) - $15/fixture
	2x4 LED (new or retrofit kit) - $25/fixture
LED Outdoor Pole/Arm-mounted Area and Roadway luminaires (New or Retrofit)	$100 per fixture
LED Outdoor Pole/Arm-mounted decorative luminaires (New or Retrofit)	$50 per fixture
LED Outdoor wall-mounted Area luminaires	$100 per fixture
LED Parking garage luminaires	$100 per fixture
LED Retrofit Kits for Large Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	$150 per fixture
LED Refrigerated/Freezer case lighting: incentive for replacement of fluorescent lighting systems in medium or low temperature display cases	$30 per 4' fixture
	$42 per 5' fixture
	$65 per 6' fixture

Pre-approval prior to installation is required.

Prescriptive Lighting Application - July 1, 2015 through June 30, 2016

LED Fixture Categories Continued	
LED Shelf-mounted display and task lights	$15 per linear foot
LED Stairwell and Passageway luminaires	$40 per fixture
LED Track or mono-Point directional lighting Fixtures	$30 per fixture
LED Wall-wash lights	$30 per fixture
LED Wrapped Lens	$10 per fixture

EnergyStar ® Commercial Lighting Fixtures	
Bath Vanity	$5.00 per fixture
Cove Mount	$5.00 per fixture
Decorative Candle: Other	$5.00 per fixture
Decorative: Other	$5.00 per fixture
Downlight Pendant	$5.00 per fixture
Downlight Recessed	$5.00 per fixture
Downlight Solid State Retrofit	$5.00 per fixture
Downlight Surface Mount	$5.00 per fixture
Other	$5.00 per fixture
Outdoor Porch Wall Mount	$5.00 per fixture
Outdoor Post-Mount	$5.00 per fixture
Porch (wall mounted)	$5.00 per fixture
Portable Desk Task Light	$5.00 per fixture
Torchiere	$5.00 per fixture
Ceiling Mount	$10.00 per fixture
Close to Ceiling Mount	$10.00 per fixture
Decorative Pendant	$10.00 per fixture
Inseparable SSL - Other	$10.00 per fixture
Security	$10.00 per fixture
Wall Sconces	$10.00 per fixture
Wrapped Lens	$10.00 per fixture

EnergyStar ® Screw- and Pin-Based Bulbs	
PAR30	$5.00 per lamp
PAR30L	$5.00 per lamp
PAR38	$5.00 per lamp
R30	$5.00 per lamp
B10	$5.00 per lamp
CA10	$5.00 per lamp
F10	$5.00 per lamp
G16.5	$5.00 per lamp
G25	$5.00 per lamp
MR16	$5.00 per lamp
PAR16	$5.00 per lamp
PAR20	$5.00 per lamp
R20	$5.00 per lamp
A15	$10.00 per lamp
A19	$10.00 per lamp
A21	$10.00 per lamp
BR30	$10.00 per lamp
BR40	$10.00 per lamp
R40	$10.00 per lamp
B13	$10.00 per lamp
BA10	$10.00 per lamp
F15	$10.00 per lamp
MRX16	$10.00 per lamp

Other Lighting/Project Types	
Ground-Up New Construction	To be evaluated through the Performance Lighting application
Gut Rehab of Existing Facility	May be evaluated through Prescriptive (1-for-1) or through Performance Lighting application
LED products that are qualified and listed by DLC or EnergyStar® in a category not identified above	To be evaluated through the Custom Measures path

Mail or fax your application package Directly to the Commercial/Industrial Market Manager.

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Pre-approval prior to installation is required.

Prescriptive Lighting Application - July 1, 2015 through June 30, 2016

For larger projects, please use large project spreadsheet available at NJCleanEnergy.com/Forms

Customer Information

Company Name:		**Facility Address:**	
Indicate Yes/No if multiple worksheets are being submitted for 1 project/building:		**Date Submitted:**	

Prescriptive Lighting Information

		Existing Fixture/Lamp Information			Proposed Fixture/Lamp Information						
	Upgrade Type **N-** New Fixture **R-** Retrofit of existing fixture	**Existing Fixture Type** *ex: Incandescent, CFL, HID, T8, T5, etc.*	**Number of lamps in Existing Fixture** *(required for LED linear replacement lamps 2' and 4' only)*	**Existing Fixture Wattage** *For LED Tube Replacements list wattage per tube*	**Proposed Fixture Type**	**Number of lamps in Proposed Fixture** *(required for LED linear replacement lamps 2' and 4' only)*	**Proposed Fixture Wattage** *For LED Tube Replacements list wattage per tube*	**Location** *(Building/Room name. Please be as descriptive as possible)*	**A** Incentive Per Fixture *(for LED tubes, list incentive per fixture)*	**B** Fixture Quantity	**Total Incentives** (A * B)
ex	R	4' F32 T8 2L fixture	2	32	4' LED tube 1L/fixture	2	15	Office #10	$10.00	4	$40
ex	N	5' T8 fluorescent	n/a	38	5' LED end case	n/a	17	Dairy Case #5	$42.00	25	$1,050
ex	N	400 w Metal Halide	n/a	450	LED high bay	n/a	127	Warehouse A	$150.00	10	$1,500
ex	R	Incandescent BR30	n/a	60	LED BR30	n/a	12	Above reception desk	$10.00	12	$120
1											
2											
3											
4											
5											
6											
7											
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11											
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14											
15											
										Total:	

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NJ SmartStart Buildings®

Program Terms and Conditions

Definitions:

Energy-Efficient Measures – Any device eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings).

New Jersey Utilities – The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under “Incentive Amount” heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

Eligibility: In order to be eligible for program incentives, a customer, or an agent (contractor/vendor) authorized by a customer, must submit a properly completed application package. A complete application package should include:

- Completed application forms signed by the customer.
- Manufacturer specification sheets and supporting documentation of qualifications.
- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
    - Name of the customer listed on the application must match the name of the customer listed on the utility bill.
    - For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.
- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities’ service territory and designated on the Participating Customer’s incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Refrigeration Controls - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	Doing Business as (if applicable)	Installation Start Date:	
		Installation Completion Date:	

Facility Address	City	State	Zip Code
		NJ	

Electric Utility Serving Applicant	Electric Account Number*	NAICS Code

Building Type (Office, Retail, Hospital, School, etc).	Building Type (if "Other")	How did you hear about the program? (See above

Project Type (New Construction, Renovation)	Size of Building

Mailing Address	City	State	Zip Code

Contact Person	E-mail Address	Telephone Number	Fax Number

Incorporated (Yes, No, Other)	Federal Tax ID #	Incentive Payment To (Customer, Contractor or Other)	Customer Signature (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor Information

Company	Contact Person		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Refrigeration Controls - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

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Refrigeration Controls - July 1, 2015 through June 30, 2016

Specific Program Requirements* (these requirements are in addition to the Program Terms and Conditions)

1. Include the manufacturer's specification sheet with the application package and mail or fax directly to the Commercial/Industrial Market Manager.
2. Replacement of existing refrigeration controls not eligible for incentive.
3. All eligible refrigeration control devices must be listed by UL or other OSHA approved Nationally recognized Testing Laboratory (NRTL) in accordance with the applicable US standards.

Refrigeration Controls Information

Replacement Type N - New	**Control Type** **D** - Door Heater Control **E** - Electric Defrost Control **EF** - Evaporator Fan Control **N** - Novelty Cooler Shutoff	**Manufacturer**	**Location**	**Refrigeration Case Temperature** Low Temperature (-35°F to -5°F) Medium Temperature (0°F to 30°F) High Temperature (35°F to 55°F)	**Equipment Info** **Door Heater** and **Electric Defrost:** Enter nameplate kW **Evaporator Fan:** Enter fan and compressor (Amps/Volts/Phase) **Novelty Cooler:** Enter (Amps/Volts/Phase)	**A** **# of units**	**B** **Incentive** (Table)	**Total Incentives** **=** A * B
N	D	Acme	Dairy Cooler	Low	0.5 kW	4	$50.00	4*$50 = $200
N	N	Acme	Open Dairy Case	Medium	0.9A / 230V / 3-phase	5	$50.00	5*$50 = $250
							Total:	

Refrigeration Controls Incentives

Type	Incentive
Door Heater Control	$50 per control
Electric Defrost Control	$50 per control
Evaporator Fan Control	$75 per control
Novelty Cooler Shutoff	$50 per control

NJ SmartStart Buildings®

Program Terms and Conditions

Definitions:

Energy-Efficient Measures – Any device eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings).

New Jersey Utilities – The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under "Incentive Amount" heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

Eligibility: In order to be eligible for program incentives, a customer, or an agent (contractor/vendor) authorized by a customer, must submit a properly completed application package. A complete application package should include:

- Completed application forms signed by the customer.
- Manufacturer specification sheets and supporting documentation of qualifications.
- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
    - Name of the customer listed on the application must match the name of the customer listed on the utility bill.
    - For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.
- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities' service territory and designated on the Participating Customer's incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Refrigeration Doors/Covers Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	**Doing Business as (if applicable)**	**Installation Start Date:**	
		Installation Completion Date:	

Facility Address	**City**	**State**	**Zip Code**
		NJ	

Electric Utility Serving Applicant	**Electric Account Number***	**NAICS Code**

Building Type (Office, Retail, Hospital, School, etc).	**Building Type** (if "Other")	**How did you hear about the program?** (See above

Project Type (Renovation, Replacement)	**Size of Building**

Mailing Address	**City**	**State**	**Zip Code**

Contact Person	**E-mail Address**	**Telephone Number**	**Fax Number**

Incorporated (Yes, No, Other)	**Federal Tax ID #**	**Incentive Payment To** (Customer, Contractor or Other)	**Customer Signature** (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	**Contact Person**

Mailing Address	**City**	**State**	**Zip Code**

Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor Information

Company	**Contact Person**

Mailing Address	**City**	**State**	**Zip Code**

Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Refrigeration Doors/Covers Application - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program
c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Refrigeration Doors/Covers Application - July 1, 2015 through June 30, 2016

Specific Program Requirements* (these requirements are in addition to the Program Terms and Conditions)

1. Include the manufacturer's specification sheet with the application package and mail or fax directly to the Commercial/Industrial Market Manager.
2. Replacement of existing doors/covers not eligible for incentive.
3. Incentives for existing open refrigerated cases only.
4. Doors must have either heat reflective treated glass, be gas filled, or both.
5. Aluminum night curtains incentive applicable for existing refrigerated cases, used for non-frozen products which do not have doors or other means of full or partial closure to reduce cold air loss to ambient room air.

Refrigeration Doors/Covers Information

Replacement Type N - New	**Door/Cover Type** **C** - Aluminum Night Covers **D** - Energy-Efficient Doors	**Manufacturer**	**Location**	**Refrigeration Case Temperature** Low Temperature (-35°F to -5°F) Medium Temperature (0°F to 30°F) High Temperature (35°F to 55°F)	**Hours Store Closed Per Day** (For Covers Only)	**A^1** # of Energy-Efficient Doors	**A^2** Width of Protected Opening In Linear Feet (A^2)	**B** **Incentive** (Table)	**Total Incentives** **=** A^1 or A^2 * B
(example) N	C	Acme	Non-Dairy Refrigerated Foods	High	6	n/a	40 feet	$3.50	40 * $3.50 = $140
N	D	Acme	Open Dairy Cases	High	n/a	10	30 feet	$100	10 * $100 = $1,000
								Total:	

Refrigeration Covers/Doors Incentives

Type	Incentive
Energy-Efficient Doors/Covers for Installation on Open Refrigerated Cases	$100 per door
Aluminum Night Curtains for Installation on Open Refrigerated Cases	$3.50 per linear foot

NJ SmartStart Buildings®

Program Terms and Conditions

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Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under "Incentive Amount" heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

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Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities' service territory and designated on the Participating Customer's incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Refrigerator/Freezer Motors Application - July 1, 2015 through June 30, 2016

Customer Information

Company Name (as listed on utility bill)	**Doing Business as (if applicable)**	**Installation Start Date:**	
		Installation Completion Date:	

Facility Address	**City**	**State**	**Zip Code**
		NJ	

Electric Utility Serving Applicant	**Electric Account Number***	**NAICS Code**

Building Type (Office, Retail, Hospital, School, etc).	**Building Type (if "Other")**	**How did you hear about the program?** (See above)

Project Type (Renovation, Equipment Replacement)	**Size of Building**

Mailing Address	**City**	**State**	**Zip Code**

Contact Person	**E-mail Address**	**Telephone Number**	**Fax Number**

Incorporated (Yes, No, Other)	**Federal Tax ID #**	**Incentive Payment To** (Customer, Contractor or Other)	**Customer Signature** (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	**Contact Person**		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Contractor Information

Company	**Contact Person**		
Mailing Address	**City**	**State**	**Zip Code**
Contact Email Address	**Federal Tax ID #**	**Telephone Number**	**Fax Number**

Refrigerator/Freezer Motors Application - July 1, 2015 through June 30, 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

New Jersey's Clean Energy Program
c/o TRC Energy Services
900 Route 9 North, Suite 404
Woodbridge, NJ 07095
Phone: 866-657-6278 Fax: 732-855-0422

Visit our website: NJCleanEnergy.com/ssb

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited. *Incentives/Requirements subject to change.

Refrigerator/Freezer Motors Application - July 1, 2015 through June 30, 2016

Qualifying Refrigerator/Freezer Case Premium Motor Efficiencies and Incentives*	
Fractional Motor Incentives - Electronic Commutated Motors (ECM)	
Size (HP)	**Customer Incentive ($/Motor)**
< 1 HP	$40 per ECM for replacement of existing shaded-pole motor in refrigerated/freezer cases

Refrigerator/Freezer Case Premium Motor Equipment Information

Reason R- Replaced	**Existing Motor Type** **SP -** Shaded Pole **PSC -** Permanent Split Capacitor	**Manufacturer**	**Model Number**	**Location** (Building/Room Name)	**Location Type** **WI -** Walk-In **DC -** Display Case	**Evatorator Fan Control Present? (Yes/No)** *For Display Cases Only*	**Size (HP)**	**A** **Incentive Per Motor**	**B** **Quantity**	**Total Incentives = A*B**
(Example) R	*PSC*	*GE*	*26-ECM*	*Freezer Case #2*	*DC*	*No*	*1/15*	*$40.00*	*3*	*$120.00*
								$40.00		
								$40.00		
								$40.00		
								$40.00		
								$40.00		
									Total:	

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NJ SmartStart Buildings®

Program Terms and Conditions

Definitions:

Energy-Efficient Measures – Any device eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings).

New Jersey Utilities – The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

Program Incentives – Refers to the amount or level of incentive that the Program provides to Participating Customers pursuant to the Program offered herein (see description under "Incentive Amount" heading).

Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

Market Manager – TRC Energy Services.

Application and Eligibility Process . For all Prescriptive measures with the exception of Prescriptive & Performance Lighting, Lighting Controls and Custom measures, pre-approval is not required prior to installation, however any customer and/or agent who purchases and installs equipment without Market Manager approval does so at his/her own risk.

Eligibility: In order to be eligible for program incentives, a customer, or an agent (contractor/vendor) authorized by a customer, must submit a properly completed application package. A complete application package should include:

- Completed application forms signed by the customer.
- Manufacturer specification sheets and supporting documentation of qualifications.
- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
    - Name of the customer listed on the application must match the name of the customer listed on the utility bill.
    - For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.
- W-9 form completed for incentive payee.

For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities' service territory and designated on the Participating Customer's incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

Tax Clearance Certificate Requirements: The name of the customer listed on the certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on the application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.

Utility account –

1. Each utility account requires a complete, separate application. Projects for the same utility account and the same technology being done at the same time should be submitted on one application.
2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Variable Frequency Drives Application - July 1, 2015 through June, 30 2016

Customer Information

Company Name (as listed on utility bill)	Doing Business as (if applicable)	Installation Start Date:	
		Installation Completion Date:	

Facility Address	City	State	Zip Code
		NJ	

Electric Utility Serving Applicant	Electric Account Number*	NAICS Code

Building Type (Office, Retail, Hospital, School, etc).	Building Type (if "Other")	How did you hear about the program? (See above

Project Type (New Construction, Renovation, Replacement)	Size of Building

Mailing Address	City	State	Zip Code

Contact Person	E-mail Address	Telephone Number	Fax Number

Incorporated (Yes, No, Other)	Federal Tax ID #	Incentive Payment To (Customer, Contractor or Other)	Customer Signature (if payee is different from customer, please print and sign customer name.)

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

Payee Information *(if different from customer/contractor; entity must supply W-9 form)*

Company	Contact Person		

Mailing Address	City	State	Zip Code

Contact Email Address	Federal Tax ID #	Telephone Number	Fax Number

Contractor Information

Company	Contact Person		

Mailing Address	City	State	Zip Code

Contact Email Address	Federal Tax ID #	Telephone Number	Fax Number

Variable Frequency Drives Application - July 1, 2015 through June, 30 2016

Application Checklist

Before submitting your application, please make sure you have signed in the space below and completed the following items.

The following documentation must be submitted with all applications for approval:

Payee Information is filled out and a signed W-9 form for the payee is included	☐
Manufacturer's specification sheets and performance documentation for technology are included	☐
A copy (all pages) of a recent electric bill from a NJ utility which lists the required Societal Benefits Charge and customer name matches the name listed on this application*	☐
Check the box if an Energy Savings Improvement Program (ESIP) is a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings	☐

*For new construction projects where a utility account has not yet been established, the customer will be required to submit a utility bill prior to incentive payment however it does not need to be included with the initial application submission.

If your project is already completed, please include the following additional documentation for approval and payment. Please note, a post inspection may be required prior to incentive being processed:

The application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided to the Market Manager confirming date of equipment purchase (material invoice, purchase order, etc.).	☐
A valid Tax Clearance Certificate. The name of the customer listed on the Certificate must match the customer name listed on the utility bill and this application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive.	☐

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval: All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Acknowledgement (submit a printed, signed copy of this tab with application)

Customer - Print and Sign _____

By signing, I certify that I have read, understand and agree to the Specific Program Requirements/Terms and Conditions listed on this application form, I have also submitted a properly completed application package, which includes this signed application, worksheet (if applicable), manufacturer's specification sheets and a complete utility bill which lists the required Societal Benefits Charge (name and address on utility bill must match name and address on application).

Mail or Fax your application package DIRECTLY to the Commercial/Industrial Market Manager.

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Specific Program Requirements*

1. Include the manufacturer's specification sheet with the application packageand mail or fax directly to the Commercial/Industrial Market Manager.
2. Incentives for VFDs in HVAC VAV systems are available only for installing a VFD on existing VAV systems as an add-on measure. Replacement of an existing VFD on VAV systems and installations on VAV systems in new construction are not eligible.
3. Incentives for VFDs in existing constant volume HVAC rooftop equipment (RTU) systems are provided for existing HVAC supply, exhaust, or return air fans only. Throttling devices, such as inlet vanes or bypass dampers and throttling valves must be removed or permanently disabled.
4. The Variable Frequency Drive (VFD) incentive for cooling towers is available for existing single speed motors only. Replacement of two speed motor with single speed/VFD motor, replacement of existing VFD and new construction do not qualify.
5. The Variable Frequency Drive (VFD) incentive for pumps is available only for VFDs installed on centrifugal chilled water pump motors for HVAC systems.
6. The VFDs must be installed in a system (VAV air supply or chilled water pumping systems) that incorporates pressure sensors (or other applicable sensor devices) in the flow stream.

For Compressed Air Systems:

7. Incentives are available for new air or water cooled, single or double stage, oil lubricated or oil free twin rotor screw air compressors outfitted with VFDs (providing compressed air for typical plant air use).
8. Replacement of VFD on an existing air compressor that had VFD control is not eligible for incentives.
9. New construction projects are not eligible for VFD incentives. However, VFD control may be available through the custom electric equipment program.
10. Only one VFD controlled air compressor will be eligible for an incentive for each compressed air system.
11. The applicant shall provide sufficient documentation to demonstrate that a VFD controlled air compressor operates, at a minimum, for 2000 hours annually. Documentation may include P&IDs, Control Logic Diagrams, and Plant Operating Schedules.

For Boiler System Motors:

12. Specific VFD requirements for boiler draft fan and feed water pumps:
a. Incentive for existing single speed motors only. Replacement of twospeed motor with single speed / VFD motor, replacement of existing VFD and new construction do not qualify.
b. VFDs must be controlled by an automatic signal in response to modulating air/water flows.

For Kitchen Hood Systems:

13. Specific VFD requirements for kitchen hoods:
a. All VFDs/controls used in kitchen hoods must be UL or other OSHA approved Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable US standards.
b. VFD incentives will not be provided for replacement of two speed motor with single speed / VFD motor or replacement of existing VFD.

For All VFDs:

14. The VFD must have either an input line reactor or isolation transformer.

Variable Frequency Drive and Incentives*

Centrifugal Fan Applications of Variable Air Volume HVAC Systems	
Cumulative Motor HP Controlled By Each VFD	Incentive $/Cumulative HP Controlled
5 to <10 HP	$155 per HP
10 to <20 HP	$120 per HP
20+ HP	$65 per HP
Centrifugal Fan Applications on Constant Volume HVAC Systems:	
All sizes	$80 per VFD rated HP; maximum $6,000 per VFD
Cooling Tower Fan Systems	
≥ 10 HP	$60 per VFD rated HP
Chilled Water Pump Motors for HVAC Systems	
20+ HP	$60 per VFD rated HP
Rotary Screw Air Compressors	
25 to 29 HP	Up to $5,250
30 to 30 HP	Up to $6,000
40 to 49 HP	Up to $7,200
50 to 59 HP	Up to $8,000
60 to 199 HP	Up to $9,000
200 to 249 HP	Up to $10,000
≥ 250 HP	Up to $12,500

Boiler Motor Systems		
	HP	Incentive
Boiler Fans	≤ 5 to 10	$155/HP
	≥ 10 to < 20	$120/HP
	≥ 20	$65/HP
Boiler Feed Water Pumps	≤ 5 to 10	$155/HP
	≥ 10 to < 20	$120/HP
	≥ 20	$60/HP

Commercial Kitchen Hoods			
New Hood		Retrofit	
HP of motor	$/HP	HP of motor	$/HP
0-4.99	$250	0-4.99	$300
5-9.99	$200	5-9.99	$200
10-14.99	$150	10-14.99	$160
15-19.99	$125	15-19.99	$125
20-24.99	$105	20-24.99	$95
25-29.99	$90	25-29.99	$80
30-50	$55	30-50	$55

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Variable Frequency Drives Application - July 1, 2015 through June, 30 2016

Variable Frequency Drive Information

Reason **N -** New **R -** Retrofit	**Type of Usage (see below)**	**Manufacturer**	**Model**	**Annual Operating Hours**	**Drive Efficiency %**	**Motor Efficiency %**	**Location (Building/Room Name)**	**A** HP of Controlled Motors	**B** Incentive Per HP or unit *See Incentive Amounts tab*	**C** Quantity	**Total Incentive (A * B * C)** **Air compressors only: (B*C)**
(ex) N	VAV-C	ACME	RR/C1957	4,000	97.0%	94.1%	Mech Room #4	30	$65	2	30*$65*2 = $3,900
(ex) N	BF-F	ACME	CC1234	5,000	97.0%	82.0%	Boiler Room	15	$120	1	15*$120*1= $1,800
										Total:	

A	Air Compressor
BF-C	Boiler Fan Motor - Forward Curved Fan
BF-F	Boiler Fan Motor - Airfoil/Backward Inclined Fan
BP	Boiler Feed Water Pump
CV-C	Constant Volume HVAC Systems - Forward Curved Fan
CV-F	Constant Volume HVAC Systems - Airfoil/Backward Inclined Fan
P	Chilled Water Pump
T	Cooling Tower
VAV-C	Variable Air Volume HVAC Systems - Forward Curved Fan
VAV-F	Variable Air Volume HVAC Systems - Airfoil/Backward Inclined Fan

Kitchen Hood Information

Reason **N -** New **R -** Retrofit	**Kitchen Square Feet**	**Location (Building/Room Name)**	**Manufacturer**	**Model**	**Facility Type** (Campus, Lodging, Restaurant, Supermarket, Other)	**Drive Efficiency %**	**Motor Efficiency %**	**Quantity of VFDs**	**A** Total Controlled HP	**B** Incentive Per HP *See Incentive Amounts tab*	**Total Incentive (A * B)**
(ex) N	4000	Cafeteria Kitchen	ACME	KH20	Other	98.00%	95.00%	1	20	$105.00	20*$105 = $2100
										Total:	

NJ SmartStart Buildings®

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Administrator – New Jersey Board of Public Utilities, Office of Clean Energy.

Participating Customers – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

Product Installation or Equipment Installation – Installation of the Energy-Efficient Measures.

Prevailing Wage – Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Program – The Commercial and Industrial Energy-Efficient Construction Program (New Jersey SmartStart Buildings) offered herein by the New Jersey Board of Public Utilities, Office of Clean Energy pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

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Program Offer – Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities identified above.

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- Recent copy of a full utility bill from a participating utility (gas or electric depending on technology) showing societal benefits charge.
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For completed projects that do not require program pre-approval (excluding Prescriptive Lighting, Prescriptive Lighting Controls, Performance Lighting and Custom Measures) the application must be submitted to the Market Manager within 12 months of equipment purchase. Sufficient documentation must be provided confirming the date of equipment purchase (material invoice, purchase order, etc.). In order to expedite the payment processing for completed projects, customers should submit a valid Tax Clearance Certificate for the customer (see tax clearance requirements) and material/labor invoice documentation. All projects are subject to post-inspection to confirm equipment installation prior to payment.

Energy-Efficient Measures must be installed in buildings located within a New Jersey Utilities' service territory and designated on the Participating Customer's incentive application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program materials and incentive applications. The Participating Customer must ultimately own the equipment, through an up-front purchase.

Equipment procured by Participating Customers through another program offered by New Jersey's Clean Energy Program or the New Jersey Utilities, as applicable, are not eligible for incentives through this program. Customers who have not contributed to the Societal Benefits Charge of the applicable New Jersey Utility are not be eligible for incentives offered through this program.

Pre-Inspections: The Market Manager reserves the right to conduct a pre-inspection of the facility prior to the installation of lighting, lighting control equipment and custom measures. This will be done prior to the issuance of the approval letter. Work must not begin prior to formal program approval.

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2. Applications for measures that are self-installed by customers must be signed by the customer and not the sales vendor of the measure, however, the customer may elect to assign payment of the incentive to the sales vendor.
3. This application package must be received by the Market Manager on or before June 30, 2016 in order to be eligible for the fiscal year program (July 1, 2015 - June 30, 2016) incentives.

Expirations: Pre-approved projects are given a one year approval in which the proposed measure is to be installed and operational. When a project has expired the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. Extension requests must be in writing from the customer and include the circumstances that led to the extension request, and the percentage of the project completed. Extension requests may be granted for a period no longer than six (6) months. The Market Manager may provide up to two, six month extensions from the original approval expiration date. If the project has not started and the applicant is still interested in installing the equipment, the existing application will be cancelled and a new application must be submitted and approved prior to installation as applicable per technology. The incentive amount will be based upon the program guidelines in effect at the time of the new submission. If no response is received within 30 days of expiration the project will be cancelled.

Change in customer name/payee after pre-approval: If a request is received to change the customer name or payee listed on a pre-approved application the following must be provided:

- Documentation from the approved applicant authorizing the change.
- A new signed application and acknowledgement page with updated customer or payee name.
- For name change - a utility bill in the name of the new customer.
- For payee change - a signed W9 for payee and documentation from the original customer authorizing the change.

All name changes requests are subject to Market Manager approval. Certain requests may require additional information to be submitted defined by the Market Manager.

Notice to customers requesting pre-approval or implementing a project prior to program pre-approval. All applicants are required to submit the current FY2016 application form. All submissions will be reviewed based on the current program requirements and incentive levels approved by the Board of Public Utilities. Applicants choosing to install prior to program pre-approval do so at their own risk.

Deficient Applications – If an application package is incomplete or information is missing or deemed insufficient, a deficiency letter will be mailed to the applicant requesting additional information. The information or documentation requested on the letter must be received by the Market Manager within 30 days of the date of the request. If additional deficiencies are still noted, there will be up to two additional notifications issued with the same time frames. If a customer fails to respond to a deficiency request within 30 days or exceeds the three attempts provided, the application will be cancelled. If cancelled, customers may re-apply under the program incentives and requirements in place at that time.

Installation Requirements for All Measures - The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect pre-existing product or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, prior to issuing incentives or at a later time.

Incentive Amount – Program Incentives will not exceed: a) the approved Program Incentive amount, or b) total project cost of the Energy-Efficient Measure, whichever is less, excluding NJ state sales tax as determined by the Market Manager. Products offered at no direct cost to the customer are ineligible. Incomplete application submissions, applications requiring inspections and unanticipated periods of high volume may cause processing delays. Program Incentives are limited to $500,000 per utility account in a fiscal year. Contact the Market Manager regarding any questions.

Tax Liability – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number to the Market Manager on the application form in order to receive a Program Incentive. In addition, Participating Customers must also provide a Tax Clearance Form (entitled "Business Assistance or Incentive Clearance Certificate"). The name of the customer listed on the Certificate must match the customer name listed on the utility bill and the application. In addition, the customer tax ID listed on this application must agree with the tax ID listed on the Certificate. Certificates are valid for 180 days and must be valid on the date the Market Manager signs off on the incentive

Endorsement – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

Warranties – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITLY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

Limitation of Liability – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against the Market Manager or the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator, be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

Assignment – The Participating Customer may assign Program Incentive payments to a specified vendor.

Participating Customer's Certification – Participating Customer certifies that he/she purchased and installed the equipment listed in their application at their defined New Jersey location. Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements listed in the application.

Termination – The New Jersey Board of Public Utilities reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

Acknowledgement – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the New Jersey SmartStart Buildings Program. Additionally, I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program.

Energy Performance

Date Generated: 07/11/2016 12:57 PM EDT

Number of properties in report: 10

Property Id	Property Name	Year Ending	City	State/Province	Postal Code	Property GFA - EPA Calculated (Buildings) (ft²)	Site EUI (kBtu/ft²)	Source EUI (kBtu/ft²)	Weather Normalized Site EUI (kBtu/ft²)	Weather Normalized Source EUI (kBtu/ft²)	Site EUI - Adjusted to Current Year (kBtu/ft²)	Source EUI - Adjusted to Current Year (kBtu/ft²)	National Median Site EUI (kBtu/ft²)	National Median Source EUI (kBtu/ft²)	Difference from National Median Source EUI	Energy Cost ($)
4820278	Dewatering Building 2	12/31/2015	Rahway	New Jersey	07067	15600	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available
4820279	Employees Facility Building 2	12/31/2015	Rahway	New Jersey	07067	4530	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	67.3	148.1	Not Available	Not Available
4820280	Administration Building 2	12/31/2015	Rahway	New Jersey	07067	11400	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	67.3	148.1	Not Available	Not Available
4820281	Laboratory 2	12/31/2015	Rahway	New Jersey	07067	3360	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	78.8	123.1	Not Available	Not Available
4820282	Warehouse/Maintenance Shop 2	12/31/2015	Rahway	New Jersey	07067	5270	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	19.8	47.6	Not Available	Not Available
4820283	Service Building 2	12/31/2015	Rahway	New Jersey	07067	9700	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available
4820284	Admin Annex 2	12/31/2015	Rahway	New Jersey	07067	1100	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	67.3	148.1	Not Available	Not Available
4820285	Garage 2	12/31/2015	Rahway	New Jersey	07067	1100	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	19.8	47.6	Not Available	Not Available
4820286	Pump & Blower 2	12/31/2015	Rahway	New Jersey	07067	17500	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available
4820287	COGEN Building 2	12/31/2015	Rahway	New Jersey	07067	10278	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available

Appendix G
ECRM Financial Analysis

ECM	Admin. Annex Condensing Boiler	Administration Building Condensing Boiler	Dewatering Condensing Boiler	Admin, Annex, Dewatering Central HW Loop	Thermal Oil to Process HW Heat Exchanger
Assumed Inflation (Gas, Oil)	2%	2%	2%	2%	2%
Initial Yearly Savings (Gas, Oil)	$97.19	$940.29	$1,645.53	$7,358.33	$14,877.00
Assumed Inflation (Electricity)	3%	3%	3%	3%	3%
Initial Yearly Savings (Electricity)	$0.00	$0.00	$0.00	$0.00	$0.00
Annual Maintence Cost Savings	$0.00	$0.00	$1,500.00	$0.00	$0.00
Assumed Average Useful Life (Years)	24	24	24	24	20
Lifetime Savings	**$2,956.80**	**$28,605.26**	**$28,456.75**	**$157,558.81**	**$361,471.97**
Year	Annual Savings	Annual Savings	Annual Savings	Annual Savings	Annual Savings
1	$97.19	$940.29	$1,645.53	$7,358.33	$14,877.00
2	$99.14	$959.09	$1,678.44	$7,505.49	$15,174.54
3	$101.12	$978.27	$1,712.00	$7,655.60	$15,478.03
4	$103.14	$997.84	$1,746.24	$7,808.72	$15,787.59
5	$105.21	$1,017.80	$1,781.17	$7,964.89	$16,103.34
6	$107.31	$1,038.15	$1,816.79	$8,124.19	$16,425.41
7	$109.46	$1,058.91	$1,853.13	$8,286.67	$16,753.92
8	$111.64	$1,080.09	$1,890.19	$8,452.41	$17,089.00
9	$113.88	$1,101.70	$1,927.99	$8,621.45	$17,430.78
10	$116.15	$1,123.73	$1,966.55	$8,793.88	$17,779.39
11	$118.48	$1,146.20	$2,005.89	$8,969.76	$18,134.98
12	$120.85	$1,169.13	$2,046.00	$9,149.16	$18,497.68
13	$123.26	$1,192.51	$2,086.92	$9,332.14	$18,867.63
14	$125.73	$1,216.36	$2,128.66	$9,518.78	$19,244.99
15	$128.24	$1,240.69	$2,171.24	$9,709.16	$19,629.89
16	$130.81	$1,265.50	$2,214.66	$9,903.34	$20,022.48
17	$133.43	$1,290.81	$2,258.95	$10,101.41	$20,422.93
18	$136.09	$1,316.63	$2,304.13	$10,303.44	$20,831.39
19	$138.82	$1,342.96	$2,350.22	$10,509.50	$21,248.02
20	$141.59	$1,369.82	$2,397.22	$10,719.69	$21,672.98
21	$144.42	$1,397.22	$2,445.16	$10,934.09	
22	$147.31	$1,425.16	$2,494.07	$11,152.77	
23	$150.26	$1,453.66	$2,543.95	$11,375.83	
24	$153.26	$1,482.74	$2,594.83	$11,603.34	

IRR, NPV, AROI - HVAC ECRMS

Admin. Annex Condensing Boiler		Administration Building Condensing Boiler		Dewatering Condensing Boiler		Admin, Annex, Dewatering Central HW Loop		Thermal Oil to Process HW Heat Exchanger	
Year	Cash Flow	Year	Cash Flow	Year	Cash Flow	Year	Cash Flow	Year	Cash Flow
0	($4,000.00)	0	($14,000.00)	0	($33,410.00)	0	($82,492.00)	0	($247,773.00)
1	$97.19	1	$940.29	1	$1,645.53	1	$7,358.33	1	$14,877.00
2	$99.14	2	$959.09	2	$1,678.44	2	$7,505.49	2	$15,174.54
3	$101.12	3	$978.27	3	$1,712.00	3	$7,655.60	3	$15,478.03
4	$103.14	4	$997.84	4	$1,746.24	4	$7,808.72	4	$15,787.59
5	$105.21	5	$1,017.80	5	$1,781.17	5	$7,964.89	5	$16,103.34
6	$107.31	6	$1,038.15	6	$1,816.79	6	$8,124.19	6	$16,425.41
7	$109.46	7	$1,058.91	7	$1,853.13	7	$8,286.67	7	$16,753.92
8	$111.64	8	$1,080.09	8	$1,890.19	8	$8,452.41	8	$17,089.00
9	$113.88	9	$1,101.70	9	$1,927.99	9	$8,621.45	9	$17,430.78
10	$116.15	10	$1,123.73	10	$1,966.55	10	$8,793.88	10	$17,779.39
11	$118.48	11	$1,146.20	11	$2,005.89	11	$8,969.76	11	$18,134.98
12	$120.85	12	$1,169.13	12	$2,046.00	12	$9,149.16	12	$18,497.68
13	$123.26	13	$1,192.51	13	$2,086.92	13	$9,332.14	13	$18,867.63
14	$125.73	14	$1,216.36	14	$2,128.66	14	$9,518.78	14	$19,244.99
15	$128.24	15	$1,240.69	15	$2,171.24	15	$9,709.16	15	$19,629.89
16	$130.81	16	$1,265.50	16	$2,214.66	16	$9,903.34	16	$20,022.48
17	$133.43	17	$1,290.81	17	$2,258.95	17	$10,101.41	17	$20,422.93
18	$136.09	18	$1,316.63	18	$2,304.13	18	$10,303.44	18	$20,831.39
19	$138.82	19	$1,342.96	19	$2,350.22	19	$10,509.50	19	$21,248.02
20	$141.59	20	$1,369.82	20	$2,397.22	20	$10,719.69	20	$21,672.98
21	$144.42	21	$1,397.22	21	$2,445.16	21	$10,934.09	21	
22	$147.31	22	$1,425.16	22	$2,494.07	22	$11,152.77	22	
23	$150.26	23	$1,453.66	23	$2,543.95	23	$11,375.83	23	
24	$153.26	24	$1,482.74	24	$2,594.83	24	$11,603.34	24	
IRR	-2.14%	IRR	1.84%	IRR	-1.86%	IRR	9.17%	IRR	3.64%
NPV	($1,971.04)	NPV	($1,199.10)	NPV	($11,008.10)	NPV	$71,117.11	NPV	$15,947.05
AROI	-1.74%	AROI	0.05%	AROI	-1.74%	AROI	4.75%	AROI	1.84%

ECM	Employee Facility Condensing Furnace	Laboratory Condensing Furnace	Garage Condensing Furnace
Assumed Inflation (Gas, Oil)	2%	2%	2%
Initial Yearly Savings (Gas, Oil)	$959.94	$1,537.94	$1,557.40
Assumed Inflation (Electricity)	3%	3%	3%
Initial Yearly Savings (Electricity)	$0.00	$0.00	$0.00
Annual Maintence Cost Savings	$0.00	$0.00	$0.00
Assumed Average Useful Life (Years)	24	24	24
Lifetime Savings	**$29,203.29**	**$46,786.89**	**$26,932.72**
Year	Annual Savings	Annual Savings	Annual Savings
1	$959.94	$1,537.94	$1,557.40
2	$979.14	$1,568.70	$1,588.55
3	$998.73	$1,600.07	$1,620.32
4	$1,018.70	$1,632.07	$1,652.72
5	$1,039.07	$1,664.71	$1,685.78
6	$1,059.86	$1,698.01	$1,719.49
7	$1,081.05	$1,731.97	$1,753.88
8	$1,102.67	$1,766.61	$1,788.96
9	$1,124.73	$1,801.94	$1,824.74
10	$1,147.22	$1,837.98	$1,861.23
11	$1,170.17	$1,874.74	$1,898.46
12	$1,193.57	$1,912.23	$1,936.43
13	$1,217.44	$1,950.48	$1,975.16
14	$1,241.79	$1,989.48	$2,014.66
15	$1,266.63	$2,029.27	$2,054.95
16	$1,291.96	$2,069.86	$2,096.05
17	$1,317.80	$2,111.26	$2,137.97
18	$1,344.15	$2,153.48	$2,180.73
19	$1,371.04	$2,196.55	$2,224.35
20	$1,398.46	$2,240.48	$2,268.83
21	$1,426.43	$2,285.29	$2,314.21
22	$1,454.96	$2,331.00	$2,360.49
23	$1,484.05	$2,377.62	$2,407.70
24	$1,513.74	$2,425.17	$2,455.86

IRR, NPV, AROI - HVAC ECRMS

Employee Facility Condensing Furnace		Laboratory Condensing Furnace		Garage Condensing Furnace	
Year	Cash Flow	Year	Cash Flow	Year	Cash Flow
0	($26,500.00)	0	($19,500.00)	0	($4,000.00)
1	$959.94	1	$1,537.94	1	$1,557.40
2	$979.14	2	$1,568.70	2	$1,588.55
3	$998.73	3	$1,600.07	3	$1,620.32
4	$1,018.70	4	$1,632.07	4	$1,652.72
5	$1,039.07	5	$1,664.71	5	$1,685.78
6	$1,059.86	6	$1,698.01	6	$1,719.49
7	$1,081.05	7	$1,731.97	7	$1,753.88
8	$1,102.67	8	$1,766.61	8	$1,788.96
9	$1,124.73	9	$1,801.94	9	$1,824.74
10	$1,147.22	10	$1,837.98	10	$1,861.23
11	$1,170.17	11	$1,874.74	11	$1,898.46
12	$1,193.57	12	$1,912.23	12	$1,936.43
13	$1,217.44	13	$1,950.48	13	$1,975.16
14	$1,241.79	14	$1,989.48	14	$2,014.66
15	$1,266.63	15	$2,029.27	15	$2,054.95
16	$1,291.96	16	$2,069.86	16	$2,096.05
17	$1,317.80	17	$2,111.26	17	$2,137.97
18	$1,344.15	18	$2,153.48	18	$2,180.73
19	$1,371.04	19	$2,196.55	19	$2,224.35
20	$1,398.46	20	$2,240.48	20	$2,268.83
21	$1,426.43	21	$2,285.29	21	$2,314.21
22	$1,454.96	22	$2,331.00	22	$2,360.49
23	$1,484.05	23	$2,377.62	23	$2,407.70
24	$1,513.74	24	$2,425.17	24	$2,455.86
IRR	0.73%	IRR	3.95%	IRR	40.62%
NPV	($6,460.64)	NPV	$1,437.21	NPV	$17,202.15
AROI	-0.54%	AROI	1.22%	AROI	32.27%

Lighting Upgrades Financial Summary

Measure	Base Cost	Incentives	Annual Energy Savings (kWh)	Simple Payback (Yr)	IRR	NPV	20 Yr Savings
4', 2-Lamp Fluorescent T8s - Retain Fixture, Upgrade Lamps to LED	$26,674	$3,940	96,640	1.9	712%	$208,105	$316,178
Indoor 175W HID Fixtures - Upgrade to LED	$99,686	$29,400	96,149	6	45%	$136,138	$264,005
Outdoor 250W Area & Roadway HID Fixtures - Upgrade to LED	$65,985	$6,500	36,461	13.4	16%	$58,757	$151,236
4', 3-Lamp Fluorescent T8s - Retain Fixture, Upgrade Lamps to LED	$8,271	$1,545	37,895	1.5	288%	$72,811	$110,078
Indoor Damp/Hazardous HID Susp. Fixtures - Upgrade to LED	$59,055	$9,300	53,439	7.6	14%	$34,200	$105,198
Outdoor Stanchion Mounted HID Fixtures - Upgrade to LED	$19,144	$4,000	11,995	10.3	96%	$36,524	$65,189
Outdoor 70W Wallpack Fixtures - Upgrade to LED	$14,877	$3,800	9,578	9.5	355%	$27,032	$47,805
2'x2' U-Bent Fluorescent Troffer Fixtures - Upgrade to LED	$26,859	$910	20,719	10.3	8%	$8,029	$42,728
Outdoor 250W HID Floodlight Fixtures - Upgrade to LED	$8,497	$1,300	9,592	6.2	33%	$16,150	$30,204
2', 3-Lamp Fluorescent T8s - Retain Fixture, Upgrade Lamps to LED	$3,014	$600	8,409	2.4	332%	$18,567	$29,159
8', 2-Lamp Fluorescent T12 Fixtures - Upgrade to LED	$8,283	$3,450	9,268	4.3	51%	$12,664	$22,614
60W Incandescent Bulbs - Upgrade to LED	$170	$170	466	0	N/A	$1,066	$1,379
100W & 200W Incandescent Bulbs - Upgrade to LED	$135	$90	162	2.3	N/A	$325	$467
Total	**$340,650**	**$65,005**	**389,736**	**5.8**	**53%**	**$639,643**	**$1,186,245**

Solar Financial Summary

Building Name	Aggregate Utility Cost ($/kWh)	Square Footage	Usable Square Footage	First Year Production (kWh)
Effluent Filters Roof	0.122	23625	20000	355558
Maintenance Building Roof	0.122	5175	5000	88748
Adjacent to Headworks	0.122	5600	5600	101941

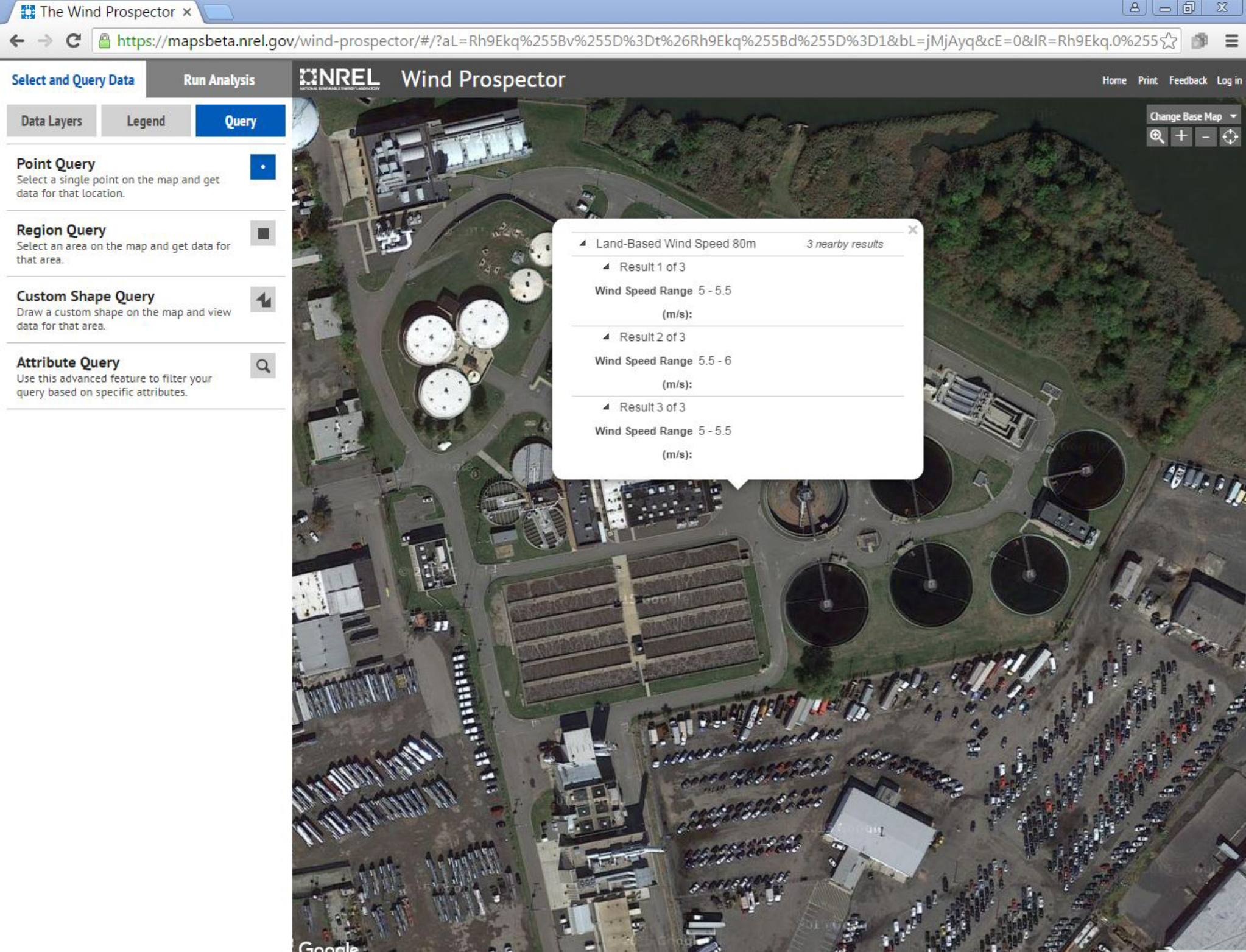
Summary Data Over 25 Yr For All Systems

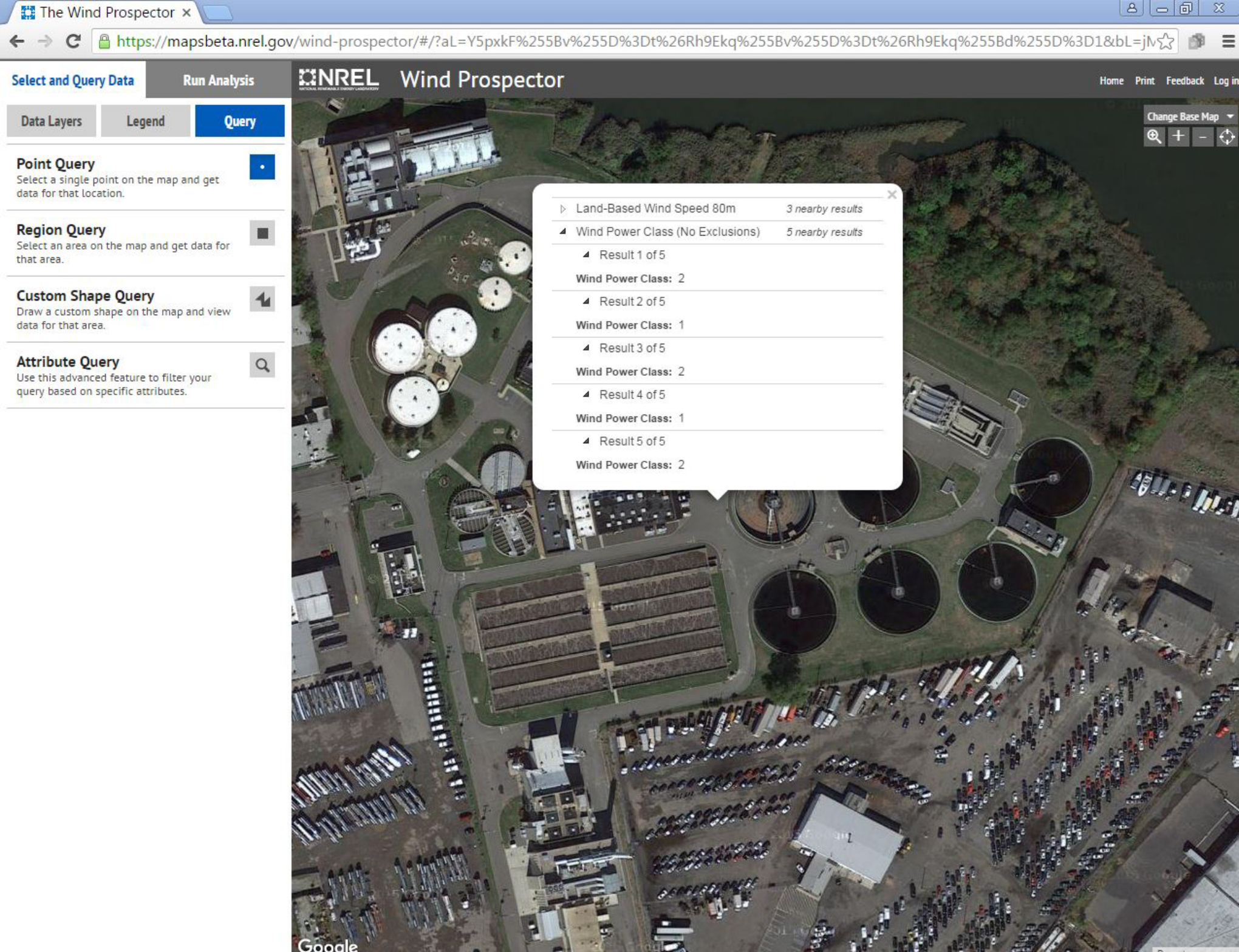
Total kWh generated	12,867,368
Utility Savings	$2,271,929
SRECS	$1,969,033
Installation	-$2,908,200
Maintenance	-$257,347
Net	$1,075,415

Building Name	AROI	IRR	NPV	Lifetime Savings	Simple Payback	Energy Savings	SRECS
UV Filters Roof	1.720%	3.296%	$55,304.24	$2,592,977.34	17.5	$43,378.08	$67,051.13
Storage Building Roof	0.942%	1.900%	($57,114.83)	$647,212.42	20.2	$10,827.26	$16,736.10
Adjacent to Headworks	1.107%	2.206%	($46,236.19)	$743,424.99	19.6	$12,436.80	$19,224.03

	Aerated Grit Blower - VFD	Peracetic Acid	Primary Sludge Pump - Operation Modification	UV - Automatic Mode	Aeration Tank - Reduced SRT	WAS Pumps
Assumed Inflation Rate	3%	3%	3%	3%	3%	3%
Initial Capital Cost (Minus Incentives)	$26,000.00	$100,000.00	$0.00	$0.00	$0.00	$0.00
Initial Energy Savings	$11,000.00	$355,000.00	$14,000.00	$260,000.00	$9,000.00	$10,000.00
Initial O&M Savings	$0.00	-$1,010,000.00	$0.00	$61,000.00	$0.00	$0.00
Total Initial Yearly Savings	$11,000.00	-$655,000.00	$14,000.00	$321,000.00	$9,000.00	$10,000.00
Assumed Average Useful Life (Years)	20	20	20	20	20	20
Year	Cash Flow	Cash Flow	Cash Flow	Cash Flow	Cash Flow	Cash Flow
0	-$26,000.00	-$100,000.00	$0.00	$0.00	$0.00	$0.00
1	$11,000.00	-$655,000.00	$14,000.00	$321,000.00	$9,000.00	$10,000.00
2	$11,330.00	-$674,650.00	$14,420.00	$330,630.00	$9,270.00	$10,300.00
3	$11,669.90	-$694,889.50	$14,852.60	$340,548.90	$9,548.10	$10,609.00
4	$12,020.00	-$715,736.19	$15,298.18	$350,765.37	$9,834.54	$10,927.27
5	$12,380.60	-$737,208.27	$15,757.12	$361,288.33	$10,129.58	$11,255.09
6	$12,752.01	-$759,324.52	$16,229.84	$372,126.98	$10,433.47	$11,592.74
7	$13,134.58	-$782,104.25	$16,716.73	$383,290.79	$10,746.47	$11,940.52
8	$13,528.61	-$805,567.38	$17,218.23	$394,789.51	$11,068.86	$12,298.74
9	$13,934.47	-$829,734.40	$17,734.78	$406,633.20	$11,400.93	$12,667.70
10	$14,352.51	-$854,626.44	$18,266.82	$418,832.19	$11,742.96	$13,047.73
11	$14,783.08	-$880,265.23	$18,814.83	$431,397.16	$12,095.25	$13,439.16
12	$15,226.57	-$906,673.19	$19,379.27	$444,339.07	$12,458.10	$13,842.34
13	$15,683.37	-$933,873.38	$19,960.65	$457,669.24	$12,831.85	$14,257.61
14	$16,153.87	-$961,889.58	$20,559.47	$471,399.32	$13,216.80	$14,685.34
15	$16,638.49	-$990,746.27	$21,176.26	$485,541.30	$13,613.31	$15,125.90
16	$17,137.64	-$1,020,468.66	$21,811.54	$500,107.54	$14,021.71	$15,579.67
17	$17,651.77	-$1,051,082.72	$22,465.89	$515,110.77	$14,442.36	$16,047.06
18	$18,181.32	-$1,082,615.20	$23,139.87	$530,564.09	$14,875.63	$16,528.48
19	$18,726.76	-$1,115,093.66	$23,834.06	$546,481.01	$15,321.90	$17,024.33
20	$19,288.57	-$1,148,546.46	$24,549.08	$562,875.44	$15,781.55	$17,535.06
AROI	37.31%	-660.00%	-	-	-	-
IRR	45.26%	-	-	-	-	-
NPV	$187,592.23	-$12,818,446.60	$271,844.66	$6,233,009.71	$174,757.28	$194,174.76

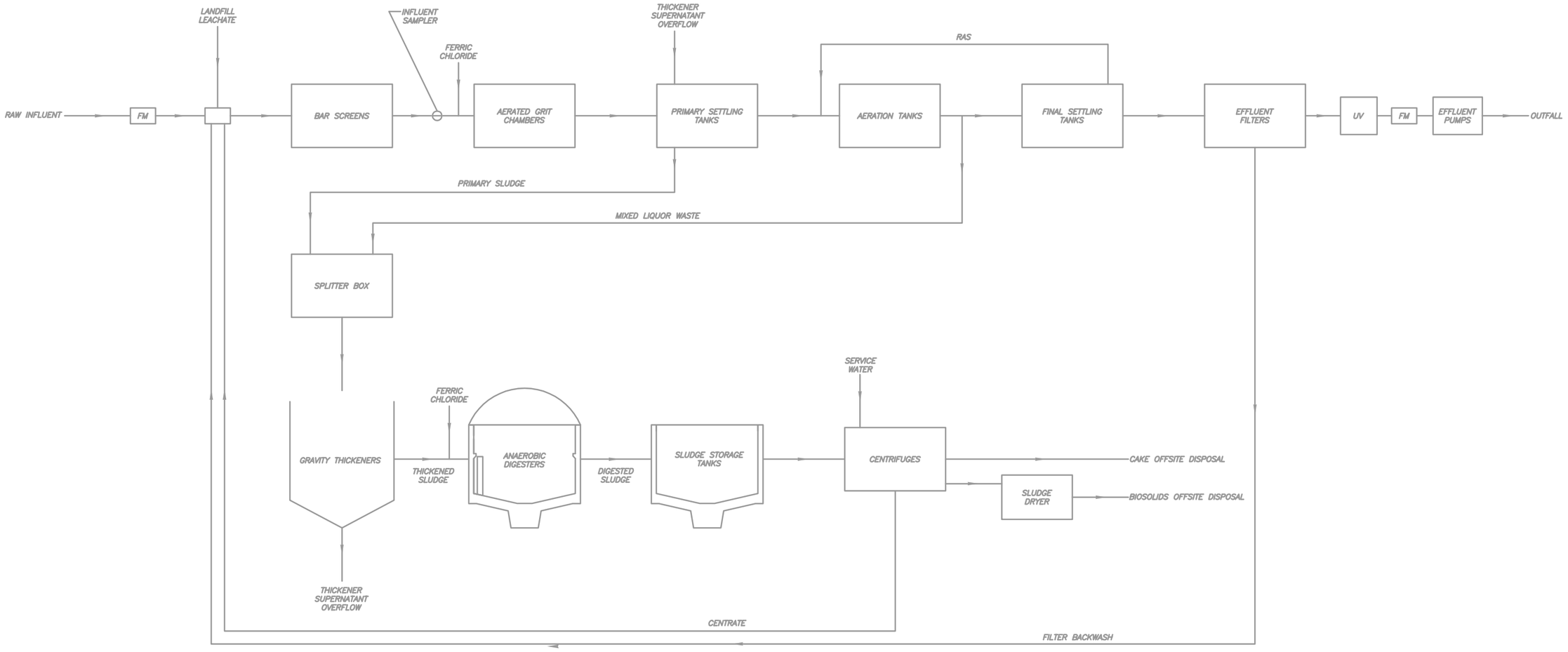
Appendix H
NREL Wind Prospector


The Wind Prospector
https://mapsbeta.nrel.gov/wind-prospector/#/?aL=Rh9Ekq%255Bv%255D%3Dt%26Rh9Ekq%255Bd%255D%3D1&bL=jMjAyq&cE=0&IR=Rh9Ekq.0%255
Select and Query Data
Run Analysis
NREL
Wind Prospector
Home
Print
Feedback
Log in
Data Layers
Legend
Query
Point Query
Select a single point on the map and get data for that location.
Region Query
Select an area on the map and get data for that area.
Custom Shape Query
Draw a custom shape on the map and view data for that area.
Attribute Query
Use this advanced feature to filter your query based on specific attributes.
Change Base Map
Land-Based Wind Speed 80m
3 nearby results
Result 1 of 3
Wind Speed Range (m/s): 5 - 5.5
Result 2 of 3
Wind Speed Range (m/s): 5.5 - 6
Result 3 of 3
Wind Speed Range (m/s): 5 - 5.5
Google


The Wind Prospector
https://mapsbeta.nrel.gov/wind-prospector/#/?aL=Y5pxkF%255Bv%255D%3Dt%26Rh9Ekq%255Bv%255D%3Dt%26Rh9Ekq%255Bd%255D%3D1&bL=jM
Select and Query Data
Run Analysis
NREL
Wind Prospector
Home
Print
Feedback
Log in
Data Layers
Legend
Query
Point Query
Select a single point on the map and get data for that location.
Region Query
Select an area on the map and get data for that area.
Custom Shape Query
Draw a custom shape on the map and view data for that area.
Attribute Query
Use this advanced feature to filter your query based on specific attributes.
Change Base Map
Land-Based Wind Speed 80m
3 nearby results
Wind Power Class (No Exclusions)
5 nearby results
Result 1 of 5
Wind Power Class: 2
Result 2 of 5
Wind Power Class: 1
Result 3 of 5
Wind Power Class: 2
Result 4 of 5
Wind Power Class: 1
Result 5 of 5
Wind Power Class: 2
Google

Appendix I
Process Flow Diagram

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Camp Dresser McKee & Smith

Process Flow Diagram
RVSA
MARCH 2016

Appendix J
Wastewater Process Data

LABORATORY and OPERATING RECORDS

	SETTLABLE SOLIDS		SUSPENDED SOLIDS MG/L					Primary sludge load	CBOD						FILTER	FILTER	DISSOLVED	FECAL
	INFLUENT	FINAL	INFLUENT	PRIMARY	% REMOV.	FINAL	OVERALL		INFLUENT	PRIMARY	% REM.	Secondary	sol cbod	OVERALL	TSS	CBOD	OXYGEN	AT
Data					PRIMARY	TSS	% REMOV				PRIMARY			% REM.	MG/L	MG/L	MG/L	DSN 001/002
Average	7.9	0.3	163.7	86.7	45.2	10.4	92.8	569.9	118.6	81.7	28.3	5.9		94.4				56.6
Min	0.0	0.0	60.0	0.0	-722.2	0.0	32.1	-11926.2	17.6	0.0	-329.5	0.0		32.1				0.0
Max	44.0	5.0	518.0	1480.0	100.0	84.0	99.7	3077.5	242.0	288.0	100.0	32.8		99.4				10640.0
5th	4	0.01	102	41.325	-61.8	1.9	82.9	-566.3	78.3	46.2	-13.3	1.4		87.6				2.0
95th	11	0.6	253	313.4	75.0	20.9	98.6	1392.6	154.8	138.0	48.8	11.9		98.5				76.1
98th	13	1.5	302.4	407.4	79.6	29.6	98.9	1784.4	168.0	178.6	54.9	14.8		98.8				184.9
99th	17	2	361.2	482.42	82.8	36.1	99.2	2034.4	178.0	199.3	57.7	18.0		99.0				521.4

																	SECONDARY OPERATIONS		
	UV at time of sample												HW SODIUM	RDT SODIUM	TOTAL SODIUM		AVG. S.S.	AVG SOLIDS	AVG. VOL.	24 HOUR
	Dose				UV				Power				HYPOCHLORITE	HYPOCHLORITE	HYPOCHLORITE		UNDER	UNDER	SOLIDS	COMPOSITE mg/l
Data	mJ/cm²				mW/cm²				%				GALLONS	GALLONS	GAL/DAY	DATE	AERATION	AERATION	AERATION	MIXED	RET.ACT.
Average	80.5	78.3	69.3	107.5	10.8	14.2	9.0	14.6	196.0	102.1	207.7	99.2			0.0	41822.0	2852.5	163279.7	138392.6	1811.8	3791.9
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	41275.0	1270.0	72694.8	63244.5	680.0	1605.0
Max	2369.7	1111.0	749.0	1391.0	1839.0	128.0	323.0	183.9	100100.0	1001.0	100100.0	1100.0			0.0	42369.0	6950.0	397818.0	324619.5	4340.0	10185.0
5th	0.0	0.0	0.0	0.0	0.0	3.9	0.0	4.4	100	100	100	100			0	41329.7	2015.8	115381.5	96876.0	1190.0	2865.0
95th	248.5	219.9	206.8	250.0	22.9	23.1	24.0	23.5	100	100	100	100			0	42314.3	4624.3	264692.1	217100.2	3360.0	5239.0
98th	250.0	250.0	234.0	250.0	25.1	24.9	25.8	25.4	100	100	100	100			0	42347.12	5974.3	341968.9	277113.6	3760.0	5975.0
99th	250.0	250.0	246.8	250.0	25.9	26.1	27.2	26.7	100	100	1001	100			0	42358.06	6344.3	363144.9	292183.8	3760.0	6946.8

SECONDARY OPERATIONS

No. aeration tanks (AT)	2
Volume/AT (MG)	3.5

SECONDARY CONTROL OPERATORS REPORT

Data	DRY SOLIDS LBS SOLIDS	DRY SOLIDS LBS SOLIDS	LBS. S.S. TO SECONDARY	LBS CBOD TO SECONDARY	AERATION % MIXED LIQ. VOL.	S.V.I. MIX LIQ	R.A.S. S.V.I.	TOT SOLIDS WASTED AND IN	F/M RATIO	Calculated SRT	M.C.R.T.	DATE	PLANT FLOW WWTP	PRIMARY SLUDGE	RETURN ACT. SLUDGE	WASTE ACT. SLUDGE	SECONDARY FLOW	TOTAL AIR X MILLION
Average	14967.9	2273.5	23420.0	24459.8		103.9	137.1	16653.0		7.1	10.9	41783.8	24.9	0.8902	12.5	1.0	35.7	316800.0
Min	0.0	0.0	0.0	2735.4		44.4	0.0	0.0		1.6	3.3	0.0	13.0	0.1	8.7	0.1	0.0	316800.0
Max	63342.3	27067.8	360420.2	73088.0		282.7	543.7	63342.3		33.9	44.1	42369.0	75.7	1.7	15.2	2.2	88.1	316800.0
5th	4588.6	0.0	13840.8	17205.3		64.8	59.2	4507.3		3.9	6.3	41328.7	18.3	0.7	11.5	0.4	13.3	316800
95th	34251.1	5757.3	45812.0	33845.9		138.9	308.2	36698.2		14.3	20.8	42314.3	37.7	1.1	13.2	1.7	49.5	316800
98th	47116.9	9034.7	86325.3	38892.2		161.5	336.5	47152.8		19.6	24.2	42347.1	46.8	1.1	13.4	1.8	58.1	316800
99th	50452.9	13549.0	97900.4	44128.3		181.5	345.5	50245.3		23.3	28.3	42358.1	53.0	1.2	13.6	1.8	65.3	316800

	ELECTRIC BLOWERS HRS.				PUMPS IN SERVICE HOURS													
	#1	#2	# 3	TOTAL		MAIN SEWAGE PUMPS						INTERMEDIATE PUMPS					RETURN PUMPS		
Data	HRS.	HRS.	HRS.		DATE	# 1	# 2	# 3	# 4	# 5	TOTAL	# 1	#2	#3	#4	TOTAL	# 1	# 2	# 3
Average	7.1	8.1	8.8	23.4	41822.3	8.2	7.0	8.5	13.8	8.7	45.2	0.0	4.4	23.9	19.6	46.9	9.0	5.9	9.1
Min	0.0	0.0	0.0	0.0	41275.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max	25.0	24.0	25.0	26.0	42369.0	25.1	24.6	25.0	24.7	24.0	116.3	18.0	24.0	25.0	25.0	50.0	24.8	24.0	25.0
5th	0	0	0	24	41329.7	0	0	0	0	0	38.7	0	0	24	0	48	0	0	0
95th	24	24	24	24	42314.3	24	24	24	24	24	66.8	0	24	24	24	48	24	24	24
98th	24	24	24	24	42347.1	24	24	24	24	24	81.8	0	24	24	24	48	24	24	24
99th	24	24	24	24	42358.1	24	24	24	24	24	93.1	0	24	24	24	48	24	24	24

	WASTE PUMPS		WASTE PUMPS			THICKENER SLUDGE PUMPS									RDT PUMPS			PRIMARY SLUDGE PUMPS				
Data	# 1	# 2	#1	#2	#3	1A	1B	1C	2A	2B	2C	3A	3B	3C	#2	#3	#4	#1	#2	#3	#4	#5
Average	14.6	9.4	0.0	0.0	0.0	4.4	5.7	2.9	1.9	6.6	4.3	0.0	0.0	0.0	0.0	0.0	0.0	16.1	23.8	16.8	18.7	0.0
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max	25.0	25.0	0.0	0.0	0.0	24.0	24.0	24.0	24.0	24.0	24.0	0.0	0.0	0.0	0.0	0.0	9.0	24.0	25.0	25.0	25.0	0.0
5th	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0
95th	24	24	0	0	0	21.8	20.8	14.0	13.8	19.7	18.0	0	0	0	0	0	0	24	24	24	24	0
98th	24	24	0	0	0	24.0	24.0	16.0	20.4	23.8	22.0	0	0	0	0	0	0	24	24	24	24	0
99th	24	24	0	0	0	24.0	24.0	17.6	24.0	24.0	24.0	0	0	0	0	0	0	24	24	24	24	0

																		DMR	INFLUENT		
	P & B BOILER #3			PRIMARY	PRIMARY	PRIMARY	PRIMARY	PRIMARY	PRIMARY	NAT. GAS	SLUDGE TO	SLUDGE TO	SLUDGE TO	POLYMER	POLYMER	POLYMER		SLUDGE	SLUDGE			
	Nat Gas	Nat Gas	Dig Gas	BOILER #1	BOILER #1	BOILER #2	BOILER #2	BOILER #2	BOILER #2	PRIMARY	RTD #1	RTD #2	RTD #3	USED	USED	USED	DIG.ADD	TO DIG.	TO DIG.	FLOW	RAIN	FLOW
Data	CU-FT*100	HOURS	HOURS	HOURS	NAT. GAS	HOURS NG	NAT. GAS	HOURS DG	DIG. GAS	DAY	GAL/DAY	GAL/DAY	GAL/DAY	INCHES	GALLONS	POUNDS	TENTHS	CF/DAY	GAL/DAY	MGD		7 DAY AVG
Average	0.6	0.0	16.4	9.1	28700.6	5.6	13375.3	0.0	0.0	1086.8	0.0	0.0	0.0	0.0	0.0	0.0	31.0	13417.5	100362.9	23.5	0.1	23.4
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max	442.0	4.6	24.7	24.0	107205.0	24.0	94001.0	0.0	1.0	59896.0	0.0	0.0	0.0	0.0	0.0	0.0	89.0	39299.2	293958.1	75.7	5.3	52.5
5th	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13.0	4857.2	36331.9	0.0	0.0	0.0
95th	0	0	24	24	95731.2	24	66131.3	0	0	139.5	0	0	0	0	0	0	51.0	22519.8	168447.9	37.2	0.8	33.9
98th	0	0	24	24	97699.2	24	70411.9	0	0	23940.6	0	0	0	0	0	0	57.6	25222.1	188661.6	46.0	1.3	42.7
99th	0	0	24	24	98898.4	24	71627.8	0	0	50238.5	0	0	0	0	0	0	62.0	27377.0	204779.8	52.9	1.8	46.5

Data	TSS MG/L	TSS 7 DAY AVG MG/L	LOADING KG/DAY	7 DAY AVG KG/DAY	LBS LOAD LBS/DAY	CBOD MG/L	7 DAY AVG. MG/L	LOADING KG/DAY	7 DAY AVG. KG/DAY	LBS LOAD LBS/DAY	W.A.S. FLOW	CBOD MG/L	FLOW M-16	TSS MG/L	7 DAY AVG. MG/L	LOADING KG/DAY	7 DAY AVG. KG/DAY	LBS LOAD LBS/DAY	DATE	CBOD MG/L	7 DAY AVG. MG/L	COLIFORM COL/100/ML
Average	160.1	160.2	14062.7	13479.5	30986.3	115.5	115.3	10113.0	10090.8	22283.3	1.0	81.6	30.4	10.4	10.2	1240.5	1220.0	2733.3	41822.0	5.9	5.8	56.6
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.7	0.0	0.0	0.0	0.0	0.0	41275.0	0.0	0.0	0.0
Max	518.0	297.7	51009.9	30422.3	112397.0	242.0	166.6	21911.7	14615.7	48281.0	2.2	288.0	104.8	84.0	34.7	19434.3	8990.2	42822.3	42369.0	32.8	19.7	10640.0
5th	94.0	107.1	0.0	0.0	0.0	69.4	79.1	0.0	0.0	0.0	0.3	45.8	21.4	1.9	2.1	0.0	0.0	0.0	41329.7	1.4	1.7	2.0
95th	252.0	218.3	23241.2	19953.2	51210.6	154.0	144.2	14314.5	13133.9	31541.1	1.7	138.0	47.2	21.1	20.6	3219.0	3046.4	7092.8	42314.3	11.9	10.7	76.1
98th	300.5	238.1	30026.3	22940.6	66160.9	168.0	151.0	15515.8	13571.1	34187.9	1.8	178.5	55.1	30.2	24.6	4836.7	4387.1	10657.3	42347.1	14.8	11.8	184.9
99th	360.2	250.3	37570.1	24485.0	82783.3	178.0	155.8	17233.3	13852.2	37972.5	1.8	199.3	69.0	37.6	27.2	7335.3	4862.2	16162.9	42358.1	18.0	14.4	521.4

		RAW	RAW	FINAL	FINAL	SETTABLE		TEMP		P.H.	P.H.	P.H.	P.H.	P.H.	P.H.
	DO	TEMP	TEMP	TEMP	TEMP	RAW	FINAL	RAW	FINAL	RAW	RAW	RAW	FINAL	FINAL	FINAL
Data	MG/L	HIGH	LOW	HIGH	LOW			AVERAGE	AVERAGE	AVERAGE	MAX/DAY	MIN/DAY	AVERAGE	MAX/DAY	MIN/DAY
Average	6.9	18.9	17.2	19.4	17.7	5.4	0.0	18.1	18.6	7.3	7.6	7.1	7.1	7.3	6.9
Min	4.1	9.5	6.0	10.0	7.0	1.0	0.0	9.0	9.7	6.9	7.0	5.1	6.2	6.8	6.4
Max	9.1	27.0	25.0	28.0	25.5	34.0	8.5	25.6	34.2	7.7	8.2	7.5	7.6	8.3	7.5
5th	5.8	12.0	10.0	12.5	10.5	2.8	0.0	11.1	11.6	7.1	7.3	6.9	6.9	7.1	6.7
95th	8.0	25.0	23.5	26.0	24.0	7.7	0.0	24.3	24.9	7.5	7.8	7.3	7.4	7.6	7.2
98th	8.2	26.0	24.0	26.5	24.5	8.4	0.0	24.6	25.3	7.5	7.9	7.4	7.5	7.7	7.3
99th	8.6	26.0	24.0	27.0	24.5	9.3	0.0	24.9	25.5	7.6	7.9	7.4	7.5	7.8	7.4

Appendix K
Wastewater Process Calculations

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: Grit Chamber - Blower Flow Rate

By: E. Moody
By Date: 1/22/2016
Checked By: V. Apa
Checked By Date: 2/7/2016
Last Revision: 1. Bottom floor slope is 23 degrees

Purpose: Calculation is to check minimum required blower flow rates at aerated grit chambers based on MOP 8 standards. Minimum flow rate will be compared with actual flow rate used at RVSA WWTP to determine if energy savings can be achieved by blower turndown.

4) Per MOP8, 5E, Chapter 11, Section 4.0 Grit Removal:

A) Air rates typically range from 3 to 8-CFM/ft. Rates as low as 1-CFM/SF have been used for shallow/narrow tanks and >5-CFM/ft have been used for deep/wide tanks.

Aerated Grit Chambers

	Typical Design	Actual		
Dimensions				
Depth		12	ft	
Length		34	ft	
Width		20	ft	
Width-Depth Ratio	0.8:1	1.7	ratio	
Length-Width Ratio	3:1 to 8:1	1.7	ratio	122.4
Bottom Floor Slope	30°	30	°	*assuming 30 degrees. Record drawings are electrical, pl
Diffuser Location	70% of total depth			*assumed
Air Supply per foot of basin length	3 to 8 cfm/ft	3	cfm/ft	
		5	cfm/ft	
		8	cfm/ft	
Air Supply	Min	102	scfm	
	Avg	170	scfm	
	Max	272	scfm	

Existing aerated grit blowers are rated for 340 scfm

Total Air Supply Required

Air Supply		102	scfm	Max blower turndown is ~145 scfm

CDM Smith

By: V. Apa

Client: Rahway Valley Sewerage Authority **Date:** 3/22/2016

Project: Energy Audit **Reviewed By:**

Project #: 5049.112433 **Reviewed Date:**

Facility: RVSA WWTP **Revision:** 3/24/2016

Objectives: To estimate the Actual Oxygen Requirement (AOR) for existing and proposed conditions.

Proposed conditions include running at a lower aerobic solids retention time (SRT) to limit nitrification, which is not required by permit.

Procedure:

1. Convert CBOD load (lb/d) to BOD (estimated).
2. Estimate carbonaceous removal (BOD oxygen demand) based on formula 0.8 + 0.027*SRT.
3. Estimate the nitrogenous removal (nitrification oxygen demand) based on a few influent flow rates and concentrations; not extensive daily load data.
4. Nitrification oxygen demand assumes 4.25*(primary effluent TKN - soluble organic N - N for carbonaceous removing organisms - effluent NH3).
5. Soluble organic N from aeration tank effluent is estimated at 1.5% of influent TKN.
6. N for carb. removing organisms growth is estimated at 8.8% of the volatile fraction of mixed liquor + effluent solids (0.088*0.8*Y*BODr).

References and Data Sources:

1. 1/1/13 to 12/31/15 data for primary effluent BOD.
2. Limited primary effluent TKN data (15 data points from 2015). Limited influent TKN as well.
3. CDM Smith Activated Sludge Guidelines, V.3, 2011, p. 4-15 to 4-17.

Assumptions and Limitations:

1. Used primary effluent loads as aeration influent. This includes all recycles.
2. Limited TKN data.
3. CBOD/BOD 0.85
4. Min. day is 5th percentile and max. day is 95th percentile. Did not use true min and max day values for flow, SRT or BOD load.
5. Used influent flow data since no primary effluent flow meter.
6. RVSA currently runs both aeration tanks, each with a volume of 3.5 MG.
7. Only change between current and "future" conditions is the SRT.
8. Used CDMS calculated SRT and not RVSA MCRT values, which were much higher.
9. Assumed 95% of BOD is removed in aeration tanks.
10. Assumed effluent TKN concentrations.

Calcs:

								1.5%		0.088		4.25		
Condition	**Primary Effluent Flow (MGD)**	**Primary Effluent CBOD (lb/d)**	**Primary Effluent BOD (lb/d)**	**Primary Effluent TKN (mg/L)**	**Effluent TKN (mg/L)**	**Primary Effluent TKN (lb/d)**	**SRT (day)**	**Carb. AOR (lb/d)**	**AT Effluent Soluble Organic N (lb/d)**	**Net Yield (lb TSS prod./lb BOD rem.)**	**N for Carb. Org. Growth (lb/d)**	**Effluent TKN (lb/d)**	**Nit. AOR (lb/d)**	**AOR (lb/d)**
Current Minimum Day	18.3	17,205	20,241	39	25	5,952	3.7	18,215	89	0.90	1,218	3,816	3,524	21,739
Current Average Day	24.9	24,460	28,776	39	15	8,099	7.0	28,460	121	0.70	1,347	3,115	14,940	43,400
Current Maximum Day	37.7	33,846	39,819	39	15	12,262	14.2	47,122	184	0.60	1,598	4,716	24,498	71,620
Future Minimum Day	18.3	17,205	20,241	39	25	5,952	3.7	18,215	89	0.90	1,218	3,816	3,524	21,739
Future Average Day	24.9	24,460	28,776	39	25	8,099	3.7	25,896	121	0.70	1,347	5,192	6,114	32,010
Future Maximum Day	37.7	33,846	39,819	39	25	12,262	3.7	35,833	184	0.60	1,598	7,860	11,135	46,968

Conclusions:

This analysis shows an average 36% reduction in the AOR from current to proposed conditions.

CDM Smith

Client: Rahway Valley Sewerage Authority
Project: Energy Audit
Project #: 5049.112433
Facility: RVSA WWTP
Data Source: "RVSA - Actual Oxygen Requirement estimates.xlsx", "2013-2015 data.xlsx", & Comprehensive Strategic Plan, sheet AT161 "Volume 1.pdf'

By: E. Moody
Date: 3/17/2016
Reviewed By: V. Apa
Reviewed Date: 3/22/2016
Revision: 1. SOTE, diffuser height 3/23/16

This spreadsheet converts oxygen requirements to scfm.
The scfm is used to size the diffuser system and as input into the blower design.
Assumed no nitrification.

Standard conditions defined as
68^{0}F
14.7 psia
36% RH

Characteristics of atmospheric air at standard conditions
0.075 lb/cu ft
23.2% oxygen by weight

Density of air (γ) = 144p/53.5R

γ	density in lb/cu ft
p	pressure in lbs/sq ft
R	temperature in degrees Rankine (^{0}R = ^{0}F + 460)
53.5	universal gas constant for air, ft lb/lb

Depth Correction for Diffuser Submergence

C_{sc}= {[P_a + (cxd)]/P_a} x C_s

C_{sc}	depth corrected saturation factor
P_a	atmospheric pressure, ft of water
c	depth correction factor (0.25 - 0.45 typ)
d	diffuser submergence in ft

β 0.7 - 0.98; 0.95 is normal

α 0.40-0.45 for non-nitrifying systems; 0.55-0.65 for nitrifying systems

Temperature Corrections

$\theta^{(T-20)}$ corrects alpha for temperature

T	in ^{0}C
θ	1.024

$$\tau = \frac{C_{ST}}{C_{S\,20}}$$ See attached saturation table

C_{ST}	Solubility at process temperature - ^{0}C
C_{S20}	Solubility at 20^{0}C

Pressure Correction

corrects for plant altitude at diffuser submergence greater that 20 ft

$$\Omega = \frac{P_{ambient} + (c \times d) - P_{vapor}}{P_{standard} + (c \times d) - P_{vapor}}$$

$P_{ambient}$	atmospheric pressure at plant
$P_{standard}$	14.7 psi (atmospheric pressure at sea level)
P_{vapor}	vapor pressure dependent on wastwater temperature
c	depth correction factor in %
d	diffuser submergence

Driving Force Correction

$$Driving\ \ force\ \ corection\ = \frac{C^*_{SC} - C}{C_{SC}}$$

C^*_{SC}	DO saturation corrected for pressure, temperature & wastewater, mg/l
C_{SC}	DO saturation corrected for depth of submergence, mg/l
C	min DO under operating conditions

Summary Equation

$$OTE_{field} = SOTE \frac{\beta\tau\ \Omega\ C_{SC} - C}{C_{SC}} \alpha\ \theta^{(T-20)}$$

Requires user input; defaults given where appropriate
Output
3.7 day SRT Carbon oxygen req'd = 0.8 +0.027*SRT Based on BOD removed; assumed 95% removal.
Assumed no nitrification.

INPUT		
21,739	Min Oxygen requirements, lb/d	AOR, *RVSA - Actual Oxygen Requirement estimates*
15.03	Depth of aeration Tanks, ft	High WS EL 119.7 & FF EL 104.67
0.98	β	
0.45	α	Assumed, no nitrification
25	Process temp, ^{0}C	Assumed
0.33	c (depth correction factor for submergence)	Assumed
2.0	Min Operating DO, mg/l	Assumed
34	atmospheric pressure, ft of water	
1.024	θ	
8.26	C_{ST}	Used water temperature of 25ºC and 0 mg/L salinity.
9.09	C_{S20}	
14.62	Ambient pressure, psi	Based on altitude of 132.5 feet (WSEI.).
14.7	Standard pressure, psi	
0.47	Vapor pressure, psi	Based on wastewater temperature of 25^{o}C
1.00	Allowance for diffuser fouling	Assumed no fouling.
1.96	SOTE, % per ft of diffuser submergence	

Design Conditions		
13.81	Depth of diffuser submergence - ft	Assumed 1.22' diffuser height off floor.
27.0	SOTE-%	Compehensive Strategic Plan, Table 3.3. Sanitaire Diffusers
10.31	C_{SC}	
0.91	τ	
1.00	Ω	
1.126	$\theta^{(T-20)}$	

Output	
9.78	OTE_{FIELD}
5.00	OTE_{FIELD}/SOTE
8,874	Minimum air, scfm
n/a	Max Day air, scfm

Dissolved Oxygen Saturation

Solubility of oxygen at atmospheric pressure

	Chlorinity mg/l		
Temp ^{0}C	0	5	10
0	14.62	13.73	12.89
1	14.22	13.36	12.55
2	13.83	13.00	12.22
3	13.46	12.66	11.91
4	13.11	12.34	11.61
5	12.77	12.02	11.32
6	12.45	11.73	11.05
7	12.14	11.44	10.78
8	11.84	11.17	10.53
9	11.56	10.91	10.29
10	11.29	10.66	10.06
11	11.03	10.42	9.84
12	10.78	10.18	9.62
13	10.54	9.96	9.41
14	10.31	9.75	9.22
15	10.08	9.54	9.03
16	9.87	9.34	8.84
17	9.67	9.15	8.67
18	9.47	8.97	8.50
19	9.28	8.79	8.33
20	9.09	8.62	8.17
21	8.91	8.46	8.02
22	8.74	8.30	7.87
23	8.58	8.14	7.73
24	8.42	7.99	7.59
25	8.26	7.85	7.46
26	8.11	7.71	7.33
27	7.97	7.58	7.20
28	7.83	7.44	7.08
29	7.69	7.32	6.96
30	7.56	7.19	6.85

CDM Smith

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By: E. Moody
Date: 3/17/2016
Reviewed By: V. Apa
Reviewed Date: 3/22/2016
Revision: 1. SOTE, diffuser height 3/23/16

This spreadsheet converts oxygen requirements to scfm.
The scfm is used to size the diffuser system and as input into the blower design.
Assumed nitrification occurs.

Standard conditions defined as
- 68^0F
- 14.7 psia
- 36% RH

Characteristics of atmospheric air at standard conditions
- 0.075 lb/cu ft
- 23.2% oxygen by weight

Density of air (γ) = 144p/53.5R

γ	density in lb/cu ft
p	pressure in lbs/sq ft
R	temperature in degrees Rankine (^{0}R = ^{0}F + 460)
53.5	universal gas constant for air, ft lb/lb

Depth Correction for Diffuser Submergence

C_{sc}= {[P_a + (cxd)]/P_a} x C_s

C_{sc}	depth corrected saturation factor
P_a	atmospheric pressure, ft of water
c	depth correction factor (0.25 - 0.45 typ)
d	diffuser submergence in ft

β 0.7 - 0.98; 0.95 is normal

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$\theta^{(T-20)}$ corrects alpha for temperature

T	in ^{0}C
θ	1.024

$$\tau = \frac{C_{ST}}{C_{S\,20}}$$ See attached saturation table

C_{ST}	Solubility at process temperature - ^{0}C
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Pressure Correction

corrects for plant altitude at diffuser submergence greater that 20 ft

$$\Omega = \frac{P_{ambient} + (c \times d) - P_{vapor}}{P_{standard} + (c \times d) - P_{vapor}}$$

$P_{ambient}$	atmospheric pressure at plant
$P_{standard}$	14.7 psi (atmospheric pressure at sea level)
P_{vapor}	vapor pressure dependent on wastewater temperature
c	depth correction factor in %
d	diffuser submergence

Driving Force Correction

$$Driving\ \ force\ \ corection = \frac{C^*_{SC} - C}{C_{SC}}$$

C^*_{SC}	DO saturation corrected for pressure, temperature & wastewater, mg/l
C_{SC}	DO saturation corrected for depth of submergence, mg/l
C	min DO under operating conditions

Summary Equation

$$OTE_{field} = SOTE \quad \frac{\beta\tau\ \Omega\ C_{SC} - C}{C_{SC}}\ \alpha\ \theta^{(T-20)}$$

Requires user input; defaults given where appropriate
Output
7.0 day SRT Carbon oxygen req'd = 0.8 +0.027*SRT Based on BOD removed; assumed 95% removal.
Assumed nitrification occurs. Based on TKN removed; assumed 20% removal

INPUT		
43,400	Average Oxygen requirements, lb/d	AOR, *RVSA - Actual Oxygen Requirement estimates*
15.03	Depth of aeration Tanks, ft	High WS EL 119.7 & FF EL 104.67
0.98	β	
0.60	α	Assumed, nitrification occurs
25	Process temp, ^{0}C	Assumed
0.33	c (depth correction factor for submergence)	Assumed
2.0	Min Operating DO, mg/l	Assumed
34	atmospheric pressure, ft of water	
1.024	θ	
8.26	C_{ST}	Used water temperature of 25ºC and 0 mg/L salinity.
9.09	C_{S20}	
14.62	Ambient pressure, psi	Based on altitude of 132.5 feet (WSEl.).
14.7	Standard pressure, psi	
0.47	Vapor pressure, psi	Based on wastewater temperature of 25^{0}C
1.05	Allowance for diffuser fouling	Assumed
1.96	SOTE, % per ft of diffuser submergence	Vendor assumed.

Design Conditions		
13.81	Depth of diffuser submergence - ft	Assumed 1.22' diffuser height off floor.
27.00	SOTE -%	Compehensive Strategic Plan, Table 3.3. Sanitaire Diffusers
10.31	C_{SC}	
0.91	τ	
1.00	Ω	
1.126	$\theta^{(T-20)}$	

Output	
13.04	OTE_{FIELD}
6.67	OTE_{FIELD}/SOTE
13,952	Average air, scfm
n/a	Max Day air, scfm

Dissolved Oxygen Saturation

Solubility of oxygen at atmospheric pressure

	Chlorinity mg/l		
Temp ^{0}C	0	5	10
0	14.62	13.73	12.89
1	14.22	13.36	12.55
2	13.83	13.00	12.22
3	13.46	12.66	11.91
4	13.11	12.34	11.61
5	12.77	12.02	11.32
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20	9.09	8.62	8.17
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23	8.58	8.14	7.73
24	8.42	7.99	7.59
25	8.26	7.85	7.46
26	8.11	7.71	7.33
27	7.97	7.58	7.20
28	7.83	7.44	7.08
29	7.69	7.32	6.96

30	7.56	7.19	6.85

CDM Smith

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Revision: 1. SOTE, diffuser height 3/23/16

This spreadsheet converts oxygen requirements to scfm.
The scfm is used to size the diffuser system and as input into the blower design.
Assumed nitrification occurs.

Standard conditions defined as
68^0F
14.7 psia
36% RH

Characteristics of atmospheric air at standard conditions
0.075 lb/cu ft
23.2% oxygen by weight

Density of air (γ) = 144p/53.5R

γ	density in lb/cu ft
p	pressure in lbs/sq ft
R	temperature in degrees Rankine (^{0}R = ^{0}F + 460)
53.5	universal gas constant for air, ft lb/lb

Depth Correction for Diffuser Submergence

C_{sc}= {[P_a + (cxd)]/P_a} x C_s

C_{sc}	depth corrected saturation factor
P_a	atmospheric pressure, ft of water
c	depth correction factor (0.25 - 0.45 typ)
d	diffuser submergence in ft

β 0.7 - 0.98; 0.95 is normal

α 0.40-0.45 for non-nitrifying systems; 0.55-0.65 for nitrifying systems

Temperature Corrections

$\theta^{(T-20)}$ corrects alpha for temperature

T	in ^{0}C
θ	1.024

$$\tau = \frac{C_{ST}}{C_{S\,20}}$$ See attached saturation table

C_{ST}	Solubility at process temperature - ^{0}C
C_{S20}	Solubility at 20^{0}C

Pressure Correction

corrects for plant altitude at diffuser submergence greater that 20 ft

$$\Omega = \frac{P_{ambient} + (c \times d) - P_{vapor}}{P_{standard} + (c \times d) - P_{vapor}}$$

$P_{ambient}$	atmospheric pressure at plant
$P_{standard}$	14.7 psi (atmospheric pressure at sea level)
P_{vapor}	vapor pressure dependent on wastewater temperature
c	depth correction factor in %
d	diffuser submergence

Driving Force Correction

$$Driving\ \ force\ \ corection\ = \frac{C^*_{SC} - C}{C_{SC}}$$

C^*_{SC}	DO saturation corrected for pressure, temperature & wastewater, mg/l
C_{SC}	DO saturation corrected for depth of submergence, mg/l
C	min DO under operating conditions

Summary Equation

$$OTE_{field} = SOTE \quad \frac{\beta \tau\ \Omega\ C_{SC} - C}{C_{SC}}\ \alpha\ \theta^{(T-20)}$$

Requires user input; defaults given where appropriate
Output

14.2 day SRT Carbon oxygen req'd = 0.8 +0.027*SRT Based on BOD removed; assumed 95% removal.
Assumed nitrification occurs. Based on TKN removed; assumed 20% removal

INPUT		
71,620	Max Oxygen requirements, lb/d	AOR, *RVSA - Actual Oxygen Requirement estimates*
15.03	Depth of aeration Tanks, ft	High WS EL 119.7 & FF EL 104.67
0.98	β	
0.60	α	Assumed
25	Process temp, ^{0}C	Assumed
0.33	c (depth correction factor for submergence)	Assumed
2.0	Min Operating DO, mg/l	Assumed
34	atmospheric pressure, ft of water	
1.024	θ	
8.26	C_{ST}	Used water temperature of 25ºC and 0 mg/L salinity.
9.09	C_{S20}	
14.62	Ambient pressure, psi	Based on altitude of 132.5 feet (WSEl.).
14.7	Standard pressure, psi	
0.47	Vapor pressure, psi	Based on wastewater temperature of 25^{0}C
1.05	Allowance for diffuser fouling	Assumed
1.96	OTE, % per ft of diffuser submergence	

Design Conditions		
13.81	Depth of diffuser submergence - ft	Assumed 1.22' diffuser height off floor.
27.00	SOTE -%	Compehensive Strategic Plan, Table 3.3. Sanitaire Diffusers
10.31	C_{SC}	
0.91	τ	
1.00	Ω	
1.126	$\theta^{(T-20)}$	

Output	
13.04	OTE_{FIELD}
6.67	OTE_{FIELD}/SOTE
23,024	Maximum air, scfm

Dissolved Oxygen Saturation

Solubility of oxygen at atmospheric pressure

	Chlorinity mg/l		
Temp ^{0}C	0	5	10
0	14.62	13.73	12.89
1	14.22	13.36	12.55
2	13.83	13.00	12.22
3	13.46	12.66	11.91
4	13.11	12.34	11.61
5	12.77	12.02	11.32
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CDM Smith

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The scfm is used to size the diffuser system and as input into the blower design.
Assumed no nitrification.

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68^{0}F
14.7 psia
36% RH

Characteristics of atmospheric air at standard conditions
0.075 lb/cu ft
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Density of air (γ) = 144p/53.5R

γ	density in lb/cu ft
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53.5	universal gas constant for air, ft lb/lb

Depth Correction for Diffuser Submergence

C_{sc}= {[P_a + (cxd)]/P_a} x C_s

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$\theta^{(T-20)}$ corrects alpha for temperature

T	in ^{0}C
θ	1.024

$$\tau = \frac{C_{ST}}{C_{S\,20}}$$ See attached saturation table

C_{ST}	Solubility at process temperature - ^{0}C
C_{S20}	Solubility at 20^{0}C

Pressure Correction

corrects for plant altitude at diffuser submergence greater that 20 ft

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d	diffuser submergence

Driving Force Correction

$$Driving\ \ force\ \ corection\ = \frac{C^*_{SC} - C}{C_{SC}}$$

C^*_{SC}	DO saturation corrected for pressure, temperature & wastewater, mg/l
C_{SC}	DO saturation corrected for depth of submergence, mg/l
C	min DO under operating conditions

Summary Equation

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Requires user input; defaults given where appropriate
Output
3.7 day SRT Carbon oxygen req'd = 0.8 +0.027*SRT Based on BOD removed; assumed 95% removal.
Assumed no nitrification.

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0.98	β	
0.45	α	Assumed
25	Process temp, ^{0}C	Assumed
0.33	c (depth correction factor for submergence)	Assumed
2.0	Min Operating DO, mg/l	Assumed
34	atmospheric pressure, ft of water	
1.024	θ	
8.26	C_{ST}	Used water temperature of 25ºC and 0 mg/L salinity.
9.09	C_{S20}	
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1.05	Allowance for diffuser fouling	Assumed
1.96	OTE, % per ft of diffuser submergence	

Design Conditions		
13.81	Depth of diffuser submergence - ft	Assumed 1.22' diffuser height off floor.
27.00	SOTE -%	Compehensive Strategic Plan, Table 3.3. Sanitaire Diffusers
10.31	C_{SC}	
0.91	τ	
1.00	Ω	
1.126	$\theta^{(T-20)}$	

Output	
9.78	OTE_{FIELD}
5.00	OTE_{FIELD}/SOTE
9,318	Maximum air, scfm

Dissolved Oxygen Saturation

Solubility of oxygen at atmospheric pressure

	Chlorinity mg/l		
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1	14.22	13.36	12.55
2	13.83	13.00	12.22
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20	9.09	8.62	8.17
21	8.91	8.46	8.02
22	8.74	8.30	7.87
23	8.58	8.14	7.73
24	8.42	7.99	7.59
25	8.26	7.85	7.46
26	8.11	7.71	7.33
27	7.97	7.58	7.20
28	7.83	7.44	7.08
29	7.69	7.32	6.96
30	7.56	7.19	6.85

CDM Smith

Client: Rahway Valley Sewerage Authority
Project: Energy Audit
Project #: 5049.112433
Facility: RVSA WWTP
Data Source: "RVSA - Actual Oxygen Requirement estimates.xlsx", "2013-2015 data.xlsx", & Comprehensive Strategic Plan, sheet AT161 "Volume 1.pdf"

By: E. Moody
Date: 3/17/2016
Reviewed By: V. Apa
Reviewed Date: 3/22/2016
Revision: 1. SOTE, diffuser height 3/23/16

This spreadsheet converts oxygen requirements to scfm.
The scfm is used to size the diffuser system and as input into the blower design.
Assumed no nitrification.

Standard conditions defined as
68^0F
14.7 psia
36% RH

Characteristics of atmospheric air at standard conditions
0.075 lb/cu ft
23.2% oxygen by weight

Density of air (γ) = 144p/53.5R

γ	density in lb/cu ft
p	pressure in lbs/sq ft
R	temperature in degrees Rankine (^{0}R = ^{0}F + 460)
53.5	universal gas constant for air, ft lb/lb

Depth Correction for Diffuser Submergence

C_{sc}= {[P_a + (cxd)]/P_a} x C_s

C_{sc}	depth corrected saturation factor
P_a	atmospheric pressure, ft of water
c	depth correction factor (0.25 - 0.45 typ)
d	diffuser submergence in ft

β 0.7 - 0.98; 0.95 is normal

α 0.40-0.45 for non-nitrifying systems; 0.55-0.65 for nitrifying systems

Temperature Corrections

$\theta^{(T-20)}$ corrects alpha for temperature

T	in ^{0}C
θ	1.024

$$\tau = \frac{C_{ST}}{C_{S\,20}}$$ See attached saturation table

C_{ST}	Solubility at process temperature - ^{0}C
C_{S20}	Solubility at 20^{0}C

Pressure Correction

corrects for plant altitude at diffuser submergence greater that 20 ft

$$\Omega = \frac{P_{ambient} + (c \times d) - P_{vapor}}{P_{standard} + (c \times d) - P_{vapor}}$$

$P_{ambient}$	atmospheric pressure at plant
$P_{standard}$	14.7 psi (atmospheric pressure at sea level)
P_{vapor}	vapor pressure dependent on wastewater temperature
c	depth correction factor in %
d	diffuser submergence

Driving Force Correction

$$Driving\ \ force\ \ corection = \frac{C^*_{SC} - C}{C_{SC}}$$

C^*_{SC}	DO saturation corrected for pressure, temperature & wastewater, mg/l
C_{SC}	DO saturation corrected for depth of submergence, mg/l
C	min DO under operating conditions

Summary Equation

$$OTE_{field} = SOTE \quad \frac{\beta \tau\ \Omega\ C_{SC} - C}{C_{SC}}\ \alpha\ \theta^{(T-20)}$$

Requires user input; defaults given where appropriate
Output
3.7 day SRT Carbon oxygen req'd = 0.8 +0.027*SRT Based on BOD removed; assumed 95% removal.
Assumed no nitrification.

INPUT		
32,010	Max Oxygen requirements, lb/d	AOR, *RVSA - Actual Oxygen Requirement estimates*
15.03	Depth of aeration Tanks, ft	High WS EL 119.7 & FF EL 104.67
0.98	β	
0.45	α	Assumed
25	Process temp, ^{0}C	Assumed
0.33	c (depth correction factor for submergence)	Assumed
2.0	Min Operating DO, mg/l	Assumed
34	atmospheric pressure, ft of water	
1.024	θ	
8.26	C_{ST}	Used water temperature of 25ºC and 0 mg/L salinity.
9.09	C_{S20}	
14.62	Ambient pressure, psi	Based on altitude of 132.5 feet (WSEl.).
14.7	Standard pressure, psi	
0.47	Vapor pressure, psi	Based on wastewater temperature of 25^{0}C
1.05	Allowance for diffuser fouling	Assumed
1.96	OTE, % per ft of diffuser submergence	

Design Conditions		
13.81	Depth of diffuser submergence - ft	Assumed 1.22' diffuser height off floor.
27.00	SOTE -%	Compehensive Strategic Plan, Table 3.3. Sanitaire Diffusers
10.31	C_{SC}	
0.91	τ	
1.00	Ω	
1.126	$\theta^{(T-20)}$	

Output	
9.78	OTE_{FIELD}
5.00	OTE_{FIELD}/SOTE
13,721	Maximum air, scfm

Dissolved Oxygen Saturation

Solubility of oxygen at atmospheric pressure

	Chlorinity mg/l		
Temp ^{0}C	0	5	10
0	14.62	13.73	12.89
1	14.22	13.36	12.55
2	13.83	13.00	12.22
3	13.46	12.66	11.91
4	13.11	12.34	11.61
5	12.77	12.02	11.32
6	12.45	11.73	11.05
7	12.14	11.44	10.78
8	11.84	11.17	10.53
9	11.56	10.91	10.29
10	11.29	10.66	10.06
11	11.03	10.42	9.84
12	10.78	10.18	9.62
13	10.54	9.96	9.41
14	10.31	9.75	9.22
15	10.08	9.54	9.03
16	9.87	9.34	8.84
17	9.67	9.15	8.67
18	9.47	8.97	8.50
19	9.28	8.79	8.33
20	9.09	8.62	8.17
21	8.91	8.46	8.02
22	8.74	8.30	7.87
23	8.58	8.14	7.73
24	8.42	7.99	7.59
25	8.26	7.85	7.46
26	8.11	7.71	7.33
27	7.97	7.58	7.20
28	7.83	7.44	7.08
29	7.69	7.32	6.96
30	7.56	7.19	6.85

CDM Smith

Client: Rahway Valley Sewerage Authority
Project: Energy Audit
Project #: 5049.112433
Facility: RVSA WWTP
Data Source: "RVSA - Actual Oxygen Requirement estimates.xlsx", "2013-2015 data.xlsx", & Comprehensive Strategic Plan, sheet AT161 "Volume 1.pdf"

By: E. Moody
Date: 3/17/2016
Reviewed By: V. Apa
Reviewed Date: 3/22/2016
Revision: 1. SOTE, diffuser height 3/23/16

This spreadsheet converts oxygen requirements to scfm.
The scfm is used to size the diffuser system and as input into the blower design.
Assumed no nitrification.

Standard conditions defined as
68^0F
14.7 psia
36% RH

Characteristics of atmospheric air at standard conditions
0.075 lb/cu ft
23.2% oxygen by weight

Density of air (γ) = 144p/53.5R

γ	density in lb/cu ft
p	pressure in lbs/sq ft
R	temperature in degrees Rankine (^{0}R = ^{0}F + 460)
53.5	universal gas constant for air, ft lb/lb

Depth Correction for Diffuser Submergence

C_{sc}= {[P_a + (cxd)]/P_a} x C_s

C_{sc}	depth corrected saturation factor
P_a	atmospheric pressure, ft of water
c	depth correction factor (0.25 - 0.45 typ)
d	diffuser submergence in ft

β 0.7 - 0.98; 0.95 is normal

α 0.40-0.45 for non-nitrifying systems; 0.55-0.65 for nitrifying systems

Temperature Corrections

$\theta^{(T-20)}$ corrects alpha for temperature

T	in ^{0}C
θ	1.024

$$\tau = \frac{C_{ST}}{C_{S\,20}}$$ See attached saturation table

C_{ST}	Solubility at process temperature - ^{0}C
C_{S20}	Solubility at 20^{0}C

Pressure Correction

corrects for plant altitude at diffuser submergence greater that 20 ft

$$\Omega = \frac{P_{ambient} + (c \times d) - P_{vapor}}{P_{standard} + (c \times d) - P_{vapor}}$$

$P_{ambient}$	atmospheric pressure at plant
$P_{standard}$	14.7 psi (atmospheric pressure at sea level)
P_{vapor}	vapor pressure dependent on wastewater temperature
c	depth correction factor in %
d	diffuser submergence

Driving Force Correction

$$Driving\ \ force\ \ corection = \frac{C^*_{SC} - C}{C_{SC}}$$

C^*_{SC}	DO saturation corrected for pressure, temperature & wastewater, mg/l
C_{SC}	DO saturation corrected for depth of submergence, mg/l
C	min DO under operating conditions

Summary Equation

$$OTE_{field} = SOTE \quad \frac{\beta\tau\ \Omega\ C_{SC} - C}{C_{SC}}\ \alpha\ \theta^{(T-20)}$$

Requires user input; defaults given where appropriate
Output

3.7 day SRT — Carbon oxygen req'd = 0.8 +0.027*SRT — Based on BOD removed; assumed 95% removal.
Assumed no nitrification.

INPUT		
46,968	Max Oxygen requirements, lb/d	AOR, *RVSA - Actual Oxygen Requirement estimates*
15.03	Depth of aeration Tanks, ft	High WS EL 119.7 & FF EL 104.67
0.98	β	
0.45	α	Assumed
25	Process temp, ^{0}C	Assumed
0.33	c (depth correction factor for submergence)	Assumed
2.0	Min Operating DO, mg/l	Assumed
34	atmospheric pressure, ft of water	
1.024	θ	
8.26	C_{ST}	Used water temperature of 25ºC and 0 mg/L salinity.
9.09	C_{S20}	
14.62	Ambient pressure, psi	Based on altitude of 132.5 feet (WSEl.).
14.7	Standard pressure, psi	
0.47	Vapor pressure, psi	Based on wastewater temperature of 25^{0}C
1.05	Allowance for diffuser fouling	Assumed
1.96	OTE, % per ft of diffuser submergence	

Design Conditions		
13.81	Depth of diffuser submergence - ft	Assumed 1.22' diffuser height off floor.
27.00	SOTE -%	Compehensive Strategic Plan, Table 3.3. Sanitaire Diffusers
10.31	C_{SC}	
0.91	τ	
1.00	Ω	
1.126	$\theta^{(T-20)}$	

Output	
9.78	OTE_{FIELD}
5.00	OTE_{FIELD}/SOTE
20,132	Maximum air, scfm

Dissolved Oxygen Saturation

Solubility of oxygen at atmospheric pressure

	Chlorinity mg/l		
Temp ^{0}C	0	5	10
0	14.62	13.73	12.89
1	14.22	13.36	12.55
2	13.83	13.00	12.22
3	13.46	12.66	11.91
4	13.11	12.34	11.61
5	12.77	12.02	11.32
6	12.45	11.73	11.05
7	12.14	11.44	10.78
8	11.84	11.17	10.53
9	11.56	10.91	10.29
10	11.29	10.66	10.06
11	11.03	10.42	9.84
12	10.78	10.18	9.62
13	10.54	9.96	9.41
14	10.31	9.75	9.22
15	10.08	9.54	9.03
16	9.87	9.34	8.84
17	9.67	9.15	8.67
18	9.47	8.97	8.50
19	9.28	8.79	8.33
20	9.09	8.62	8.17
21	8.91	8.46	8.02
22	8.74	8.30	7.87
23	8.58	8.14	7.73
24	8.42	7.99	7.59
25	8.26	7.85	7.46
26	8.11	7.71	7.33
27	7.97	7.58	7.20
28	7.83	7.44	7.08
29	7.69	7.32	6.96
30	7.56	7.19	6.85

CDM Smith

By: E. Moody

Client: Rahway Valley Sewerage Authority
Date: 3/17/2016
Project: Energy Audit
Reviewed By: V. Apa
Project #: 5049.112433
Reviewed Date: 3/22/2016
Facility: RVSA WWTP
Revision: 3/24/2016
Data Source: "2013-2015 data.xlsx" & Comprehensive Strategic Plan, sheet AT161 "Volume 1.pdf"

This spreadsheet converts oxygen requirements to scfm.
The scfm is used to size the diffuser system and as input into the blower design.

	Current			Proposed		
	DO (mg/L)	AOR (lb/d)	AOR (scfm)	DO (mg/L)	AOR (lb/d)	AOR (scfm)
Min Day	2	21,739	8,874	2	21,739	9,318
Avg Day	2	43,400	13,952	2	32,010	13,721
Max Day	2	71,620	23,024	2	46,968	20,132

CDM Smith

Client: Rahway Valley Sewerage Authority
Project: Energy Audit
Project #: 5049.112433
Facility: RVSA WWTP
Objective: Estimate Average Air Flows at Current Condition

By: E. Moody
Date: 3/17/2016
Reviewed By: V. Apa
Reviewed Date: 3/22/2016
Revision: 3/24/2016

Requires User Input; defaults given where appropriate
Output
Based on Sanitaire 9" membrane diffusers

INPUT	
8,870	Current min day air requirements, scfm
13,945	Current avg day air requirements, scfm
23,013	Current max day air requirements, scfm
14.62	Ambient pressure psia (14.7 sea level default) (see table below); Blower Elev. 132.5
0.15	Inlet Losses, psia; assumed.
1.90	Discharge side losses, psia
14.53	Diffuser submergence, ft
0.283	"n"
0.354	n/blower efficiency (must do for centrifugal since polytrophic device)
100	Maximum Inlet Temperature, ºF; assumed
0	Minimum Inlet Temperature; assumed.
0.85	Relative Humidity; assumed max
0.80	Blower efficiency; assumed
0.4593	Saturated vapor pressure of water at standard temperature, psia
0.9492	Saturated vapor pressure of water at ambient temp (max 100ºF), psia (see table)

Design Conditions	
13,945	Avg air flow rate-scfm
14.47	**Blower Inlet pressure, psia**
6.29	Static pressure, psia
22.81	**Blower discharge pressure, psia**
0.0696	Density of air at blower inlet, lb/ cu ft
528	Standard Temperature ^{0}R
0.36	Standard RH
14.7	Standard Pressure, psia
560	Maximum Inlet Temperature, ^{0}R
460	Minimum Inlet Temperature, ^{0}R
53.5	R - Gas constant for air, ft-lb/lb

Actual Air flow rates	
560	Ambient Temperature, ^{0}R
15,723	Max airflow rate, acfm
1	Number of duty blowers
15,723	**Max airflow rate per blower, acfm**

Blower BHP	
8.34	**pressure rise during compression, psia**
18.226	weight flow of air, lb/sec
613	Brake HP @ max temp
1.22	Temp Adjust for cold weather
746	**BHP @ min temp**

Atmospheric pressure	
Altitude-ft	Ambient psi
0	14.7
500	14.4
1000	14.2
1500	13.9
2000	13.7
2500	13.4
3000	13.2
3500	12.9
4000	12.7
4500	12.5
5000	12.25
5500	12.5
6000	12.75
6500	11.5
7000	11.3
7500	11.1
8000	10.9
8500	10.7
9000	10.5

Saturated vapor pressure of water			
Temp ^{0}F	absol psi	Temp ^{0}F	absol psi
32	0.0885	74	0.4156
33	0.0922	75	0.4298
34	0.0963	76	0.4443
35	0.1000	77	0.4593
36	0.1040	78	0.4747
37	0.1082	79	0.4906
38	0.1126	80	0.5069
39	0.1171	81	0.5237
40	0.1217	82	0.5410
41	0.1265	83	0.5588
42	0.1315	84	0.5771
43	0.1367	85	0.5959
44	0.1420	86	0.6152
45	0.1475	87	0.6351
46	0.1532	88	0.6556
47	0.1591	89	0.6766
48	0.1653	90	0.6982
49	0.1716	91	0.7204
50	0.1781	92	0.7432
51	0.1849	93	0.7668
52	0.1918	94	0.7906
53	0.1990	95	0.8153
54	0.2064	96	0.8407
55	0.2142	97	0.8668
56	0.2220	98	0.8935
57	0.2302	99	0.9210
58	0.2386	100	0.9492
59	0.2473	101	0.9781
60	0.2583	102	1.0078
61	0.2655	103	1.0382
62	0.2751	104	1.0695
63	0.2850	105	1.1016
64	0.2951	106	1.1345
65	0.3056	107	1.1683
66	0.3164	108	1.2029
67	0.3276	109	1.2384
68	0.3390	110	1.2748
69	0.3509	111	1.3121
70	0.3631	112	1.3504
71	0.3756	113	1.3896
72	0.3886	114	1.4298
73	0.4019		

CDM Smith

Client: Rahway Valley Sewerage Authority
Project: Energy Audit
Project #: 5049.112433
Facility: RVSA WWTP
Objective: Estimate Average Air Flows at Proposed Condition

By: E. Moody
Date: 3/17/2016
Reviewed By: V. Apa
Reviewed Date: 3/22/2016
Revision: 3/24/2016

Requires User Input; defaults given where appropriate
Output
Based on Sanitaire 9" membrane diffusers

INPUT	
9,314	Proposed min day air requirements, scfm
13,714	Proposed avg day air requirements, scfm
20,123	Proposed max day air requirements, scfm
14.62	Ambient pressure psia (14.7 sea level default) (see table below); Blower Elev. 132.5
0.15	Inlet Losses, psia; assumed.
1.90	Discharge side losses, psia
14.53	Diffuser submergence, ft
0.283	"n"
0.354	n/blower efficiency (must do for centrifugal since polytrophic device)
100	Maximum Inlet Temperature, ºF; assumed
0	Minimum Inlet Temperature; assumed.
0.85	Relative Humidity; assumed max
0.80	Blower efficiency; assumed
0.4593	Saturated vapor pressure of water at standard temperature, psia
0.9492	Saturated vapor pressure of water at ambient temp (max 100ºF), psia (see table)

Design Conditions	
13,714	Avg air flow rate-scfm
14.47	**Blower Inlet pressure, psia**
6.29	Static pressure, psia
22.81	**Blower discharge pressure, psia**
0.0696	Density of air at blower inlet, lb/ cu ft
528	Standard Temperature ^{0}R
0.36	Standard RH
14.7	Standard Pressure, psia
560	Maximum Inlet Temperature, ^{0}R
460	Minimum Inlet Temperature, ^{0}R
53.5	R - Gas constant for air, ft-lb/lb

Actual Air flow rates	
560	Ambient Temperature, ^{0}R
15,463	Max airflow rate, acfm
1	Number of duty blowers
15,463	**Max airflow rate per blower, acfm**

Blower BHP	
8.34	**pressure rise during compression, psia**
17.924	weight flow of air, lb/sec
603	Brake HP @ max temp
1.22	Temp Adjust for cold weather
734	**BHP @ min temp**

Atmospheric pressure	
Altitude-ft	Ambient psi
0	14.7
500	14.4
1000	14.2
1500	13.9
2000	13.7
2500	13.4
3000	13.2
3500	12.9
4000	12.7
4500	12.5
5000	12.25
5500	12.5
6000	12.75
6500	11.5
7000	11.3
7500	11.1
8000	10.9
8500	10.7
9000	10.5

Saturated vapor pressure of water			
Temp ^{0}F	absol psi	Temp ^{0}F	absol psi
32	0.0885	74	0.4156
33	0.0922	75	0.4298
34	0.0963	76	0.4443
35	0.1000	77	0.4593
36	0.1040	78	0.4747
37	0.1082	79	0.4906
38	0.1126	80	0.5069
39	0.1171	81	0.5237
40	0.1217	82	0.5410
41	0.1265	83	0.5588
42	0.1315	84	0.5771
43	0.1367	85	0.5959
44	0.1420	86	0.6152
45	0.1475	87	0.6351
46	0.1532	88	0.6556
47	0.1591	89	0.6766
48	0.1653	90	0.6982
49	0.1716	91	0.7204
50	0.1781	92	0.7432
51	0.1849	93	0.7668
52	0.1918	94	0.7906
53	0.1990	95	0.8153
54	0.2064	96	0.8407
55	0.2142	97	0.8668
56	0.2220	98	0.8935
57	0.2302	99	0.9210
58	0.2386	100	0.9492
59	0.2473	101	0.9781
60	0.2583	102	1.0078
61	0.2655	103	1.0382
62	0.2751	104	1.0695
63	0.2850	105	1.1016
64	0.2951	106	1.1345
65	0.3056	107	1.1683
66	0.3164	108	1.2029
67	0.3276	109	1.2384
68	0.3390	110	1.2748
69	0.3509	111	1.3121
70	0.3631	112	1.3504
71	0.3756	113	1.3896
72	0.3886	114	1.4298
73	0.4019		

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: Contact Time Calc - Peroxychem Sample Analysis

By: E. Moody
By Date: 2/10/2016
Checked By: V. Apa
Checked By Date: 2/10/2016
Last Revision:

References:

1.) Rahway Valley Sewerage Authority Contract No. 155 Comprehensive Strategic Plan Drawings.
Drawings EF 161, EF 242, EP 141, UV 141, UV 161

2.) Rahway Valley Sewerage Authority Contract No. 155 Comprehensive Strategic Plan O&M Manual p.3-51

3.) WEDECO UV Disinfection Equipment O&M Manual, section 3 page 3

Assumptions:

1.) Contract Time (CT) was measured in two senarios, 1st from effluent filters to effluent pump station.
2nd scenario measured CT from UV chambers to effluent pump station.
2.) Measurement stopped at effluent pump station due to sampling station located at that process.
Assuming sampling station is intended to measure disinfection

1.) Effluent Filter

Filter Beds:	**6**	
Length	110	ft
Width	16	ft
Depth	4.75	ft
Volume:	50160	CF
	375222.8832	gal
CT @ 30 MGD	18.0	minutes
CT @ 105 MGD	5.1	minutes

2.) UV Channel

Channels:	**2**	
Length	33	ft
Width	10.25	ft
Depth	3.51	ft
Volume:	2374.515	CF
	17762.60695	gal
CT @ 30 MGD	0.9	minutes
CT @ 105 MGD	0.2	minutes

3.) Collection Channel

Length	6.5	ft
Width	24.5	ft
Depth	7.16	ft
Volume:	1140.23	CF
	8529.51332	gal
CT @ 30 MGD	0.4	minutes
CT @ 105 MGD	0.1	minutes

4.) 6' Pipe Collection Channel to Effluent Pump Station

Length	52.75	ft
Width	6	ft
Volume:	1491.469853	CF
	11156.97006	gal
CT @ 30 MGD	0.5	minutes
CT @ 105 MGD	0.2	minutes

5.) CT from Effluent Filter to Effluent Pump Station

30 MGD	19.8	minutes
105 MGD	5.7	minutes

6.) CT from UV to Effluent Pump Station

30 MGD	1.8	minutes
105 MGD	0.5	minutes

					Calc By: E. Moody
Client: RVSA					**Date:** 2/22/2016
Project: Energy Audit					**Checked By:** V. Apa
Facility: RVSA WWTP					**Date:** 3/30/16
Detail: Gravity Thickener Loading Check (2013)					**Last Revised:**
	Primary & WAS		Primary & ML		
Parameters	Average Day	Design Criteria	Average Day	Design Criteria	Notes
Primary Sludge Flow (mgd)[1]	0.8784	MIN 3ft/s in 8-in	0.8784		2013-2015 Data, Column AS and AV: Used Average obtained from Summary of Data for 2013.
Primary Sludge Flow (gpd)	878,400		878,400		
Primary Sludge Concentration (mg/L)	5,287		5,287		Used Average Primary Sludge TS Concentration from 2013-2015 data, primary, thickener, digester tab. 2013 data
Primary Sludge Load (lb/d)	38,732		38,732		
Total WAS Volume to be Wasted (gal)	309,013		927,038		2013-2015 data, lab data and secondary: Avg Gallons Wasted per Day from secondary control operators report. 2013 data
Duration of Wasting (hrs/day)	24		24		
WAS flow while wasting(mgd)	0.309		0.927		
WAS flow while wasting(gpd)	309,013		927,038		
WAS concentration (mg/L)	8,049		2,683		2013-2015 data, lab data and secondary: Avg SS under aeration. 2013 data
WAS load (lb/d)	20,744		20,744		
Total sludge to gravity thickener (lb/d)	59,475		59,475		
Total flow to gravity thickener (mgd)	1.187		1.805		
Total flow to gravity thickener (gpd)	1,187,413		1,805,438		
Hydraulic Loading rate (gpd/sf)	210	150 to 300	319	380 to 760	Column C: Reference from M&E WW Eng., 5th Edition (range is for combined primary & WAS). Column E: 380-760 Primary Only (Page 1489)
Number of gravity thickeners	2		2		Note Loading rates are based on 2 out of 3 GT's operating. 1 GT out of service during site visit
Inside Diameter of gravity thickener (ft)	60		60		
Surface area of gravity thickener (sf)	5,652		5,652		
Sludge loading to gravity thickener (lb/d/sf)	10.5	8 to 16	10.5	20 to 30	Reference from M&E WW Eng., 5th Edition and MOP, 8 4th Edition (range is for combined primary & WAS when feed solids are 2.5% to 4%). (Page 1490)
Concentration of Thickened Solids (%)	3.6	4 to 7	3.6	5 to 10	Assumed based on mass balances (M&E WW Eng., 5th Edition and MOP 8, 4th Edition). (Page 1490)
% Capture	0.85		0.85		85% for combined, 90% for primary only (M&E WW Eng., 5th Edition, Page 1624)
Thickened sludge load (lb/d)	50,554		50,554		Includes % capture.
Flow of thickened sludge (gpd)	168,379		168,379		
Gravity thickener overflow (gpd)	1,019,034		1,637,059		Calculated (total sludge to GT - flow of thickened sludge)
Notes:					

					Calc By: E. Moody
Client: RVSA					**Date:** 2/22/2016
Project: Energy Audit					**Checked By:** V. Apa
Facility: RVSA WWTP					**Date:** 3/30/16
Detail: Gravity Thickener Loading Check (2014)					**Last Revised:**
	Primary & WAS		Primary & ML		
Parameters	Average Day	Design Criteria	Average Day	Design Criteria	Notes
Primary Sludge Flow (mgd)[1]	0.8873	MIN 3ft/s in 8-in	0.8873		2013-2015 Data, Column AS and AV: Used Average obtained from Summary of Data for 2014.
Primary Sludge Flow (gpd)	887,300		887,300		
Primary Sludge Concentration (mg/L)	5,458		5,458		Used Average Primary Sludge TS Concentration from 2013-2015 data, primary, thickener, digester tab. 2014 data
Primary Sludge Load (lb/d)	40,390		40,390		
Total WAS Volume to be Wasted (gal)	334,873		1,004,619		2013-2015 data, lab data and secondary: Avg Gallons Wasted per Day from secondary control operators report. 2014 data
Duration of Wasting (hrs/day)	24		24		
WAS flow while wasting(mgd)	0.335		1.005		
WAS flow while wasting(gpd)	334,873		1,004,619		
WAS concentration (mg/L)	8,064		2,688		2013-2015 data, lab data and secondary: Avg SS under aeration. 2014 data
WAS load (lb/d)	22,521		22,521		
Total sludge to gravity thickener (lb/d)	62,911		62,911		
Total flow to gravity thickener (mgd)	1.222		1.892		
Total flow to gravity thickener (gpd)	1,222,173		1,891,919		
Hydraulic Loading rate (gpd/sf)	216	150 to 300	335	380 to 760	Column C: Reference from M&E WW Eng., 5th Edition (range is for combined primary & WAS). Column E: 380-760 Primary Only (Page 1489)
Number of gravity thickeners	2		2		Note Loading rates are based on 2 out of 3 GT's operating. 1 GT out of service during site visit
Inside Diameter of gravity thickener (ft)	60		60		
Surface area of gravity thickener (sf)	5,652		5,652		
Sludge loading to gravity thickener (lb/d/sf)	11.1	8 to 16	11.1	20 to 30	Reference from M&E WW Eng., 5th Edition and MOP, 8 4th Edition (range is for combined primary & WAS when feed solids are 2.5% to 4%). (Page 1490)
Concentration of Thickened Solids (%)	3.6	4 to 7	3.6	5 to 10	Assumed based on mass balances (M&E WW Eng., 5th Edition and MOP 8, 4th Edition). (Page 1490)
% Capture	0.85		0.85		85% for combined, 90% for primary only (M&E WW Eng., 5th Edition, Page 1624)
Thickened sludge load (lb/d)	53,474		53,474		Includes % capture.
Flow of thickened sludge (gpd)	178,106		178,106		
Gravity thickener overflow (gpd)	1,044,067		1,713,813		Calculated (total sludge to GT - flow of thickened sludge)
Notes:					

					Calc By: E. Moody
Client: RVSA					**Date:** 2/22/2016
Project: Energy Audit					**Checked By:** V. Apa
Facility: RVSA WWTP					**Date:** 3/30/16
Detail: Gravity Thickener Loading Check (2015)					**Last Revised:**
	Primary & WAS		Primary & ML		
Parameters	Average Day	Design Criteria	Average Day	Design Criteria	Notes
Primary Sludge Flow (mgd)[1]	0.9058	MIN 3ft/s in 8-in	0.9058		2013-2015 Data, Column AS and AV: Used Average obtained from Summary of Data for 2015.
Primary Sludge Flow (gpd)	905,800		905,800		
Primary Sludge Concentration (mg/L)	7,619		7,619		Used Average Primary Sludge TS Concentration from 2013-2015 data, primary, thickener, digester tab. 2015 data
Primary Sludge Load (lb/d)	57,557		57,557		
Total WAS Volume to be Wasted (gal)	343,107		1,029,322		2013-2015 data, lab data and secondary: Avg Gallons Wasted per Day from secondary control operators report. 2015 data
Duration of Wasting (hrs/day)	24		24		
WAS flow while wasting(mgd)	0.343		1.029		
WAS flow while wasting(gpd)	343,107		1,029,322		
WAS concentration (mg/L)	9,636		3,212		2013-2015 data, lab data and secondary: Avg SS under aeration. 2015 data
WAS load (lb/d)	27,574		27,574		
Total sludge to gravity thickener (lb/d)	85,130		85,130		
Total flow to gravity thickener (mgd)	1.249		1.935		
Total flow to gravity thickener (gpd)	1,248,907		1,935,122		
Hydraulic Loading rate (gpd/sf)	221	150 to 300	342	380 to 760	Column C: Reference from M&E WW Eng., 5th Edition (range is for combined primary & WAS). Column E: 380-760 Primary Only (Page 1489)
Number of gravity thickeners	2		2		Note Loading rates are based on 2 out of 3 GT's operating. 1 GT out of service during site visit
Inside Diameter of gravity thickener (ft)	60		60		
Surface area of gravity thickener (sf)	5,652		5,652		
Sludge loading to gravity thickener (lb/d/sf)	15.1	8 to 16	15.1	20 to 30	Reference from M&E WW Eng., 5th Edition and MOP, 8 4th Edition (range is for combined primary & WAS when feed solids are 2.5% to 4%). (Page 1490)
Concentration of Thickened Solids (%)	3.6	4 to 7	3.6	5 to 10	Assumed based on mass balances (M&E WW Eng., 5th Edition and MOP 8, 4th Edition). (Page 1490)
% Capture	0.85		0.85		85% for combined, 90% for primary only (M&E WW Eng., 5th Edition, Page 1624)
Thickened sludge load (lb/d)	72,361		72,361		Includes % capture.
Flow of thickened sludge (gpd)	241,010		241,010		
Gravity thickener overflow (gpd)	1,007,898		1,694,112		Calculated (total sludge to GT - flow of thickened sludge)
Notes:					

Client: RVSA
Project: Energy Audit
Detail: Energy Use per Volume of Influent Treated

Date: 2/15/2015
By: E. Moody
Reviewed By: V. Apa
Review Date: 3/18/2016
Revision: 1. Addition of cogen data 3/26/16 - EM

Data Sources:

1.) MG per Period, 2013-2015 Data Summary, column AS
2.) Total Energy Usage, Electric Bill Review, column H
3.) Cogen Daily Run Summary, column W

NOTES:

1.) Total volume of flow (based on average daily influent flow data) is compared to the electricity usage as reported the main plant utility bills for flow period.
2.) Cogen data added to determine total plant power consumption
3.) Data from 3/14/15 onward is low in comparison to previous months. Additional cogen data could provide insight. 3/14/15-10/31/15 excluded from calc at this time.

Year	Period	Total Flow per Period (MG)	Energy Usage Data (kWh)	Energy Usage per Volume Treated (kWh/MG)	Cogen Data (kWh)	Combined Energy Usage (kWh)	Combined Energy Usage per Volume Treated (kWh/MG)	Notes
2013	1/12/13 - 2/11/13	805	1,452,744	1805		1,452,744	1,805	
2013	2/12/13 - 3/13/13	958	1,468,765	1533		1,468,765	1,533	
2013	3/14/13 - 4/12/13	829	1,432,409	1728		1,432,409	1,728	
2013	4/13/13 - 5/13/13	760	1,380,190	1815		1,380,190	1,815	
2013	5/14/13-6/12/13	922	1,434,785	1556		1,434,785	1,556	
2013	6/13/13-7/12/13	879	1,405,605	1599		1,405,605	1,599	
2013	7/13/13-8/12/13	713	1,386,017	1945		1,386,017	1,945	
2013	8/13/13-9/11/13	648	1,346,415	2077		1,346,415	2,077	
2013	9/12/13-10/10/13	585	1,228,121	2098		1,228,121	2,098	
2013	10/11/13-11/8/13	558	1,294,632	2320		1,294,632	2,320	
2013	11/9/13-12/11/13	677	1,578,091	2331		1,578,091	2,331	
2014	12/12/13-1/11/14	806	1,672,348	2074		1,672,348	2,074	
2014	1/12/14-2/11/14	808	1,678,419	2077		1,678,419	2,077	
2014	2/12/14-3/13/14	1,028	1,678,991	1633		1,678,991	1,633	
2014	3/14/14-4/11/14	942	1,565,517	1662		1,565,517	1,662	
2014	4/12/14-5/13/14	1,025	1,533,660	1496		1,533,660	1,496	
2014	5/14/14-6/12/14	775	1,102,896	1424	167,903	1,270,799	1,641	
2014	6/13/14-7/14/14	832	473,237	569	1,076,167	1,549,404	1,862	
2014	7/15/14-8/12/14	630	1,205,296	1913	144,357	1,349,653	2,142	
2014	8/13/14-9/11/14	571	677,805	1188	720,982	1,398,787	2,451	
2014	9/12/14-10/10/14	544	185,000	340	1,168,483	1,353,483	2,486	
2014	10/11/14-10/21/14	213	58,375	274	465,598	523,973	2,463	
2014	10/22/14-11/10/14	404	81,035	201	883,323	964,358	2,387	
2014	11/11/14-12/11/14	774	554,341	717	937,427	1,491,768	1,928	
2015	12/12/14-1/13/15	838	440,571	526	1,518,633	1,959,204	2,337	
2015	1/14/15-2/11/15	798	1,494,133	1873		1,494,133	1,873	
2015	2/12/15-3/13/15	857	1,440,112	1681		1,440,112	1,681	
2015	3/14/15-3/31/15	660	478,774	726		478,774	726	*Cogen data not known from 3/14/15 onward
2015	4/1/15-4/30/15	754	517,040	686		517,040	686	
2015	5/1/15-5/31/15	673	536,056	797		536,056	797	
2015	6/1/15-6/1/15	40	5,670	142		5,670	142	
2015	6/2/15-6/30/15	739	520,514	704		520,514	704	
2015	7/1/15-7/31/15	645	348,156	540		348,156	540	
2015	8/1/15-8/31/15	574	309,790	540		309,790	540	
2015	9/1/15-9/30/15	533	246,875	463		246,875	463	
2015	10/1/15-10/31/15	644	204,490	317		204,490	317	
MIN		40	5,670	142	144,357	5,670	142	
AVG		707	956,024	1,260	786,986	1,152,771	1,609	
MAX		1,028	1,678,991	2,331	1,518,633	1,959,204	2,486	
Without considering 3/14/15 onward								
MIN		213	58,375	201	144,357	523,973	1,496	
AVG		747	1,157,389	1,498	786,986	1,419,718	1,963	
MAX		1,028	1,678,991	2,331	1,518,633	1,959,204	2,486	

References:

Energy use (kWh/MG) 1,303 Per Energy Recovery from Wastewater Treatment Plants in the United Status: A Case Study of the Energy-Water Nexus, *Sustainability 2010*. Table A3. Energy Requirements Advanced Treatment Plant without Nitrification. Energy consumption

Energy use (kWh/MG) 1,676 Per Energy Recovery from Wastewater Treatment Plants in the United Status: A Case Study of the Energy-Water Nexus, *Sustainability 2010*. Table A4. Energy Requirements Advanced Treatment Plant with Nitrification. Energy consumption for

Energy use (kWh/MG) 1250-2300 Energy Audit Manual for Water/Wastewater Facilities, CEC Report CR-104300. July 1994. Figure 3.1

Energy use (kWh/MG) 1,700 Per NYSERDA Clearwaters article Spring 2008, average kWh/MG for NYS municipal wastewater treatment facilities 20 -< 75 MGD

Energy use (kWh/MG) 1,200 Per NYSERDA report Nov. 2008; national average for collection, conveyance and treatment.

Hydraulic Spreadsheet for Pumping Station Design
Version 1.0

PURPOSE:

The purpose of this spreadsheet is to aid in the design of pumping systems.

CONTENTS:

1. Introduction:	Description of the capabilities of the hydraulic spreadsheet.
2. Info Sheet	Sheet for input of descriptive information on the pumping system.
3. TH Worksheet:	Calculates total head (station losses and system losses) for design condition.
4. K values:	Reference for input of minor loss coefficients into hydraulic worksheet.
5. System Curve Data:	Calculates data for plotting of representative system curve.
6. System Curves:	Graphical representation of system curves and station losses curve.
7. Pump Curve Data:	Generates data for pump curve plot based on user defined pump curve. Capable of generating variable speed curves and curves for up to seven pumps in parallel or series.
8. Pump Curves:	Graphical Representation of Pump and System Curves.
9. NPSH:	Calculates Net Positive Suction Head Available in pumping system
10. Conversions:	Calculates unit conversions.
11. Velocities:	Informational sheet on pipe velocities in the pumping system.
12. Pump Data Sheet:	Compilation of data required to properly specify the pump
13. Motors:	Motor data for informational purposes.
14. Controls:	Information sheet on wetwell control elevations for a constant speed pumping operation.
15. Seals:	Informational sheet on pump shaft seals.
16. Bearings:	Informational sheet on pump shaft bearings.
17. Materials:	Informational sheet on pump materials of construction.

DIRECTIONS:

1. Input data into the TH Worksheet where prompted by the shaded cells
2. Be sure that units are correct. (Use "3. Conversions" if necessary.)
3. System Curves are automatically generated given the results from the Hydraulic Worksheet.
4. Select a pump given the results from the Hydraulic Worksheet.
5. Input points from the manufacturer's curve and other data into "6. Pump Curve Data":

Pumping System Descriptive Information

CLIENT: **Rahway Valley Sewerage Authority**

PROJECT: **RVSA WWTP Energy Audit**

JOB NO.:

FILE NAME: **WASP-GT Headloss**

FILE LOCATION:

COMPUTED BY: **E. Moody** DATE: **2/11/2016**

CHECKED BY: **V. Apa** DATE: **3/18/2016**

REVIEWED BY: DATE:

PUMP SYSTEM:

PUMP FROM: **ML, WAS Pumps**

PUMP TO: **Gravity Thickener Splitter Box**

DESCRIPTION: **Total head required from WASP to GT splitter box. From data, one new WAS pump operates at a time (each is rated for 600 gpm at 55' head). Existing mixed liquor or old WAS pumps are each rated for 3,200 gpm at 25' head. Estimated head loss of 34' < 55' head produced by WASP**

METHODS: These pump calculations used the method outlined by Sanks Pumping Station Design 2nd Edition.

CDM	Calculation Form (Excel)		Job #	5049.112433	Calc. By: E. Moody
Client:	RVSA		Checked By:	V. Apa	Date: 01/12/16
Project:	Energy Audit		Date:	03/18/16	Calc. No.: 1
Detail:	ML Pump to GT		Reviewed By:		Revision#:
			Date:		Date:

PUMP SYSTEM HEAD LOSS AND MOTOR CALCULATIONS

EQUATIONS:

1) Cross Sectional Area: $A = pi * r^2$

where: A = Cross sectional area (ft^2 or m^2)
r = radius (ft or m)

2) Velocity: V = Q/A

where: V = Velocity (fps or m/s)

3) Velocity Head: $H_v=V^2/2g$

where: g = 32.2 ft/sec^2 or 9.81 m/sec^2

4) Pipe Friction Headloss: Hl = L * Sf

where: Sf = Slope of energy grade line, (m/m or ft/ft)
$Sf= (10.44\ Q^{1.85})/(C^{1.85}\ D^{4.8655})$ in english units or
$Sf= (10.7\ Q^{1.85})/(C^{1.85}\ D^{4.8655})$ in metric units
C = Coefficient of roughness
D = Diameter of pipe, (in. or m)
Q = flow (gpm or m^3/s)

5) Fitting Headloss: Hl = K * Hv (all but reducers and increasers)

6) Increasers Headloss: Hl = K * (change in Hv)

7) Reducer Headloss: Hl = K * (change in Hv)

8) Design Static Head = (Discharge Water Surface (A)) - (Suction Wet Well High Level Elevation (A))
Secondary Static Head = (Discharge Water Surface (B)) - (Suction Wet Well Water Surface Elevation (B))

9) Input Shaft Power: $Ps = (Q*TH)/(C_f*E)$

where: Q = flow (gpm or m^3/s)
TH = total head of pump (ft or m)
E = pump efficiency

10) Sludge Correction Factor Headloss: HLk = HL*Friction Loss Correction Factor (f)

ASSUMPTIONS:

Please do not repeat data.

REQUIRED INPUT INFORMATION:

Shading indicates where data must be input.

UNITS:
Select the proper units, English or Metric. Enter all subsequent data according to the units specified.

Enter **E** for English Units or **M** for Metric Units: **E**

FLOW:
Enter the discharge flow of the pump station and the number of duty pumps required to pump the design flow. The rated capacity of each pump will be calculated. If desired, the user can override this calculation by directly inputting a pump capacity. This capacity is used to calculated station losses.

Pump System Design Flow (Q):	3,200	gpm
Number of Duty Pumps:	1	
Pump Design Capacity:	3,200	gpm

C-VALUES:
Enter the minimum and maximum C-Values for which System curves will be plotted. The minimum C-Value should be considered the design C-Value. It is recommended that the minimum C be 100 and the maximum C be 140 to provide an acceptable envelope of operation.

	Pipe:	
Min. Roughness Factor (C):	100	(Design Case)
Max. Roughness Factor (C):	140	
Gravity:	32.2	ft²/s

WATER SURFACE ELEVATIONS:
Enter wetwell (pump suction) and discharge water surface elevations for the design case static head (A) and for a secondary static head (B). It is recommended that the wetwell high water level be used as the design case elevation.

Min. **Influent Elevation**:	100.00	feet	
Max Discharge Water Surface Elev:	129.67	feet	
Min. BS Feed Loop Pressure:	0.00	feet	
Maximum Static Water Level:	*29.7*		*(Static Head for Design Case)*
Max **Influent Elevation:**	100.00	feet	
Min Discharge Water Surface Elev:	129.67	feet	
Minimum Static Water Level:	*29.7*		

HEADLOSS CALCULATIONS:

Input the required information into the headloss calculation tables below in the units specified. Additional rows can be added as necessary.

INPUT DATA							FROM ABOVE		CALCULATED							
				For Increasers & Reducers Only:					(Eqn 1)	(Eqn 2)	(Eqn 3)	(increasers	(Eqn4)	(Eqn 4)		(Eqn 10)
Item Description	Pipe Diam. D in	Pipe Length L ft	Fitting K Value	Upstream Diam. in	Downstream Diam. in	Type	Design C-Value	Flow Q gpm	Area A ft²	Velocity V fps	Vel. Head Hv ft	& reducers) DHv ft	Sf ft/ft	Head Loss Hl ft	Friction Multiplier	Corrected Head Loss ft
Use end pump pumping to meet middle pump- (if want exact - use average of Central and end pump both pumping)																
Suction Piping																
Tee - Main to Branch	18		1.80			--	100	3,200	1.77	4.03	0.25	---	---	0.46		
Pipe	18	228				--	100	3,200	1.77	4.03	0.25	---	0.0050	1.13		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	86				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.43		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	5				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.02		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	16				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.08		
Pipe	18	38				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.19		
Tee - Run of Main	18		0.60			--	100	3,200	1.77	4.03	0.25	---	---	0.15		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	7				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.03		
Bend - 45	18		0.15			--	100	3,200	1.77	4.03	0.25	---	---	0.04		
Exit	18		1.00			--	100	3,200	1.77	4.03	0.25	---	---	0.25		
Discharge Piping																
Flush Entrance	12		0.50			--	100	3,200	0.79	9.08	1.28	---	---	0.64		
Gate Valve	12		0.10			--	100	3,200	0.79	9.08	1.28	---	---	0.13		
Tee - Run of Main	12		0.60			--	100	3,200	0.79	9.08	1.28	---	---	0.77		
Bend - 90	12		0.30			--	100	3,200	0.79	9.08	1.28	---	---	0.38		
Bend - 90	12		0.30			--	100	3,200	0.79	9.08	1.28	---	---	0.38		
Bend - 90	12		0.30			--	100	3,200	0.79	9.08	1.28	---	---	0.38		
Bend - 90	12		0.30			--	100	3,200	0.79	9.08	1.28	---	---	0.38		
Pipe	12	5				--	100	3,200	0.79	9.08	1.28	---	0.0357	0.18		
Bend - 90	12		0.30			--	100	3,200	0.79	9.08	1.28	---	---	0.38		
Bend - 90	12		0.30			--	100	3,200	0.79	9.08	1.28	---	---	0.38		
Pipe	12	0.83				--	100	3,200	0.79	9.08	1.28	---	0.0357	0.03		
Bend - 90	12		0.30			--	100	3,200	0.79	9.08	1.28	---	---	0.38		
Pipe	12	0.75				--	100	3,200	0.79	9.08	1.28	---	0.0357	0.03		
Increaser (12x18)	18		1.00	12	18	I	100	3,200	1.77	4.03	---	1.03	---	1.03		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	86.33				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.43		
Bend - 45	18		0.15			--	100	3,200	1.77	4.03	0.25	---	---	0.04		
Bend - 45	18		0.15			--	100	3,200	1.77	4.03	0.25	---	---	0.04		
Pipe	18	13.5				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.07		
Bend - 45	18		0.15			--	100	3,200	1.77	4.03	0.25	---	---	0.04		
Bend - 45	18		0.15			--	100	3,200	1.77	4.03	0.25	---	---	0.04		
Pipe	18	12.75				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.06		
Pipe	18	25.5				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.13		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	9.5				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.05		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	2.75				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.01		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	4.25				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.02		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	2.75				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.01		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	38.25				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.19		
Pipe	18	8.17				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.04		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	3.67				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.02		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	2				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.01		
Bend - 45	18		0.15			--	100	3,200	1.77	4.03	0.25	---	---	0.04		
Pipe	18	7.75				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.04		
Bend - 45	18		0.15			--	100	3,200	1.77	4.03	0.25	---	---	0.04		
Pipe	18	1.75				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.01		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Pipe	18	12.75				--	100	3,200	1.77	4.03	0.25	---	0.0050	0.06		
Bend - 90	18		0.30			--	100	3,200	1.77	4.03	0.25	---	---	0.08		
Exit	18		1.00			--	100	3,200	1.77	4.03	0.25	---	---	0.25		
	Total Discharge Piping			0	ft											
	Total Discharge K			0.00												
													Total Discharge Losses	11.04		0.00
													Friction Losses:	11.04 ft		0.00 ft
													Total Friction Losses:	11.04 ft		0.00 ft
													Total Friction Loss:			11.04 ft
													DESIGN STATIC HEAD			29.67 ft
													TOTAL HEAD (TH):			40.71 ft
													psi:			17.64

CDM	Calculation Form (Excel)		Job #	5049.112433	Calc. By: E. Moody
Client:	RVSA		Checked By:	V. Apa	Date: 02/11/16
Project:	Energy Audit		Date:	03/18/16	Calc. No.: 1
Detail:	WAS Pump to GT		Reviewed By:		Revision#:
			Date:		Date:

PUMP SYSTEM HEAD LOSS AND MOTOR CALCULATIONS

EQUATIONS:

1) Cross Sectional Area: $A = pi * r^2$

where: A = Cross sectional area (ft^2 or m^2)
r = radius (ft or m)

2) Velocity: V = Q/A

where: V = Velocity (fps or m/s)

3) Velocity Head: $H_v=V^2/2g$

where: g = 32.2 ft/sec^2 or 9.81 m/sec^2

4) Pipe Friction Headloss: Hl = L * Sf

where: Sf = Slope of energy grade line, (m/m or ft/ft)
$Sf= (10.44\ Q^{1.85})/(C^{1.85}\ D^{4.8655})$ in english units or
$Sf= (10.7\ Q^{1.85})/(C^{1.85}\ D^{4.8655})$ in metric units
C = Coefficient of roughness
D = Diameter of pipe, (in. or m)
Q = flow (gpm or m^3/s)

5) Fitting Headloss: Hl = K * Hv (all but reducers and increasers)

6) Increasers Headloss: Hl = K * (change in Hv)

7) Reducer Headloss: Hl = K * (change in Hv)

8) Design Static Head = (Discharge Water Surface (A)) - (Suction Wet Well High Level Elevation (A))
Secondary Static Head = (Discharge Water Surface (B)) - (Suction Wet Well Water Surface Elevation (B))

9) Input Shaft Power: $Ps = (Q*TH)/(C_f*E)$

where: Q = flow (gpm or m^3/s)
TH = total head of pump (ft or m)
E = pump efficiency

10) Sludge Correction Factor Headloss: HLk = HL*Friction Loss Correction Factor (f)

ASSUMPTIONS:

Please do not repeat data.

REQUIRED INPUT INFORMATION:

Shading indicates where data must be input.

UNITS:
Select the proper units, English or Metric. Enter all subsequent data according to the units specified.

Enter **E** for English Units or **M** for Metric Units: **E**

FLOW:
Enter the discharge flow of the pump station and the number of duty pumps required to pump the design flow. The rated capacity of each pump will be calculated. If desired, the user can override this calculation by directly inputting a pump capacity. This capacity is used to calculated station losses.

Pump System Design Flow (Q):	**600**	gpm
Number of Duty Pumps:	**1**	
Pump Design Capacity:	**600**	gpm

C-VALUES:
Enter the minimum and maximum C-Values for which System curves will be plotted. The minimum C-Value should be considered the design C-Value. It is recommended that the minimum C be 100 and the maximum C be 140 to provide an acceptable envelope of operation.

	Pipe:	
Min. Roughness Factor (C):	**100**	(Design Case)
Max. Roughness Factor (C):	**140**	
Gravity:	**32.2**	ft²/s

WATER SURFACE ELEVATIONS:
Enter wetwell (pump suction) and discharge water surface elevations for the design case static head (A) and for a secondary static head (B). It is recommended that the wetwell high water level be used as the design case elevation.

Min. **Influent Elevation**:	**98.50**	feet	
Max Discharge Water Surface Elev:	**129.67**	feet	
Min. BS Feed Loop Pressure:	**0.00**	feet	
Maximum Static Water Level:	***31.2***		***(Static Head for Design Case)***
Max **Influent Elevation:**	**98.50**	feet	
Min Discharge Water Surface Elev:	**129.67**	feet	
Minimum Static Water Level:	***31.2***		

HEADLOSS CALCULATIONS:

Input the required information into the headloss calculation tables below in the units specified. Additional rows can be added as necessary.

INPUT DATA							FROM ABOVE		CALCULATED							
				For Increasers & Reducers Only:					(Eqn 1)	(Eqn 2)	(Eqn 3)	(increasers	(Eqn4)	(Eqn 4)		(Eqn 10)
Item Description	Pipe Diam. D in	Pipe Length L ft	Fitting K Value	Upstream Diam. in	Downstream Diam. in	Type	Design C-Value	Flow Q gpm	Area A ft²	Velocity V fps	Vel. Head Hv ft	& reducers) DHv ft	Sf ft/ft	Head Loss Hl ft	Friction Multiplier	Corrected Head Loss ft
Use end pump pumping to meet middle pump- (if want exact - use average of Central and end pump both pumping)																
Suction Piping																
Flush Entrance	24		0.50			--	100	600	3.14	0.43	0.00	---	---	0.00		
Pipe	24	20				--	100	600	3.14	0.43	0.00	---	0.0001	0.00		
Tee - Branch to Main	24		1.50			--	100	600	3.14	0.43	0.00	---	---	0.00		
Reducer (6x8)	24		1.00	24	10	R	100	600	3.14	0.43	---	0.09	---	0.09		
Valve	10		0.40				100	600	0.55	2.45			---			
Pipe	10	17.75				--	100	600	0.55	2.45	0.09	---	0.0039	0.07		
Exit	10		1.00			--	100	600	0.55	2.45	0.09	---	---	0.09		
Discharge Piping																
Flush Entrance	6		0.50			--	100	600	0.20	6.81	0.72	---	---	0.36		
Increaser (6x8)	8		1.00	6	8	I	100	600	0.35	3.83	---	0.49	---	0.49		
Pipe	8	1				--	100	600	0.35	3.83	0.23	---	0.0116	0.01		
Bend - 90	8		0.30			--	100	600	0.35	3.83	0.23	---	---	0.07		
Pipe	8	1.5				--	100	600	0.35	3.83	0.23	---	0.0116	0.02		
Bend - 90	8		0.30			--	100	600	0.35	3.83	0.23	---	---	0.07		
Tee - Branch to Main	8		1.50			--	100	600	0.35	3.83	0.23	---	---	0.34		
Pipe	10	5.5				--	100	600	0.55	2.45	0.09	---	0.0039	0.02		
Tee - Run of Main	10		0.60			--	100	600	0.55	2.45	0.09	---	---	0.06		
Tee - Branch to Main	10		1.50			--	100	600	0.55	2.45	0.09	---	---	0.14		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Reducer (10x6)	10		0.50	10	6	R	100	600	0.55	2.45	---	0.63	---	0.31		
Pipe	6	2.5				--	100	600	0.20	6.81	0.72	---	0.0470	0.12		
Flow Meter (Magnetic)	6		0.00			--	100	600	0.20	6.81	0.72	---	---	---		
Pipe	6	2.5				--	100	600	0.20	6.81	0.72	---	0.0470	0.12		
Increaser (6x10)	10		1.00	6	10	I	100	600	0.55	2.45	---	0.63	---	0.63		
Pipe	10	3.5				--	100	600	0.55	2.45	0.09	---	0.0039	0.01		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Pipe	10	23.25				--	100	600	0.55	2.45	0.09	---	0.0039	0.09		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Pipe	10	15.5				--	100	600	0.55	2.45	0.09	---	0.0039	0.06		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Pipe	10	12				--	100	600	0.55	2.45	0.09	---	0.0039	0.05		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	54				--	100	600	0.55	2.45	0.09	---	0.0039	0.21		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	27.5				--	100	600	0.55	2.45	0.09	---	0.0039	0.11		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	79				--	100	600	0.55	2.45	0.09	---	0.0039	0.31		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	33.5				--	100	600	0.55	2.45	0.09	---	0.0039	0.13		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	254				--	100	600	0.55	2.45	0.09	---	0.0039	0.99		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	64				--	100	600	0.55	2.45	0.09	---	0.0039	0.25		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	64				--	100	600	0.55	2.45	0.09	---	0.0039	0.25		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	269.5				--	100	600	0.55	2.45	0.09	---	0.0039	1.06		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	21.75				--	100	600	0.55	2.45	0.09	---	0.0039	0.09		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	91.5				--	100	600	0.55	2.45	0.09	---	0.0039	0.36		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	8.75				--	100	600	0.55	2.45	0.09	---	0.0039	0.03		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	115.75				--	100	600	0.55	2.45	0.09	---	0.0039	0.45		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Pipe	10	15				--	100	600	0.55	2.45	0.09	---	0.0039	0.06		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	4.33				--	100	600	0.55	2.45	0.09	---	0.0039	0.02		
Bend - 45	10		0.15			--	100	600	0.55	2.45	0.09	---	---	0.01		
Pipe	10	7.75				--	100	600	0.55	2.45	0.09	---	0.0039	0.03		
Pipe	10	3.5				--	100	600	0.55	2.45	0.09	---	0.0039	0.01		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Pipe	10	1				--	100	600	0.55	2.45	0.09	---	0.0039	0.00		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Pipe	10	15				--	100	600	0.55	2.45	0.09	---	0.0039	0.06		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Pipe	10	11				--	100	600	0.55	2.45	0.09	---	0.0039	0.04		
Bend - 90	10		0.30			--	100	600	0.55	2.45	0.09	---	---	0.03		
Exit	10		1.00			--	100	600	0.55	2.45	0.09	---	---	0.09		
	Total Discharge Piping			1208.08	ft											
	Total Discharge K			12.10												
											Total Discharge Losses			8.29		0.00
													Friction Losses:	8.29 ft		0.00 ft
															Total Friction Losses:	8.29 ft

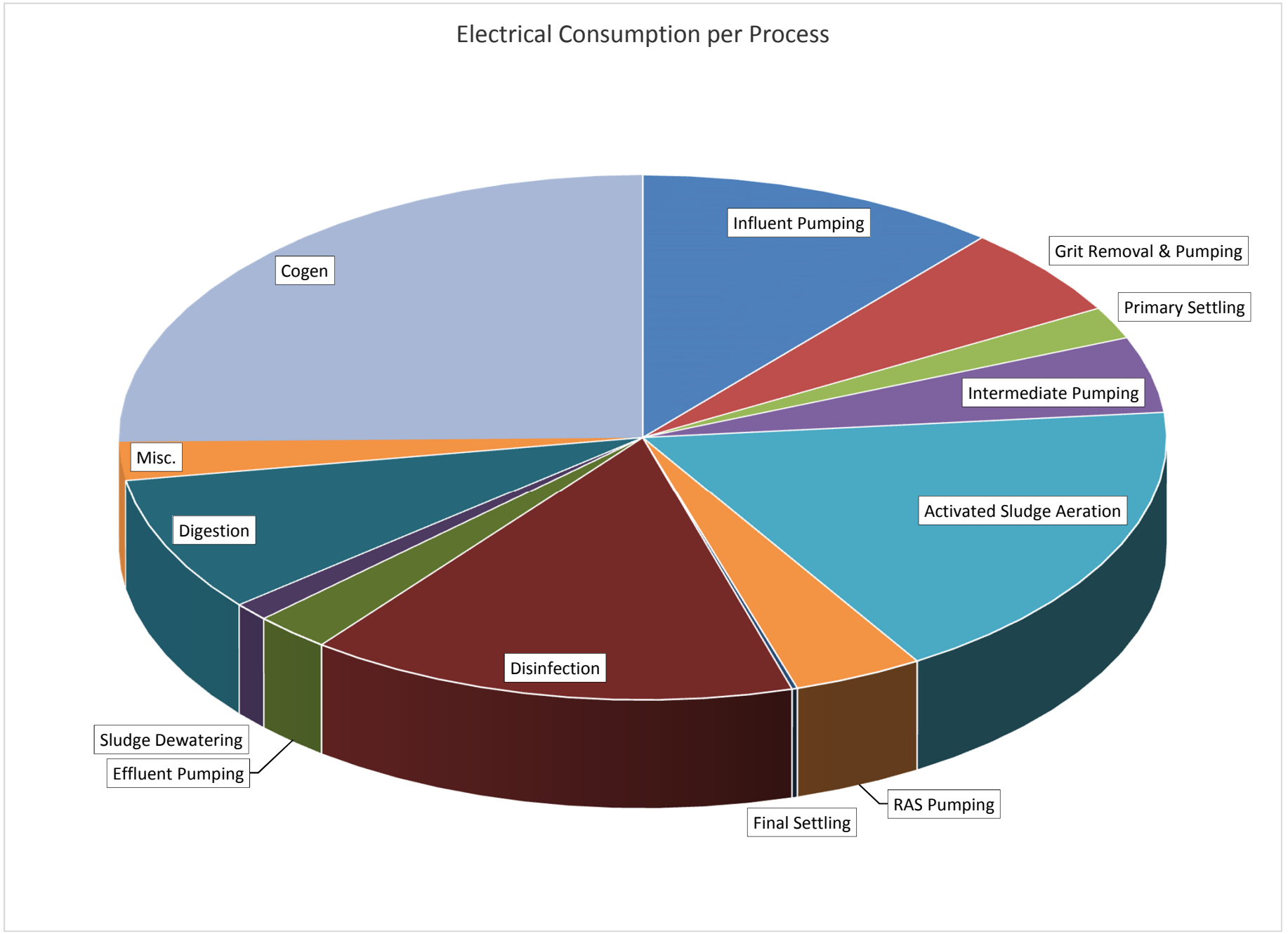
Total Adjusted Friction Loss:	8.29 ft
DESIGN STATIC HEAD	31.17 ft
TOTAL HEAD (TH):	39.46 ft
psi:	17.10

Appendix L
Motor Upgrades

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
2	**Existing Conditions**															
3	**Description**	**Mode**	**Capacity**	**Location**		**Process**	**VFD?**	**HP**	**NEMA Eff. (%)**	**Voltage**	**Motor Speed (RPM)**	**Power Factor**	**Full Load Amps**	**Load (%)**	**Annual Runtime (hr/yr)**	**Annual Power Used (kWh/yr)**
4																
5																
6	Grit Belt Conveyor 1A			RVSA	Headworks Facility	Headworks		7.5	91.7	460	1750		9.8	90	8,760	48,104
7	Grit Belt Conveyor 1A - Thumper Drive			RVSA	Headworks Facility	Headworks		1	82.5	460	1140		1.4	90	8,760	7,129
8	Grit Belt Conveyor 1B			RVSA	Headworks Facility	Headworks		7.5	91.7	460	1750		9.8	90	8,760	48,104
9	Grit Belt Conveyor 1B - Thumper Drive			RVSA	Headworks Facility	Headworks		1	82.5	460	1140		1.4	90	8,760	7,129
10	Coarse Screenings Belt Conveyor 2			RVSA	Headworks Facility	Headworks		7.5	91.7	460	1750		9.8	90	8,760	48,104
11	Reversing Screenings Belt Conveyor 3			RVSA	Headworks Facility	Headworks		5	90.2	460	1750		6.5	90	8,760	32,602
12	Reversing Screenings Belt Conveyor 4			RVSA	Headworks Facility	Headworks		5	90.2	460	1750		6.5	90	8,760	32,602
13	Fine Screenings Screw Conveyor No. 1			RVSA	Headworks Facility	Headworks		5	91.2		1750		6.5	90	8,760	32,245
14	Fine Screenings Screw Conveyor No. 2			RVSA	Headworks Facility	Headworks		5	91.2		1750		6.5	90	8,760	32,245
15	Fine Screenings Screw Conveyor No. 3			RVSA	Headworks Facility	Headworks		5	91.2		1750		6.5	90	8,760	32,245
16	Fine Screenings Screw Conveyor No. 4			RVSA	Headworks Facility	Headworks		5	91.2					90	8,760	32,245
17	Fine Screenings Screw Conveyor No. 5			RVSA	Headworks Facility	Headworks		5	91.2					90	8,760	32,245
18	Fine Screenings Screw Conveyor No. 6			RVSA	Headworks Facility	Headworks		5	91.2					90	8,760	32,245
19	Fine Screenings Screw Conveyor No. 7			RVSA	Headworks Facility	Headworks		7.5	90.0	460	1770		9.5	90	8,760	49,012
20	Fine Screenings Screw Conveyor No. 8			RVSA	Headworks Facility	Headworks		7.5	90.0	460	1770		9.5	90	8,760	49,012
21	Fine Screenings Washer Compactor No. 1		Removed, Out of Service	RVSA	Headworks Facility	Headworks		5	87.5	460	1150		7.5	90	0	0
22	Fine Screenings Washer Compactor No. 2			RVSA	Headworks Facility	Headworks		5	87.5	460	1150		7.5	90	8,760	33,608
23	Fine Screenings Washer Compactor No. 3			RVSA	Headworks Facility	Headworks		5	87.5	460	1150		7.5	90	8,760	33,608
24	Gravity Relief Sewer Sump Pump 1		2150 gpm @ 40' head	RVSA	Headworks Facility	Headworks		35	90.0	460	1170			95	0	0
25	Grit Washer No. 1			RVSA	Headworks Facility	Headworks		1.5	85.0	230/460	1800			90	8,760	10,379
26	Grit Washer No. 2			RVSA	Headworks Facility	Headworks		1.5	85.0	230/460	1800			90	8,760	10,379
27	Grit Washer No. 3			RVSA	Headworks Facility	Headworks		1.5	85.0	230/460	1800			90	8,760	10,379
28	Grit Washer No. 4			RVSA	Headworks Facility	Headworks		1.5	85.0	230/460	1800			90	8,760	10,379
29	Course Bar Screen 1 Headworks Building			RVSA	Headworks Facility	Headworks		3	90.0	460				90	1,460	3,267
30	Course Bar Screen 2 Headworks Building			RVSA	Headworks Facility	Headworks		3	90.0	460				90	1,460	3,267
31	Course Bar Screen 3 Headworks Building			RVSA	Headworks Facility	Headworks		3	90.0	460				90	1,460	3,267
32	Fine Bar Screen 1 Headworks Building			RVSA	Headworks Facility	Headworks		3	90.0	460				90	1,460	3,267
33	Fine Bar Screen 2 Headworks Building			RVSA	Headworks Facility	Headworks		3	90.0	460				90	1,460	3,267
34	Fine Bar Screen 3 Headworks Building			RVSA	Headworks Facility	Headworks		3	90.0	460				90	1,460	3,267
40	Hot Water Pump 6			RVSA	Headworks Facility	Headworks		10	91.7	460	1770		12.5	80	4,380	28,506
41	Hot Water Pump 7			RVSA	Headworks Facility	Headworks		10	91.7	460	1770		12.5	80	4,380	28,506
42	Aerated Grit Blower			RVSA	Headworks Facility	Headworks	Proposed	20	93.0	460			23	80	8,760	112,429
43	Aerated Grit Blower			RVSA	Headworks Facility	Headworks	Proposed	20	93.0	460			23	80	8,760	112,429
44	Aerated Grit Blower			RVSA	Headworks Facility	Headworks	Proposed	20	93.0	460			23	80	8,760	112,429
45	Aerated Grit Blower			RVSA	Headworks Facility	Headworks	Proposed	20	93.0	460			23	80	8,760	112,429
46	Raw Sewerage Pump No. 1		27 MGD @ 40' head	RVSA	Headworks Facility	Headworks	Yes	250	95.0	460	710		320	70	2,976	408,965
47	Raw Sewerage Pump No. 2		27 MGD @ 40' head	RVSA	Headworks Facility	Headworks	Yes	250	95.0	460	710		320	70	2,559	351,660
48	Raw Sewerage Pump No. 3		27 MGD @ 40' head	RVSA	Headworks Facility	Headworks	Yes	250	95.0	460	710		320	70	3,096	425,456
49	Raw Sewerage Pump No. 4		27 MGD @ 40' head	RVSA	Headworks Facility	Headworks	Yes	250	95.0	460	710		320	70	5,032	691,503
50	Raw Sewerage Pump No. 5		27 MGD @ 40' head	RVSA	Headworks Facility	Headworks	Yes	250	95.0	460	710		320	70	3,174	436,174
60	No 1 Primary Settling Tank Motor 1			RVSA	Primary Settling Tanks	Primary Clarifier and pumping		1.5	85.0	460	1725		2.2	90	8,760	10,379
61	No 1 Primary Settling Tank Motor 2			RVSA	Primary Settling Tanks	Primary Clarifier and pumping		1.5	85.0	460	1725		2.2	90	8,760	10,379
62	No 2 Primary Settling Tank Motor 1			RVSA	Primary Settling Tanks	Primary Clarifier and pumping		1.5	85.0	460	1725		2.2	90	8,760	10,379
63	No 2 Primary Settling Tank Motor 2			RVSA	Primary Settling Tanks	Primary Clarifier and pumping		1.5	85.0	460	1725		2.2	90	8,760	10,379
64	No 3 Primary Settling Tank Motor 1			RVSA	Primary Settling Tanks	Primary Clarifier and pumping		1.5	85.0	460	1725		2.2	90	8,760	10,379
65	No 3 Primary Settling Tank Motor 2			RVSA	Primary Settling Tanks	Primary Clarifier and pumping		1.5	85.0	460	1725		2.2	90	8,760	10,379
66	No 4 Primary Settling Tank Motor 1			RVSA	Primary Settling Tanks	Primary Clarifier and pumping		1.5	85.0	460	1725		2.2	90	8,760	10,379
67	No 4 Primary Settling Tank Motor 2			RVSA	Primary Settling Tanks	Primary Clarifier and pumping		1.5	85.0	460	1725		2.2	90	8,760	10,379
68	Primary Sludge Pump 1		285 gpm @ 45' head. Min 125 gpm	RVSA	Primary Settling Tanks	Primary Clarifier and pumping	Yes	15	90.0		1200			95	5,863	69,252
69	Primary Sludge Pump 2		285 gpm @ 45' head. Min 125 gpm	RVSA	Primary Settling Tanks	Primary Clarifier and pumping	Yes	15	90.0		1200			95	8,703	102,797
70	Primary Sludge Pump 3		285 gpm @ 45' head. Min 125 gpm	RVSA	Primary Settling Tanks	Primary Clarifier and pumping	Yes	15	90.0		1200			95	6,139	72,512
71	Primary Sludge Pump 4		285 gpm @ 45' head. Min 125 gpm	RVSA	Primary Settling Tanks	Primary Clarifier and pumping	Yes	15	90.0		1200			95	6,826	80,626
72	Primary Sludge Pump 5 - Spare Pump		285 gpm @ 45' head. Min 125 gpm	RVSA	Primary Settling Tanks	Primary Clarifier and pumping	Yes	15			1200			95	0	
73	Intermeadiate Pump No. 1 Motor			RVSA	Pump & Blower Building	Activated Sludge Aeration	Yes	100	95.0	460	504		161	70	9	495
74	Intermeadiate Pump No. 2 Motor			RVSA	Pump & Blower Building	Activated Sludge Aeration	Yes	100	95.0	460	504		161	70	1,615	88,774
75	Intermeadiate Pump No. 3 Motor			RVSA	Pump & Blower Building	Activated Sludge Aeration	Yes	100	95.0	460	504		161	70	8,739	480,369
76	Intermeadiate Pump No. 4 Motor			RVSA	Pump & Blower Building	Activated Sludge Aeration	Yes	100	95.0	460	504		161	70	7,172	394,234
77	#1Siemens Motor for Dresser Roots Blower			RVSA	Pump & Blower Building	Activated Sludge Aeration		628	95.0	4160	1780		85.8	80	2,592	1,022,389
79	#1Motor for Oil Pump Dresser Roots Blowe			RVSA	Pump & Blower Building	Activated Sludge Aeration		3	85.0	230/460			7.4/3.7	95	2,592	6,482
85	#2 Siemens Motor for Dresser Roots Blower			RVSA	Pump & Blower Building	Activated Sludge Aeration		628	95.0	4160	1780		85.8	80	2,957	1,166,387
87	#2 Motor for Oil Pump Dresser Roots Blowe			RVSA	Pump & Blower Building	Activated Sludge Aeration		3	85.0	230/460			7.4/3.7	90	2,957	7,006
88	#3 Siemens Motor for Dresser Roots Blower			RVSA	Pump & Blower Building	Activated Sludge Aeration		628	95.0	4160	1780		85.8	80	3,212	1,267,186
90	#3 Motor for Oil Pump Dresser Roots Blowe			RVSA	Pump & Blower Building	Activated Sludge Aeration		3	85.0	230/460			7.4/3.7	90	3,212	7,611
93	Waste Sludge Pump #1 P& B Building		3200 gpm @ 25.3' head	RVSA	Pump & Blower Building	Activated Sludge Aeration		30	90.0	460	812			80	5,331	106,051
94	Waste Sludge Pump # 2 P& B Building		3200 gpm @ 25.3' head	RVSA	Pump & Blower Building	Activated Sludge Aeration		30	90.0	460	812			80	3,426	68,155
95	# 1 Final Settling Clarifier Tank			RVSA	Final Settling Tanks	Secondary Clarifiers and RAS		1	85.0					90	8,760	6,919
96	# 2 Final Settling Clarifier Tank			RVSA	Final Settling Tanks	Secondary Clarifiers and RAS		1	85.0					90	8,760	6,919
97	# 3 Final Settling Clarifier Tank			RVSA	Final Settling Tanks	Secondary Clarifiers and RAS		1	85.0					90	8,760	6,919
98	# 4 Final Settling Clarifier Tank			RVSA	Final Settling Tanks	Secondary Clarifiers and RAS		1	85.0					90	8,760	6,919
99	# 5 Final Settling Clarifier Tank			RVSA	Final Settling Tanks	Secondary Clarifiers and RAS		1	85.0					90	8,760	6,919
100	# 6 Final Settling Clarifier Tank		Out of Service	RVSA	Final Settling Tanks	Secondary Clarifiers and RAS		1	85.0					90	0	0
101	Waste Activated Sludge Pump # 1 Motor		Not in Service	RVSA	Return Sludge Pump Station	Secondary Clarifiers and RAS		30		460	890		39		0	
102	Waste Activated Sludge Pump # 2 Motor		Not in Service	RVSA	Return Sludge Pump Station	Secondary Clarifiers and RAS		30		460	890		39		0	
103	Waste Activated Sludge Pump # 3 Motor		Not in Service	RVSA	Return Sludge Pump Station	Secondary Clarifiers and RAS		30		460	890		39		0	
104	Return Activated Sludge Pump # 1 Motor			RVSA	Return Sludge Pump Station	Secondary Clarifiers and RAS	Yes	200	95.0	460	593		277	60	3,280	309,080

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
105	Return Activated Sludge Pump # 2 Motor			RVSA	Return Sludge Pump Station	Secondary Clarifiers and RAS	Yes	200	95.0	460	593		277	60	2,159	203,446
106	Return Activated Sludge Pump # 3 Motor			RVSA	Return Sludge Pump Station	Secondary Clarifiers and RAS	Yes	200	95.0	460	593		277	60	3,313	312,189
110	Seal Water System # 1 Pump			RVSA	Return Sludge Pump Station	Secondary Clarifiers and RAS		2	85.0	208 1/2	3452			95	3,280	5,469
111	Seal Water System # 2 Pump			RVSA	Return Sludge Pump Station	Secondary Clarifiers and RAS		2	85.0	208 1/2	3452			95	2,159	3,600
118	Ingersoll Rand			RVSA	UV Disinfection	Disinfection		5	87.5				6.9	80	365	1,245
119	UV Disinfection			RVSA	UV Disinfection	Disinfection		451.7	95.0					100	8,760	3,107,495
120	Service Water Pump #1			RVSA	Service Water Pump Station	Process Water	Yes	75	95.0	460	1775		85.5	95	4,380	245,061
121	Service Water Pump #2			RVSA	Service Water Pump Station	Process Water	Yes	75	95.0	460	1775		85.5	95	4,380	245,061
122	Service Water Pump #3		Out of Service	RVSA	Service Water Pump Station	Process Water	Yes	75		460	1775		85.5	95	0	
123	Effluent Pump # 1 Motor			RVSA	Effluent Pump St. Cascade Area	Effluent Pumping		150	95.0	460	1750			95	1,850	207,015
124	Effluent Pump # 2 Motor			RVSA	Effluent Pump St. Cascade Area	Effluent Pumping		150	95.0	460	1750			95	1,907	213,393
125	Effluent Pump # 3 Motor			RVSA	Effluent Pump St. Cascade Area	Effluent Pumping		150	95.0	460	1750			95	318	35,584
126	Effluent Pump # 4 Motor			RVSA	Effluent Pump St. Cascade Area	Effluent Pumping		150	95.0	460	1750			95	276	30,884
128	Reliance Electric Motor			RVSA	Sludge Thickening	Sludge Dewatering		10	92.4	460	1760		12.5	95	1,619	12,418
129	065 Moyno Pump 1 C			RVSA	Sludge Thickening	Sludge Dewatering		7.5	90.0	460	1760		9	95	2,071	12,231
130	065 Moyno Pump 2c			RVSA	Sludge Thickening	Sludge Dewatering		7.5	95.0	460	1760		9	95	1,060	5,931
131	Reliance Electric Motor			RVSA	Sludge Thickening	Sludge Dewatering		10	92.4	460	1760		12.5	95	706	5,415
132	065 Moyno Pump 1 C			RVSA	Sludge Thickening	Sludge Dewatering		7.5	90.0	460	1760		9	95	2,405	14,204
133	065 Moyno Pump 2c			RVSA	Sludge Thickening	Sludge Dewatering		7.5	90.0	460	1760		9	95	1,578	9,319
134	Reliance Electric Motor		Out of Service	RVSA	Sludge Thickening	Sludge Dewatering		10	92.4	460	1760		12.5	95	0	0
135	065 Moyno Pump 1 C		Out of Service	RVSA	Sludge Thickening	Sludge Dewatering		7.5	90.0	460	1760		9	95	0	0
136	065 Moyno Pump 2c		Out of Service	RVSA	Sludge Thickening	Sludge Dewatering		7.5	90.0	460	1760		9	95	0	0
137	Rotary Drum Thickening		Not in Service	RVSA	Rotary Drum Thickening Building	Sludge Dewatering		3	89.5	460	1760		4	95	0	0
138	Rotary Drum Thickening		Not in Service	RVSA	Rotary Drum Thickening Building	Sludge Dewatering		3	89.5	460	1760		4	95	0	0
139	Rotary Drum Thickening		Not in Service	RVSA	Rotary Drum Thickening Building	Sludge Dewatering		3	89.5	460	1760		4	95	0	0
140	Thickened Sludge Pump		Not in Service	RVSA	Rotary Drum Thickening Building	Sludge Dewatering		7.5	90.0	460	1760		9	95	0	0
141	Thickened Sludge Pump		Not in Service	RVSA	Rotary Drum Thickening Building	Sludge Dewatering		7.5	90.0	460	1760		9	95	0	0
142	Thickened Sludge Pump		Not in Service	RVSA	Rotary Drum Thickening Building	Sludge Dewatering		7.5	90.0	460	1760		9	95	0	0
143	Booster Pump			RVSA	Gravity Thickener Building	Sludge Dewatering		7.5	91.0	480	3525		8.6	95	8,760	51,167
144	Booster Pump			RVSA	Gravity Thickener Building	Sludge Dewatering		7.5	91.0	480	3525		8.6	95	8,760	51,167
145	Booster Pump		Out of Service	RVSA	Gravity Thickener Building	Sludge Dewatering		7.5	91.0	480	3525		8.6	95	0	0
146	Hot Water Recirculation Pump 6013			RVSA	Gravity Thickener Building	Sludge Dewatering		5	90.0	230/460	3450		12.4/6.2	95	8,760	34,490
147	Hot Water Recirculation Pump 6014			RVSA	Gravity Thickener Building	Sludge Dewatering		5	90.0	230/460	3450		12.4/6.2	95	8,760	34,490
152	1 A Motor Heat Exchanger Digester Bd			RVSA	Sludge Digester Building	Digester		3	85.0	230/460	1730		9.0/4.5	95	8,760	21,911
155	1 B Motor Heat Exchanger Digester Bd			RVSA	Sludge Digester Building	Digester		3	85.0	230/460	1730		9.0/4.5	95	8,760	21,911
158	2 A Motor Heat Exchanger Digester Bd			RVSA	Sludge Digester Building	Digester		3	85.0	230/460	1725		8.2/4.1	95	8,760	21,911
161	2 B Motor Heat Exchanger Digester Bd			RVSA	Sludge Digester Building	Digester		3	85.0	230/460	1730		9.0 /4.5	95	8,760	21,911
164	3 A Motor Heat Exchanger Digester Bd			RVSA	Sludge Digester Building	Digester		3	85.0	230/460	1725		8.2/4.1	95	8,760	21,911
167	3 B Motor Heat Exchanger Digester Bd			RVSA	Sludge Digester Building	Digester		3	85.0	230/460	1725		8.2/4.1	95	8,760	21,911
174	# 1 Motor Seal Water System Digester Bd			RVSA	Sludge Digester Building	Digester		3	85.0	230/460	3475		8.3/3.9	95	8,760	21,911
175	# 2 Motor Seal Water System Digester Bd			RVSA	Sludge Digester Building	Digester		3	85.0	230/460	3475		8.3/3.9	95	8,760	21,911
176	# 3 Motor Seal Water System Digester Bd			RVSA	Sludge Digester Building	Digester		1	85.0	230/460	1725			95	8,760	7,304
177	# 4 Motor Seal Water System Digester Bd			RVSA	Sludge Digester Building	Digester		1	85.0	230/460	1725			95	8,760	7,304
186	# 1 Pump Hot Water Building Heat Recirc			RVSA	Sludge Digester	Digester		5	87.3	460	1750		6.6	95	8,760	35,557
187	# 2 Pump Hot Water Building Heat Recirc			RVSA	Sludge Digester	Digester		5	87.3	460	1750		6.6	95	8,760	35,557
188	# 1 A Motor Sludge Recirculation Digester			RVSA	Sludge Digester	Digester		15	92.4	230/460	1170		38.8/19.4	95	8,760	100,783
190	# 1 B Motor Sludge Recirculation Digeste			RVSA	Sludge Digester	Digester		15	92.4	230/460	1170		38.8/19.4	95	8,760	100,783
192	# 2 A Motor Sludge Recirculation Digester			RVSA	Sludge Digester	Digester		15	92.4	230/460	1170		38.8/19.4	95	8,760	100,783
194	# 2 B Motor Sludge Recirculation Digester			RVSA	Sludge Digester	Digester		15	92.4	230/460	1170		38.8/19.4	95	8,760	100,783
196	# 3 A Motor Sludge Recirculation Digeste			RVSA	Sludge Digester	Digester		15	92.4	230/460	1170		38.8/19.4	95	8,760	100,783
198	# 3 B Motor Sludge Recirculation Digeste			RVSA	Sludge Digester	Digester		15	92.4	230/460	1170		38.8/19.4	95	8,760	100,783
208	# 3 Motor Nash Compressor Cannon Mixer			RVSA	Sludge Digester	Digester		30	93.6	230/460	1765		72.2/36.1	90	1,460	31,418
210	# 4 Motor Nash Compressor Cannon Mixer			RVSA	Sludge Digester	Digester		30	93.6	230/460	1765		72.2/36.1	90	1,460	31,418
213	# 5 Motor Nash Compressor Cannon Mixer			RVSA	Sludge Digester	Digester		30	93.6	230/460	1176		72.2/36.1	90	1,460	31,418
215	# 6 Motor Nash Compressor Cannon Mixer			RVSA	Sludge Digester	Digester		30	93.6	230/460	1765		72.2/36.1	90	1,460	31,418
218	# 7 Motor Nash Compressor Cannon Mixer			RVSA	Sludge Digester	Digester		30	93.6	230/460	1765		72.2/36.1	90	1,460	31,418
220	# 8 Motor Nash Compressor Cannon Mixer			RVSA	Sludge Digester	Digester		30	93.6	230/460	1765		72.2/36.1	90	1,460	31,418
222	# 1 Motor Methane Gas Compressor Digeste			RVSA	Sludge Digester	Digester		40	90.0	230/460	1170		96/48	80	8,760	232,354
225	# 2 Motor Methane Gas Compressor Digeste			RVSA	Sludge Digester	Digester		40	90.0	230/460	1170		96/48	80	8,760	232,354
227	Sludge Pump			RVSA	Sludge Pumping Station	Digester/Sludge Storage		40	94.1	460	1775		47.7	95	520	15,665
228	Sludge Pump			RVSA	Sludge Pumping Station	Digester/Sludge Storage		40	94.1	460	1775		47.7	95	520	15,665
229	Sludge Pump			RVSA	Sludge Pumping Station	Digester/Sludge Storage		100	95.0	460	1750		117	95	520	38,792
230	Komline Sludge Dryer Hydraulic Drive Motor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		250	95.0	460	1780		272	95	4,992	931,008
231	Motor Dryer Feed Pump DFP 1		40hp/30 kW	RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		40	90.0	3 x 460 V	1760			95	4,992	157,237
232	Motor Dryer Feed Pump DFP 2		40hp/30 kW	RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		40	90.0	3 x 460 V	1760			95	4,992	157,237
234	Hydraulic Power Pack for EH-1			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		15	90.0	460	1775		18.5	90	4,992	55,860
238	Motor Sludge Feed Conveyor Dewat & Dry			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		5	90.0	460	1720		6.8	95	4,992	19,655
240	Motor Vertical Conveyor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		5	90.0	460			6.8	90	4,992	18,620
242	Motor Sludge Feedl Conveyor After Vertic			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		7.5	90.0	460	1750		9.4	95	4,992	29,482
244	Motor Sludge Feedl Conveyor to EH1 Hoppe			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		5	90.0	460	1720		6.8	95	4,992	19,655
251	Hot Oil Pump No. 1 Motor Recirculating			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		100	93.0	460	3570		110	95	4,992	380,412
255	Hot Oil Pump No. 3 Thermal Heater Motor		600 gpm	RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		100	93.0	460	3570		110	95	4,992	380,412
256	Cooling Tower Pump No. 1			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		40	94.5	460	1775		46	95	4,992	149,749
257	Cooling Tower Pump No. 2			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		40	94.5	460	1775		46	95	4,992	149,749
258	Cooling Tower Pump No. 3			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		40	94.5	460	1775		46	95	4,992	149,749
259	JKT Water Pump No. 1			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		40	94.5	460	1775		46	95	4,992	149,749
260	JKT Water Pump No. 2			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		40	94.5	460	1775		46	95	4,992	149,749
261	JKT Water Pump No. 3			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		40	94.5	460	1775		46	95	4,992	149,749
262	Thermal Oil Pump			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		25	89.5	460	3535		28.4	95	4,992	98,822
263	Screw Conveyor on Dryer			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		5	90.0	460			6.5	90	4,992	18,620
264	Screw Conveyor on Dryer			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		5	90.0	460			6.5	90	4,992	18,620
266	Dried Sludge Transport Compressor PSC-1			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		20	90.0					80	4,992	66,205

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
268	Dried Product Conveyor Motor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		5	87.5	460	1745		6.5	90	4,992	19,152
270	Dried Product Bucket Elevator Motor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		2	85.0	460	1750			90	4,992	7,886
272	Fines Bucket Elevator Motor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		2	85.0	230/460	1725		1.5/1.2	90	4,992	7,886
274	Fines Return Conveyor Motor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		2	85.0	230/460	1725		3.1/1.6	90	4,992	7,886
276	Vibrating Screen Separator Motor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		5	90.0	230/460	1200			90	4,992	18,620
278	Dry Product Cooling Conveyor Motor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		10	90.0	230/460	1770		26/13	90	4,992	37,240
280	Liquid Ring Compressor OGS Motor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		40	90.0	460	1775		47.7	90	4,992	148,961
282	# 1 Off Gas System Booster Pump Motor		300 gpm @ 58.5' head	RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		7.5	90.0	230/460	1800		17.84/8.9	95	4,992	29,482
284	# 2 Off Gas System Booster Pump Motor			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		7.5	90.0	230/460	1800		17.84/8.9	95	4,992	29,482
285	City Water Booster Pump Dryer System			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		2	85.0	230/460	3450			95	4,992	8,324
286	City Water Booster Pump Dryer System			RVSA	Cogen/Sludge Drying Facility	Solids Dewatering		2	85.0	230/460	3450			95	4,992	8,324
298	Muffin Monster Grinder - Motor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		3	85.0	208-230/460	1725		8.5-8.2/4.	90	4,992	11,829
299	Centrisiys Centrifuge # 1 Motor Baldor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		60	95.0	230/460	3560		134/67	90	4,992	211,682
300	SEW Eurodrive Centrisys # 1			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		3	85.0	230/460	1720			90	4,992	11,829
302	Viscotherm High Pressure Pump - Motor 1			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		15	90.0	230/460	1760		34.6/17.3	90	4,992	55,860
306	US Electric Motor Taskmater Grinder			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		3	84.0	208-230/460	1750		9.3-9.0/4.	90	4,992	11,970
307	Centrisiys Centrifuge # 2 Motor Baldor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		60	94.4	230/460	3560		134/67	90	4,992	213,027
310	Viscotherm High Pressure Pump - Motor 2			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		15	91.0	230/460	1760		34.6/17.3	90	4,992	55,247
321	Polymer Motors (lump sum)			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		5	90.0					95	4,992	19,655
352	# 1 Motor Quincy Air Comp. Dewatering			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		2	85.0	230/460	1725		6.2/3.1	90	6,240	9,858
353	# 2 Motor Quincy Air Comp. Dewatering			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		2	85.0	230/460	1725		6.2/3.1	90	6,240	9,858
356	# 1 Sludge Dewatering Pump Motor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		20	90.0	230/460	1770		47/23.7	95	6,240	98,273
357	# 2 Sludge Dewatering Pump Motor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		20	90.0	230/460	1770		47/23.7	95	6,240	98,273
358	# 3 Sludge Dewatering Pump Motor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		20	90.0	230/460	1770		47/23.7	95	6,240	98,273
359	# 4 Sludge Dewatering Pump Motor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		20	90.0	230/460	1770		47/23.7	95	6,240	98,273
360	# 5 Sludge Dewatering Pump Motor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		20	90.0	230/460	1770		47/23.7	95	6,240	98,273
361	# 6 Sludge Dewatering Pump Motor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		20	90.0	230/460	1770		47/23.7	95	6,240	98,273
363	# 1 Hot Water Recirc.Pump Motor Boiler			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		1.5	85.0	230/460	1715		4.8/2.4	95	6,240	7,804
365	# 2 Hot Water Recirc.Pump Motor Boiler			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		1.5	85.0	230/460	1740		4.2/2.1	95	6,240	7,804
366	# 2 Hot Water Recirc.Pump Boiler DW			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		1.5	85.0		1750			95	6,240	7,804
369	# 1 ERU Motor Dewatering Building Roof			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		10	90.0	230/460	1745		24/12	90	6,240	46,550
370	# 1 ERU Motor Dewatering Building Roof			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		10	90.0	230/460	1745		24/12	90	6,240	46,550
372	# 2 ERU Motor Dewatering Building Roof			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		20	90.0	230/460	1760		43/23.5	90	6,240	93,101
373	# 2 ERU Motor Dewatering Building Roof			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		15	90.0	230/460	1760		37.4/18.7	90	6,240	69,826
377	# 1 Truck Scale Exhaust Fan Dewatering			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		0.5	85.0	460	1800		0.11	90	6,240	2,464
378	# 2 Truck Scale Exhaust Fan Dewatering			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		0.5	85.0	460	1800		0.11	90	6,240	2,464
379	Conveyor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		3	85.0	460	1720		4.3	90	6,240	14,787
381	Motor Dewatering Sludge Vertical Conve			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		5	90.0	460	1680		6.8	90	6,240	23,275
383	Motor Dewatering Sludge Bypass Conveyor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		7.5	90.0	460	1750		9.4	90	6,240	34,913
385	Motor Dewatering Sludge Bypass Conveyor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		5	90.0	460	1680		6.8	90	6,240	23,275
387	Motor Dewatering Sludge Reversi Conveyor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		5	90.0	460	1720		6.8	90	6,240	23,275
389	Motor Dewatering Sludge Reversi Conveyor			RVSA	Cogeneration/Sludge Dewatering	Cogeneration/Sludge Dewatering		5	90.0	460	1680		9.4	90	6,240	23,275
398																
399	**SUMMARY OF WWTP DUTY MOTORS (kWh/yr)**															20,605,076
400	**SUMMARY OF SOLIDS TRAIN DUTY MOTORS (kWh/yr)**															0
401	**SUMMARY OF WWTP DUTY MOTORS (MW)**															
402	AVERAGE WWTP POWER USE (kWh/yr)															12,410,791
403	% estimated/actual WWTP power usage															166%
404																
405					Key											
406					Not considered in evaluation											
407	Aggregate Electricity Cost - WWTP				Motor added to table		0.12									
408					Missing Information											
410	**NOTES:**				Assumed Value											
411	1. Where known motor loads were not available, The following assumed loads were used:															
412					Positive Displacement Pump	95 %										
413					Centrifugal Pump	75 %										
418					Clarifier or Misc. Drive Mechanism	90 %										
419					Mixer	90 %										
420					Blower	80 %										
421																
422																
423																


Electrical Consumption per Process
Influent Pumping
Grit Removal & Pumping
Primary Settling
Intermediate Pumping
Activated Sludge Aeration
RAS Pumping
Final Settling
Disinfection
Effluent Pumping
Sludge Dewatering
Digestion
Misc.
Cogen

Appendix M
Wastewater Process O&M Costs

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: Aeration Tank SRT Turndown

By: E. Moody
By Date: 3/24/2016
Checked By: V. Apa
Checked By Date: 3/24/2016
Last Revision: 6/16/2016

Purpose of calculation is to determine electrical cost savings of reducing aeration tank SRT

Assumptions:
Used average of max and min temp. for blower power estimate.

Current BHP	679	hp
Original hp in kW	507	kW
Proposed BHP	668	hp
Proposed hp in kW	498	kW
# of Active Blowers	1	
Run Time (current)	8760	hrs/yr
Run Time (proposed)	8760	hrs/yr
$/kWh	$0.12	

1.) Calculate current annual electrical use and cost

Annual electric consumption = 4,438,283 kWh

Annual electrical costs = $532,594

2.) Calculate proposed set point annual electrical use and cost

Annual electric consumption = 4,364,763 kWh

Annual electrical costs = $523,772

3.) Cost Savings per year

Annual Savings = $8,822

Annual Savings = $9,000

4.) Electric Savings per year

Annual Savings = 73,521 kWh

Annual Savings = 74,000 kWh

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: Aerated Grit Blower Cost Savings

By: E. Moody
By Date: 2/11/2016
Checked By: V. Apa
Checked By Date: 3/18/2016
Last Revision: 6/16/2016

Objective: To estimate the energy savings from put a VFD on each aerated grit blower and running at ~150 scfm (min. turndown), rather than 290 scfm current output

Original HP (full speed at ~ 290 scfm)	14.1	hp
Original hp in kW	10.51437	kW
Proposed HP (with VFD at 150 scfm)	7.4	hp
Proposed hp in kW	5.51818	kW
# of Blowers	4	
Run Time	4380	hrs/yr
$/kWh	$0.12	

1.) Calculate O&M set point annual electrical cost

Annual electric consumption = 184,212 kWh

Annual electrical costs = $22,105.41

2.) Calculate proposed set point annual electrical cost

Annual electric consumption = 96,679 kWh

Annual electrical costs = $11,601.42

3.) Cost Savings per year

Annual Savings = $10,503.99

Rounded Annual Savings = $11,000.00

Payback Period = 2.4 years

4.) Electrical Savings per year

Annual Savings = 87,533 kWh

Annual Savings = 88,000 kWh

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: Primary Sludge Pumps Electrical Cost Savings

By: E. Moody
By Date: 2/11/2016
Checked By: V. Apa
Checked By Date: 3/18/2016
Last Revision: 1. Programming cost associated with operatior
2. Electrical consumption savings

Purpose of calculation is to determine electrical cost savings as a result of reduced pump usage.

Assumptions:
*Hours for current run time is from 2013-2015 data summary. Averaged all four pumps average run time during that time period.

Primary sludge pump hp	15	hp	
Original hp in kW	11.1855	kW	
# of Pumps	4		
Run Time (current)	6898.5	hrs/yr	*
Run Time (proposed)	4380	hrs/yr	
$/kWh	$0.12		

1.) Calculate current annual electrical cost

Annual electric consumption = 308,653 kWh

Annual electrical costs = $37,038.32

2.) Calculate proposed set point annual electrical cost

Annual electric consumption = 195,970 kWh

Annual electrical costs = $23,516.40

3.) Cost Savings per year

Annual Savings = $13,521.93

Rounded Annual Savings = $14,000.00

Payback Period = 0.0 years

4.) Electrical Savings per year

Annual Savings = 112,683 kWh

Annual Savings = 113,000 kWh

ı modification

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: UV/PAA Cost Annual Cost Estimates

By: E. Moody
By Date: 3/25/2016
Checked By: V. Apa
Checked By Date: 3/25/2016
Last Revision: 6/16/2016

Annual Costs for RVSA WWTP (Current Use - Maintenance Mode)			
Average treated flow (mgd)	25		
Number of Lamps per MGD @ ADF	37.44		
Days per year of treatment	365		
UV dose (mJ/cm2)	40		
Number of lamps at average flow	936		
Power input per lamp (watts)	360		
Annual Electric Usage (kW-hr/yr)	2,920,000		
Electricity cost ($/kW-hr)	$0.120		
Filter Backwash (FBW) Power Consumption (kWh/day)	216.4	Table 3.9, Comprehensive Strategic Plan O&M	
FBW Operation (days/year)	574	-	
Annual electricity costs for UV		$ 350,000	
Annual electricity costs for		$ 14,895	
Guaranteed lamp life (hours)	15,000	Reported lamp life in maintenance mode by RVSA	
Lamp replacement cost	$214	Xylem Water Contract Price - Lamps, Sleeve and (2) wipers	
Guaranteed ballast life (years)	2		
Ballast replacement cost	$450	Xylem Water Contract Price - Ballast	
Annual costs for lamp replacement		$ 120,000	
Annual costs for ballast replacement		$ 123,000	
Lifecycle in years	20		
Discount rate	4.13%	*P/A factor =*	
Inflation rate	3.00%	17.87	
Annual Costs		$ 590,000	
Present Value of Annual Costs		$ 11,000,000	

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: UV/PAA Cost Annual Cost Estimates

By: E. Moody
By Date: 3/25/2016
Checked By: V. Apa
Checked By Date: 3/25/2016
Last Revision: 6/16/2016

Annual Costs for RVSA WWTP (Proposed Use - Automatic Mode)			
Average treated flow (mgd)	25		
Number of Lamps per MGD @ ADF	18.72		
Days per year of treatment	365		
UV dose (mJ/cm2)	40		
Number of lamps at average flow	468	*2 channels, 2 banks per channel. One is duty, one is assist*	
Power input per lamp (watts)	237.6	*WEDECO. Power turndown to 66%*	
Annual Electric Usage (kW-hr/yr)	1,000,000		
Electricity cost ($/kW-hr)	$0.120		
Filter Backwash (FBW) Power Consumption (kWh/day)	216.4	Table 3.9, Comprehensive Strategic Plan O&M	
FBW Operation (days/year)	574	-	
Annual electricity costs for UV		$ 120,000	
Annual electricity costs for		$ 14,895	
Guaranteed lamp life (hours)	10,000		
Lamp replacement cost	$214	Xylem Water Contract Price - Lamps, Sleeve and (2) wipers	
Guaranteed ballast life (years)	1.1		
Ballast replacement cost	$450	Xylem Water Contract Price - Ballast	
Annual costs for lamp replacement		$ 90,000	
Annual costs for ballast replacement		$ 92,000	
Lifecycle in years	20		
Discount rate	4.13%	*P/A factor =*	
Inflation rate	3.00%	17.87	
Annual Costs		$ 300,000	
Present Value of Annual Costs		$ 6,000,000	

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: UV/PAA Cost Annual Cost Estimates

By: E. Moody
By Date: 3/25/2016
Checked By:
Checked By Date:
Last Revision: 6/16/2016

Annual Costs for Peracetic Acid - Peroxychem's Budgetary Proposal			
Average treated flow, mgd	25		
Days per year of treatment	365		
PAA dose, mg/L	2.0		
Percent solution PAA, %	15		
Specific density of PAA, lbs/gal	9.7		
Lbs per year, as delivered	1,583,400		Lbs from Peroxychem Budget w/ 30% mixing factor
Price per lb, as delivered	$0.69		Cost from Peroxychem budgetary quote
Annual chemical costs for PAA		$ 1,093,000	
SBS dose, mg/L	0.0		No quenching required with 2 mg/l dose.
Percent solution SBS, %	38	-	
Specific density of SBS, lbs/gal	11.1		
Gallons per year, as delivered	-		
Price per gallon, as delivered	$1.55		
Annual chemical costs for SBS		$ -	
Annual Costs for Equipment and Service Lease		$ 20,000.00	Cost from Peroxychem budgetary quote
Lifecycle in years	20		
Discount rate	4.13%	*P/A factor =* 17.87	
Inflation rate	3.00%		
Annual Costs for Peracetic Acid		$ 1,110,000	
Capital Costs		$ 100,000	Capital cost - miscellanous civil work
Present Value of Annual Costs		$ 20,100,000	

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: UV/PAA Cost Annual Cost Estimates

By: E. Moody
By Date: 3/25/2016
Checked By:
Checked By Date:
Last Revision: 6/16/2016

Description	Annual Costs	Annual Savings	NPV of Annual Costs
UV System (Current Operation)	$ 590,000	-	$ 11,000,000
UV System (Automatic Mode)	$ 300,000	$ 290,000	$ 6,000,000
PAA System - Revised P. Budget	$ 1,110,000	$ (520,000)	$ 20,100,000

Description	Annual Energy Savings (kWh)
UV System (Current Operation)	-
UV System (Automatic Mode)	1,920,000

Client: Rahway Valley Sewerage Authority
Job No: 5049.112433
Project: Energy Audit
Facility: RVSA WWTP
Detail: New WAS Pumps

By: E. Moody
By Date: 3/29/2016
Checked By: V. Apa
Checked By Date: 3/29/2016
Last Revision: 6/16/2016

Purpose of calculation is to determine electrical cost savings of utilizing new WAS pumps vs old WAS pumps

Assumptions:
Hours for old WAS run time is from 2013-2015 data summary.
Old WAS pump produces 700 gpm on average while running, although rated for 3200 gpm.
Old WAS pump operates at 660 rpm per field visit.
New WAS pump would operate same hours as old WAS pump
New WAS pump would operate at an estimated 1/3 of existing flow or 0.33* 700 gpm (231 gpm).

1.) Determine Old WAS Pump flow rate based on affinity laws at 812 rpm (full speed).

Equation:

$$\frac{Q_2}{Q_1} = \frac{n_2}{n_1} \qquad \frac{BHP_2}{BHP_1} = (\frac{n_2}{n_1})^3$$

1a.) Flow rate at 660 rpm

Q1 = 2601 gpm

1b.) Flow rate at 505 rpm minimum speed

Q1 = 1990 gpm
Discussion: The estimated flow at minimum pump speed is much greater than reported by RVSA from data (1990 vs. 700

Parameters

Design Old WAS pump BHP at 812 rpm	24	hp	
BHP at 660 rpm	13	hp	Affinity laws
BHP at 505 rpm	6	hp	Affinity laws
Design WAS Efficiency	80	%	
Pump Efficiency at 660 rpm	76	%	
Pump Efficiency at 505 rpm	64	%	
Design hp in kW	22	kW	
hp at 660 rpm in kW	13	kW	
hp at 505 rpm in kW	7	kW	
# of Pumps (Total)	2		
Design Speed	812	rpm	
Current Speed	660	rpm	
Minimum Speed	505	rpm	
Run hours	8757	hrs	
$/kWh	$0.12		
New WAS pump Design hp	14	hp	From pump curve
BHP at 505 rpm	2.7	hp	Assumed min speed, used affinity la
Design Speed	880	rpm	
Flow at min speed of 505 rpm	344	GPM	Affinity laws
New WAS Design Efficiency	58	%	
New hp in kW	3.5	kW	
# of Pumps (total)	3		
Run hours	8,757		

1.) Calculate old WAS pump annual electrical cost

Annual electrical consumption =	110,734	kWh
Annual electrical costs =	$13,288.08	

2.) Calculate New WAS annual electrical cost

Annual electrical consumption =	30,639	kWh
Annual electrical costs =	$3,676.73	

3.) Cost Savings per year

Annual Savings =	$9,611.35	
	$10,000.00	

4.) Electrical savings per year

Annual Savings =	80,095	kWh
Annual Savings =	80,000	kWh

Appendix N
Wastewater Process Equipment Quotes

Budgetary Proposal

VigorOx® WWT II
Wastewater Disinfection Technology

Rahway Valley WWTP

Rahway, NJ

Proposal B-164-JR

April 8th, 2016

PeroxyChem

DISINFECTION SYSTEM PROPOSAL

PLANT:	**Rahway Valley WWTP**	**PROPOSAL:**	**B-164-JR**
LOCATION:	**Rahway, NJ**	**REVISION:**	**0**
OWNER/OPERATOR:	**Rahway Valley Sewage Authority**	**DATE:**	**04/08/2016**

1. FOREWORD

The following proposal is for budgetary purposes only. PeroxyChem recommends conducting a trial to determine the efficacy of disinfecting with PAA alone as well as in conjunction with UV.

PeroxyChem proposes a full scale implementation of VigorOx disinfection at the Rahway Valley WWTP under a five (5) year supply agreement covering 100% of the plant's PAA requirements.

In order to facilitate the implementation of a VigorOx disinfection regime, PeroxyChem will install a complete standard storage and chemical feed system. Equipment will be leased to the Rahway Valley Sewage Authority for the duration of the chemical supply agreement in accordance with the Equipment Lease Agreement.

2. SCOPE

2.1 Supply and Delivery of VigorOx WWT II

Throughout the contract, PeroxyChem will supply and deliver an estimated 1,218,000 lbs per year of VigorOx WWT II Peracetic Acid, U.S. EPA Registration 65402-8, in bulk deliveries. This amount is expected to be consumed during one (1) year based on average daily flow of 30.0 MGD and an average dose of 2.0 mg/L.

2.2 Installation and Startup Equipment

The following equipment (the "Equipment") will be delivered, installed and started up by PeroxyChem or its contractors at the Site:

Quantity	Description
1	PeroxyChem System Control Panel configured for one injection point and one storage tank. AB ControlLogix PLC, AB PanelView HMI, NEMA 4X free-standing stainless steel enclosure.
1	Bulk Storage Tank, 6500 gal capacity, HDPE, vertical, double wall, with leak detection, level and temperature instrumentation.
1	Pipe Rack assembly with provisions for fill, discharge and vapor return lines.
1	Truck Unloading Pump Skid with 33gpm centrifugal pump and related piping and wiring.
1	PAA Feed Pump Skid, with duty and redundant peristaltic pumps, and related piping and wiring.
1	PAA On-line Residual Analyzer.

The following tasks will be performed by PeroxyChem:

- Mechanical and electrical installation of storage and feed equipment outlined in equipment lease agreement.
- Installation of PAA distribution piping from pump skid to injection point location.
- Drainage piping tie-in to existing nearby sanitary drain line.
- Potable water piping tie-in to existing nearby supply line.
- Electrical tie-in to existing nearby electrical panel.

3. SITE OWNER/OPERATOR RESPONSIBILITIES

3.1 Equipment Location & Utilities

Site Owner/Operator will be responsible for providing an appropriate location for the installation of the Equipment, including:

- A concrete pad for anchoring of the tank and pump skids.
- A source of nearby 480V 60Hz power.
- A source of nearby potable water.
- A 4-20mA flow pacing signal.
- SCADA integration services
- Necessary permit modifications/approvals.

3.2 Training

Site Owner/Operator will be responsible for identifying which personnel should be trained by PeroxyChem in the operation of Equipment and related operational tasks, and make such personnel available to the on-site training session offered by PeroxyChem.

3.3 Equipment Operation

Site Owner/Operator will be responsible for operation of Equipment in accordance with training materials and operating recommendations provided by PeroxyChem.

3.4 Access & Security

Site Owner/Operator will provide PeroxyChem personnel access to the Site to inspect and maintain the Equipment as needed during the contract, and secure and/or properly mark the Equipment location to ensure that only Site personnel who has been properly trained by PeroxyChem has access to Equipment and chemical.

3.5 Compliance

Site Owner/Operator will be responsible for maintaining compliance within permit limits.

4. SCHEDULE

Installation, startup, and first delivery of chemical and feed equipment.	14-16 Weeks

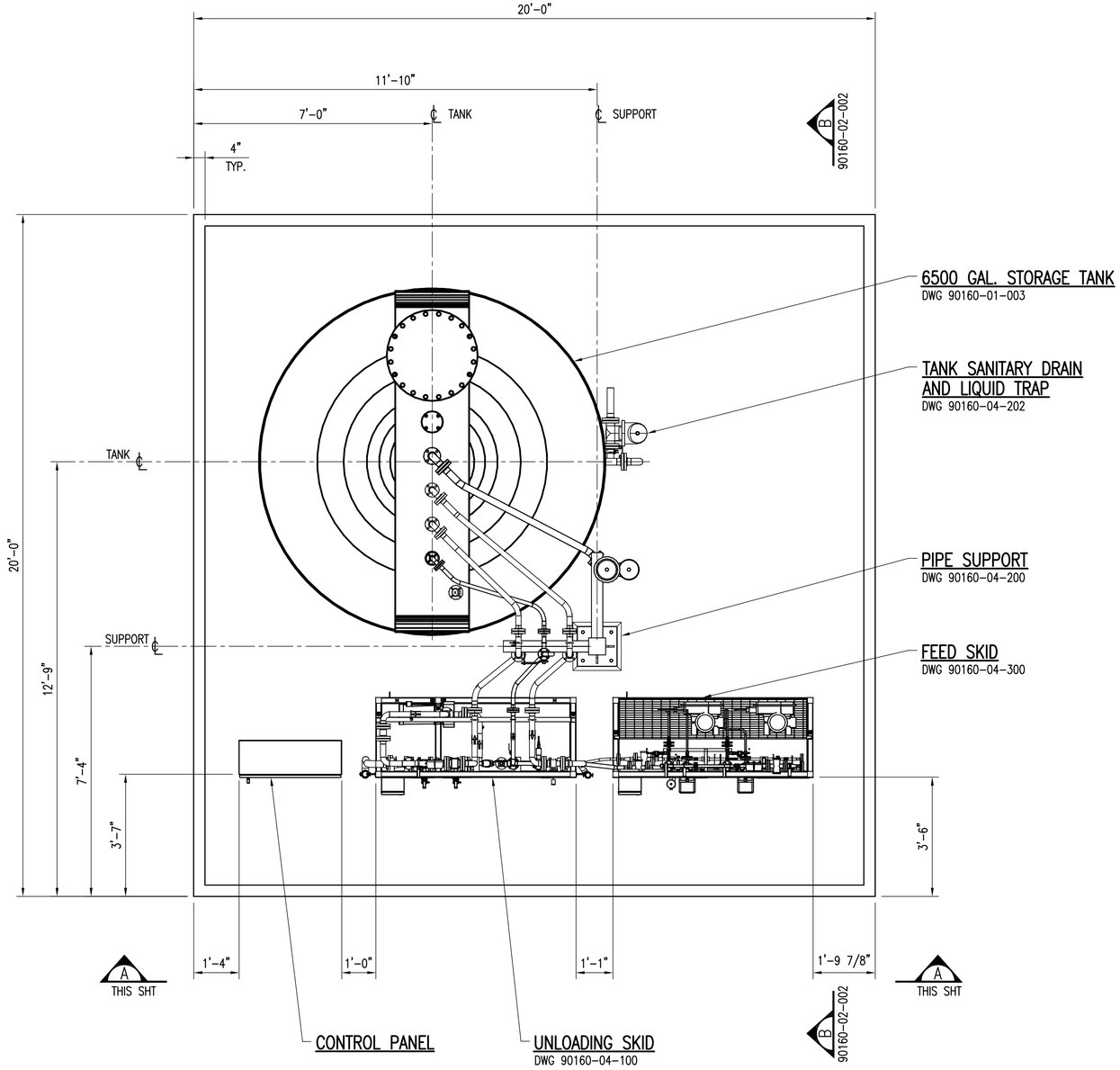
Please note that in order to control cost and schedule, no modifications to the standard storage and feed equipment will be allowed.

5. COMMERCIAL TERMS

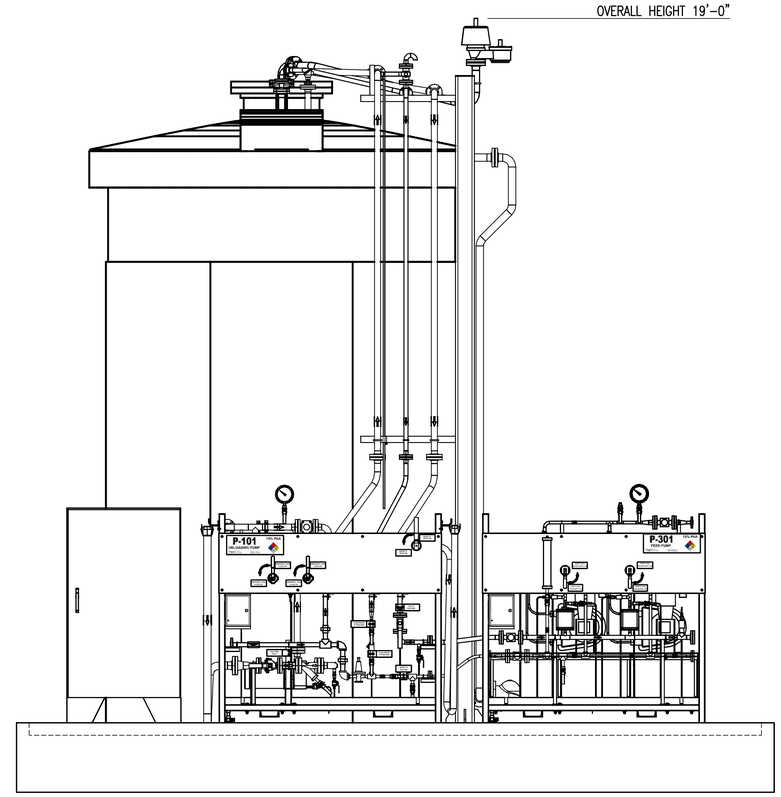
- Price: $0.69 per pound of VigorOx WWT II delivered in bulk.
- Equipment Lease and Service Fee: $20,000.00/year for the length of the contract.
- Quantity: Total amount required to disinfect 100% of plants effluent discharge for a period of five (5) years.
- Offer is valid for 60 days
- Offer is contingent upon execution of:
    - Supply Agreement
    - Equipment Lease Agreement
- Offer price is based on materials and labor estimates generated from plant drawings. PeroxyChem reserves the right to adjust the offer price if additional expenses are incurred during installation due to material errors or omissions in plant drawings.

Thank you for your interest in the VigorOx WWT II Disinfection System. We look forward to reviewing this proposal with you at your earliest convenience.

Jim Robinson
Regional Sales Manager – Eastern Region
M 404.420.2585
james.robinson@peroxychem.com



PLAN VIEW



SECTION A-A

REV	DESCRIPTION	DATE	BY	CHK
0	ISSUE FOR CONSTRUCTION	10/23/15	TRF	ATSI

REVISIONS

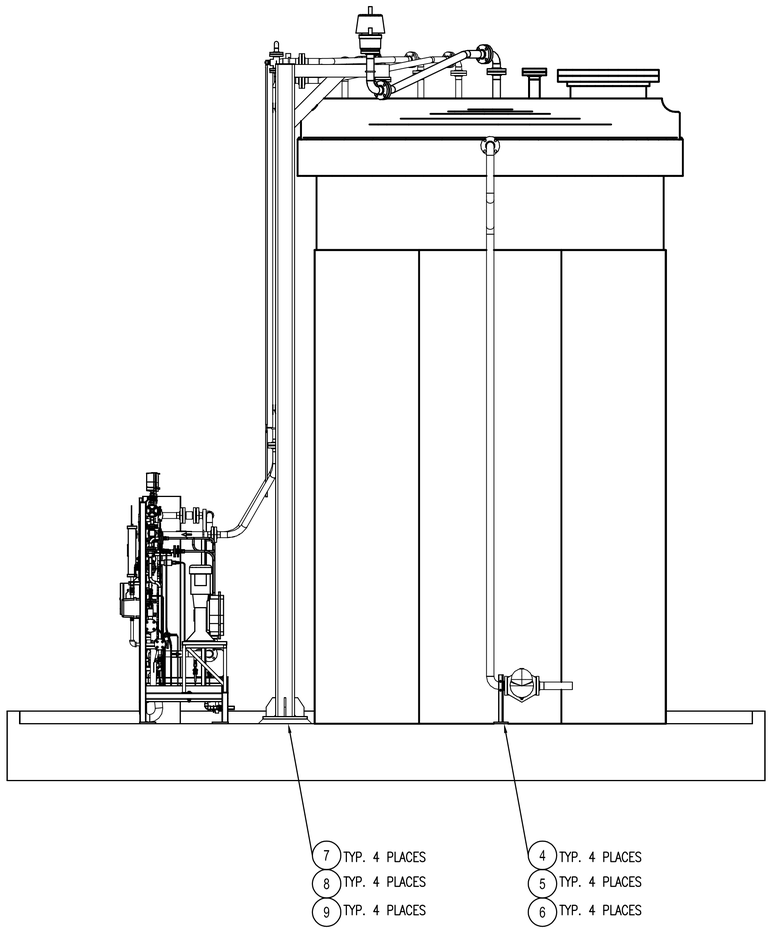
PeroxyChem
2005 Market Street, Suite 3200
Philadelphia, PA 19103

REFERENCE DRAWINGS	VIGOROX WWT II (15% PAA)	
90160-01-003	PAA WASTEWATER DISINFECTION	
90160-02-002	1T65-1P400	
–	PLAN AND SECTION A-A	
–		
–	DRAWN: DMZ	DATE: 9/09/15
–	SCALE: 1/2"=1'-0"	ENGINEER: GMC

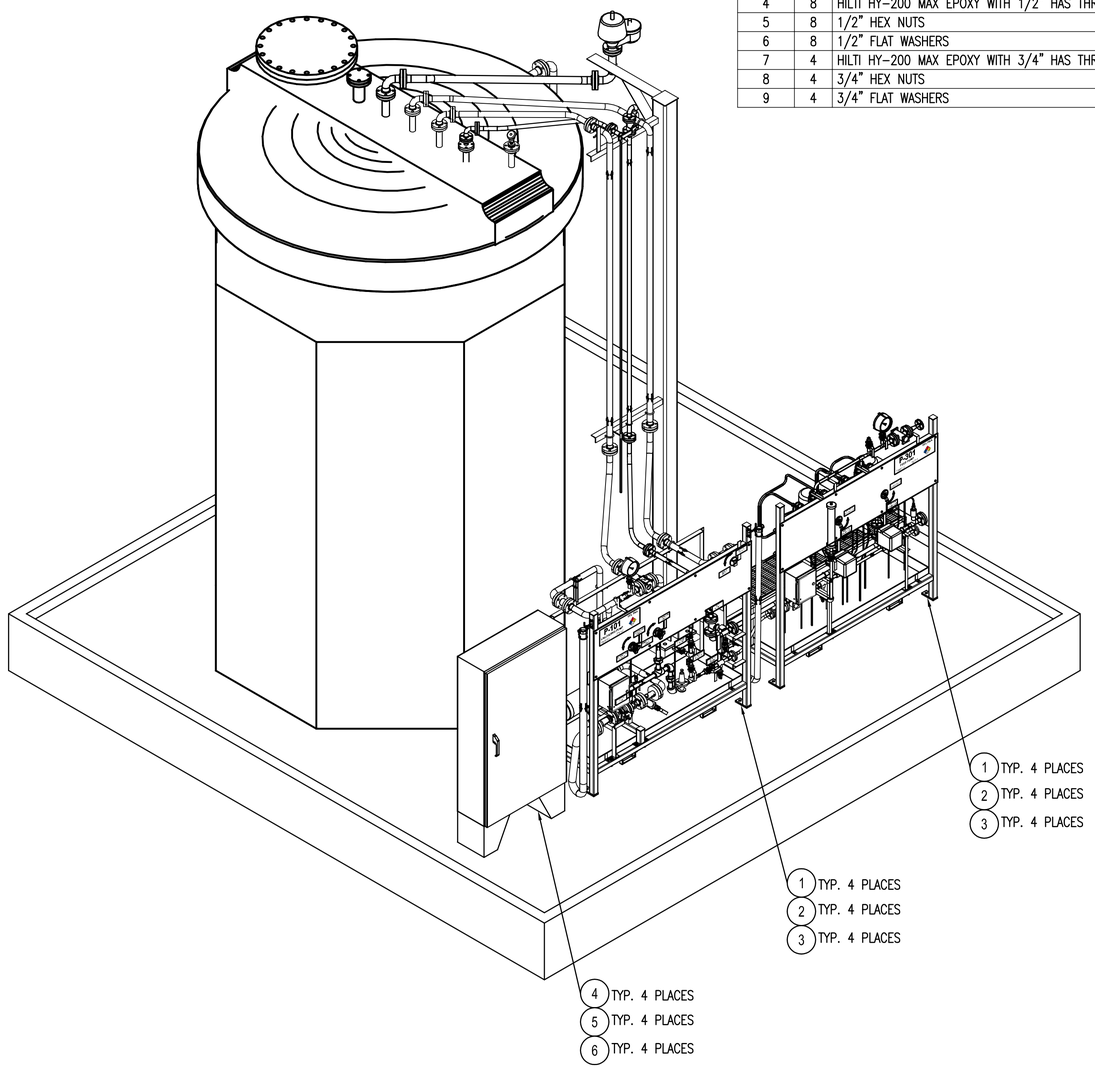
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PeroxyChem

DRAWING NO. 90160-02-001 REV. 0

BILL OF MATERIAL				
ITEM	QUAN.	DESCRIPTION	MATL.	REMARKS
1	8	HILTI HY-200 MAX EPOXY WITH 5/8" HAS THREADED ROD	SS	SEE DWG. 90160-05-011
2	8	5/8" HEX NUTS	SS	SEE DWG. 90160-05-011
3	8	5/8" FLAT WASHERS	SS	SEE DWG. 90160-05-011
4	8	HILTI HY-200 MAX EPOXY WITH 1/2" HAS THREADED ROD	SS	SEE DWG. 90160-05-011
5	8	1/2" HEX NUTS	SS	SEE DWG. 90160-05-011
6	8	1/2" FLAT WASHERS	SS	SEE DWG. 90160-05-011
7	4	HILTI HY-200 MAX EPOXY WITH 3/4" HAS THREADED ROD	SS	SEE DWG. 90160-05-011
8	4	3/4" HEX NUTS	SS	SEE DWG. 90160-05-011
9	4	3/4" FLAT WASHERS	SS	SEE DWG. 90160-05-011



SECTION B-B
90160-02-001
1/2" = 1'-0'



ISOMETRIC VIEW
NTS

NOTES:

1. FOR ANCHORING DETAILS SEE DWG. 90160-05-011

REV	DESCRIPTION	DATE	BY	CHK
0	ISSUE FOR CONSTRUCTION	10/23/15	TRF	ATSI

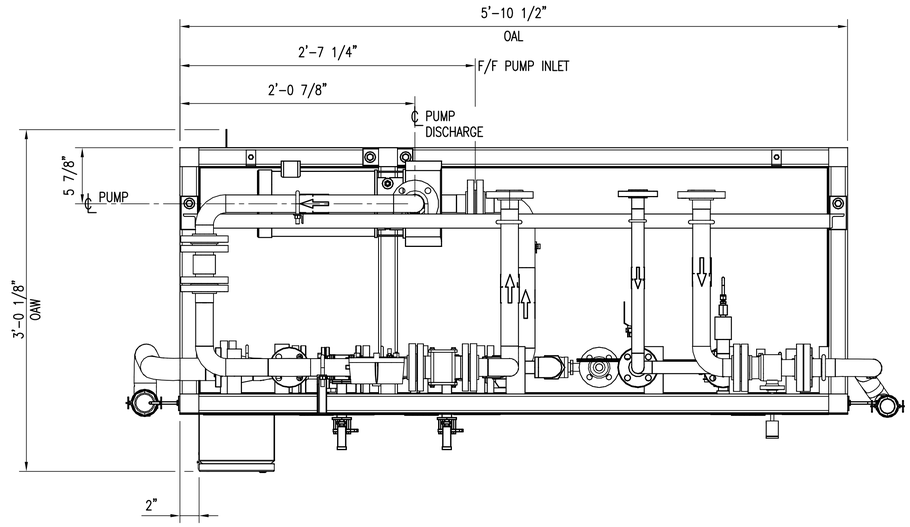
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PeroxyChem
2005 Market Street, Suite 3200
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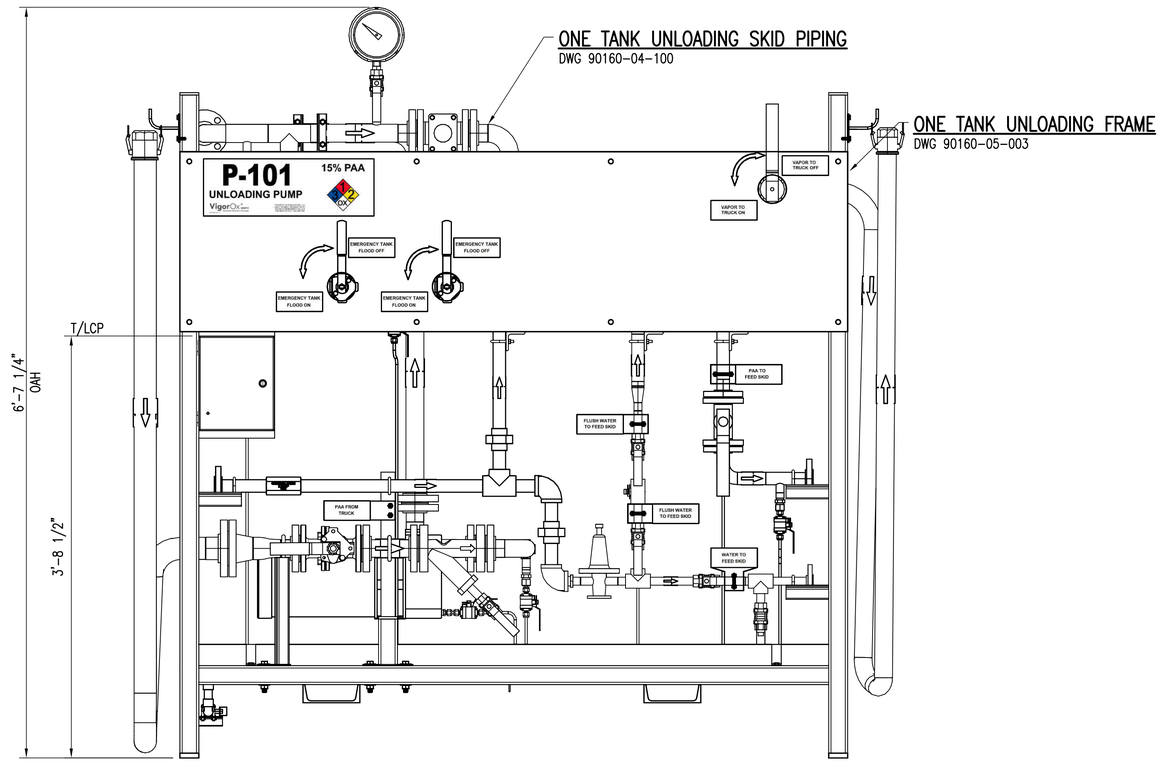
REFERENCE DRAWINGS	
	VIGOROX WWT II (15% PAA)
90160-01-003	PAA WASTEWATER DISINFECTION
90160-02-001	1T65-1P400
90160-05-011	SECTION B-B, ISOMETRIC VIEW &
-	ANCHORING DETAILS
-	DRAWN: DMZ — DATE: 9/09/15
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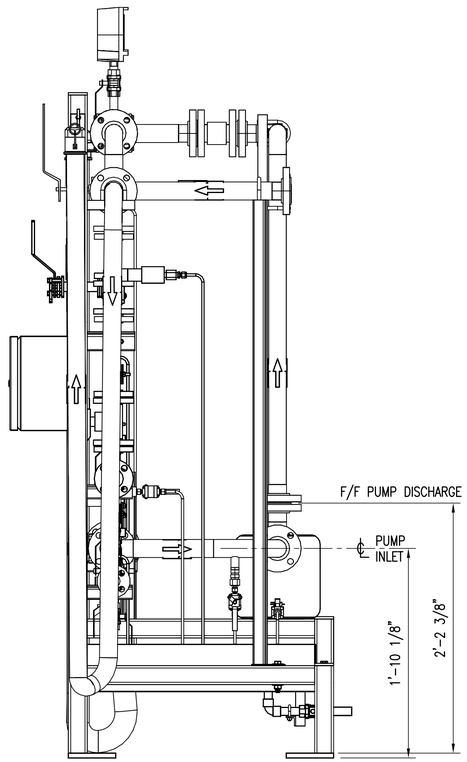
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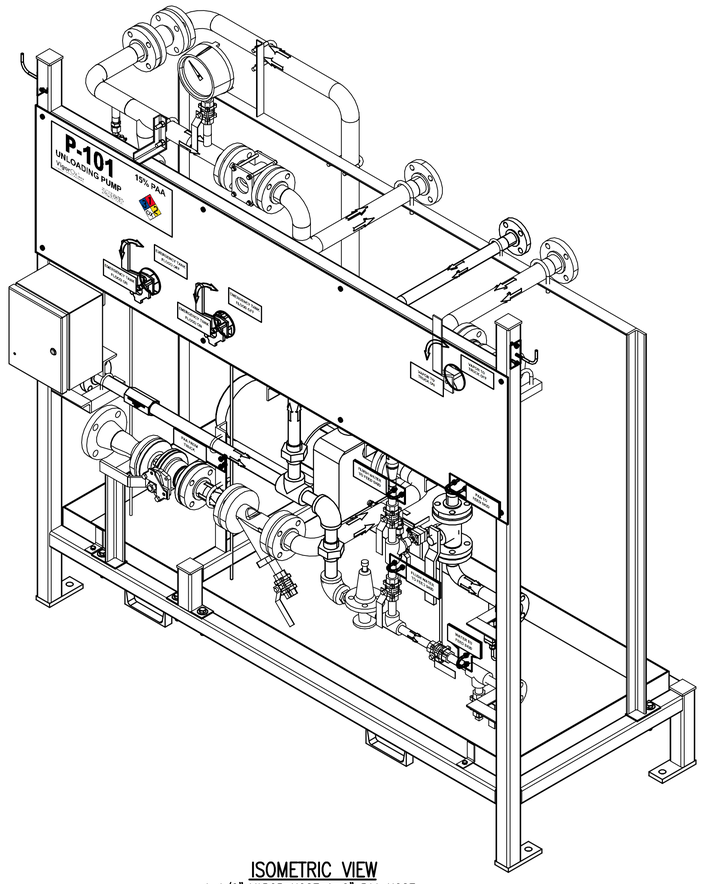
PLAN VIEW



FRONT VIEW



SIDE VIEW



ISOMETRIC VIEW
1 1/2" VAPOR HOSE & 2" PAA HOSE
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NOTES:

1. SEE DWG 90160-05-012 FOR TAG DETAILS

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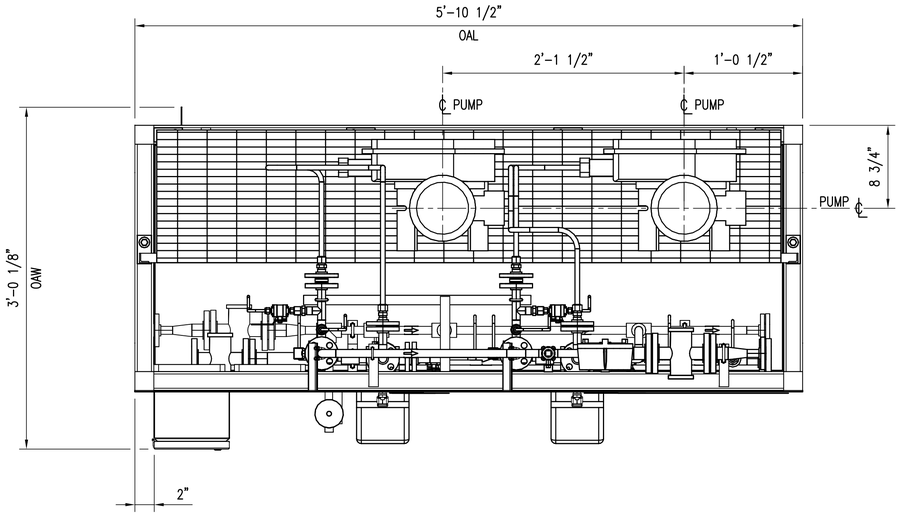
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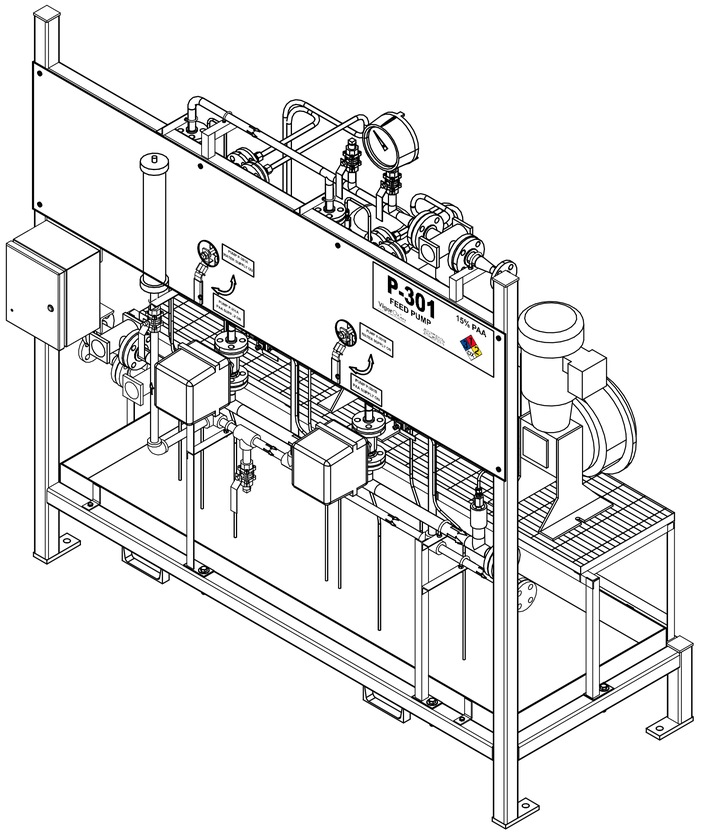
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90160-05-003	PAA WASTEWATER DISINFECTION
–	UNLOADING SKID ONE TANK SYSTEM
–	MECHANICAL LAYOUT
–	TOP, FRONT & SIDE VIEWS
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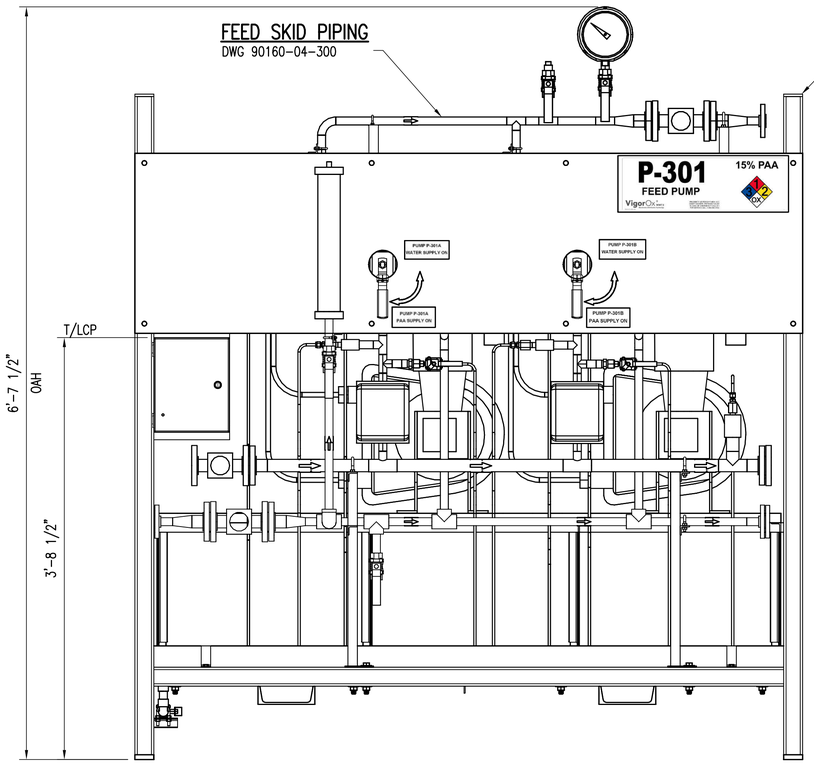
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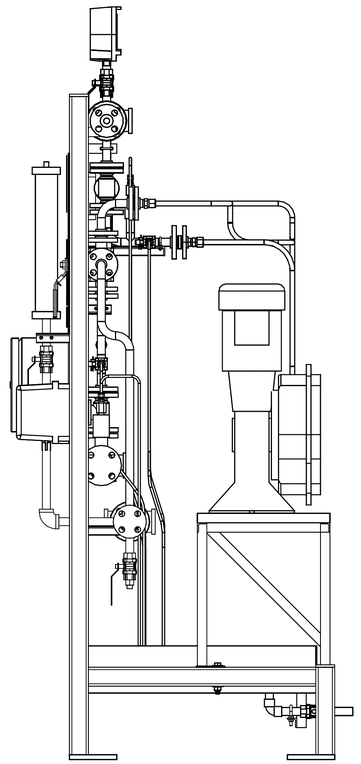
PLAN VIEW



ISOMETRIC VIEW
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FRONT VIEW



SIDE VIEW

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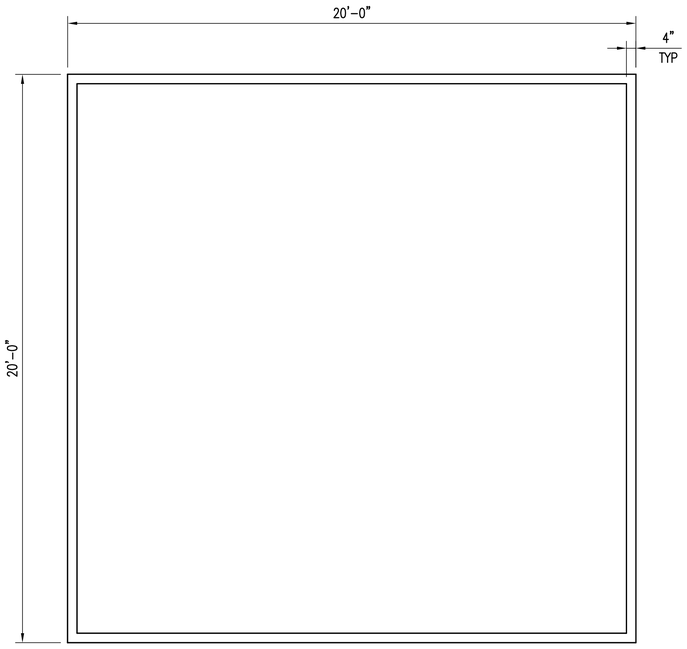
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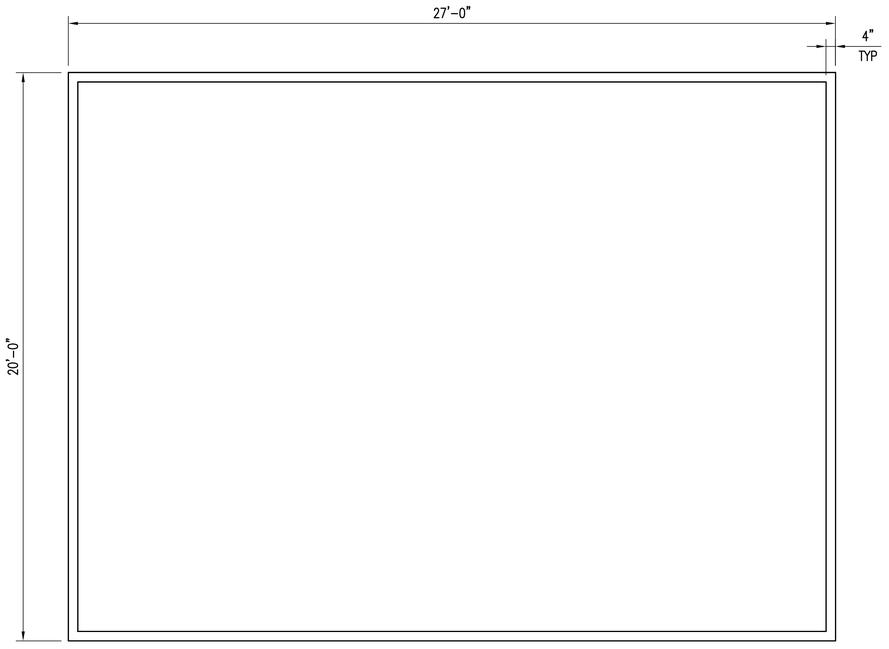
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90160-05-007	FEED SKID
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PLAN VIEW
1T65-1P400



PLAN VIEW
1T65-2P400
2T65-1P400
2T65-2P400

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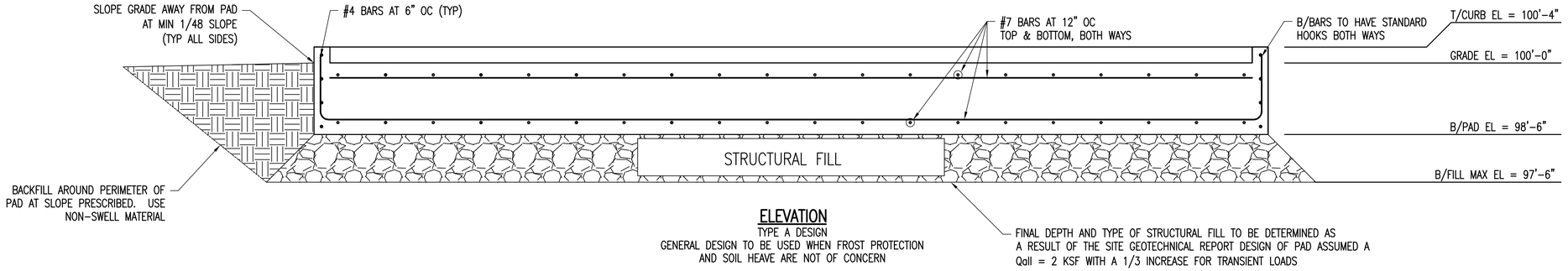
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90160-02-100	CONCRETE PAD DESIGNS	
90160-02-200	PLAN VIEW	
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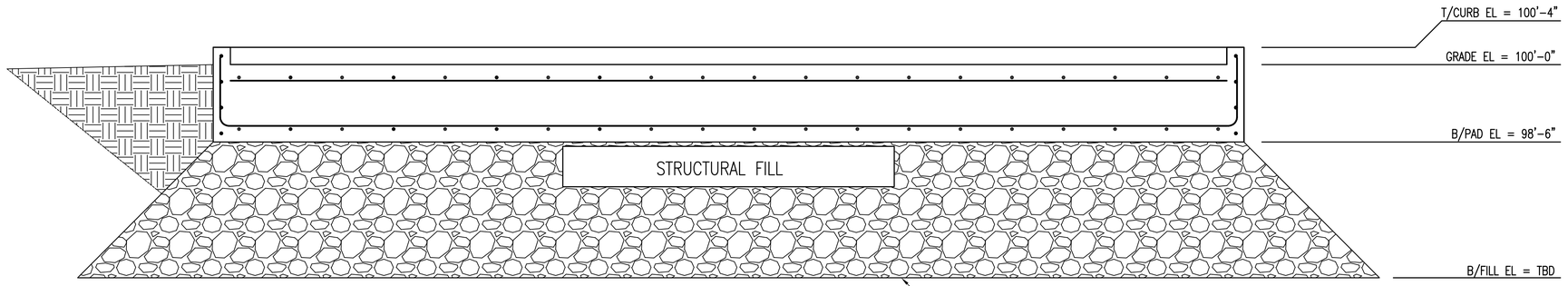
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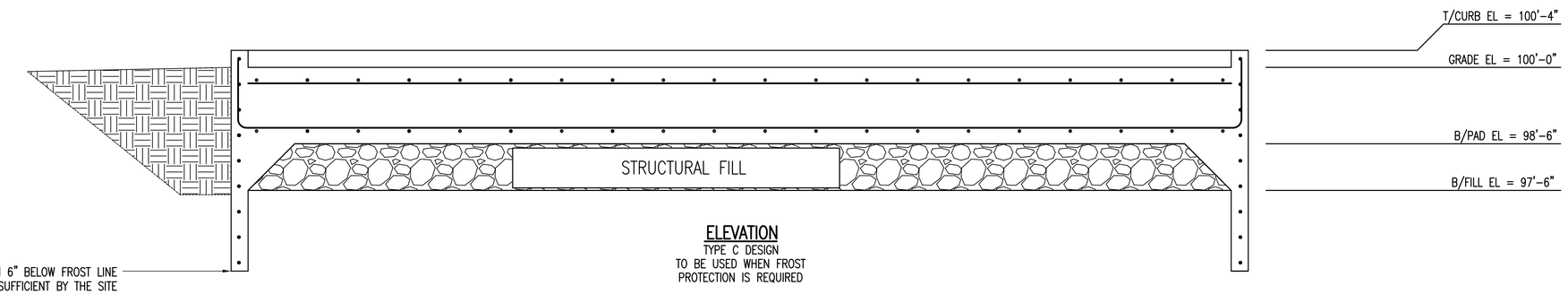
REV. 0



ELEVATION
TYPE A DESIGN
GENERAL DESIGN TO BE USED WHEN FROST PROTECTION AND SOIL HEAVE ARE NOT OF CONCERN



ELEVATION
TYPE B DESIGN
TO BE USED WHEN SOIL HEAVE IS OF CONCERN



ELEVATION
TYPE C DESIGN
TO BE USED WHEN FROST PROTECTION IS REQUIRED

NOTES:

1. NOTES FROM TYPE A APPLY TO TYPE B & C UNLESS NOTED OTHERWISE

REV	DESCRIPTION	DATE	BY	CHK
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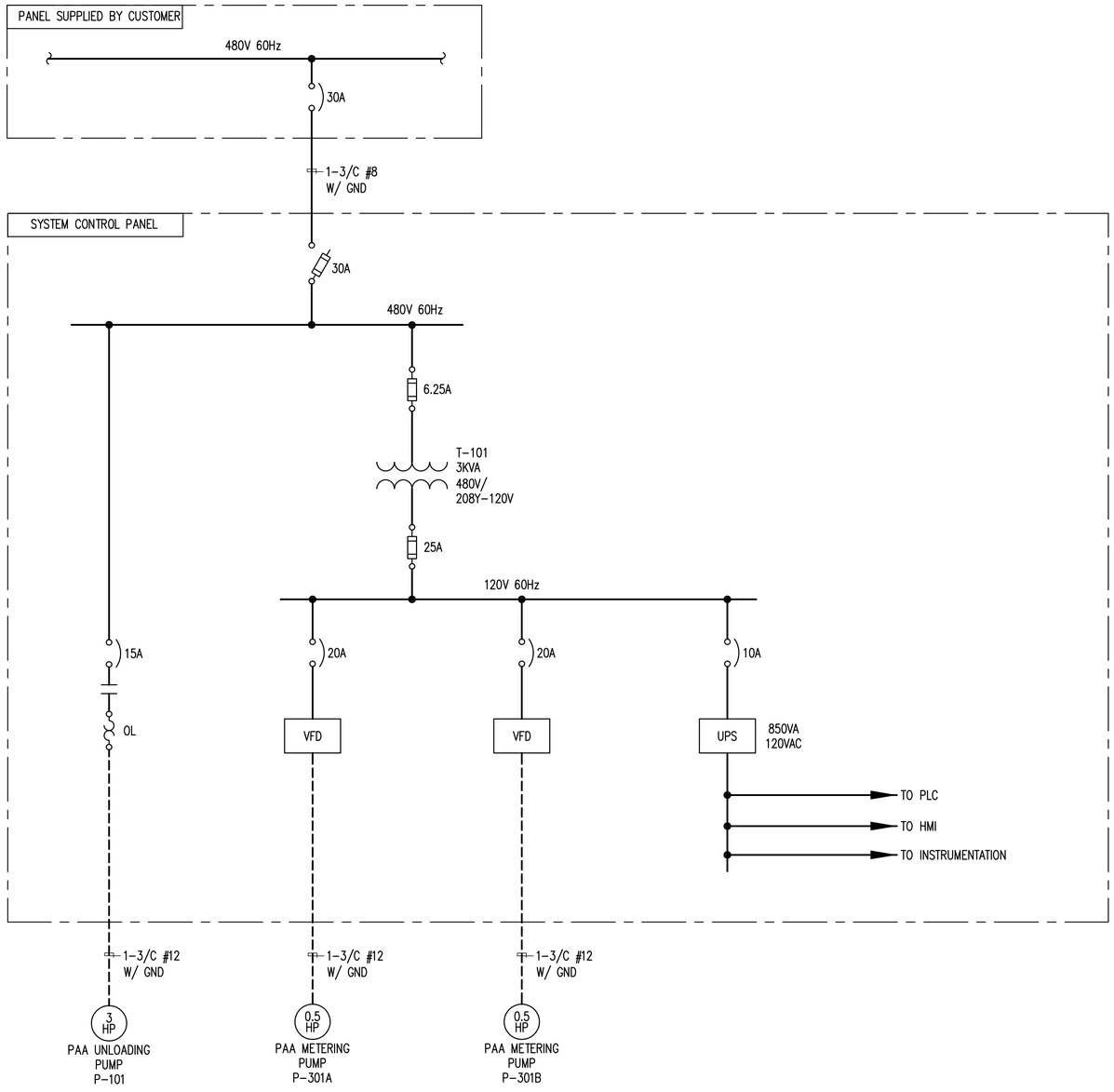
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REFERENCE DRAWINGS	
	VIGOROX WWT II (15% PAA)
90160-05-009	PAA WASTEWATER DISINFECTION
–	CONCRETE PAD DESIGNS
–	ELEVATION VIEWS
–	
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NOTES:

1. FOR DETAILS OF THE SYSTEM CONTROL PANEL REFER TO DWG 90160-06-400 THRU 90160-06-407.

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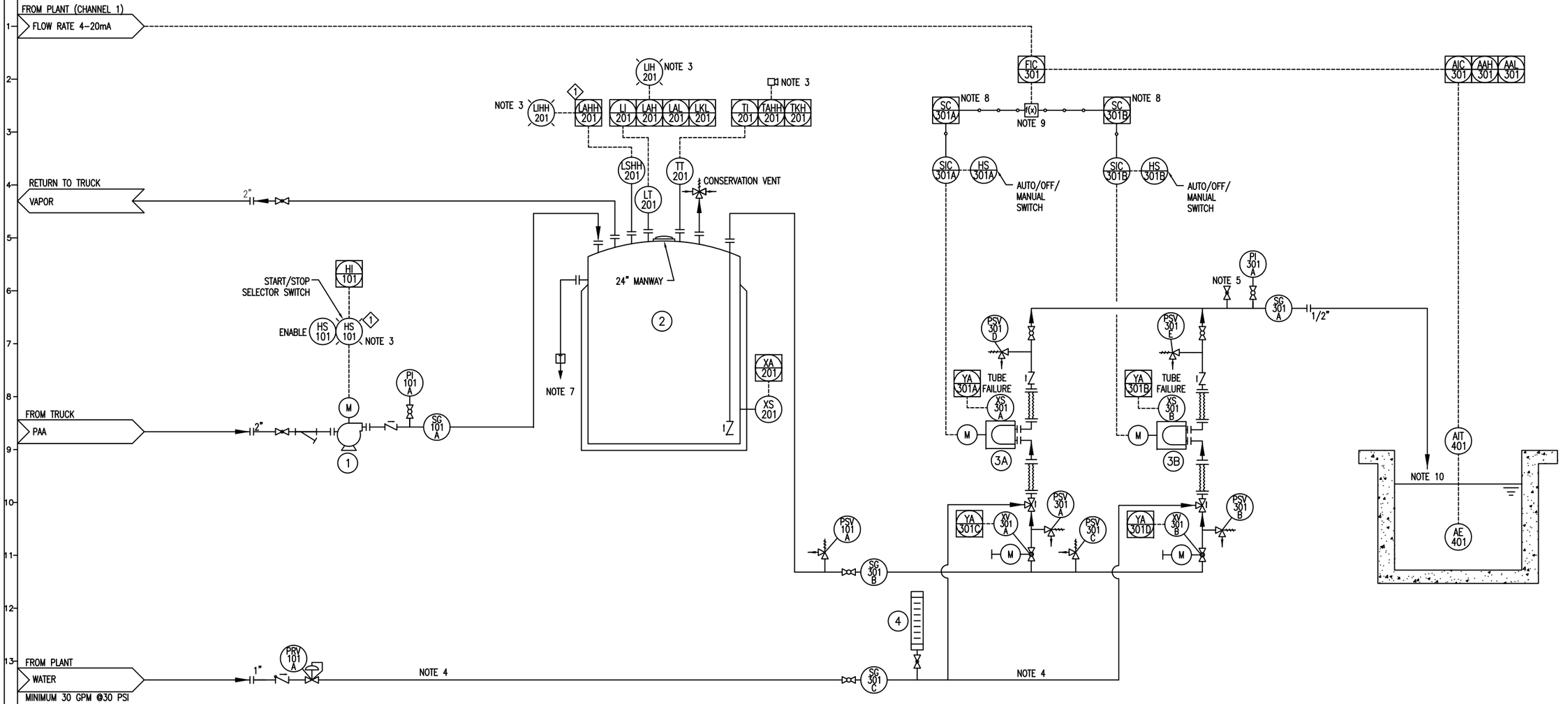
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REFERENCE DRAWINGS	VIGOROX WW II (15%PAA)
	PAA WASTEWATER DISINFECTION
	SYSTEM CONTROL PANEL
	SINGLE LINE
	ONE INJECTION
	DRAWN: AW — DATE: 5/5/2015
	SCALE: NTS — ENGINEER: GMC

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NOTES:

1. ALL PSV DISCHARGE LINES ROUTED TO SKID CONTAINMENT. CONTAINMENT NOT SHOWN FOR CLARITY.
2. ALL DRAIN VALVE DISCHARGE LINES ROUTED TO SKID CONTAINMENT. FLUSH AND DRAIN LINES NOT SHOWN FOR CLARITY.
3. LOCATED ON LOCAL CONTROL PANEL ON P–101 SKID.
4. OPTIONAL INSULATION AND HEAT TRACE TO BE DETERMINED BY SITE CONDITIONS.
5. OPTIONAL PULSATION DAMPER.
6. N/A
7. SANITARY DRAIN TIE IN MUST BE PROVIDED FOR SKID CONTAINMENT, LINE FLUSH, AND TANK FLUSH OVERFLOW.
8. PUMP WILL AUTOMATICALLY SHUT DOWN AND SWITCH TO BACKUP ON VFD FAULT OR TUBE RUPTURE.
9. VIGOROX FEED RATE CONTROLLED BY PLC BASED ON ONE OF THE FOLLOWING:
   9.1. PLANT FLOW
   9.2. PLANT FLOW + PAA RESIDUAL
   9.3. PLANT FLOW + PAA DEMAND
10. INJECTION METHOD TO BE DETERMINED BY SITE CONDITIONS.

EQUIPMENT	PUMP	(1)	TANK	(2)	PUMP	(3A)/(3B)	CALIBRATION COLUMN	(4)
PLANT ID.	P–101		T–201		P–301A P–301B		CC–301	
NAME	UNLOADING PUMP		PAA STORAGE TANK		PAA FEED PUMP		CALIBRATION COLUMN	
DESCRIPTION: PART NO.	SP150SS		TK6500CP		4001V		500ML	
DWG.NO.	SP150		D001306				KD–1032	
MATERIAL	SS / TEFLON		HDLPE		SS / FLOPRENE		PVC	
SIZE	4.75 IMPELLER		120"D X 201"H		1/2" TUBING ID		16"	
CAPACITY	40GPM		6500 GAL		109GPH		500 ML	
TEMP/PRESS	130F (MAX) / 30FT		130F(TYP) / 4"WC (TYP)		120F (MAX) / 60PSI			
HP/V/RPM	3/480/3600				0.5/230/70 (MAX)			
WEIGHT			5300 LB		75 LB			
VENDOR	PRICE PUMP		SNYDER INDUSTRIES		FLOMOTION SYSTEMS		KOFLO	

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REFERENCE DRAWINGS	FUNCTIONAL SCHEMATIC
90160–01–001	VIGOROX WWTII WASTEWATER DISINFECTION
90160–01–002	1T65–1P400
90160–01–003	ONE TANK
XXXX	ONE INJECTION
XXXX	DRAWN: DATE: 6/24/2015
XXXX	SCALE: NTS ENGINEER:

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MCP
E – STOP
P-101
UNLOADING PUMP
15% PAA
P-301
FEED PUMP
15% PAA
Israel
Israel
AERZEN

VigorOx® WWT II
Wastewater Disinfection Technology

VigorOx® WWT II Disinfection Bench Scale Test for Rahway Valley WWTP Rahway, NJ

Final Report

PeroxyChem

April 14, 2016

Executive Summary

Bench scale testing successfully demonstrated that the VigorOx® WWT II peracetic acid (PAA) disinfection technology can be effective for the Rahway Valley WWTP, Rahway (NJ). For the secondary effluent sample, a PAA dose rate of 1.5 mg/L was able to reduce fecal coliform concentration to below 200 MPN/100 mL at a contact time of 30 minutes. For the filtered effluent sample, a PAA dose rate of 1.0 mg/L was able to reduce fecal coliform concentration to below 200 MPN/100 mL at the same contact time.

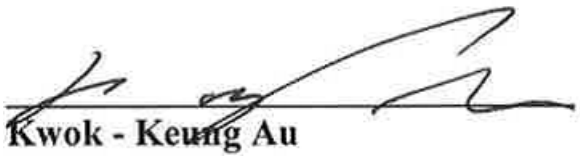
The fecal coliform concentration of the un-disinfected secondary effluent sample was 3,860 MPN/100 mL. It was reduced to 96 MPN/100 mL at a dose of 1.5 PAA mg/L and contact time of 30 minutes, a reduction of 1.61 logs (97.52%). The contact time required to reduce fecal coliform to below 200 MPN/100 mL decreased to 20 minutes if the dose was increased to 2.0 mg/L. Further data analysis indicated that a minimum Ct (C being dose in mg PAA/L and t being contact time in minutes) of 40 min-mg/L was sufficient to consistently achieve the disinfection goal of controlling fecal coliform to below 200 MPN/100 mL.

The fecal coliform concentration of the un-disinfected filtered effluent sample was 2,820 MPN/100 mL. It was reduced to 179 MPN/100 mL at a dose of 1.0 PAA mg/L and contact time of 30 minutes, a reduction of 1.20 logs (93.66%). The contact time required to reduce fecal coliform to below 200 MPN/100 mL decreased to 15 minutes if the dose was increased to 2.0 mg/L. Further data analysis indicated that a minimum Ct (C being dose in mg PAA/L and t being contact time in minutes) of 30 min-mg/L was sufficient to consistently achieve the disinfection goal of controlling fecal coliform to below 200 MPN/100 mL.

For the secondary effluent sample, the measured PAA residual was 0.9 mg/L at the effective dose of 1.5 mg PAA/L and a contact time of 30 minutes. For the filtered effluent sample, the measured PAA residual was 0.8 mg/L at the effective dose of 1.0 mg PAA/L and a contact time of 30 minutes. While the final site specific discharge limit for PAA needs to be confirmed with New Jersey Department of Environmental Protection (NJDEP), it is likely that quenching of PAA before final discharge will not necessary if the VigorOx® WWT II PAA disinfection technology is implemented at this plant.

Since the test is based on one sample at each potential dosing location, it is recommended that a full scale trial be conducted to validate the VigorOx® WWT II dose rates and contact times required to achieve the plant's disinfection goals under varying influent conditions. A PAA dose of 1.5 mg/L should be used as a starting basis for the field trial if PAA is dosed prior to the filters. A PAA dose of 1.0 mg/L should be used as a starting basis for the field trial if PAA is dosed after the filters.

This report and the conclusions herein are accurate based on the data generated from the bench test.



Kwok-Keung (Amos) Au, PhD
Technology Application Manager – Water Treatment, PeroxyChem

1. Introduction

1.1 Test Objectives

A bench scale disinfection test was performed for wastewater samples collected from the Rahway Valley WWTP in Rahway, NJ. The objectives of this test were to evaluate the disinfection efficiency of VigorOx® WWT II against fecal coliform for the wastewater samples and to determine the dose rate and contact time required to achieve compliance with the plant's National Pollutant Discharge Elimination System (NPDES) permit requirement.

The plant's NPDES permit has the requirement for fecal coliform concentration not to exceed 200 MPN/100 mL based on monthly geometric mean. This limit value of 200 MPN/100 mL was used as the criteria to determine the dose and contact time required in this study.

1.2 VigorOx® WWT II Peracetic Acid

VigorOx WWT II is a strong disinfectant that results from the equilibrium reaction between acetic acid (vinegar) and hydrogen peroxide (H_2O_2). The resulting solution contains 15% peracetic acid (PAA) and 23% hydrogen peroxide (see Figure 1-1 for the chemical structure). The PAA molecule attacks and kills microbial organisms of concern in wastewater treatment, such as fecal coliforms and *E. coli* by disruption of cell membranes.

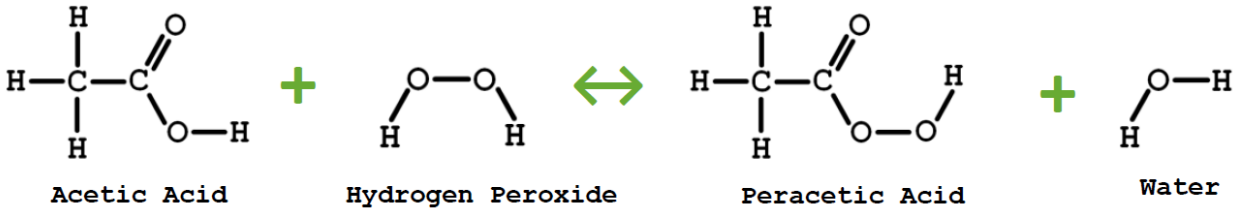


Figure 1-1 Chemical Structure of VigorOx WWT II

The oxidation potential of PAA is greater than that of hyporchlorous acid and hypochlorite ion, resulting in typically lower dosages and contact times as compared to chlorine disinfection. In addition, PAA has a much lower aquatic toxicity profile than chlorine and decays rapidly in the environment. PAA is not a chlorine-based chemistry and does not result in the formation of chlorinated disinfection by-products. As a result, PAA generally does not need a quenching step, such as de-chlorination, reducing process complexity and cost.

2. Test Plan

An un-disinfected secondary effluent sample and an un-disinfected filtered effluent sample were used in the test. The samples was collected from the plant and shipped to PeroxyChem's Research and Development Laboratory on February 16, 2016. The samples were received on February 17 and tested the day of arrival. Five VigorOx WWT II doses and five contact times were used in the test (shown in Table 2-1).

During the jar test, each wastewater sample was measured into one-liter aliquots and placed into cleaned and disinfected beakers on a jar tester apparatus. The stirrers were set to 100 revolutions per minute for the duration of the test. VigorOx® WWT II was dosed into the stirred beakers at the five different doses using a micropipette. Samples were taken at each detention time point for analysis of water quality parameters, in accordance to the test plan shown in Table 2-2.

Table 2-1 Testing Doses and Contact Times

Wastewater Sample	VigorOx® WWT II Dose (mg/L as PAA)	Contact Time (minute)
Secondary Effluent	1.0, 1.5, 2.0, 3.0 and 5.0	5, 10, 15, 20 and 30
Filtered Effluent	1.0, 2.0, 3.0, 5.0 and 7.0	5, 10, 15, 20 and 30

Table 2-2 Water Quality Testing Matrix(1)

Water Quality Parameters	Sampling Conditions	Methods/Instruments
Fecal Coliform (MNP/100 mL)	Control(2) Five Doses at Five Contact Times	IDEXX
PAA Residual (mg/L)	Under Five Doses at Five Contact Times	CHEMetrics I-2020 Single Analyte Meter
Carbonaceous Biochemical Oxygen Demand$_{(5\text{-days})}$ ($cBOD_5$) (mg/L)	Control	SM5210B
Total Suspended Solid (TSS) (mg/L)		SM2540D
Ammonia		350.1

Notes:

(1) All tests and measurements were conducted at PeroxyChem's Research and Development Laboratory in Tonawanda (NY), except for the following: $cBOD_5$, TSS and ammonia. Samples were sent to Test America for these measurements.
(2) Control: the un-disinfected secondary effluent sample or the un-disinfected filtered effluent sample.

3. Results and Discussions

3.1 Wastewater Characteristics

Selected physical-chemical and microbiological characteristics of the un-disinfected secondary effluent sample and the un-disinfected filtered effluent sample are shown in Table 3-1 and Table 3-1, respectively. The results were indicative of a typically secondary effluent and filtered effluent in terms of the levels of fecal coliform, $cBOD_5$, TSS and ammonia. The fecal coliform concentration of the secondary effluent was 3,860 MPN/100 mL. To achieve the disinfection goal of fecal coliform below 200 MPN/100 mL for this sample, a minimum log inactivation of 1.29 (94.82%) was required. The fecal coliform concentration of the filtered effluent was 2,820 MPN/100 mL. To achieve the disinfection goal of fecal coliform below 200 MPN/100 mL for this sample, a minimum log inactivation of 1.15 (92.91%) was required.

Table 3-1 Selected Characteristics of Un-disinfected Secondary Effluent Sample

Water Quality Parameters	Concentrations
Fecal Coliform (MPN/100 mL)	3,860 (average of two measurements)
$cBOD_5$ (mg/L)	2.5
TSS (mg/L)	N.D.
Ammonia (mg/L)	4.7

N.D.: non-detected (TSS < 4.0 mg/L)

Table 3-2 Selected Characteristics of Un-disinfected Filtered Effluent Sample

Water Quality Parameters	Concentrations
Fecal Coliform (MPN/100 mL)	2,820 (average of two measurements)
$cBOD_5$ (mg/L)	3.6
TSS (mg/L)	4.8
Ammonia (mg/L)	1.5

3.2 Disinfection Performance

The disinfection testing results for the secondary effluent sample are shown in Figure 3-1, presented as fecal coliform concentrations as a function of contact time at various PAA doses. The horizontal, red line represents the target disinfection goal of 200 MPN/100 mL for fecal coliform.

The results indicated that VigorOx® WWT II was very effective in disinfecting fecal coliform for the secondary effluent sample. The effective dose rate to achieve the disinfection goals was 1.5 mg/L (as PAA):

- As expected, fecal coliform counts decreased with increasing PAA dose and increasing contact time.
- Fecal coliform was reduced to 96 MPN/100 mL at a dose of 1.5 PAA mg/L and contact time of 30 minutes, a reduction of 1.61 logs (97.52%).
- Contact time required to reduce fecal coliform to below 200 MPN/100 mL decreased with increasing PAA dose. At a dose of 2.0 mg/L, fecal coliform was reduced to 98 MPN/100 mL at a contact time of 15 minutes.

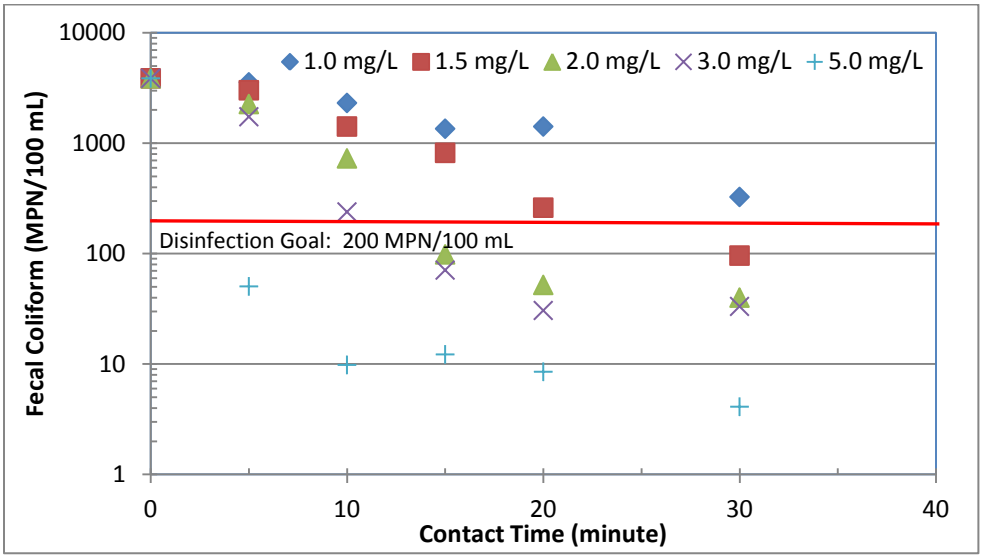


Figure 3-1 Fecal Coliform Counts as a Function of Contact Time at Various PAA Doses (secondary effluent)

To assess the combined impact of dose and contact time on disinfection performance, the results are shown in Figure 3-2 as fecal coliform counts at different Ct (C being PAA dose and t being contact time). The results indicated that a Ct value of 40 min-mg/L or higher was sufficient to consistently reduce fecal coliform to achieve disinfection goal for the secondary effluent sample.

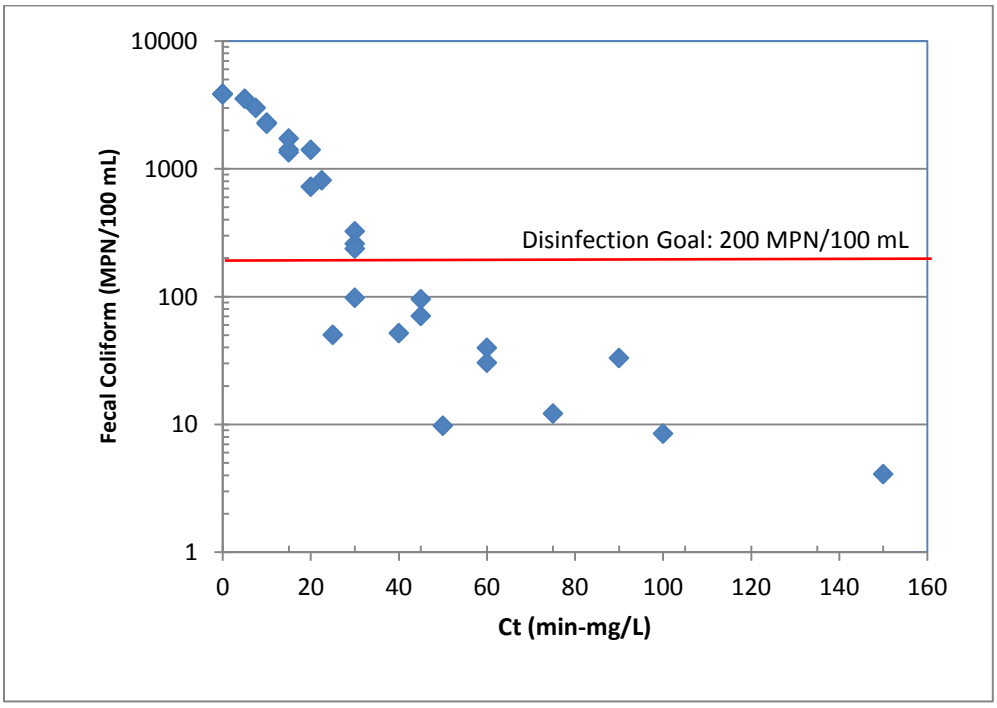


Figure 3-2 Fecal Coliform Counts at Different Ct (secondary effluent)

The disinfection testing results for the filtered effluent sample are shown in Figure 3-3, presented as fecal coliform concentrations as a function of contact time at various PAA doses. The horizontal, red line represents the target disinfection goal of 200 MPN/100 mL for fecal coliform.

The results indicated that VigorOx® WWT II was also very effective in disinfecting fecal coliform for the filtered effluent sample. The effective dose rate to achieve the disinfection goals was 1.0 mg/L (as PAA):

- Fecal coliform was reduced to 179 MPN/100 mL at a dose of 1.0 PAA mg/L and contact time of 30 minutes, a reduction of 1.20 logs (93.66%).

- Contact time required to reduce fecal coliform to below 200 MPN/100 mL decreased with increasing PAA dose. At a dose of 2.0 mg/L, fecal coliform was reduced to 110 MPN/100 mL at a contact time of 15 minutes.

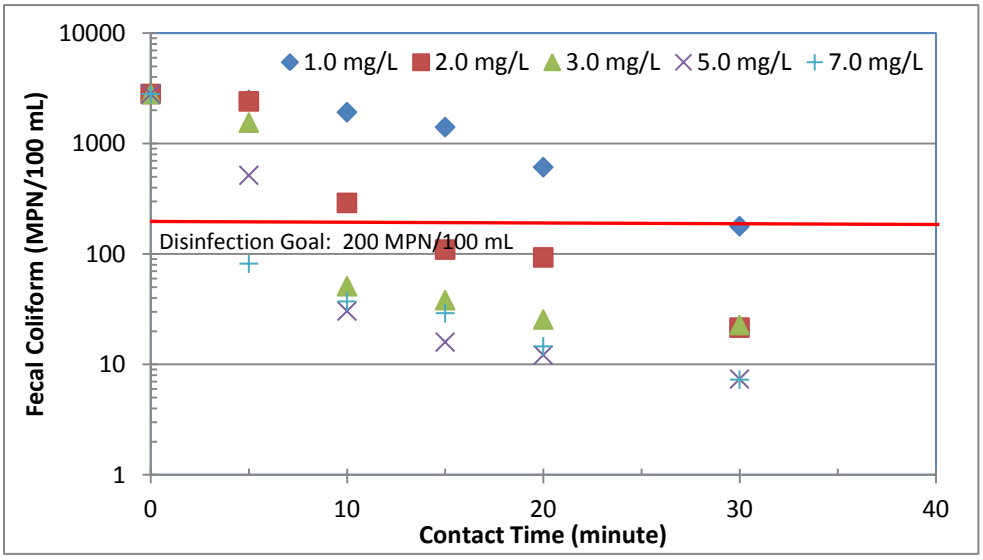


Figure 3-3 Fecal Coliform Counts as a Function of Contact Time at Various PAA Doses (filtered effluent)

Similarly, the results are shown in Figure 3-4 as fecal coliform counts at different Ct The results indicated that a Ct value of 30 min-mg/L or higher was sufficient to consistently reduce fecal coliform to below 200 MPN/100 mL for the filtered effluent sample.

3.3 PAA Residual and Discharge Limits

The results of the PAA residual concentration as a function of contact time at various VigorOx® WWT II PAA doses for the secondary effluent sample and the filtered effluent sample are shown in Figure 3-5 and Figure 3-6, respectively. As expected, PAA residual gradually decay with increasing contact time in both samples. At the effective dose of 1.5 mg PAA/L, the measured PAA residual in the secondary effluent sample was 0.9 mg/L at a contact time of 30 minutes. At the effective dose of 1.0 mg PAA/L, the measured PAA residual in the filtered effluent sample was 0.8 mg/L at a contact time of 30 minutes.

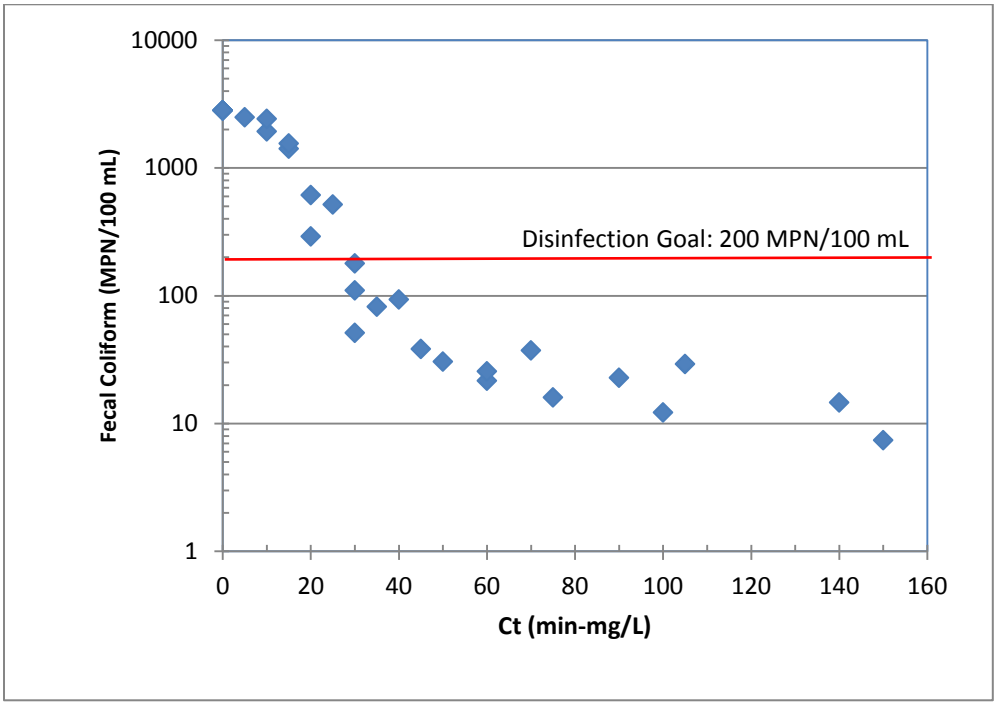


Figure 3-4 Fecal Coliform Counts at Different Ct (filtered effluent)

Due to its low toxicity impacts to aquatic organisms, the USEPA approved labeling for VigorOx® WWT II has allowable, dilution factor based, discharge limits for PAA as:

1.0 ppm (mg/L), if dilution factor (DF) is < 12 or unknown

0.09 ppm x DF, if DF is equal to or greater than 12 (for example, if DF is 20, then the limit is 1.8 ppm)

Where $DF = \frac{plant\ effluent\ dishcarge + receiving\ stream\ 7Q10}{plant\ effluent\ discharge}$

(7Q10 is the lowest seven-day average stream flow of the receiving stream over a ten year period).

The site specific limit for PAA residual at this plant needs to be confirmed with New Jersey Department of Environmental Protection (NJDEP). Based on the trial results and the US EPA discharge limits, quenching of PAA is not likely to be necessary, if the plant implements the VigorOx® WWT II peracetic acid disinfection technology.

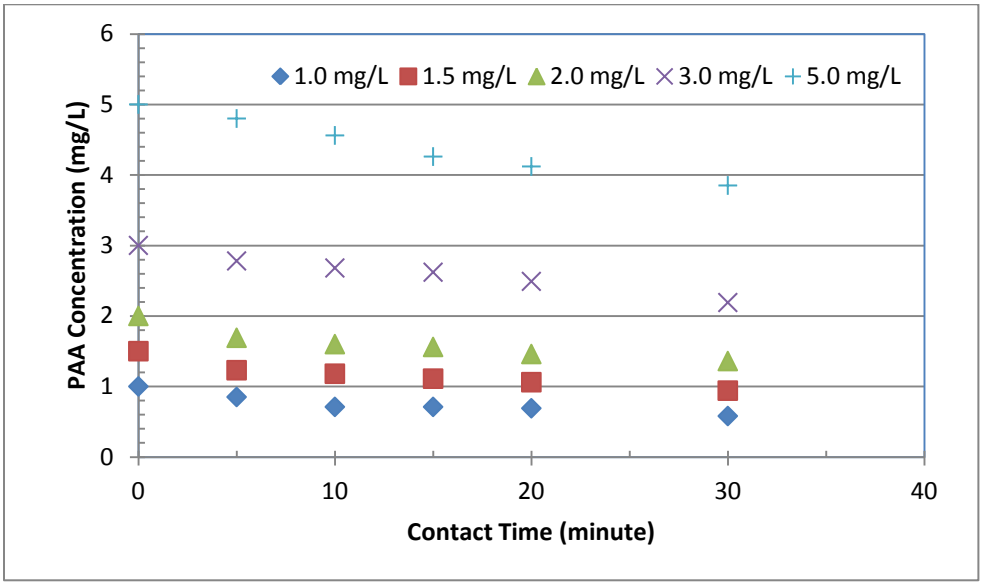


Figure 3-5 PAA Residual as Function of Contact Time at Various PAA Doses (secondary effluent)

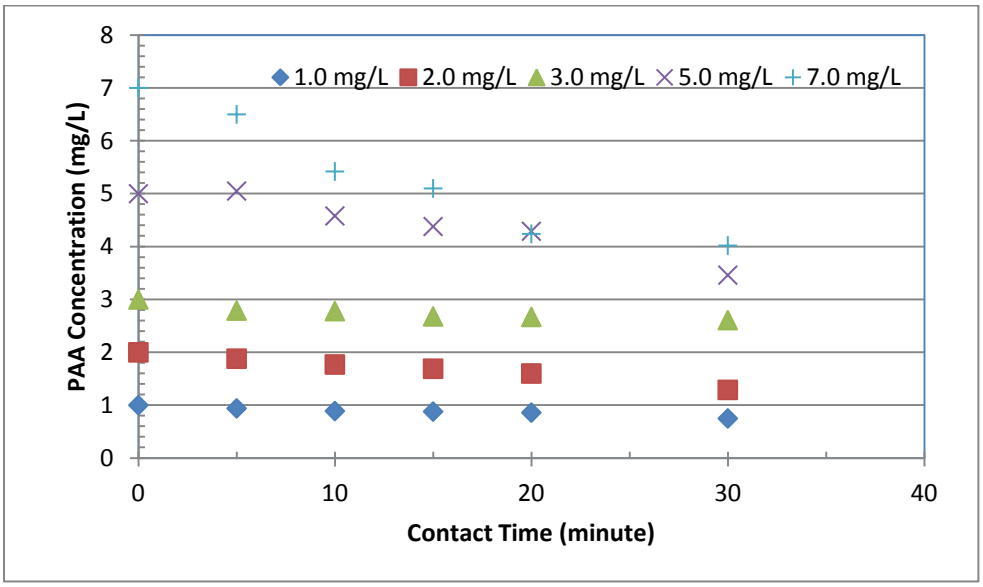


Figure 3-6 PAA Residual as Function of Contact Time at Various PAA Doses (filtered effluent)

4. Conclusions

Bench scale testing successfully demonstrated that the VigorOx® WWT II peracetic acid (PAA) disinfection technology can be effective for the Rahway Valley WWTP, Rahway (NJ). For the secondary effluent sample, a PAA dose rate of 1.5 mg/L was able to reduce fecal coliform concentration to below 200 MPN/100 mL at a contact time of 30 minutes. For the filtered effluent sample, a PAA dose rate of 1.0 mg/L was able to reduce fecal coliform concentration to below 200 MPN/100 mL at the same contact time.

The fecal coliform concentration of the un-disinfected secondary effluent sample was 3,860 MPN/100 mL. It was reduced to 96 MPN/100 mL at a dose of 1.5 PAA mg/L and contact time of 30 minutes, a reduction of 1.61 logs (97.52%). The contact time required to reduce fecal coliform to below 200 MPN/100 mL decreased to 20 minutes if the dose was increased to 2.0 mg/L. Further data analysis indicated that a minimum Ct (C being dose in mg PAA/L and t being contact time in minutes) of 40 min-mg/L was sufficient to consistently achieve the disinfection goal of controlling fecal coliform to below 200 MPN/100 mL.

The fecal coliform concentration of the un-disinfected filtered effluent sample was 2,820 MPN/100 mL. It was reduced to 179 MPN/100 mL at a dose of 1.0 PAA mg/L and contact time of 30 minutes, a reduction of 1.20 logs (93.66%). The contact time required to reduce fecal coliform to below 200 MPN/100 mL decreased to 15 minutes if the dose was increased to 2.0 mg/L. Further data analysis indicated that a minimum Ct (C being dose in mg PAA/L and t being contact time in minutes) of 30 min-mg/L was sufficient to consistently achieve the disinfection goal of controlling fecal coliform to below 200 MPN/100 mL.

For the secondary effluent sample, the measured PAA residual was 0.9 mg/L at the effective dose of 1.5 mg PAA/L and a contact time of 30 minutes. For the filtered effluent sample, the measured PAA residual was 0.8 mg/L at the effective dose of 1.0 mg PAA/L and a contact time of 30 minutes. While the final site specific discharge limit for PAA needs to be confirmed with New Jersey Department of Environmental Protection (NJDEP), it is likely that quenching of PAA before final discharge will not necessary if the VigorOx® WWT II PAA disinfection technology is implemented at this plant.

Since the test is based on one sample at each potential dosing location, it is recommended that a full scale trial be conducted to validate the VigorOx® WWT II dose rates and contact times required to achieve the plant's disinfection goals under varying influent conditions. A PAA dose of 1.5 mg/L should be used as a starting basis for the field trial if PAA is dosed prior to the filters. A PAA dose of 1.0 mg/L should be used as a starting basis for the field trial if PAA is dosed after the filters.

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Testing, Design and Operation of PAA Disinfection for Municipal WWTPs

Brian Hilts, P.E.

February 8, 2016

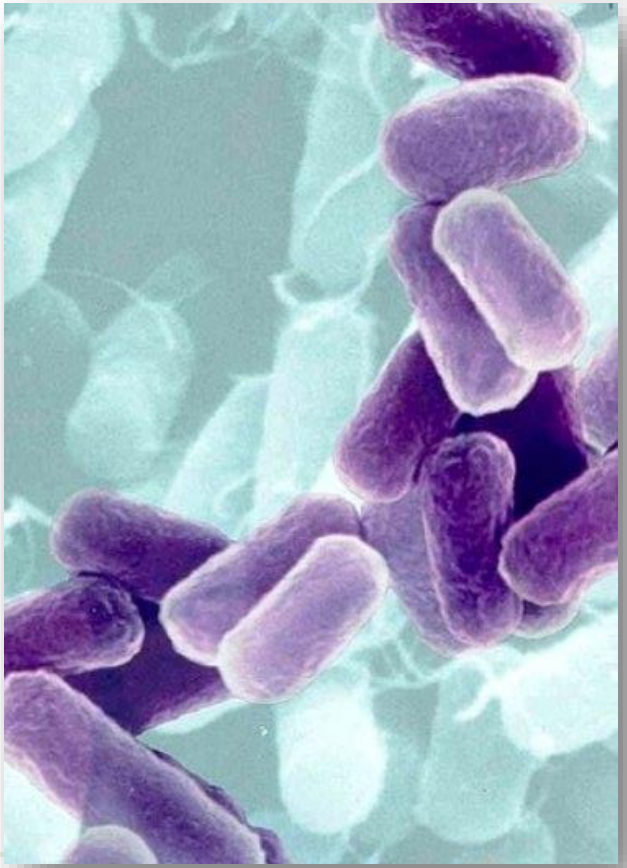


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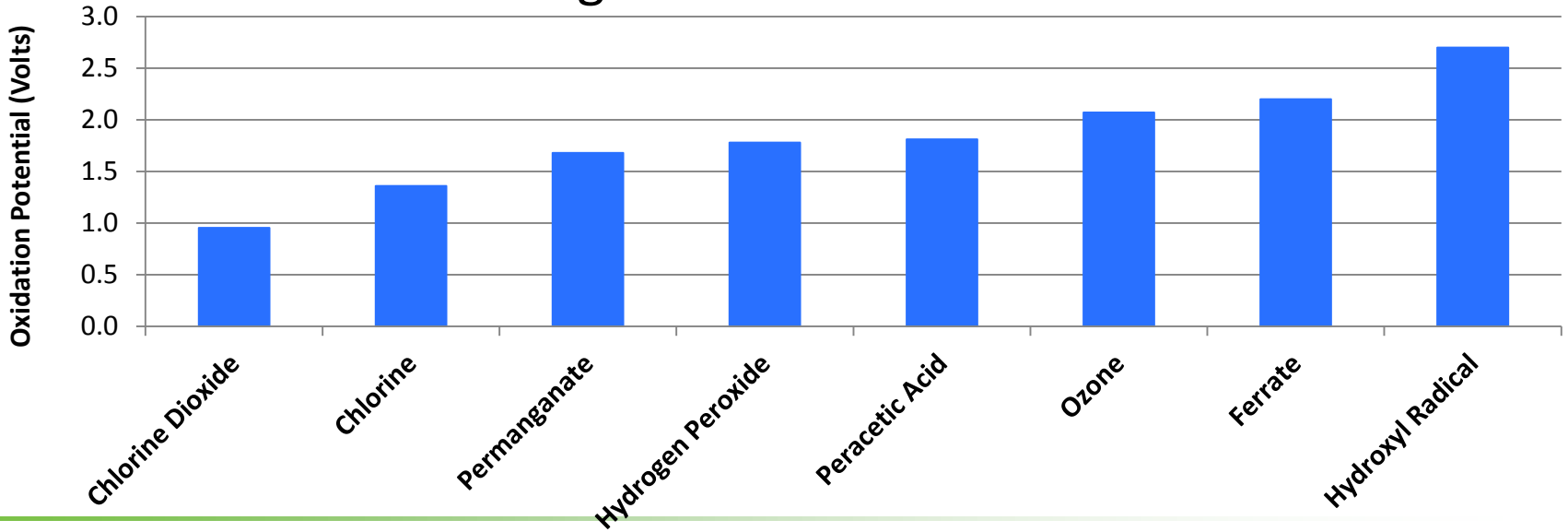
Presentation Outline

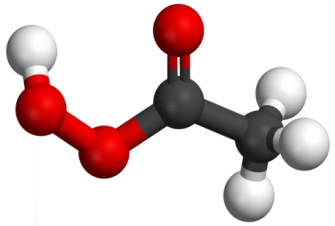
- PAA Background
- PAA Testing
- PAA Design Criteria
- Lifecycle Costs
- Design Elements & Considerations
- Implementation & Advances in the Technology



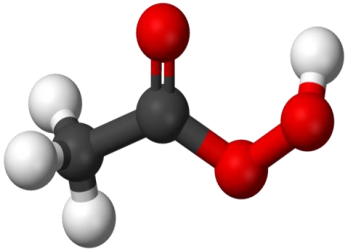
PAA Background

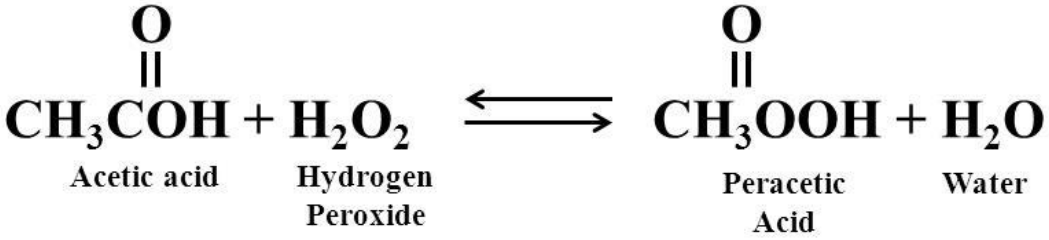
- Mature technologies
  - Chemical oxidants
  - Photolysis (UV irradiation)
- Innovative technologies





PAA Background





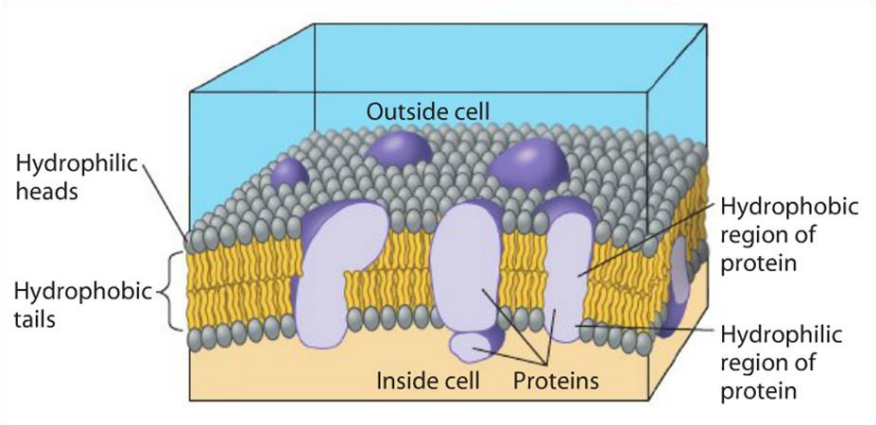
	Vigorox WWT II	Proxitane® WW-12	Peragreen® 22WW
Peracetic Acid (CH_3COOOH)	15%	12%	22%
Hydrogen Peroxide (H_2O_2)	23%	18.5%	5%
Acetic Acid (CH_3COOH)	16%	20%	42-50%
Sulfuric Acid (H_2SO_4)	<1%	--	--
Water (free)	45%	balance	balance

- PAA adds BOD to the effluent at a rate of 0.4 – 1.2 mg/L BOD per 1 mg/L of PAA

PAA Background

- Antimicrobial mode of action has chemical specificity[1]
  - Active oxygen disrupts sulfhydryl (-SH) and disulfide (S-S) bonds in enzymes and proteins in cell membranes
  - PAA also reacts with the base pairs in DNA and RNA

- This reaction specificity results in low doses of chemical for disinfection



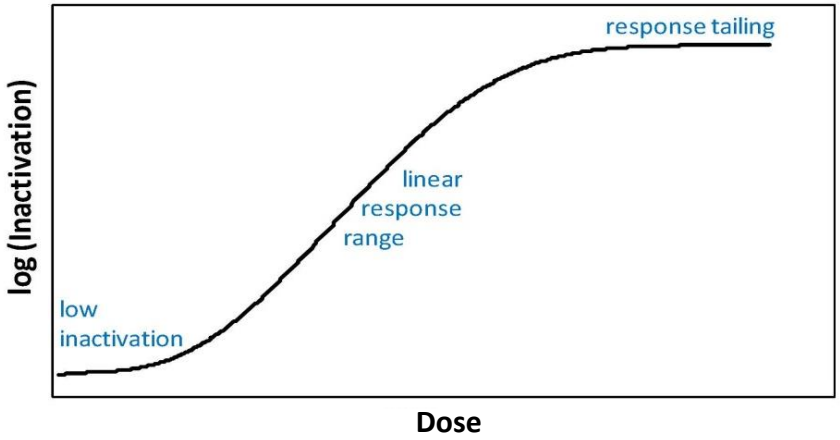
[1]*Kitis, M. (2004). Disinfection of Wastewater with Peracetic Acid: A Review. Environment International, (30):47-55.*

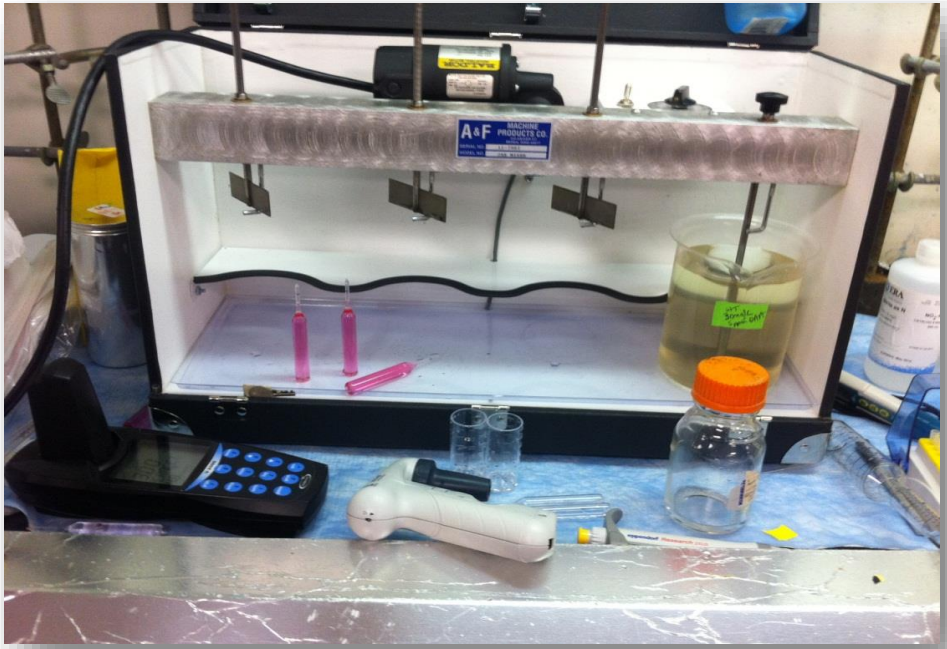
When is PAA Viable?

- From a process operations perspective, we consider PAA when:
  - Disinfection by-products are a concern
  - Water has widely variable water quality considerations
  - Water has high color, high TSS, or low UVT
  - In CSO applications where chlorine is stored for long periods of time without use
- From a cost perspective, we consider PAA when:
  - Capital costs are a primary driver
  - Existing infrastructure supports easy conversion to PAA

PAA Testing

- Site specific bench testing is recommended
- Dose-response and residual is measured





PAA Bench Testing

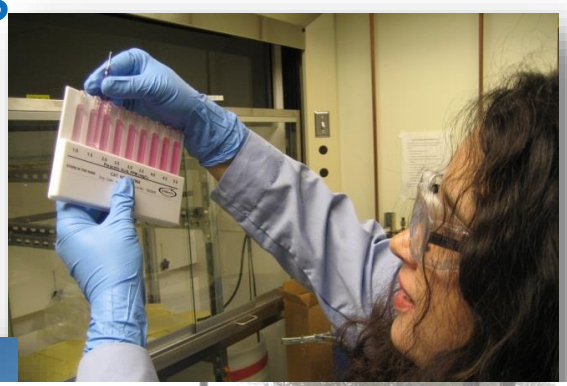
- Jar testing to determine demand/decay and efficacy
- Grab samples taken from WWTP effluent over a variety of days and times for a representative sample
- Typically performed with bench-scale testing of alternative disinfectants (ozone or sodium hypochlorite) for comparison





PAA Pilot Testing

- For small to medium plants, a full-scale pilot could be conducted
- For large plants, a side stream pilot is recommended
- Data should be collected
  - Flow
  - pH, TSS, COD, BOD
  - Color, UVT
  - Dose and residual
  - Bacteria







PAA Pilot Testing

- Side stream pilots
  - Typically around 25 gpm
  - Give more real time data
  - Multiple sample points
  - Pilot skids systems are available through PAA Providers





PAA Testing Result Analysis

- Determine C*T (mg*min/L) value required for Log Inactivation
- Develop inactivation model
  - Many models available, most are variations of the Chick-Watson model with adjustments for first-order kinetics

Homs Model

$$ln\left(\frac{N}{N_0}\right) = -kC^n t^m$$

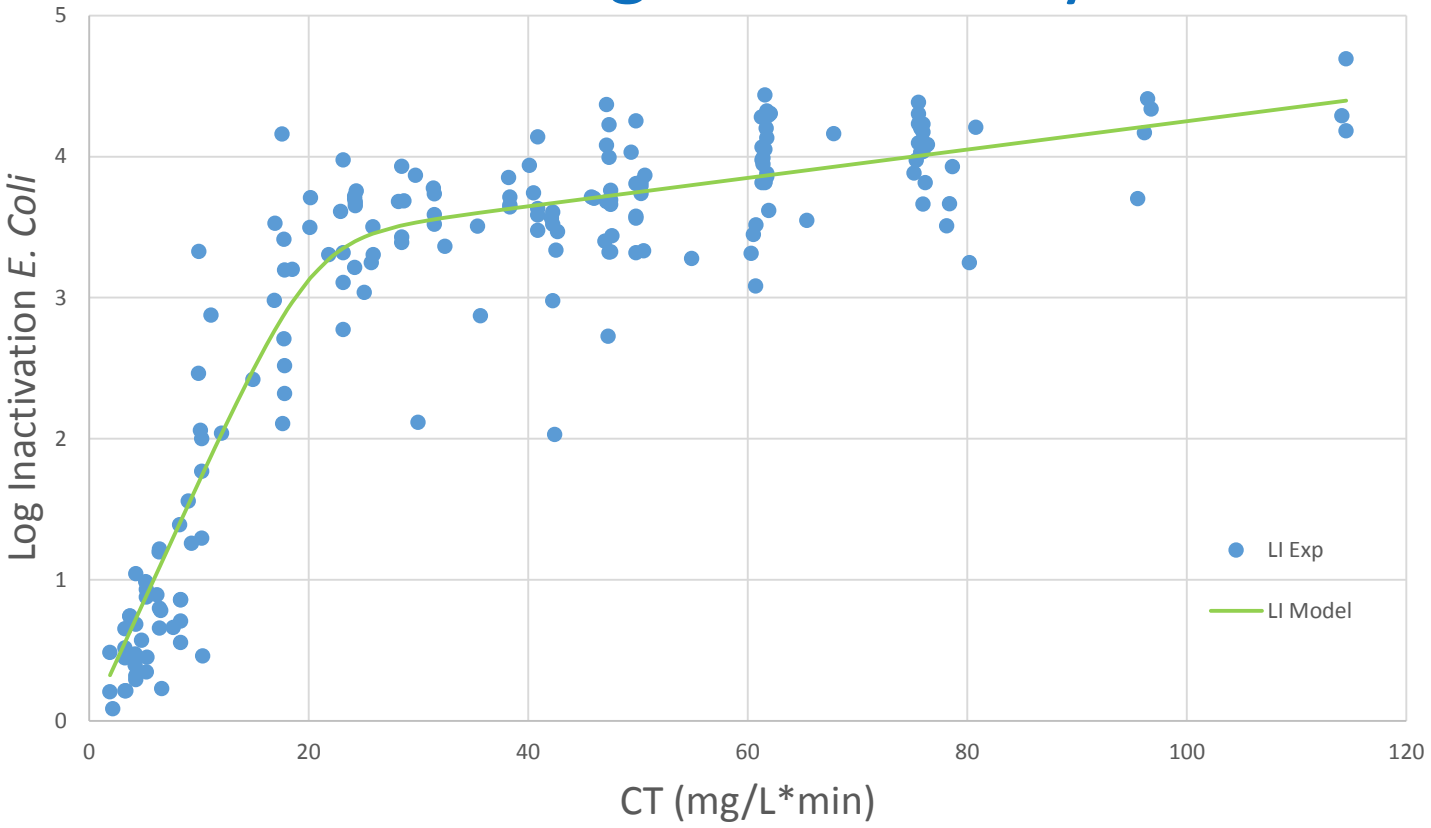
- N = Organism concentration
- No = Initial organism concentration
- K = Disinfection rate constant
- C = PAA concentration
- n, m = weighting factors
- t = time

Double Exponential Model

$$N = N_o * fNd * e^{-k_d * CT} + N_o * fNp * e^{-k_p * CT}$$

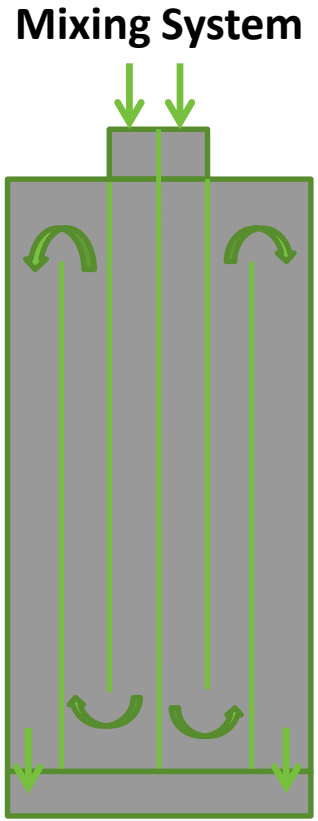
- N = Organism concentration
- No = Initial organism concentration
- fNd = the fraction of the organism population that is “easy to inactive”
- kd = the specific decay rate of the “easy to inactive” organism
- fNp = the fraction of the organism population that is “hard to inactive”
- kd = the specific decay rate of the “hard to inactive” organism
- t = time
- C = PAA concentration

PAA Testing Result Analysis



PAA Design Criteria

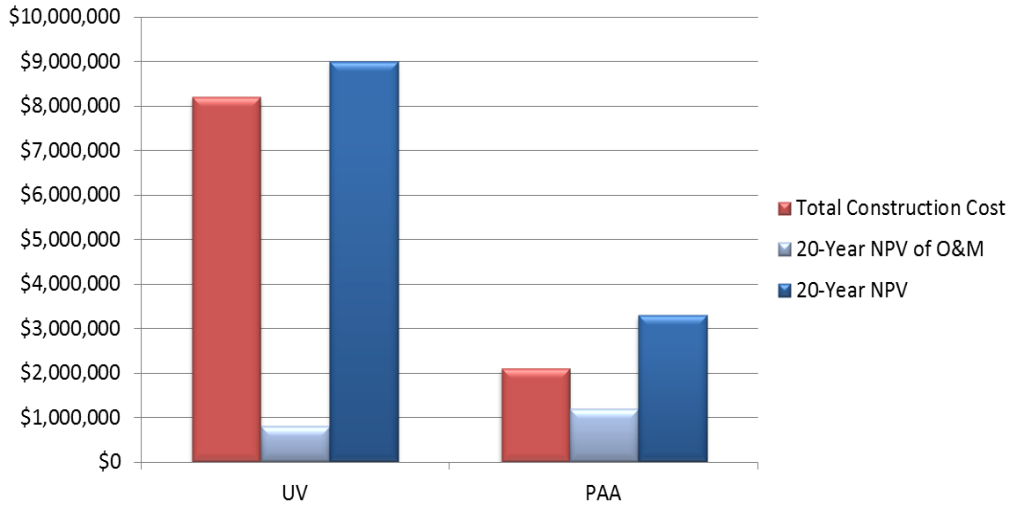
- Contact Basin v. PAA Dose v. PAA Residual
- Contact Basin Size
  - L:W Ratio of 72:1 or greater
  - H:W Ratio <1
  - Mixing Chamber and Flow Split
  - Effluent Flow Measurement
- Metering Pumps and Storage Tank Design
  - Similar to Sodium Hypochlorite Systems
- With the contact time and doses known, cost comparisons can be made between PAA and a variety of alternatives



PAA Costs and Lifecycle Analysis

Case Study 1

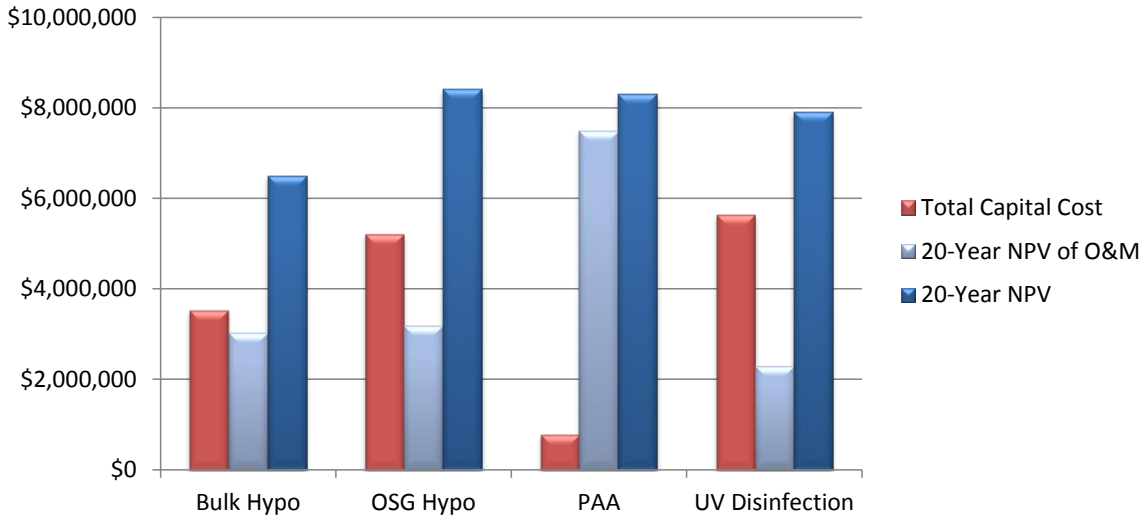
- Conventional Activated Sludge Facility
  - Tertiary Filters w/post aeration
  - Bulk Chlorination/Dechlorination
  - Violating DBP in Permit
  - Tight effluent hydraulics
- ADF (mgd) = 5.5/10
- PHF (mgd) = 25



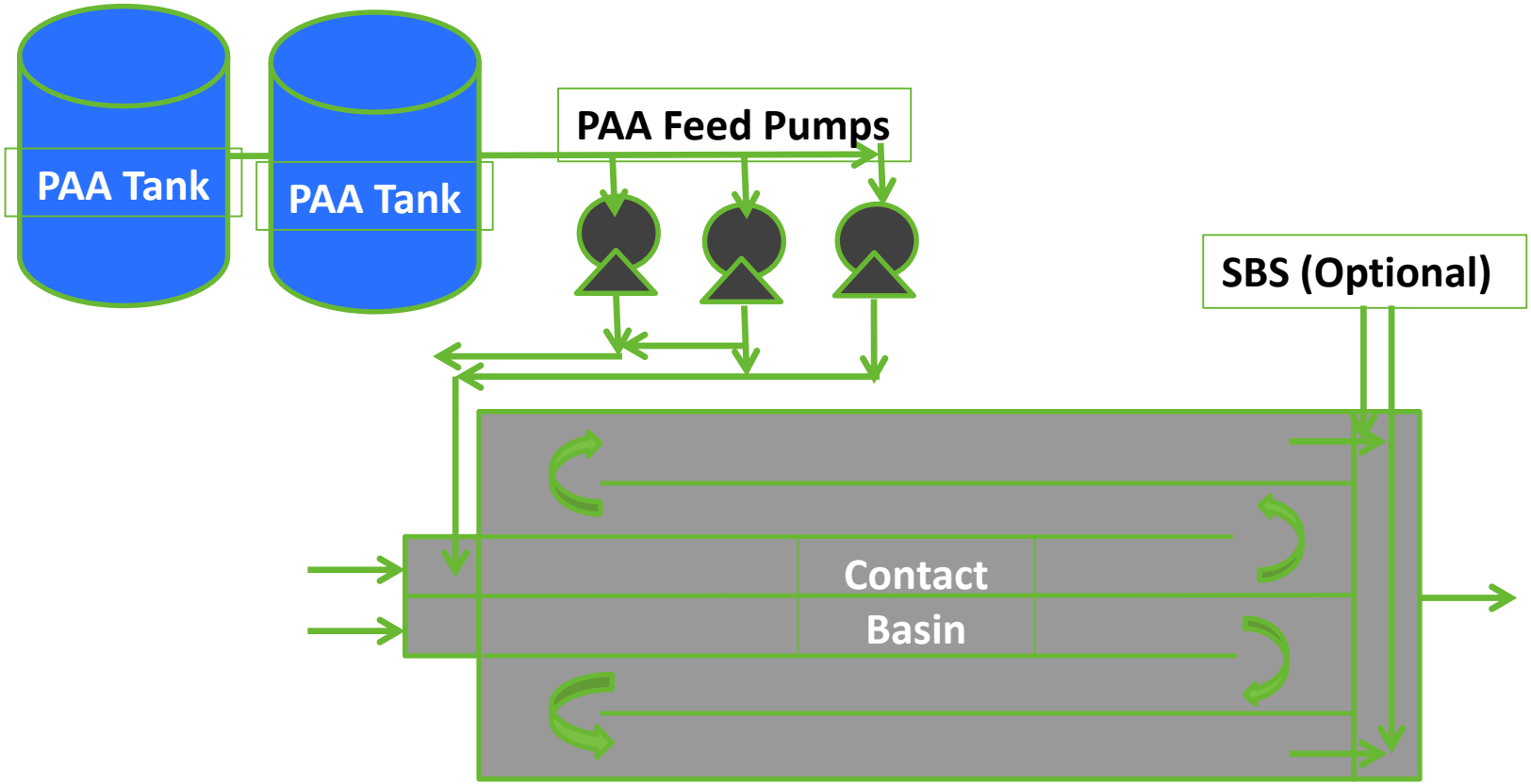
PAA Costs and Lifecycle Analysis

Case Study 2

- Conventional Activated Sludge Facility
  - Gaseous Chlorination/Dechlorination
  - Moving to new technology because of safety concerns
- ADF (mgd) = 25
- PHF (mgd) = 63



PAA Design Considerations



PAA Design Considerations - Mixing

- Chemical mixing or induction system similar to hypochlorite
- Mechanical or Static Mixing
- Dilution water for mixing?
- There is a possibility to install a system without
- Consider CFD modeling



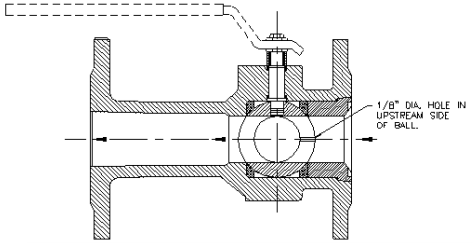
Mechanical mixer (xtolhydro.com)



Induction mixer (gasmastrrr.com)

PAA Design Considerations - Storage

- Chemical storage system
  - 14 days of storage at average conditions
  - Storage in delivery totes or bulk
  - Dual containment tanks with HDPE or passivated SS
  - Chemical venting/scrubbers – *Strongly recommend*
  - Does not need a heated space





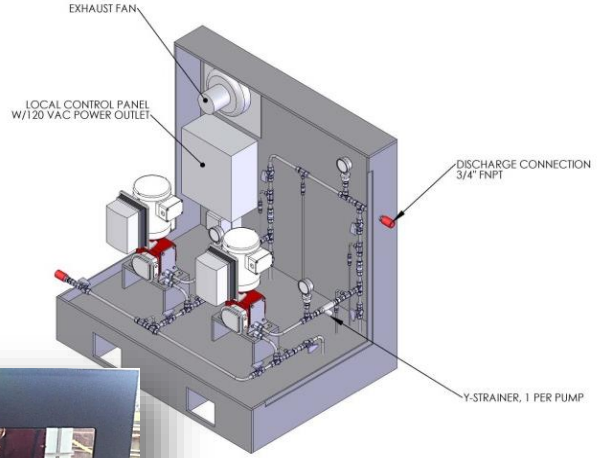


PAA Design Considerations - Storage

- Regulatory Limits
  - Coordinate RMP requirements specific to the PAA blend with the PAA Provider
- Spill Considerations
  - SARA Title III Section 302: Reportable Quantity (RQ): PAA 500 lb.
  - SARA Title III Section 312: Threshold Planning Quantity 10,000 lb.
  - CERCLA Designation & RQ: 5,000 lb. as Acetic Acid
- International Fire Code dictates an H occupancy if more than 25 gals are stored inside.
  - Fire walls, automatic sprinklers, exterior venting

PAA Design Considerations - Pumping

- Chemical feed and transfer pumps
  - Redundancy
  - Transfer pumps
    - Air Diaphragm or Centrifugal
  - Feed Pumps
    - Peristaltic or Gear Pumps
  - PRVs included in all segments of piping that can be isolated by valves





PAA Design Considerations - Materials

Chemical Compatibility/Materials of Construction			
Metals	Stainless Steel (type 304L and 316L only)	√	Passivation is required for continuous or repeated exposure
	Carbon Steel	Prohibited	Quick decomposition of 15% solutions
Polymers	Polyethylene (HDPE/LLDPE)	√ - 5 year life	Unpigmented only
	Teflon & Kalrez	√	
	PVC (white, low carbon type)	√ - short term exposure	Embrittlement can occur with continued use
	Polyethyl-ether-ketone (PEEK)	√ - short term exposure	Use at ambient temperature only Embrittlement can occur with continued use
	Santoprene	√	Use at ambient temperature only
	Tygon	√ - short term exposure	Use at ambient temperature only Embrittlement can occur with continued use
	Kynar	√	Unpigmented only
Silicon Rubber	Synthetic (white only)	√ - limited exposure	Use for 15% solutions only when no other alternative is available (hose gaskets) may require annual replacement
EPDM/Rubber **NOT** RECOMMENDED			
Teflon Tape and Locktite PST567 RECOMMENDED			

PAA Design Considerations - Analyzers

- Location is dependent upon control
- Similar units to chlorine analyzers with proprietary PAA analysis equations.
- CHEMetrics I-2020 PAA Single-Analyte Photometer Kit
- Tests field samples for PAA concentration





PAA Design Considerations – Process Control

- Dose-response is site-specific
- Various process control parameters (UVT, color, COD)
- Several process control approaches are now feasible:
  - Constant dose (residual confirmed by grab samples)
  - Constant residual monitoring (single feedback loop using online analyzer)
  - Residual control including minimum dose (double feedback loop using online analyzer)
  - Pilot demonstration work ongoing
  - **ACCURATE FLOW MEASUREMENT IS CRITICAL TO CONTROL DOSE**

Implementation

- PAA is a viable and cost-effective disinfection alternative for NPDES compliance with numerous ongoing projects
- Regulatory acceptance is still a hurdle

- Full Scale Operation
  - NW Langley WWTP in Metro Vancouver
  - St. Augustine WWTP in St. Augustine, FL
  - Steubenville WWTP in Steubenville, OH
  - Greenville WWTP in Greenville, KY
  - Whitehouse WWTP in Whitehouse, TN
  - Flagler Beach WWTP in Flagler Beach, FL
  - Three Rivers Regional WWTP in Longview, WA
  - Tri Cities WWTP in Clackmas, OR
- In Design
  - Stiles WWTP, Memphis, TN (PHF = 250 mgd)
  - Maxson WWTP, Memphis, TN (PHF = 170 mgd)
  - Dry Creek WWTP, MWS Nashville, TN (PHF = 63 mgd)
- Start up
  - Confidential client, Houston, TX (PHF = 48 mgd)

Implementation

- **Option 1** - Lease of chemical storage and feed equipment and purchase of chemical with the Owner or the PAA Provider operating and/or maintaining the system.
- **Option 2** - Chemical contract for disinfection paid for based on a dollar per million gallons of treated effluent with the PAA Provider providing a complete package for operation and maintenance.
- **Option 3** - Installation of the Owner's own equipment and with the Owner operating and maintaining this equipment with a straight chemical purchase contract.

Technology Advances

- UV & PAA as a combined disinfectant
  - Bench testing performed in Memphis, TN in fall of 2015
  - Low UVT effluent
  - Results show promise with UV followed by PAA
  - Redundancy via dual disinfection systems
  - Can minimize the size of each system to reduce capital costs
  - Further pilot testing is scheduled

Summary

- PAA is a viable disinfection alternative for NPDES compliance
- Site specific parameters identified through testing
- Proper basis of design considerations needed for accurate sizing of system for alternative evaluation
- Challenges Remain
  - Regulatory acceptance
  - Process control strategies for variable effluent quality
- Advances in technology are promising



QUESTIONS

Brian Hilts, P.E., CDM Smith
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Appendix O
Calculation Summaries

Building	Amin. Annex
Address	RVSA
Heating Fuel	Gas
Cooling System	DX

100000

Existing Building Envelope		
Wall Area	2075.2	sqft
Wall Conductivity	0.083333	u Value
Window Area	203.4	sqft
Window Conductivity	0.603736	u Value
Roof Area	1099.75	sqft
Roof Conductivity	0.05	u Value
Floor Area	1100	sqft
Volume	8800	cuft

Set Points		
Heating Set Point	72	deg F
Cooling Set Point	78	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.30	w/sqft
Occupancy	4	people
Occupant Sensible Load	150	btu/person
Infiltration	117.3	cfm
Exhaust	25	cfm
Equipment Density	0.00	therms
Building Equipment		
Heating System	199,000	Btuh
Heating Efficiency	83	%
Cooling System	18,000	Btuh
Cooling Efficiency	12.0	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Existing Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-8,593	-2,477	-3,766	-14,836
97.5	23	0	1	-6,839	-2,477	-2,998	-12,314
92.5	93	0	1	-5,085	-2,477	-2,229	-9,792
87.5	237	0	1	-3,332	-2,477	-1,460	-7,269
82.5	451	0	1	-1,578	-2,477	-692	-4,747
77.5	692	0	1	175	-2,477	77	-2,225
72.5	858	0	1	1,929	-2,477	845	0
67.5	753	1	0	1,578	-2,477	692	0
62.5	734	1	0	3,332	-2,477	1,460	2,315
57.5	670	1	0	5,085	-2,477	2,229	4,837
52.5	736	1	0	6,839	-2,477	2,998	7,359
47.5	708	1	0	8,593	-2,477	3,766	9,882
42.5	756	1	0	10,346	-2,477	4,535	12,404
37.5	704	1	0	12,100	-2,477	5,303	14,926
32.5	545	1	0	13,853	-2,477	6,072	17,448
27.5	340	1	0	15,607	-2,477	6,841	19,970
22.5	229	1	0	17,361	-2,477	7,609	22,493
17.5	134	1	0	19,114	-2,477	8,378	25,015
12.5	57	1	0	20,868	-2,477	9,146	27,537
7.5	22	1	0	22,621	-2,477	9,915	30,059
2.5	9	1	0	24,375	-2,477	10,684	32,581
-2.5	2	1	0	26,129	-2,477	11,452	35,104
-7.5	0	1	0	27,882	-2,477	12,221	37,626
Total	8,754	6,399	2,355				

Existing Heating System			Existing Cooling System			Existing Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-14,836	-17,454	1	0	100	0
0	0	0	-12,314	-314,685	26	0	100	0
0	0	0	-9,792	-958,540	80	0	100	0
0	0	0	-7,269	-1,722,833	144	0	100	0
0	0	0	-4,747	-1,946,325	162	0	100	0
0	0	0	-2,225	-1,283,043	107	0	100	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2,789	2,047,274	20	0	0	0	0	0	0
5,828	3,904,762	39	0	0	0	0	0	0
8,867	6,525,967	65	0	0	0	0	0	0
11,906	8,429,167	84	0	0	0	0	0	0
14,944	11,297,969	113	0	0	0	0	0	0
17,983	12,660,175	127	0	0	0	0	0	0
21,022	11,456,992	115	0	0	0	0	0	0
24,061	8,180,673	82	0	0	0	0	0	0
27,100	6,205,809	62	0	0	0	0	0	0
30,138	4,038,546	40	0	0	0	0	0	0
33,177	1,891,101	19	0	0	0	0	0	0
36,216	796,752	8	0	0	0	0	0	0
39,255	353,293	4	0	0	0	0	0	0
42,294	84,587	1	0	0	0	0	0	0
45,332	0	0	0	0	0	0	0	0
	77,873,068	779		-6,242,880	520		149,700	0

System Summary		
Existing	Usage	
System	kWh	therms
Heating	0	779
Cooling	520	0
Vent Cooling	0	0
Lighting	1,926	0
Equipment	2,889	0
Total	5,335	779
	6,264	767
	15%	-2%

Proposed Building Envelope		
Wall Area	2075.2	sqft
Wall Conductivity	0.083333	u Value
Window Area	203.4	sqft
Window Conductivity	0.603736	u Value
Roof Area	1099.75	sqft
Roof Conductivity	0.05	u Value
Floor Area	1100	sqft
Volume	8800	cuft

Set Points		
Heating Set Point	72	deg F
Cooling Set Point	78	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.30	w/sqft
Occupancy	4	people
Occupant Sensible Load	150	btu/person
Infiltration	117.3	cfm
Exhaust	25	cfm
Equipment Density	0.00	therms/sqft
Building Equipment		
Heating System	199,000	Btuh
Heating Efficiency	92	%
Cooling System	18,000	Btuh
Cooling Efficiency	12.0	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Proposed Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-8,593	-2,477	-3,766	-14,836
97.5	23	0	1	-6,839	-2,477	-2,998	-12,314
92.5	93	0	1	-5,085	-2,477	-2,229	-9,792
87.5	237	0	1	-3,332	-2,477	-1,460	-7,269
82.5	451	0	1	-1,578	-2,477	-692	-4,747
77.5	692	0	1	175	-2,477	77	-2,225
72.5	858	0	1	1,929	-2,477	845	0
67.5	753	1	0	1,578	-2,477	692	0
62.5	734	1	0	3,332	-2,477	1,460	2,315
57.5	670	1	0	5,085	-2,477	2,229	4,837
52.5	736	1	0	6,839	-2,477	2,998	7,359
47.5	708	1	0	8,593	-2,477	3,766	9,882
42.5	756	1	0	10,346	-2,477	4,535	12,404
37.5	704	1	0	12,100	-2,477	5,303	14,926
32.5	545	1	0	13,853	-2,477	6,072	17,448
27.5	340	1	0	15,607	-2,477	6,841	19,970
22.5	229	1	0	17,361	-2,477	7,609	22,493
17.5	134	1	0	19,114	-2,477	8,378	25,015
12.5	57	1	0	20,868	-2,477	9,146	27,537
7.5	22	1	0	22,621	-2,477	9,915	30,059
2.5	9	1	0	24,375	-2,477	10,684	32,581
-2.5	2	1	0	26,129	-2,477	11,452	35,104
-7.5	0	1	0	27,882	-2,477	12,221	37,626
Total	8,754	6,399	2,355				

Proposed Heating System			Proposed Cooling System			Proposed Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-14,836	-17,454	1	0	100	0
0	0	0	-12,314	-314,685	26	0	100	0
0	0	0	-9,792	-958,540	80	0	100	0
0	0	0	-7,269	-1,722,833	144	0	100	0
0	0	0	-4,747	-1,946,325	162	0	100	0
0	0	0	-2,225	-1,283,043	107	0	100	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2,516	1,846,998	18	0	0	0	0	0	0
5,258	3,522,774	35	0	0	0	0	0	0
7,999	5,887,557	59	0	0	0	0	0	0
10,741	7,604,574	76	0	0	0	0	0	0
13,482	10,192,733	102	0	0	0	0	0	0
16,224	11,421,680	114	0	0	0	0	0	0
18,966	10,336,199	103	0	0	0	0	0	0
21,707	7,380,390	74	0	0	0	0	0	0
24,449	5,598,719	56	0	0	0	0	0	0
27,190	3,643,471	36	0	0	0	0	0	0
29,932	1,706,102	17	0	0	0	0	0	0
32,673	718,809	7	0	0	0	0	0	0
35,415	318,732	3	0	0	0	0	0	0
38,156	76,312	1	0	0	0	0	0	0
40,898	0	0	0	0	0	0	0	0
	70,255,050	703		-6,242,880	520		149,700	0

System Summary		
Proposed	Usage	
System	kWh	therms
Heating	0	703
Cooling	520	0
Vent Cooling	0	0
Lighting	1,926	0
Equipment	2,889	0
Total	5,335	703

Proposed Savings		
Estimated	kWh	therms
Savings	0	76

Notes:
1. Negative Numbers indicate heat needs to be removed from the space
2. Heating and Cooling columns determine if the building should be heating or cooling
3. Vent Power is the ventilation fan motor horse power.

Newark, NJ		Day Time Hours		
Deg F	Hours	01 to 08	09 to 16	17 to 00
102.5	1		1	0
97.5	23	0	19	4
92.5	93	1	68	24
87.5	237	5	160	72
82.5	451	41	252	158
77.5	692	163	274	255
72.5	858	306	254	298
67.5	753	285	227	241
62.5	734	258	225	251
57.5	670	231	214	225
52.5	736	259	225	252
47.5	708	245	225	238
42.5	756	266	230	260
37.5	704	273	198	233
32.5	545	229	143	173
27.5	340	139	93	108
22.5	229	104	55	70
17.5	134	69	25	40
12.5	57	34	9	14
7.5	22	13	4	5
2.5	9	5	2	2
-2.5	2	2	0	0
-7.5	0	0	0	0
	8754			

This page is for ease of chaning weather data. If building scheduling is a factor the bin hours by day time have been included for reference.

Existing Envelope						
	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	11	5				
Width (ft)	154	3				
Count	1	11	0	0	0	11
R-value	12	1.5	3	1.5	1	
U-value	0.083333	0.6666667	0.3333333	0.6666667	1	0.666666667
Area	1694	165	0	0	0	165
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	4	3.2				
Width (ft)	95.3	3		0	0	
Count	1	4	0	0	0	4
R-value	12	3	3	1	1	
U-value	0.083333	0.3333333	0.3333333	1	1	0.333333333
Area	381.2	38.4	0	0	0	38.4
Total Wall Area (sqft)		**2075.2**				
Average U-value		**0.0833333**				
	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	41.5	0	0	0	0	
Width (ft)	26.5	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	1099.75	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)		0	0	0	0	
Width (ft)		0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0
Total Roof Area (sqft)		**1099.75**				
Average U-value		**0.05**				
Total Window Area (sqft)		**203.4**				
Average U-value		**0.6037365**				

Proposed Envelope						
	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	11	5	0	0	0	
Width (ft)	154	3	0	0	0	
Count	1	11	0	0	0	11
R-value	12	1.5	3	1.5	1	
U-value	0.083333333	0.666666667	0.333333333	0.666666667	1	0.666666667
Area	1694	165	0	0	0	165
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	4	3.2	0	0	0	
Width (ft)	95.3	3	0	0	0	
Count	1	4	0	0	0	4
R-value	12	3	3	1	1	
U-value	0.083333333	0.333333333	0.333333333	1	1	0.333333333
Area	381.2	38.4	0	0	0	38.4
Total Wall Area (sqft)		**2075.2**				
Average U-value		**0.083333333**				
	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	41.5	0	0	0	0	
Width (ft)	26.5	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	1099.75	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	0	0	0	0	0	
Width (ft)	0	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0
Total Roof Area (sqft)		**1099.75**				
Average U-value		**0.05**				
Total Window Area (sqft)		**203.4**				
Average U-value		**0.60373648**				

Administration Building - Condensing Boiler

Building	Amin.	
Address	RVSA	
Heating Fuel	Gas	100000
Cooling System	DX	

Existing Building Envelope		
Wall Area	6156	sqft
Wall Conductivity	0.083333	u Value
Window Area	612	sqft
Window Conductivity	0.578431	u Value
Roof Area	11400	sqft
Roof Conductivity	0.05	u Value
Floor Area	11400	sqft
Volume	91200	cuft

Set Points		
Heating Set Point	72	deg F
Cooling Set Point	78	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.30	w/sqft
Occupancy	42	people
Occupant Sensible Load	150	btu/person
Infiltration	2,128.0	cfm
Exhaust	100	cfm
Equipment Density	0.02	therms
Building Equipment		
Heating System	400,000	Btuh
Heating Efficiency	75	%
Cooling System	120,000	Btuh
Cooling Efficiency	12.0	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Existing Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-35,207	-27,254	-58,953	-121,413
97.5	23	0	1	-28,022	-27,254	-46,922	-102,197
92.5	93	0	1	-20,837	-27,254	-34,890	-82,981
87.5	237	0	1	-13,652	-27,254	-22,859	-63,765
82.5	451	0	1	-6,467	-27,254	-10,828	-44,549
77.5	692	0	1	719	-27,254	1,203	-25,332
72.5	858	0	1	7,904	-27,254	13,234	-6,116
67.5	753	1	0	6,467	-27,254	10,828	0
62.5	734	1	0	13,652	-27,254	22,859	9,257
57.5	670	1	0	20,837	-27,254	34,890	28,473
52.5	736	1	0	28,022	-27,254	46,922	47,689
47.5	708	1	0	35,207	-27,254	58,953	66,905
42.5	756	1	0	42,392	-27,254	70,984	86,121
37.5	704	1	0	49,577	-27,254	83,015	105,338
32.5	545	1	0	56,762	-27,254	95,046	124,554
27.5	340	1	0	63,947	-27,254	107,078	143,770
22.5	229	1	0	71,132	-27,254	119,109	162,986
17.5	134	1	0	78,317	-27,254	131,140	182,202
12.5	57	1	0	85,502	-27,254	143,171	201,419
7.5	22	1	0	92,687	-27,254	155,202	220,635
2.5	9	1	0	99,872	-27,254	167,234	239,851
-2.5	2	1	0	107,057	-27,254	179,265	259,067
-7.5	0	1	0	114,242	-27,254	191,296	278,283
Total	8,754	6,399	2,355				

Existing Heating System			Existing Cooling System			Existing Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-120,000	-141,176	12	0	100	0
0	0	0	-102,197	-2,611,708	218	0	100	0
0	0	0	-82,981	-8,123,411	677	0	100	0
0	0	0	-63,765	-15,112,277	1,259	0	100	0
0	0	0	-44,549	-18,264,959	1,522	0	100	0
0	0	0	-25,332	-14,608,397	1,217	0	100	0
0	0	0	-6,116	-4,036,745	336	0	100	0
0	0	0	0	0	0	0	0	0
12,342	9,059,204	91	0	0	0	0	0	0
37,964	25,435,773	254	0	0	0	0	0	0
63,585	46,798,884	468	0	0	0	0	0	0
89,207	63,158,584	632	0	0	0	0	0	0
114,829	86,810,452	868	0	0	0	0	0	0
140,450	98,876,969	989	0	0	0	0	0	0
166,072	90,509,153	905	0	0	0	0	0	0
191,693	65,175,770	652	0	0	0	0	0	0
217,315	49,765,144	498	0	0	0	0	0	0
242,937	32,553,510	326	0	0	0	0	0	0
268,558	15,307,820	153	0	0	0	0	0	0
294,180	6,471,956	65	0	0	0	0	0	0
319,801	2,878,213	29	0	0	0	0	0	0
345,423	690,846	7	0	0	0	0	0	0
371,045	0	0	0	0	0	0	0	0
	593,492,277	5,935		-62,898,673	5,242		235,500	0

System Summary		
Existing	Usage	
System	kWh	therms
Heating	0	5,935
Cooling	5,242	0
Vent Cooling	0	0
Lighting	19,959	0
Equipment	29,939	131
Total	55,139	6,066
	57,000	6250.7
	3%	3%

Proposed Building Envelope		
Wall Area	6156	sqft
Wall Conductivity	0.083333	u Value
Window Area	612	sqft
Window Conductivity	0.578431	u Value
Roof Area	11400	sqft
Roof Conductivity	0.05	u Value
Floor Area	11400	sqft
Volume	91200	cuft

Set Points		
Heating Set Point	72	deg F
Cooling Set Point	78	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.30	w/sqft
Occupancy	42	people
Occupant Sensible Load	150	btu/person
Infiltration	2,128.0	cfm
Exhaust	100	cfm
Equipment Density	0.02	therms/sqft
Building Equipment		
Heating System	400,000	Btuh
Heating Efficiency	92	%
Cooling System	120,000	Btuh
Cooling Efficiency	12.0	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Proposed Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-35,207	-27,254	-58,953	-121,413
97.5	23	0	1	-28,022	-27,254	-46,922	-102,197
92.5	93	0	1	-20,837	-27,254	-34,890	-82,981
87.5	237	0	1	-13,652	-27,254	-22,859	-63,765
82.5	451	0	1	-6,467	-27,254	-10,828	-44,549
77.5	692	0	1	719	-27,254	1,203	-25,332
72.5	858	0	1	7,904	-27,254	13,234	-6,116
67.5	753	1	0	6,467	-27,254	10,828	0
62.5	734	1	0	13,652	-27,254	22,859	9,257
57.5	670	1	0	20,837	-27,254	34,890	28,473
52.5	736	1	0	28,022	-27,254	46,922	47,689
47.5	708	1	0	35,207	-27,254	58,953	66,905
42.5	756	1	0	42,392	-27,254	70,984	86,121
37.5	704	1	0	49,577	-27,254	83,015	105,338
32.5	545	1	0	56,762	-27,254	95,046	124,554
27.5	340	1	0	63,947	-27,254	107,078	143,770
22.5	229	1	0	71,132	-27,254	119,109	162,986
17.5	134	1	0	78,317	-27,254	131,140	182,202
12.5	57	1	0	85,502	-27,254	143,171	201,419
7.5	22	1	0	92,687	-27,254	155,202	220,635
2.5	9	1	0	99,872	-27,254	167,234	239,851
-2.5	2	1	0	107,057	-27,254	179,265	259,067
-7.5	0	1	0	114,242	-27,254	191,296	278,283
Total	8,754	6,399	2,355				

Proposed Heating System			Proposed Cooling System			Proposed Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-120,000	-141,176	12	0	100	0
0	0	0	-102,197	-2,611,708	218	0	100	0
0	0	0	-82,981	-8,123,411	677	0	100	0
0	0	0	-63,765	-15,112,277	1,259	0	100	0
0	0	0	-44,549	-18,264,959	1,522	0	100	0
0	0	0	-25,332	-14,608,397	1,217	0	100	0
0	0	0	-6,116	-4,036,745	336	0	100	0
0	0	0	0	0	0	0	0	0
10,062	7,385,221	74	0	0	0	0	0	0
30,949	20,735,684	207	0	0	0	0	0	0
51,836	38,151,264	382	0	0	0	0	0	0
72,723	51,487,976	515	0	0	0	0	0	0
93,610	70,769,390	708	0	0	0	0	0	0
114,497	80,606,225	806	0	0	0	0	0	0
135,385	73,784,635	738	0	0	0	0	0	0
156,272	53,132,421	531	0	0	0	0	0	0
177,159	40,569,411	406	0	0	0	0	0	0
198,046	26,538,187	265	0	0	0	0	0	0
218,933	12,479,201	125	0	0	0	0	0	0
239,821	5,276,051	53	0	0	0	0	0	0
260,708	2,346,369	23	0	0	0	0	0	0
281,595	563,190	6	0	0	0	0	0	0
302,482	0	0	0	0	0	0	0	0
	483,825,226	4,838		-62,898,673	5,242		235,500	0

System Summary		
Proposed	Usage	
System	kWh	therms
Heating	0	4,838
Cooling	5,242	0
Vent Cooling	0	0
Lighting	19,959	0
Equipment	29,939	131
Total	55,139	4,970

Proposed Savings		
Estimated	kWh	therms
Savings	0	1,097

Notes:
1. Negative Numbers indicate heat needs to be removed from the space
2. Heating and Cooling columns determine if the building should be heating or cooling
3. Vent Power is the ventilation fan motor horse power.

Newark, NJ		Day Time Hours		
Deg F	Hours	01 to 08	09 to 16	17 to 00
102.5	1		1	0
97.5	23	0	19	4
92.5	93	1	68	24
87.5	237	5	160	72
82.5	451	41	252	158
77.5	692	163	274	255
72.5	858	306	254	298
67.5	753	285	227	241
62.5	734	258	225	251
57.5	670	231	214	225
52.5	736	259	225	252
47.5	708	245	225	238
42.5	756	266	230	260
37.5	704	273	198	233
32.5	545	229	143	173
27.5	340	139	93	108
22.5	229	104	55	70
17.5	134	69	25	40
12.5	57	34	9	14
7.5	22	13	4	5
2.5	9	5	2	2
-2.5	2	2	0	0
-7.5	0	0	0	0
	8754			

This page is for ease of chaning weather data. If building scheduling is a factor the bin hours by day time have been included for reference.

Existing Envelope						
	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	11	5				
Width (ft)	410.4	3				
Count	1	30	0	0	0	30
R-value	12	1.5	3	1.5	1	
U-value	0.083333	0.6666667	0.3333333	0.6666667	1	0.666666667
Area	4514.4	450	0	0	0	450
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	4	3				
Width (ft)	410.4	3		0	0	
Count	1	18	0	0	0	18
R-value	12	3	3	1	1	
U-value	0.083333	0.3333333	0.3333333	1	1	0.333333333
Area	1641.6	162	0	0	0	162
Total Wall Area (sqft)		**6156**				
Average U-value		**0.0833333**				
	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	182.4	0	0	0	0	
Width (ft)	62.5	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	11400	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)		0	0	0	0	
Width (ft)		0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0
Total Roof Area (sqft)		**11400**				
Average U-value		**0.05**				
Total Window Area (sqft)		**612**				
Average U-value		**0.5784314**				

Proposed Envelope						
	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	11	5	0	0	0	
Width (ft)	410.4	3	0	0	0	
Count	1	30	0	0	0	30
R-value	12	1.5	3	1.5	1	
U-value	0.083333333	0.666666667	0.333333333	0.666666667	1	0.666666667
Area	4514.4	450	0	0	0	450
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	4	3	0	0	0	
Width (ft)	410.4	3	0	0	0	
Count	1	18	0	0	0	18
R-value	12	3	3	1	1	
U-value	0.083333333	0.333333333	0.333333333	1	1	0.333333333
Area	1641.6	162	0	0	0	162
Total Wall Area (sqft)		**6156**				
Average U-value		**0.083333333**				
	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	182.4	0	0	0	0	
Width (ft)	62.5	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	11400	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	0	0	0	0	0	
Width (ft)	0	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0
Total Roof Area (sqft)		**11400**				
Average U-value		**0.05**				
Total Window Area (sqft)		**612**				
Average U-value		**0.578431373**				

Building	Employee Facilities	
Address	RVSA	
Heating Fuel	Gas	100000
Cooling System	DX	

Existing Building Envelope		
Wall Area	3063.2	sqft
Wall Conductivity	0.083333	u Value
Window Area	400	sqft
Window Conductivity	0.573333	u Value
Roof Area	2608.2	sqft
Roof Conductivity	0.05	u Value
Floor Area	4530	sqft
Volume	36240	cuft

Set Points		
Heating Set Point	72	deg F
Cooling Set Point	78	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.10	w/sqft
Occupancy	16	people
Occupant Sensible Load	150	btu/person
Infiltration	302.0	cfm
Exhaust	2750	cfm
Equipment Density	0.02	therms
Building Equipment		
Heating System	490,000	Btuh
Heating Efficiency	80	%
Cooling System	48,000	Btuh
Cooling Efficiency	10.0	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Existing Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-15,068	-8,538	-80,756	-104,362
97.5	23	0	1	-11,993	-8,538	-64,275	-84,806
92.5	93	0	1	-8,918	-8,538	-47,794	-65,250
87.5	237	0	1	-5,843	-8,538	-31,314	-45,694
82.5	451	0	1	-2,768	-8,538	-14,833	-26,139
77.5	692	0	1	308	-8,538	1,648	-6,583
72.5	858	0	1	3,383	-8,538	18,129	0
67.5	753	1	0	2,768	-8,538	14,833	9,062
62.5	734	1	0	5,843	-8,538	31,314	28,618
57.5	670	1	0	8,918	-8,538	47,794	48,174
52.5	736	1	0	11,993	-8,538	64,275	67,730
47.5	708	1	0	15,068	-8,538	80,756	87,285
42.5	756	1	0	18,143	-8,538	97,237	106,841
37.5	704	1	0	21,218	-8,538	113,718	126,397
32.5	545	1	0	24,293	-8,538	130,198	145,953
27.5	340	1	0	27,368	-8,538	146,679	165,509
22.5	229	1	0	30,443	-8,538	163,160	185,065
17.5	134	1	0	33,518	-8,538	179,641	204,620
12.5	57	1	0	36,593	-8,538	196,122	224,176
7.5	22	1	0	39,668	-8,538	212,602	243,732
2.5	9	1	0	42,743	-8,538	229,083	263,288
-2.5	2	1	0	45,818	-8,538	245,564	282,844
-7.5	0	1	0	48,893	-8,538	262,045	302,400
Total	8,754	6,399	2,355				

Existing Heating System			Existing Cooling System			Existing Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-57,600	-67,765	6	0	100	0
0	0	0	-57,600	-1,472,000	123	0	100	0
0	0	0	-57,600	-5,638,737	470	0	100	0
0	0	0	-54,833	-12,995,482	1,083	0	100	0
0	0	0	-31,366	-12,860,158	1,072	0	100	0
0	0	0	-7,899	-4,555,216	380	0	100	0
0	0	0	0	0	0	0	0	0
11,327	8,529,606	85	0	0	0	0	0	0
35,772	26,256,876	263	0	0	0	0	0	0
60,217	40,345,472	403	0	0	0	0	0	0
84,662	62,311,184	623	0	0	0	0	0	0
109,107	77,247,577	772	0	0	0	0	0	0
133,552	100,964,979	1,010	0	0	0	0	0	0
157,996	111,229,446	1,112	0	0	0	0	0	0
182,441	99,430,446	994	0	0	0	0	0	0
206,886	70,341,239	703	0	0	0	0	0	0
231,331	52,974,755	530	0	0	0	0	0	0
255,776	34,273,933	343	0	0	0	0	0	0
280,220	15,972,565	160	0	0	0	0	0	0
304,665	6,702,635	67	0	0	0	0	0	0
329,110	2,961,991	30	0	0	0	0	0	0
353,555	707,110	7	0	0	0	0	0	0
378,000	0	0	0	0	0	0	0	0
	710,249,815	7,102		-37,589,357	3,132		149,700	0

System Summary		
Existing	Usage	
System	kWh	therms
Heating	0	7,102
Cooling	3,132	0
Vent Cooling	0	0
Lighting	7,931	0
Equipment	3,966	131
Total	15,029	7,234
	6,264	7046
	-140%	-3%

Proposed Building Envelope		
Wall Area	3063.2	sqft
Wall Conductivity	0.083333	u Value
Window Area	400	sqft
Window Conductivity	0.573333	u Value
Roof Area	2608.2	sqft
Roof Conductivity	0.05	u Value
Floor Area	4530	sqft
Volume	36240	cuft

Set Points		
Heating Set Point	72	deg F
Cooling Set Point	78	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.10	w/sqft
Occupancy	16	people
Occupant Sensible Load	150	btu/person
Infiltration	302.0	cfm
Exhaust	2750	cfm
Equipment Density	0.02	therms/sqft
Building Equipment		
Heating System	490,000	Btuh
Heating Efficiency	92	%
Cooling System	48,000	Btuh
Cooling Efficiency	10.0	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Proposed Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-15,068	-8,538	-80,756	-104,362
97.5	23	0	1	-11,993	-8,538	-64,275	-84,806
92.5	93	0	1	-8,918	-8,538	-47,794	-65,250
87.5	237	0	1	-5,843	-8,538	-31,314	-45,694
82.5	451	0	1	-2,768	-8,538	-14,833	-26,139
77.5	692	0	1	308	-8,538	1,648	-6,583
72.5	858	0	1	3,383	-8,538	18,129	0
67.5	753	1	0	2,768	-8,538	14,833	9,062
62.5	734	1	0	5,843	-8,538	31,314	28,618
57.5	670	1	0	8,918	-8,538	47,794	48,174
52.5	736	1	0	11,993	-8,538	64,275	67,730
47.5	708	1	0	15,068	-8,538	80,756	87,285
42.5	756	1	0	18,143	-8,538	97,237	106,841
37.5	704	1	0	21,218	-8,538	113,718	126,397
32.5	545	1	0	24,293	-8,538	130,198	145,953
27.5	340	1	0	27,368	-8,538	146,679	165,509
22.5	229	1	0	30,443	-8,538	163,160	185,065
17.5	134	1	0	33,518	-8,538	179,641	204,620
12.5	57	1	0	36,593	-8,538	196,122	224,176
7.5	22	1	0	39,668	-8,538	212,602	243,732
2.5	9	1	0	42,743	-8,538	229,083	263,288
-2.5	2	1	0	45,818	-8,538	245,564	282,844
-7.5	0	1	0	48,893	-8,538	262,045	302,400
Total	8,754	6,399	2,355				

Proposed Heating System			Proposed Cooling System			Proposed Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-57,600	-67,765	6	0	100	0
0	0	0	-57,600	-1,472,000	123	0	100	0
0	0	0	-57,600	-5,638,737	470	0	100	0
0	0	0	-54,833	-12,995,482	1,083	0	100	0
0	0	0	-31,366	-12,860,158	1,072	0	100	0
0	0	0	-7,899	-4,555,216	380	0	100	0
0	0	0	0	0	0	0	0	0
9,850	7,417,048	74	0	0	0	0	0	0
31,106	22,832,066	228	0	0	0	0	0	0
52,363	35,083,019	351	0	0	0	0	0	0
73,619	54,183,638	542	0	0	0	0	0	0
94,875	67,171,806	672	0	0	0	0	0	0
116,132	87,795,634	878	0	0	0	0	0	0
137,388	96,721,258	967	0	0	0	0	0	0
158,645	86,461,257	865	0	0	0	0	0	0
179,901	61,166,295	612	0	0	0	0	0	0
201,157	46,065,005	461	0	0	0	0	0	0
222,414	29,803,420	298	0	0	0	0	0	0
243,670	13,889,187	139	0	0	0	0	0	0
264,926	5,828,379	58	0	0	0	0	0	0
286,183	2,575,644	26	0	0	0	0	0	0
307,439	614,878	6	0	0	0	0	0	0
328,695	0	0	0	0	0	0	0	0
	617,608,534	6,176		-37,589,357	3,132		149,700	0

System Summary		
Proposed	Usage	
System	kWh	therms
Heating	0	6,176
Cooling	3,132	0
Vent Cooling	0	0
Lighting	7,931	0
Equipment	3,966	131
Total	15,029	6,307

Proposed Savings		
Estimated	kWh	therms
Savings	0	926

Notes:

1. Negative Numbers indicate heat needs to be removed from the space
2. Heating and Cooling columns determine if the building should be heating or cooling
3. Vent Power is the ventilation fan motor horse power.

Newark, NJ		Day Time Hours		
Deg F	Hours	01 to 08	09 to 16	17 to 00
102.5	1		1	0
97.5	23	0	19	4
92.5	93	1	68	24
87.5	237	5	160	72
82.5	451	41	252	158
77.5	692	163	274	255
72.5	858	306	254	298
67.5	753	285	227	241
62.5	734	258	225	251
57.5	670	231	214	225
52.5	736	259	225	252
47.5	708	245	225	238
42.5	756	266	230	260
37.5	704	273	198	233
32.5	545	229	143	173
27.5	340	139	93	108
22.5	229	104	55	70
17.5	134	69	25	40
12.5	57	34	9	14
7.5	22	13	4	5
2.5	9	5	2	2
-2.5	2	2	0	0
-7.5	0	0	0	0
	8754			

This page is for ease of chaning weather data. If building scheduling is a factor the bin hours by day time have been included for reference.

Existing Envelope

	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	11	2				
Width (ft)	227.5	4				
Count	1	36	0	0	0	36
R-value	12	1.5	3	1.5	1	
U-value	0.083333	0.6666667	0.3333333	0.6666667	1	0.666666667
Area	2502.5	288	0	0	0	288
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	9	7	7			
Width (ft)	62.3	8	3	0	0	
Count	1	2	0	0	0	2
R-value	12	3	1	1	1	
U-value	0.083333	0.3333333	1	1	1	0.333333333
Area	560.7	112	0	0	0	112

Total Wall Area (sqft)	**3063.2**
Average U-value	**0.0833333**

	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	63	0	0	0	0	
Width (ft)	41.4	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	2608.2	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)		0	0	0	0	
Width (ft)		0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0

Total Roof Area (sqft)	**2608.2**
Average U-value	**0.05**
Total Window Area (sqft)	**400**
Average U-value	**0.5733333**

Proposed Envelope

	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	11	2	0	0	0	
Width (ft)	227.5	4	0	0	0	
Count	1	36	0	0	0	36
R-value	12	1.5	3	1.5	1	
U-value	0.083333333	0.666666667	0.333333333	0.666666667	1	0.666666667
Area	2502.5	288	0	0	0	288
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	9	7	7	0	0	
Width (ft)	62.3	8	3	0	0	
Count	1	2	0	0	0	2
R-value	12	3	1	1	1	
U-value	0.083333333	0.333333333	1	1	1	0.333333333
Area	560.7	112	0	0	0	112

Total Wall Area (sqft)	**3063.2**
Average U-value	**0.083333333**

	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	63	0	0	0	0	
Width (ft)	41.4	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	2608.2	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	0	0	0	0	0	
Width (ft)	0	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0

Total Roof Area (sqft)	**2608.2**
Average U-value	**0.05**
Total Window Area (sqft)	**400**
Average U-value	**0.573333333**

Building	Sludge Dewatering	
Address	RVSA	
Heating Fuel	Gas	100000
Cooling System	DX	

Existing Building Envelope		
Wall Area	11718.4	sqft
Wall Conductivity	0.083333333	u Value
Window Area	72	sqft
Window Conductivity	0.666666667	u Value
Roof Area	15605.04	sqft
Roof Conductivity	0.05	u Value
Floor Area	15600	sqft
Volume	249600	cuft

Set Points		
Heating Set Point	62	deg F
Cooling Set Point	85	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.20	w/sqft
Occupancy	2	people
Occupant Sensible Load	150	btu/person
Infiltration	2,912.0	cfm
Exhaust	3000	cfm
Equipment Density	0.02	therms
Building Equipment		
Heating System	3,295,000	Btuh
Heating Efficiency	75	%
Cooling System	120,000	Btuh
Cooling Efficiency	12.0	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Existing Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-31,584	-23,097	-111,737	-166,418
97.5	23	0	1	-22,560	-23,097	-79,812	-125,469
92.5	93	0	1	-13,536	-23,097	-47,887	-84,520
87.5	237	0	1	-4,512	-23,097	-15,962	-43,571
82.5	451	0	1	4,512	-23,097	15,962	-2,623
77.5	692	0	1	13,536	-23,097	47,887	0
72.5	858	0	1	22,560	-23,097	79,812	0
67.5	753	0	1	31,584	-23,097	111,737	0
62.5	734	0	1	40,608	-23,097	143,662	0
57.5	670	1	0	8,122	-23,097	28,732	13,757
52.5	736	1	0	17,145	-23,097	60,657	54,705
47.5	708	1	0	26,169	-23,097	92,582	95,654
42.5	756	1	0	35,193	-23,097	124,507	136,603
37.5	704	1	0	44,217	-23,097	156,432	177,552
32.5	545	1	0	53,241	-23,097	188,356	218,500
27.5	340	1	0	62,265	-23,097	220,281	259,449
22.5	229	1	0	71,289	-23,097	252,206	300,398
17.5	134	1	0	80,313	-23,097	284,131	341,347
12.5	57	1	0	89,337	-23,097	316,056	382,295
7.5	22	1	0	98,361	-23,097	347,980	423,244
2.5	9	1	0	107,385	-23,097	379,905	464,193
-2.5	2	1	0	116,409	-23,097	411,830	505,141
-7.5	0	1	0	125,433	-23,097	443,755	546,090
Total	8,754	4,912	3,842				

Existing Heating System			Existing Cooling System			Existing Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-120,000	-141,176	12	0	100	0
0	0	0	-120,000	-3,066,667	256	0	100	0
0	0	0	-84,520	-8,274,084	690	0	100	0
0	0	0	-43,571	-10,326,442	861	0	100	0
0	0	0	-2,623	-1,075,330	90	0	100	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
18,342	12,289,349	123	0	0	0	0	0	0
72,941	53,684,292	537	0	0	0	0	0	0
127,539	90,297,553	903	0	0	0	0	0	0
182,137	137,695,737	1,377	0	0	0	0	0	0
236,736	166,661,807	1,667	0	0	0	0	0	0
291,334	158,776,934	1,588	0	0	0	0	0	0
345,932	117,616,923	1,176	0	0	0	0	0	0
400,530	91,721,468	917	0	0	0	0	0	0
455,129	60,987,250	610	0	0	0	0	0	0
509,727	29,054,441	291	0	0	0	0	0	0
564,325	12,415,157	124	0	0	0	0	0	0
618,924	5,570,313	56	0	0	0	0	0	0
673,522	1,347,044	13	0	0	0	0	0	0
728,120	0	0	0	0	0	0	0	0
	938,118,267	9,381		-22,883,699	1,907		80,500	0

System Summary		
Existing	Usage	
System	kWh	therms
Heating	0	9,381
Cooling	1,907	0
Vent Cooling	0	0
Lighting	27,312	0
Equipment	27,312	131
Total	56,532	9,512
	57,000	9559
	1%	0%

Proposed Building Envelope		
Wall Area	11718.4	sqft
Wall Conductivity	0.083333333	u Value
Window Area	72	sqft
Window Conductivity	0.666666667	u Value
Roof Area	15605.04	sqft
Roof Conductivity	0.05	u Value
Floor Area	15600	sqft
Volume	249600	cuft

Set Points		
Heating Set Point	62	deg F
Cooling Set Point	85	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.20	w/sqft
Occupancy	2	people
Occupant Sensible Load	150	btu/person
Infiltration	2,912.0	cfm
Exhaust	3000	cfm
Equipment Density	0.02	therms/sqft
Building Equipment		
Heating System	3,295,000	Btuh
Heating Efficiency	92	%
Cooling System	120,000	Btuh
Cooling Efficiency	12.0	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Proposed Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-31,584	-23,097	-111,737	-166,418
97.5	23	0	1	-22,560	-23,097	-79,812	-125,469
92.5	93	0	1	-13,536	-23,097	-47,887	-84,520
87.5	237	0	1	-4,512	-23,097	-15,962	-43,571
82.5	451	0	1	4,512	-23,097	15,962	-2,623
77.5	692	0	1	13,536	-23,097	47,887	0
72.5	858	0	1	22,560	-23,097	79,812	0
67.5	753	0	1	31,584	-23,097	111,737	0
62.5	734	0	1	40,608	-23,097	143,662	0
57.5	670	1	0	8,122	-23,097	28,732	13,757
52.5	736	1	0	17,145	-23,097	60,657	54,705
47.5	708	1	0	26,169	-23,097	92,582	95,654
42.5	756	1	0	35,193	-23,097	124,507	136,603
37.5	704	1	0	44,217	-23,097	156,432	177,552
32.5	545	1	0	53,241	-23,097	188,356	218,500
27.5	340	1	0	62,265	-23,097	220,281	259,449
22.5	229	1	0	71,289	-23,097	252,206	300,398
17.5	134	1	0	80,313	-23,097	284,131	341,347
12.5	57	1	0	89,337	-23,097	316,056	382,295
7.5	22	1	0	98,361	-23,097	347,980	423,244
2.5	9	1	0	107,385	-23,097	379,905	464,193
-2.5	2	1	0	116,409	-23,097	411,830	505,141
-7.5	0	1	0	125,433	-23,097	443,755	546,090
Total	8,754	4,912	3,842				

Proposed Heating System			Proposed Cooling System			Proposed Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-120,000	-141,176	12	0	100	0
0	0	0	-120,000	-3,066,667	256	0	100	0
0	0	0	-84,520	-8,274,084	690	0	100	0
0	0	0	-43,571	-10,326,442	861	0	100	0
0	0	0	-2,623	-1,075,330	90	0	100	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
14,953	10,018,491	100	0	0	0	0	0	0
59,462	43,764,369	438	0	0	0	0	0	0
103,972	73,612,135	736	0	0	0	0	0	0
148,481	112,251,960	1,123	0	0	0	0	0	0
192,991	135,865,603	1,359	0	0	0	0	0	0
237,500	129,437,718	1,294	0	0	0	0	0	0
282,010	95,883,361	959	0	0	0	0	0	0
326,519	74,772,936	748	0	0	0	0	0	0
371,029	49,717,867	497	0	0	0	0	0	0
415,538	23,685,685	237	0	0	0	0	0	0
460,048	10,121,052	101	0	0	0	0	0	0
504,557	4,541,016	45	0	0	0	0	0	0
549,067	1,098,134	11	0	0	0	0	0	0
593,576	0	0	0	0	0	0	0	0
	764,770,326	7,648		-22,883,699	1,907		80,500	0

System Summary		
Proposed	Usage	
System	kWh	therms
Heating	0	7,648
Cooling	1,907	0
Vent Cooling	0	0
Lighting	27,312	0
Equipment	27,312	131
Total	56,532	7,779

Proposed Savings		
Estimated	kWh	therms
Savings	0	1,733

Notes:
1. Negative Numbers indicate heat needs to be removed from the space
2. Heating and Cooling columns determine if the building should be heating or cooling
3. Vent Power is the ventilation fan motor horse power.

Newark, NJ		Day Time Hours		
Deg F	Hours	01 to 08	09 to 16	17 to 00
102.5	1		1	0
97.5	23	0	19	4
92.5	93	1	68	24
87.5	237	5	160	72
82.5	451	41	252	158
77.5	692	163	274	255
72.5	858	306	254	298
67.5	753	285	227	241
62.5	734	258	225	251
57.5	670	231	214	225
52.5	736	259	225	252
47.5	708	245	225	238
42.5	756	266	230	260
37.5	704	273	198	233
32.5	545	229	143	173
27.5	340	139	93	108
22.5	229	104	55	70
17.5	134	69	25	40
12.5	57	34	9	14
7.5	22	13	4	5
2.5	9	5	2	2
-2.5	2	2	0	0
-7.5	0	0	0	0
	8754			

This page is for ease of chaning weather data. If building scheduling is a factor the bin hours by day time have been included for reference.

Existing Envelope						
	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	16	6				
Width (ft)	485.4	3				
Count	1	2	0	0	0	2
R-value	12	1.5	3	1.5	1	
U-value	0.083333	0.6666667	0.3333333	0.6666667	1	0.666666667
Area	7766.4	36	0	0	0	36
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	16	6				
Width (ft)	247	3		0	0	
Count	1	2	0	0	0	2
R-value	12	1.5	3	1	1	
U-value	0.083333	0.6666667	0.3333333	1	1	0.666666667
Area	3952	36	0	0	0	36
Total Wall Area (sqft)		**11718.4**				
Average U-value		**0.0833333**				
	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	154.2	0	0	0	0	
Width (ft)	101.2	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	15605.04	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)		0	0	0	0	
Width (ft)		0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0
Total Roof Area (sqft)		**15605.04**				
Average U-value		**0.05**				
Total Window Area (sqft)		**72**				
Average U-value		**0.6666667**				

Proposed Envelope						
	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	16	6	0	0	0	
Width (ft)	485.4	3	0	0	0	
Count	1	2	0	0	0	2
R-value	12	1.5	3	1.5	1	
U-value	0.083333333	0.666666667	0.333333333	0.666666667	1	0.666666667
Area	7766.4	36	0	0	0	36
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	16	6	0	0	0	
Width (ft)	247	3	0	0	0	
Count	1	2	0	0	0	2
R-value	12	1.5	3	1	1	
U-value	0.083333333	0.666666667	0.333333333	1	1	0.666666667
Area	3952	36	0	0	0	36
Total Wall Area (sqft)		**11718.4**				
Average U-value		**0.083333333**				
	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	154.2	0	0	0	0	
Width (ft)	101.2	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	15605.04	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	0	0	0	0	0	
Width (ft)	0	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0
Total Roof Area (sqft)		**15605.04**				
Average U-value		**0.05**				
Total Window Area (sqft)		**72**				
Average U-value		**0.666666667**				

Utility Garage - Condensing Unit Heaters (Furnaces)

Building	Utilitly Garage	
Address	RVSA	
Heating Fuel	Gas	100000
Cooling System	DX	

Existing Building Envelope		
Wall Area	2156	sqft
Wall Conductivity	0.083333	u Value
Window Area	192	sqft
Window Conductivity	0.64375	u Value
Roof Area	1100	sqft
Roof Conductivity	0.05	u Value
Floor Area	1100	sqft
Volume	8800	cuft

Set Points		
Heating Set Point	72	deg F
Cooling Set Point	78	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.30	w/sqft
Occupancy	2	people
Occupant Sensible Load	250	btu/person
Infiltration	224.0	cfm
Exhaust	25	cfm
Equipment Density	0.02	therms
Building Equipment		
Heating System	400,000	Btuh
Heating Efficiency	80	%
Cooling System	10,500	Btuh
Cooling Efficiency	10.8	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Existing Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-8,778	-3,877	-6,589	-19,243
97.5	23	0	1	-6,986	-3,877	-5,244	-16,107
92.5	93	0	1	-5,195	-3,877	-3,899	-12,971
87.5	237	0	1	-3,404	-3,877	-2,555	-9,835
82.5	451	0	1	-1,612	-3,877	-1,210	-6,699
77.5	692	0	1	179	-3,877	134	-3,564
72.5	858	0	1	1,970	-3,877	1,479	-428
67.5	753	1	0	1,612	-3,877	1,210	0
62.5	734	1	0	3,404	-3,877	2,555	2,081
57.5	670	1	0	5,195	-3,877	3,899	5,217
52.5	736	1	0	6,986	-3,877	5,244	8,353
47.5	708	1	0	8,778	-3,877	6,589	11,489
42.5	756	1	0	10,569	-3,877	7,933	14,625
37.5	704	1	0	12,360	-3,877	9,278	17,761
32.5	545	1	0	14,152	-3,877	10,622	20,897
27.5	340	1	0	15,943	-3,877	11,967	24,033
22.5	229	1	0	17,734	-3,877	13,312	27,169
17.5	134	1	0	19,526	-3,877	14,656	30,305
12.5	57	1	0	21,317	-3,877	16,001	33,440
7.5	22	1	0	23,108	-3,877	17,345	36,576
2.5	9	1	0	24,900	-3,877	18,690	39,712
-2.5	2	1	0	26,691	-3,877	20,035	42,848
-7.5	0	1	0	28,482	-3,877	21,379	45,984
Total	8,754	6,399	2,355				

Existing Heating System			Existing Cooling System			Existing Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-11,667	-13,725	1	0	100	0
0	0	0	-11,667	-298,148	25	0	100	0
0	0	0	-11,667	-1,142,105	95	0	100	0
0	0	0	-10,928	-2,589,995	216	0	100	0
0	0	0	-7,444	-3,051,990	254	0	100	0
0	0	0	-3,960	-2,283,316	190	0	100	0
0	0	0	-475	-313,590	26	0	100	0
0	0	0	0	0	0	0	0	0
2,601	1,909,431	19	0	0	0	0	0	0
6,521	4,369,285	44	0	0	0	0	0	0
10,441	7,684,751	77	0	0	0	0	0	0
14,361	10,167,697	102	0	0	0	0	0	0
18,281	13,820,490	138	0	0	0	0	0	0
22,201	15,629,495	156	0	0	0	0	0	0
26,121	14,235,893	142	0	0	0	0	0	0
30,041	10,213,879	102	0	0	0	0	0	0
33,961	7,777,009	78	0	0	0	0	0	0
37,881	5,076,008	51	0	0	0	0	0	0
41,801	2,382,633	24	0	0	0	0	0	0
45,720	1,005,851	10	0	0	0	0	0	0
49,640	446,764	4	0	0	0	0	0	0
53,560	107,121	1	0	0	0	0	0	0
57,480	0	0	0	0	0	0	0	0
	94,826,304	948		-9,692,870	808		235,500	0

System Summary		
Existing	Usage	
System	kWh	therms
Heating	0	948
Cooling	808	0
Vent Cooling	0	0
Lighting	1,926	0
Equipment	2,889	131
Total	5,622	1,080
	6,264	1122
	10%	4%

Proposed Building Envelope		
Wall Area	2156	sqft
Wall Conductivity	0.083333	u Value
Window Area	192	sqft
Window Conductivity	0.666667	u Value
Roof Area	1100	sqft
Roof Conductivity	0.05	u Value
Floor Area	1100	sqft
Volume	8800	cuft

Set Points		
Heating Set Point	72	deg F
Cooling Set Point	78	deg F

Internal Loads		
Lighting Density	0.20	w/sqft
Equipment Density	0.30	w/sqft
Occupancy	2	people
Occupant Sensible Load	250	btu/person
Infiltration	224.0	cfm
Exhaust	25	cfm
Equipment Density	0.02	therms/sqft
Building Equipment		
Heating System	400,000	Btuh
Heating Efficiency	92	%
Cooling System	10,500	Btuh
Cooling Efficiency	10.8	SEER
Vent Cooling	0	CFM
Vent Power	0	kW

Proposed Load Summaries							
Bin Temp	Bin	Heating	Cooling	Shell Load	Internal Load	Ventilation Load	Combined Load
deg F	Hours			btuh	btuh	btuh	btuh
102.5	1	0	1	-8,885	-3,877	-6,589	-19,351
97.5	23	0	1	-7,072	-3,877	-5,244	-16,193
92.5	93	0	1	-5,259	-3,877	-3,899	-13,035
87.5	237	0	1	-3,445	-3,877	-2,555	-9,877
82.5	451	0	1	-1,632	-3,877	-1,210	-6,719
77.5	692	0	1	181	-3,877	134	-3,561
72.5	858	0	1	1,995	-3,877	1,479	-403
67.5	753	1	0	1,632	-3,877	1,210	0
62.5	734	1	0	3,445	-3,877	2,555	2,123
57.5	670	1	0	5,259	-3,877	3,899	5,281
52.5	736	1	0	7,072	-3,877	5,244	8,439
47.5	708	1	0	8,885	-3,877	6,589	11,597
42.5	756	1	0	10,699	-3,877	7,933	14,755
37.5	704	1	0	12,512	-3,877	9,278	17,913
32.5	545	1	0	14,325	-3,877	10,622	21,071
27.5	340	1	0	16,139	-3,877	11,967	24,228
22.5	229	1	0	17,952	-3,877	13,312	27,386
17.5	134	1	0	19,765	-3,877	14,656	30,544
12.5	57	1	0	21,579	-3,877	16,001	33,702
7.5	22	1	0	23,392	-3,877	17,345	36,860
2.5	9	1	0	25,205	-3,877	18,690	40,018
-2.5	2	1	0	27,019	-3,877	20,035	43,176
-7.5	0	1	0	28,832	-3,877	21,379	46,334
Total	8,754	6,399	2,355				

Proposed Heating System			Proposed Cooling System			Proposed Ventilation Cooling		
Output	Usage	Usage	Output	Usage	Usage	Cooling	On Time	Usage
Btuh	Btu	therms	Btuh	Btu	kWh	Btuh	%	kWh
0	0	0	-11,667	-13,725	1	0	100	0
0	0	0	-11,667	-298,148	25	0	100	0
0	0	0	-11,667	-1,142,105	95	0	100	0
0	0	0	-10,975	-2,601,002	217	0	100	0
0	0	0	-7,466	-3,061,010	255	0	100	0
0	0	0	-3,957	-2,281,906	190	0	100	0
0	0	0	-448	-295,844	25	0	100	0
0	0	0	0	0	0	0	0	0
2,308	1,693,724	17	0	0	0	0	0	0
5,740	3,845,841	38	0	0	0	0	0	0
9,173	6,751,032	68	0	0	0	0	0	0
12,605	8,924,435	89	0	0	0	0	0	0
16,038	12,124,479	121	0	0	0	0	0	0
19,470	13,707,025	137	0	0	0	0	0	0
22,903	12,481,995	125	0	0	0	0	0	0
26,335	8,953,995	90	0	0	0	0	0	0
29,768	6,816,830	68	0	0	0	0	0	0
33,200	4,448,847	44	0	0	0	0	0	0
36,633	2,088,075	21	0	0	0	0	0	0
40,065	881,439	9	0	0	0	0	0	0
43,498	391,482	4	0	0	0	0	0	0
46,930	93,861	1	0	0	0	0	0	0
50,363	0	0	0	0	0	0	0	0
	83,203,059	832		-9,693,741	808		235,500	0

System Summary		
Proposed	Usage	
System	kWh	therms
Heating	0	832
Cooling	808	0
Vent Cooling	0	0
Lighting	1,926	0
Equipment	2,889	131
Total	5,623	963

Proposed Savings		
Estimated	kWh	therms
Savings	0	116

Notes:
1. Negative Numbers indicate heat needs to be removed from the space
2. Heating and Cooling columns determine if the building should be heating or cooling
3. Vent Power is the ventilation fan motor horse power.

Newark, NJ		Day Time Hours		
Deg F	Hours	01 to 08	09 to 16	17 to 00
102.5	1		1	0
97.5	23	0	19	4
92.5	93	1	68	24
87.5	237	5	160	72
82.5	451	41	252	158
77.5	692	163	274	255
72.5	858	306	254	298
67.5	753	285	227	241
62.5	734	258	225	251
57.5	670	231	214	225
52.5	736	259	225	252
47.5	708	245	225	238
42.5	756	266	230	260
37.5	704	273	198	233
32.5	545	229	143	173
27.5	340	139	93	108
22.5	229	104	55	70
17.5	134	69	25	40
12.5	57	34	9	14
7.5	22	13	4	5
2.5	9	5	2	2
-2.5	2	2	0	0
-7.5	0	0	0	0
	8754			

This page is for ease of chaning weather data. If building scheduling is a factor the bin hours by day time have been included for reference.

Existing Envelope						
	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	14	4	10			
Width (ft)	154	3	6			
Count	1	1	3	0	0	4
R-value	12	1.5	1.5	1.5	1	
U-value	0.083333	0.3	0.6666667	0.6666667	1	0.64375
Area	2156	12	180	0	0	192
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)						
Width (ft)				0	0	
Count	1	4	0	0	0	4
R-value	12	3	3	1	1	
U-value	0.083333	0.3333333	0.3333333	1	1	0
Area	0	0	0	0	0	0
Total Wall Area (sqft)		**2156**				
Average U-value		**0.0833333**				
	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	40	0	0	0	0	
Width (ft)	27.5	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	1100	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)		0	0	0	0	
Width (ft)		0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0
Total Roof Area (sqft)		**1100**				
Average U-value		**0.05**				
Total Window Area (sqft)		**192**				
Average U-value		**0.64375**				

Proposed Envelope						
	Wall 1	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	14	4	10	0	0	
Width (ft)	154	3	6	0	0	
Count	1	1	3	0	0	4
R-value	12	1.5	1.5	1.5	1	
U-value	0.083333333	0.666666667	0.666666667	0.666666667	1	0.666666667
Area	2156	12	180	0	0	192
	Wall 2	Window 1	Window 2	Window 3	Window 4	Wall Window Total
Height (ft)	0	0	0	0	0	
Width (ft)	0	0	0	0	0	
Count	1	4	0	0	0	4
R-value	12	3	3	1	1	
U-value	0.083333333	0.333333333	0.333333333	1	1	0
Area	0	0	0	0	0	0
Total Wall Area (sqft)		**2156**				
Average U-value		**0.083333333**				
	Roof 1	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	40	0	0	0	0	
Width (ft)	27.5	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	1100	0	0	0	0	0
	Roof 2	Window 1	Window 2	Window 3	Window 4	Roof Window Total
Length (ft)	0	0	0	0	0	
Width (ft)	0	0	0	0	0	
Count	1	0	0	0	0	0
R-value	20	1	1	1	1	
U-value	0.05	1	1	1	1	0
Area	0	0	0	0	0	0
Total Roof Area (sqft)		**1100**				
Average U-value		**0.05**				
Total Window Area (sqft)		**192**				
Average U-value		**0.666666667**				

Project	RVSA Energy Audit
Task	Thermal Oil to Process Hot Water Heat Exchanger

Assumptions		
Only Used on Weekends (2/7) Days	0.29	days
Hours from below 40 deg F		
Heat exchanger efficiency (BTUs Oil -> BTUs HW)	100%	
Supply Oil Temperature	280-300	deg F
Return Oil Temperature	260-280	deg F
Oil Flowrate	1200	GPM
Specific Heat of Oil (From Paratherm Oil data sheet from John B. @ RVSA)	0.55125	BTU/lb*F
Density (From Paratherm Oil data sheet from John B. @ RVSA)	6.575	lb/gal
*Heat Load can be captured for hot water heating when sludge dryer is not in use		

Calculations
Mass Flow Rate (lbm/hr)
473,400
Heat Load (BTU/hr)*
5,219,235
HW Loop Usable Heat Load (BTU)**
3,036,103,560
Savings in Therms
30,361
$14,877

BIN hours for Newark, NJ		
Bin Temp	Total Bin	Weekend
deg F	Hours	Hours
37	703	201
32	543	155
27	338	97
22	229	65
17	133	38
12	57	16
7	21	6
2	9	3
-3	2	1
-8	1	0
Total	2,036	582

Appendix P
List of Third Party Suppliers

PSE&G ELECTRIC SERVICE TERRITORY
Last Updated: 11/5/15

***CUSTOMER CLASS - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL**

Supplier	Telephone & Web Site	*Customer Class
Abest Power & Gas of NJ, LLC 202 Smith Street Perth Amboy, NJ 08861	(888)987-6937 www.AbestPower.com	**R/C/I** **ACTIVE**
AEP Energy, Inc. f/k/a BlueStar Energy Services 309 Fellowship Road, Fl. 2 Mount Laurel, NJ 08054	(866) 258-3782 www.aepenergy.com	**R/C/I** **ACTIVE**
Agera Energy, LLC 115 route 46, Building F Parsippany, NJ 07054	(844) 692-4372 www.ageraenergy.com	R/C/I
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	(855) 553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Ambit Northeast, LLC d/b/a Ambit Energy 103 Carnegie Center Suite 300 Princeton, NJ 08540	877-282-6284 www.ambitenergy.com	**R/C** **ACTIVE**
American Power & Gas of NJ, LLC - 10000 Lincoln Drive East – Suite 201Marlton, NJ 08053	(800) 205-7491 www.GoAPG.com	**R/C/I**
American Powernet Management, LP 100 Canal Street, Suite 212 Princeton, NJ 08540	(877) 977-2636 www.americanpowernet.com	**C/I** **ACTIVE**
Amerigreen Energy, Inc. 333 Sylvan Avenue, Suite 305 Englewood Cliffs, NJ 07632	888-559-4567 www.amerigreen.com	**C/I** **ACTIVE**
AP Gas & Electric, (NJ) LLC 10 North Park Place, Suite 420 Morristown, NJ 07960	(855) 544-4895 www.apgellc.com	**R/C/I** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	(888)850-1872 www.AstralEnergyLLC.com	**R/C/I** **ACTIVE**

Barclays Capital Services, Inc. 70 Hudson Street Jersey City, NJ 07302-4585	(800) 526-7000 www.barclays.com	**C** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateasternenergy.com	**C** **ACTIVE**
Berkshire Energy Partners, LLC 9 Berkshire Road Landenberg, PA 19350 Attn: Dana A. LeSage, P.E.	(610) 255-5070 www.berkshireenergypartners.com	**C/I** **ACTIVE**
Blue Pilot Energy, LLC 197 State Rte. 18 South Ste. 3000 East Brunswick, NJ 08816	(800) 451-6356 www.bluepilotenergy.com	**R/C** **ACTIVE**
Brick Standard, LLC 235 Hudson Street Suite 1 Hoboken, NJ 07030	(201)706-8101 www.standardalternative.com	**C/I** **ACTIVE**
CCES LLC dba Clean Currents Energy Services 566 Terhune Street Teaneck, NJ 07666	(877) 933-2453 www.cleancurrents.com	**R/C** **ACTIVE**
Champion Energy Services, LLC 1500 Route 22 Bridgewater, NJ 08807	(888) 653-0093 www.championenergyservices.com	**R/C/I** **ACTIVE**
Choice Energy, LLC 4257 US Highway 9, Suite 6C Freehold, NJ 07728	(888) 565-4490 www.4choiceenergy.com	**R/C** **ACTIVE**
Clearview Electric, Inc. 1744 Lexington Avenue Pennsauken, NJ 08110	(888) CLR-VIEW (800) 746- 4702 www.clearviewenergy.com	**R/C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07446	1-866-587-8674 www.commerceenergy.com	**R/C** **ACTIVE**
Community Energy Inc. 51 Sandbrook Headquarters Road Stockton, NJ 08559	(866)946-3123 www.communityenergyinc.com	**R/C/I** **ACTIVE**

ConEdison Solutions Cherry Tree Corporate Center 535 State Highway Suite 180 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation New Energy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.constellation.com	**R/C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.constellation.com	**R** **ACTIVE**
Constellation Energy Services, Inc. **116 Village Boulevard** **Suite 200** **Princeton, NJ 08540**	1 (800) 536-0151 www.integrysenergy.com	**R/C/I**
Corporate Services Support Corp. **665 Howard Avenue** **Somerset, NJ 08873**	1(800) 761-4000 www.morganstanley.com	**C**
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(800) 325-2000 www.creditsuisse.com	**C** **ACTIVE**
Direct Energy Business, LLC 1 Hess Plaza Woodbridge	(888) 925-9115 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Business Marketing, LLC (fka Hess Energy Marketing) 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 925-9115 http://www.business.directenergy.com/small-business	**C/I** **ACTIVE**

Direct Energy Services, LLC **1 Hess Plaza** **Woodbridge, NJ 07095**	1 (866) 348-4193 www.directenergy.com	**C/I** **INACTIVE**
Discount Energy Group, LLC 811 Church Road, Suite 149 Cherry Hill, New Jersey 08002	(800) 282-3331 www.discountenergygroup.com	**R/C** **ACTIVE**
DTE Energy Supply, Inc. One Gateway Center, Suite 2600 Newark, NJ 07102	(877) 332-2450 www.dtesupply.com	**C/I** **ACTIVE**
EDF Energy Services, LLC 1 Meadowlands Plaza Suite 200, Office No. 246 East Rutherford, NJ 07073	1 (877) 432-4530 www.edfenergyservices.com	**C/I**
Energy.me Midwest LLC 90 Washington Blvd Bedminster, NJ 07921	(855) 243-7270 www.energy.me	**R/C/I** **ACTIVE**
Energy Plus Holdings LLC 309 Fellowship Road East Gate Center, Suite 200 Mt. Laurel, NJ 08054	(877) 866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
EnerPenn d/b/a **YEP Energy** 89 Headquarters Plaza North #1463 Morristown, NJ 07960	(855) 363-7736 www.yepenergyNJ.com	**R/C/I** **ACTIVE**
Ethical Electric Benefit Co. d/b/a Ethical Electric/d/b/a Clean Energy Option 100 Overlook Center, 2nd Fl. Princeton, NJ 08540	(888) 444-9452 www.ethicalelectric.com	**R/C** **ACTIVE**
Energy Service Providers, Inc., d/b/a New Jersey Gas & Electric 1 Bridge Plaza fl. 2 Fort Lee, NJ 07024	(866) 568-0290 www.njgande.com	**R/C** **ACTIVE**
Everyday Energy, LLC **One International Blvd., Suite 400** **Mahwah, NJ 07495-0400**	844-684-5506 www.energyrewards.comcast.com	**R/I**

FirstEnergy Solutions 150 West State Street Trenton, NJ 08608	(888) 254-63590- www.fes.com	**C/I** **ACTIVE**
First Point Power, LLC 90 Washington Valley Road Bedminister, NJ 07921	(888) 875-1711 www.firstpointpower.com	**R/C/I**
Frontier Utilities Northeast, LLC 199 New Road, Suite 61-187 Linwood, NJ 08221	(877) 437-6930 www.frontierutilities.com	**R/C/I**
Gateway Energy Services Corporation **1 Hess Plaza** **Woodbridge, NJ 07095**	(800) 805-8586 www.gesc.com	**R/C** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08837	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
GDF Suez Retail Energy Solutions LLC d/b/a THINK ENERGY 333 Thornall St. Sixth Floor Edison, NJ 08819	1-866-252-0078 www.mythinkenergy.com	**R/C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	(800) 542-0778 www.globalp.com	**R/C/I** **ACTIVE**
Greenlight Energy, Inc. **2608 25th Road** **Astoria, NY 11102**	(888) 453-4427 www.greenlightenergy.us	**R**
Green Mountain Energy Company 211 Carnegie Center Drive Princeton, NJ 08540	(866) 767-5818 www.greenmountain.com/commercial-home	**C/I** **ACTIVE**

Harborside Energy LLC 101 Hudson Street Suite 2100 Jersey City, NJ 07302	(877) 940-3835 www.harborsideenergynj.com	**R/C** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
HIKO ENERGY, LLC One International Blvd. Mahwah, NJ 07945	888-264-4908 www.hikoenergy.com	**R/C**
Hudson Energy Services, LLC 7 Cedar Street Ramsey, New Jersey 07466	(877) Hudson 9 www.hudsonenergyservices.com	**C** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, NJ 07102	(877) 887-6866 www.idtenergy.com	**R/C** **ACTIVE**
Independence Energy Group, LLC 211 Carnegie Center Princeton, NJ 08540	(877) 235-6708 www.chooseindependence.com	**R/C** **ACTIVE**
Inspire Energy Holdings LLC 923 Haddonfield Road 3rd Fl. Building B2 Cherry Hill, NJ 08002	(866) 403-2620 www.inspireenergy.com	**R/C/I**
Integrys Energy Services, Inc. 33 Wood Ave, South, Suite 610 Iselin, NJ 08830	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**
Jsynergy, LLC 445 Central Ave. Suite 204 Cedarhurst, NY 11516	(516) 331-2020 Jsynergyllc.com	**R/C/I** **ACTIVE**
Kuehne Chemical Company, Inc. 86 North Hackensack Avenue South Kearney, NJ 07032	(973) 589-0700 kuehnechemical@comcast.net	**I**
Liberty Power Delaware, LLC 1973 Highway 34, Suite 211 Wall, NJ 07719	(866) 769-3799 www.libertypowercorp.com	**C/I** **ACTIVE**

Liberty Power Holdings, LLC 1973 Highway 34, Suite 211 Wall, NJ 07719	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
Mansfield Power & Gas, LLC **101 Hudson Street, 21st Fl.** **Jersey City, NJ 07302**	1 800-695-6626 www.mansfieldpowergas.com	**R/C/I**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	(888) 779-7255 www.mecny.com	**R/C/I** **ACTIVE**
MP2 Energy NJ, LLC 111 River Street, Suite 1204 Hoboken, NJ 07030	(877) 238-5343 www.mp2energy.com	**R/C/I** **ACTIVE**
Natures Current, LLC 95 Fairmount Avenue Philadelphia, Pennsylvania 19123	(215) 464-6000 www.naturescurrent.com	**R/C/I** **ACTIVE**
MPower Energy NJ LLC One University Plaza, Suite 507 Hackensack, NJ 07601	(877) 286-7693 www.mpowerenergy.com	**R/C/I** **ACTIVE**
NATGASCO, Inc. (Supreme Energy, Inc.) 532 Freeman St. Orange, NJ 07050	(800) 840-4427 www.supremeenergyinc.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 10 North Park Place Suite 420 Morristown, NJ 07960	(866) 568-0290 www.njgande.com	**R/C/** **ACTIVE**
NextEra Energy Services New Jersey, LLC 651 Jernee Mill Road Sayreville, NJ 08872	(877) 528-2890 Commercial (800) 882-1276 Residential www.nexteraenergyservices.com	**R/C/I** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.noblesolutions.com	**C/I** **ACTIVE**

Nordic Energy Services, LLC 50 Tice Boulevard, Suite 340 Woodcliff Lake, NJ 07677	(877) 808-1027 www.nordiceenergy.us.com	**R/C/I** **ACTIVE**
North American Power and Gas, LLC 222 Ridgedale Avenue Cedar Knolls, NJ 07927	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 521-5861 www.entrustenergy.com	**R/C/I** **ACTIVE**
Oasis Power, LLC d/b/a Oasis Energy 11152 Westheimer, Suite 901 Houston, TX 77042	(800)324-3046 www.oasisenergy.com	**R/C** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Park Power, LLC 1200 South Church St. Suite 23 Mount Laurel, NJ 08054	(856) 778-0079 www.parkpower.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC c/o Adam Sokol 338 Maitland Avenue Teaneck, NJ 07666	(855) 327-6937 www.plymouthenergy.com	**R/C/I** **ACTIVE**
Power Management Co., LLC b/b/a PMC Lightsavers Limited Liability Company 1600 Moseley Road Victor, NY 14564	(585) 249-1360 www.powermanagementco.com	**C/I** **ACTIVE**
Progressive Energy Consulting, LLC PO Box 4582 Wayne, New Jersey 07474	(917) 837-7400 Progressivenrg@optionline.net	**R/C/I** **ACTIVE**
Prospect Resources, Inc. 208 W. State Street Trenton, NJ 08608-1002	(847) 673-1959 www.prospectresources.com	**C** **ACTIVE**
Public Power & Utility of New Jersey, LLC One International Blvd, Suite	800-354-4415	**R/C/I**

400 Mahwah, NJ 07495-0400	www.ppandu.com	**ACTIVE**
Quest Energy Solutions **203 Southbridge Street** **Auburn, MA 01501**	866-783-7820 www.questenergysolutions.com	**C/I**
Reliant Energy 211 Carnegie Center Princeton, NJ 08540	(877) 297-3795 (877) 297-3780 www.reliant.com	**R/C/I** **ACTIVE**
ResCom Energy LLC 18C Wave Crest Ave. Winfield Park, NJ 07036	(888) 238-4041 http://rescom-energy.com	**R/C/I** **ACTIVE**
Residents Energy, LLC 550 Broad Street Newark, NJ 07102	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	(888) 625-6760 www.majorenergy.com	**R/C/I** **ACTIVE**
Save on Energy, LLC 1101 Red Ventures Drive Fort Mill, SC 29707	1 (877)-658-3183 www.saveonenergy.com	**R/C**
SFE Energy One Gateway Center Suite 2600 Newark, NJ 07012	1 (877) 316-6344 www.sfeenergy.com	**R/C/I** **ACTIVE**
S.J. Energy Partners, Inc. 208 White Horse Pike, Suite 4 Barrington, NJ 08007	(800) 695-0666 www.sjnaturalgas.com	**C** **ACTIVE**
SmartEnergy Holdings, LLC 100 Overlook Center 2nd Floor Princeton, NJ NJ 08540 United States of America	(800) 443-4440 www.smartenergy.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Spark Energy Gas, LP/ Spark Energy 2105 City West Blvd.	(713)600-2600	**R/C/I**

Suite 100 Houston, TX 77042	www.sparkenergy.com	**ACTIVE**
Sperian Energy Corp. 1200 Route 22 East, Suite 2000 Bridgewater, NJ 08807	(888) 682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**
Sprague Energy Solutions Incorporated 6 Industrial Way W Eatontown, NJ 07724	(855) 466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Spring Energy, RRH, LLC **2500 Plaza 5** **Harborside Financial Center** **Jersey City, NJ 07311**	1 888-710-4782 www.springenergy.us	**R/I** **ACTIVE**
Starion Energy PA Inc. 101 Warburton Avenue Hawthorne, NJ 07506	(800) 600-3040 www.starionenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Rd., Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Services, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Talen Energy Marketing, LLC **788 Shrewsbury Avenue, Suite 2178 Tinton Falls, NJ 07724**	(888) 289-7693 www.pplenergyplus.com/*	**R/C**
Texas Retail Energy LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 Attn: Chris Hendrix	(866) 532-0761 Texasretailenergy.com	**C/I** **ACTIVE**
TransCanada Power Marketing Ltd. 190 Middlesex Essex Turnpike, Suite 200 Iselin, NJ 08830	(877) MEGAWAT www.transcanada.com/powermarketing	**C/I** **ACTIVE**

TriEagle Energy, LP 90 Washington Valley Rd Bedminster, NJ 07921	(877) 933-2453 www.trieagleenergy.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. **dba UGI Energy Link** 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 427-8545 www.ugienergylink.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 2001 Route 46 Waterview Plaza Suite 301 Parsippany, NJ 07054	(800) 388-3862 www.lowcostpower.com	**R/C** **ACTIVE**
Viridian Energy 2001 Route 46, Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	(888) 997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

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ELIZABETHTOWN GAS CO. SERVICE TERRITORY
Last Updated: 11/5/15

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I – INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Abest Power & Gas of NJ, LLC 202 Smith Street Perth Amboy, NJ 08861	(888) 987-6937 www.AbestPower.com	**R/C/I** **ACTIVE**
Agera Energy, LLC **115 route 46, Building F** **Parsippany, NJ 07054**	(844) 692-4372 www.ageraenergy.com	**R/C/I**
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	855-553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
American Power & Gas of NJ, LLC **10000 Lincoln Drive East – Suite 201** **Marlton, NJ 08053**	(800) 2057491 www.GoAPG.com	**R/C/I**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	201-384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	888-651-4121 www.greateasternenergy.com	**C** **ACTIVE**
Choice Energy, LLC 4257 US Highway 9, Suite 6C Freehold, NJ 07728	(888) 565-4490 www.4choiceenergy.com	**R/C/I**
Clearview Electric Inc. **d/b/a Clearview Gas** 1744 Lexington Ave. Pennsauken, NJ 08110	800-746-4720 www.clearviewenergy.com	**R/C** **ACTIVE**
Colonial Energy, Inc. 83 Harding Road Wyckoff, NJ 07481	845-429-3229 www.colonialgroupinc.com	**C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07746	888-817-8572 www.commerceenergy.com	**R** **ACTIVE**
Compass Energy Services, Inc. 33 Wood Avenue South, Suite 610 Iselin, NJ 08830	866-867-8328 www.compassenergy.net	**C/I** **ACTIVE**

ConocoPhillips Company 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	800-646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Consolidated Edison Solutions, Inc. Cherry Tree Corporate Center 535 State Highway 38, Suite 140 Cherry Hill, NJ 08002	888-665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
Constellation NewEnergy-Gas Division, LLC 116 Village Boulevard, Suite 200 Princeton, NJ 08540	800-785-4373 www.constellation.com	**C/I** **ACTIVE**
Constellation Energy Gas Choice, Inc. 116 Village Blvd., Suite 200 Princeton, NJ 08540	800-785-4373 www.constellation.com	**R/C/I** **ACTIVE**
Direct Energy Business Marketing, LLC (fka Hess Energy Marketing, LLC) One Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Services, LLC **1 Hess Plaza** **Woodbridge, NJ 07095**	1 (866) 348-4193 www.directenergy.com	**C/I** **INACTIVE**
Direct Energy Small Business, LLC(fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 925-9115 http://www.business.directenergy.com/smallbusiness	**C/I** **ACTIVE**
Energy Plus Natural Gas LP 309 Fellowship Road, East Gate Center Suite 200 Mt. Laurel, NJ 08054	877-866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
Everyday Energy, LLC **One International Blvd., Suite 400** **Mahwah, NJ 07495-0400**	844-684-5506 www.energyrewards.comcast.com	**R/I**
UGI Energy Services, Inc. **d/b/a GASMARK** 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Frontier Utilities Northeast, LLC 199 New Road, Suite 61-187 Linwood, NJ 08221	(877) 437-6930 www.frontierutilities.com	**R/C/I**

Gateway Energy Services Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 805-8586 www.gesc.com	**R/C** **ACTIVE**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	1-888-452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	800-542-0778 www.globalp.com	**C/I** **ACTIVE**
Great Eastern Energy 116 Village Blvd., Suite 200 Princeton, NJ 08540	888-651-4121 www.greateastern.com	**C/I** **ACTIVE**
Greenlight Energy 330 Hudson Street, Suite 4 Hoboken, NJ 07030	718-204-7467 www.greenlightenergy.us	**C** **ACTIVE**
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	888-264-4908 www.hikoenergy.com	**R/C/I** **ACTIVE**
Hudson Energy Services, LLC 7 Cedar Street Ramsey, NJ 07466	(877) Hudson 9 www.hudsonenergyservices.com	**C** **ACTIVE**
Infinite Energy dba Intelligent Energy 1200 Route 22 East Suite 2000 Bridgewater, NJ 08807-2943	(800) 927-9794 www.InfiniteEnergy.com	**R/C/I** **ACTIVE**
Mansfield Power & Gas, LLC **101 Hudson Street, 21st Fl.** **Jersey City, NJ 07302**	1 800-695-6626 www.mansfieldpowergas.com	**R/C/I**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	888-779-7255 www.mecny.com	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	1-877-750-7046 www.metromediaenergy.com	**C/I** **ACTIVE**
NATGASCO (Supreme Energy, Inc.) 532 Freeman Street Orange, NJ 07050	800-840-4427 www.supremeenergyinc.com	**R/C** **ACTIVE**
Naughton Energy Corporation 1898 Route 940, Box 709	800-372-6942	**C/I**

Pocono Pines, PA 18350	www.naughtonenergy.com	**ACTIVE**
New Energy Services LLC 101 Neptune Ave. Deal, NJ 07723`	800-660-3643 www.newenergyservicesllc.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 521-5861 www.entrustenergy.com	**R/C/I** **ACTIVE**
PPL EnergyPlus, LLC Shrewsbury Executive Offices 788 Shrewsbury Avenue, Suite 217B Tinton Falls, NJ 07724	(732)741-0505 www.pplenergyplus.com	**C/I**
Palmco Energy NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC c/o Adam Sokol 338 Maitland Avenue Teaneck, NJ 07666	855-327-6937 www.plymouthenergy.com	**R/C/I** **ACTIVE**
Power Management Co., LLC d/b/a PMC Lightsavers Limited Liability Company 1600 Moseley Road Victor, NY 14564	(585) 249-1360 www.powermanagementco.com	**C/I** **ACTIVE**
Progressive Energy Consulting, LLC PO Box 4582 Wayne, New Jersey 07474	(917) 837-7400 Progressivenrg@optionline.net	**R/C/I** **ACTIVE**
Prospect Resources, Inc. Incorp. Services Inc. 208 W. State Street Trenton, NJ 08608-1002	(847) 673-1959 www.prospectresources.com	**C** **ACTIVE**
Residents Energy, LLC 550 Broad Street Newark, NJ 07102	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	877-973-7763 www.respondpower.com	**R/C/I** **ACTIVE**
RTE Enterprises, LLC 8 Gary Lane Califon, NJ 07830	N/A www.RTEenterprises.net	**C/I** **ACTIVE**
Save on Energy, LLC 1101 Red Ventures Drive Fort Mill, SC 29707	1 (877) 658-3183 www.saveonenergy.com	**R/C** **ACTIVE**

SIMEC, LLC 116 Village Blvd. Suite 200 Princeton, NJ 08540	(917) 620-0249 www.simecenergy.com	**R/C/I**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Sperian Energy Corp. Bridgewater Center 1200 Route 22 East Bridgewater, NJ 08807	888-682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**
Sprague Operating Resources LLC 6 Industrial Way W Eatontown, NJ 07724	855-466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Spring Energy RRH, LLC **25009 Plaza 5** **Harborside Financial Center** **Jersey City, NJ 07311**	1 888-710-4782 www.springenergy.us	**R/C**
Stream Energy New Jersey, LLC 309 Fellowship Road, Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Services, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Tiger Natural Gas, Inc. dba Tiger, Inc. 234 20th Avenue Brick, NJ 008724	888-875-6122 www.tigernaturalgas.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. **dba UGI Energy Link** 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	800-427-8545 www.ugienergylink.com	**C/I** **ACTIVE**
Vista Energy Marketing, L.P. 197 State Route 18 South, Suite 3000 South Wing East Brunswick, NJ 08816	888-508-4782 www.vistaenergymarketing.com	**R/C/I** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**
Woodruff Energy US LLC 73 Water Street P.O. Box 777	800-457-1121	**C/I**

Bridgeton, NJ 08302	www.woodruffenergy.com	**ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	(888) 997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard, Suite 400 Mahwah, NJ 07495-0400	855-732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

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