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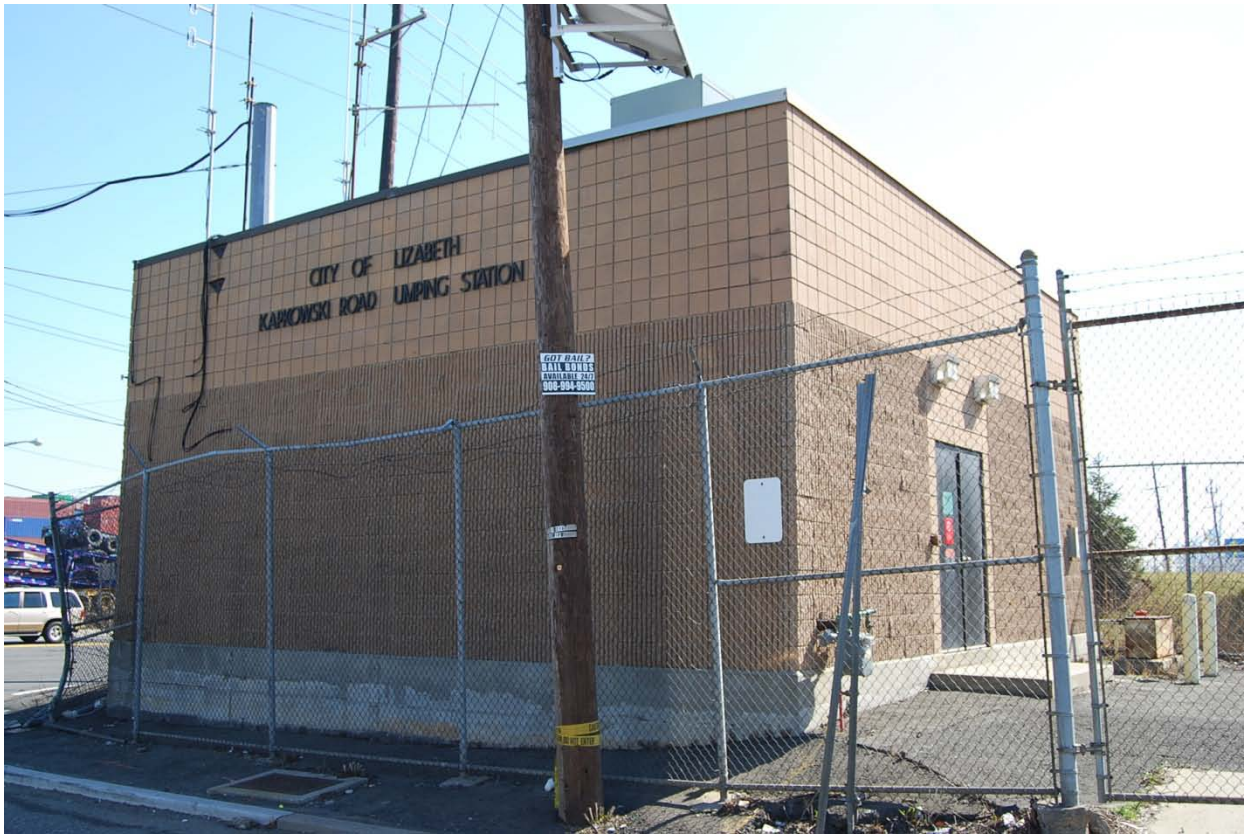
August 20, 2010

Local Government Energy Program
Energy Audit Final Report

City of Elizabeth

North Ave. Pump Station
140 North Avenue
Elizabeth, NJ 07201

Project Number: LGEA57



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EXECUTIVE SUMMARY

The City of Elizabeth North Ave Pump Station is a single-story, slab-on-grade building with 3 below-grade levels that include pumping machinery, equipment and piping comprising a total conditioned floor area of 1,023 square feet. The original structure was built in the 1980s, and there have been no major renovations or additions since then. The following chart provides an overview of current energy usage in the building based on the analysis period of February 2008 through February 2010:

Table 1: State of Building—Energy Usage

	Electric Usage, kWh/yr	Gas Usage, therms/yr	Current Annual Cost of Energy, $	Site Energy Use Intensity, kBtu/sq ft yr	Joint Energy Consumption, MMBtu/yr
Current	70,980	4,692	22,843	695.4	711
Proposed	61,766	4,692	20,735	664.7	680
Savings	9,214	0	2,108	30.7	31
% Savings	13	0	9	4	4

There may be energy procurement opportunities for the City of Elizabeth North Ave Pump Station to reduce annual utility costs, which are $4,909 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Animal Shelter in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This pump station is comprised of non-eligible ("Other") space type and as a result of being an "other" space type, a performance score could not be generated. Although a performance score could not be generated, the software was able to generate site energy use intensity. Compared to a typical commercial building that uses 104.0 kBtu/sqft-yr, the North Ave Pump House used 692.0 kBtu/sqft-yr.

Based on the current state of the building and its energy use, SWA recommends implementing various energy conservation measures from the savings detailed in Table 1. The measures are categorized by payback period in Table 2 below:

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	644	1.9	1,250	5,337
5-10 Year	-	-	-	-
>10 year	1,464	12.9	18,953	11,160
Total	2,108	9.6	20,203	16,498

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 1 car from the roads each year or avoiding the need of 40 trees to absorb the annual CO_2 generated.

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for City of Elizabeth. Based on the requirements of the LGEA program, the City of Elizabeth must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $345.

Financial Incentives and Other Program Opportunities

There are various incentive programs that the City of Elizabeth could apply for that could help lower the cost of installing the ECMs.

Please refer to Appendix F for further details.

INTRODUCTION

Launched in 2008, the Local Government Energy Audit (LGEA) Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 38-year-old architectural/engineering research and consulting firm, with specialized expertise in green technologies and procedures that improve the safety, performance, and cost effectiveness of buildings. SWA has a long-standing commitment to creating energy-efficient, cost-saving and resource-conserving buildings. As consultants on the built environment, SWA works closely with architects, developers, builders, and local, state, and federal agencies to develop and apply sustainable, 'whole building' strategies in a wide variety of building types: commercial, residential, educational and institutional.

For this project, PMK Group, Inc., a business unit of Birdsall Services Group (BSG-PMK), worked as a sub-contractor in conjunction with Steven Winter Associates, Inc. (SWA).

SWA and BSG-PMK performed an energy audit and assessment for the North Ave Pump Station at 140 North Ave, Elizabeth, NJ. The process of the audit included facility visits on March 16 and March 17, 2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the City of Elizabeth to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the North Ave Pump Station.

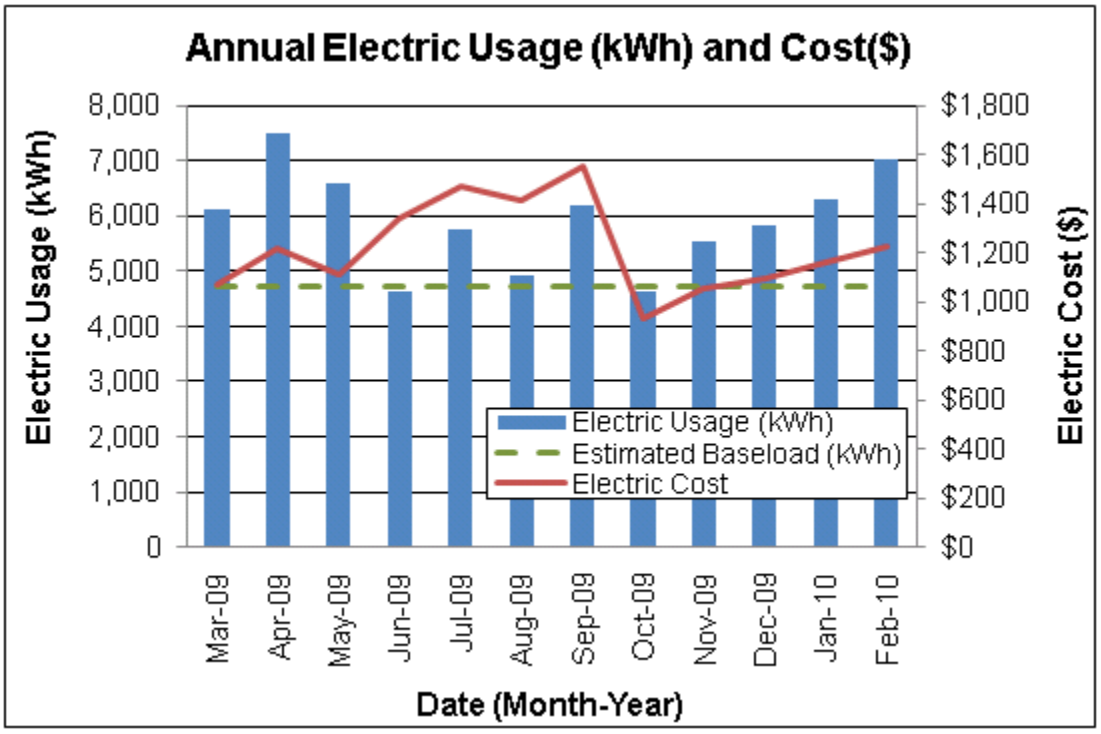
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility bills from February 2008 through February 2010 that were received from the utility companies supplying the North Ave Pump Station with electric and natural gas. A 12 month period of analysis from February 2009 through February 2010 was used for all calculations and for purposes of benchmarking the building.

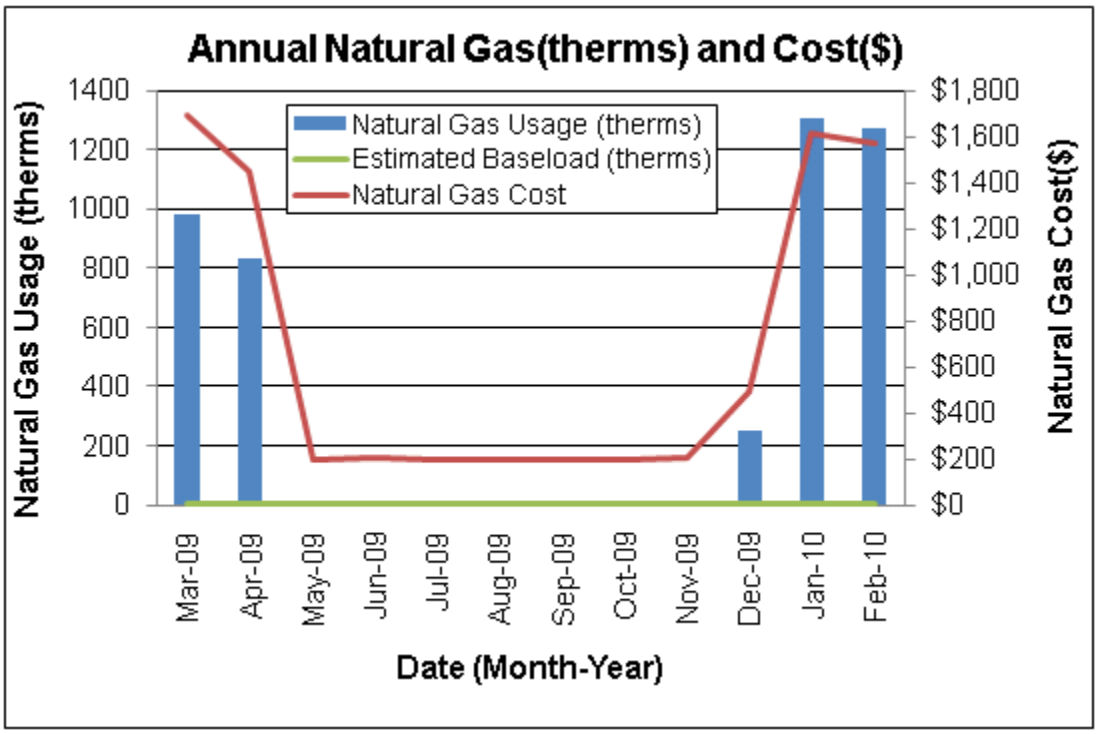
Electricity - The North Ave Pump Station is currently served by one electric meter. The North Ave Pump Station currently buys electricity from PSE&G at **an average aggregated rate of $0.206/kWh**. The North Ave Pump Station purchased **approximately 70,980 kWh, or $14,639 worth of electricity,** in the previous year. The average monthly demand was 38.5 kW and the annual peak demand was 40.2 kW.

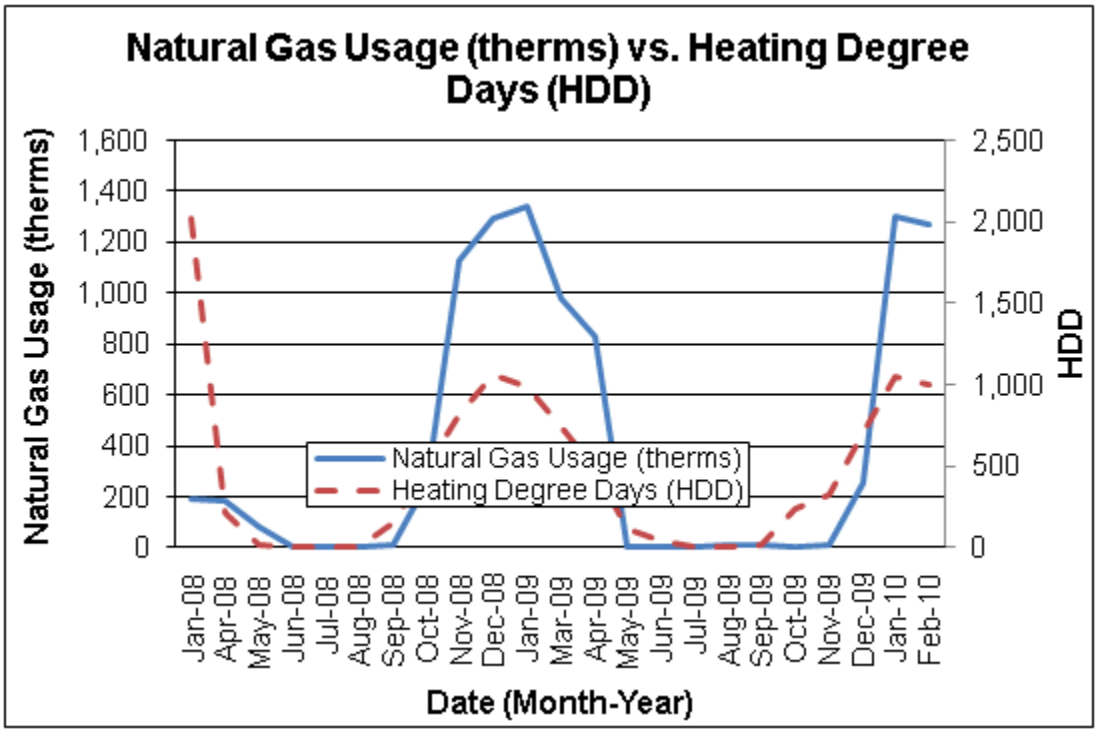
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the North Ave Pump Station.



Natural gas - The North Ave. Pump Station is currently served by one meter for natural gas. The North Ave Pump Station currently buys natural gas from Elizabethtown Gas Co. at **an average aggregated rate of $1.749/therm**. The North Ave Pump Station purchased **approximately 4,692 therms, or $8,204 worth of natural gas,** in the previous year.

The chart below shows the monthly natural gas usage and costs. The green line represents the approximate baseload or minimum natural gas usage required to operate the North Ave Pump Station.

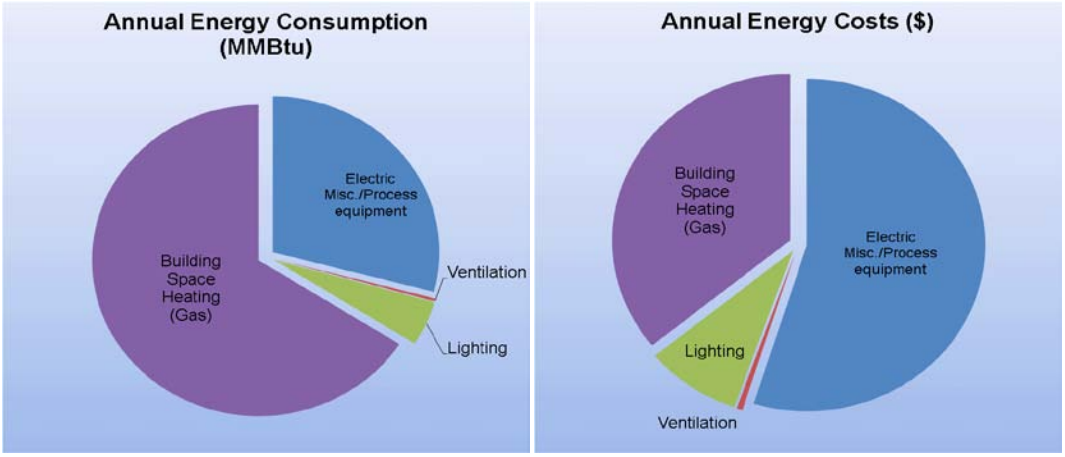




The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base temperature. SWA's analysis used a base temperature of 65 degrees Fahrenheit.

The following graphs, pie charts, and table show energy use for the BUILDING based on utility bills for the 12 month period. Note: electrical cost at $60/MMBtu of energy is 3 times as expensive as natural gas at $17/MMBtu

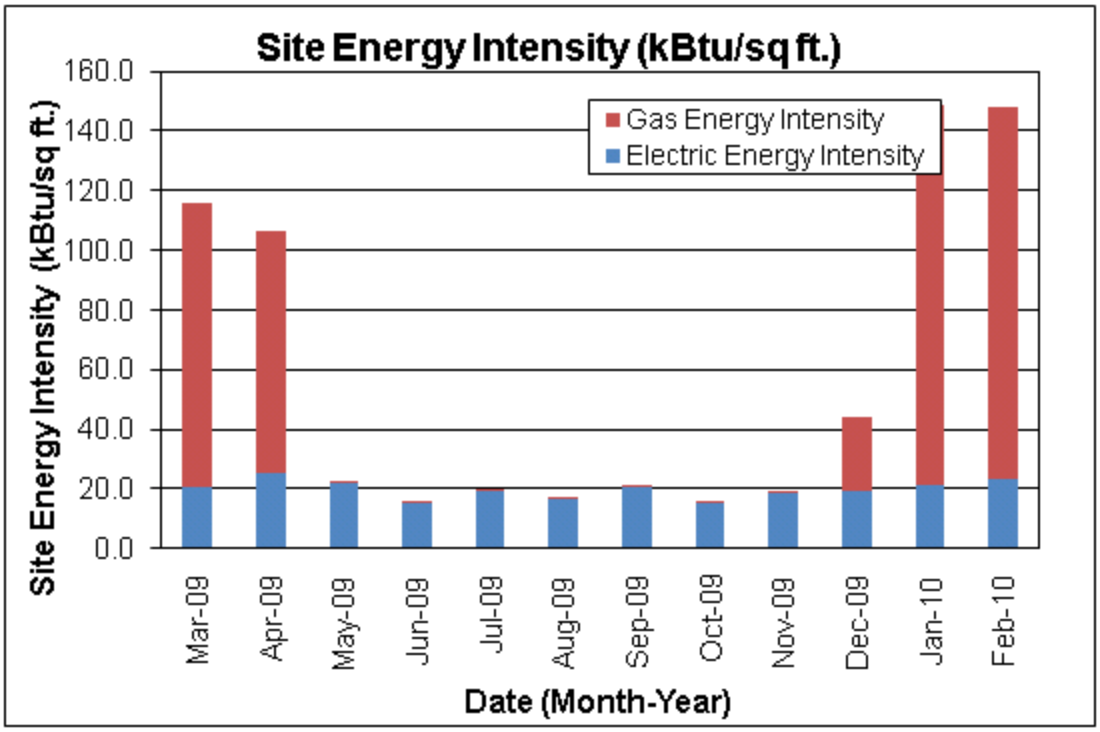
Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc./Process	207	29%	$12,522	55%	60
Ventilation	2	0%	$124	1%	60
Lighting	33	5%	$1,996	9%	60
Building Space Heating	469	66%	$8,201	36%	17
Totals	711	100%	$22,843	100%	
Total Electric Usage	242	34%	$14,639	64%	60
Total Gas Usage	469	66%	$8,204	36%	17
Totals	711	100%	$22,843	100%	



Energy benchmarking

SWA has entered energy information about the North Ave Pump Station in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This pump station facility is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the Pump Station is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 692.0 kBtu/ft^2-yr compared to the national average of a commercial building consuming 104 kBtu/ft^2-yr. See ECM section for guidance on how to improve the building's rating.

Due to the nature of its calculation based upon a survey of existing buildings of varying usage, the national average for "Other" space types is very subjective, and is not an absolute bellwether for gauging performance. Additionally, should the City of New Brunswick desire to reach this average there are other large scale and financially less advantageous improvements that can be made, such as envelope window, door and insulation upgrades that would help the building reach this goal.



Per the LGEA program requirements, SWA has assisted the City of Elizabeth to create an *ENERGY STAR® Portfolio Manager* account and share the North Ave. Pump Station facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the City of Elizabeth [redacted] and TRC Energy Services ([redacted].

Tariff analysis

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs. Tariffs are typically assigned to buildings based on size and building type.

Tariff analysis is performed to determine if the rate that a municipality is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used by the hot water boiler units. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months. Typically, electricity prices also increase during periods of high demand, due to demand charges.

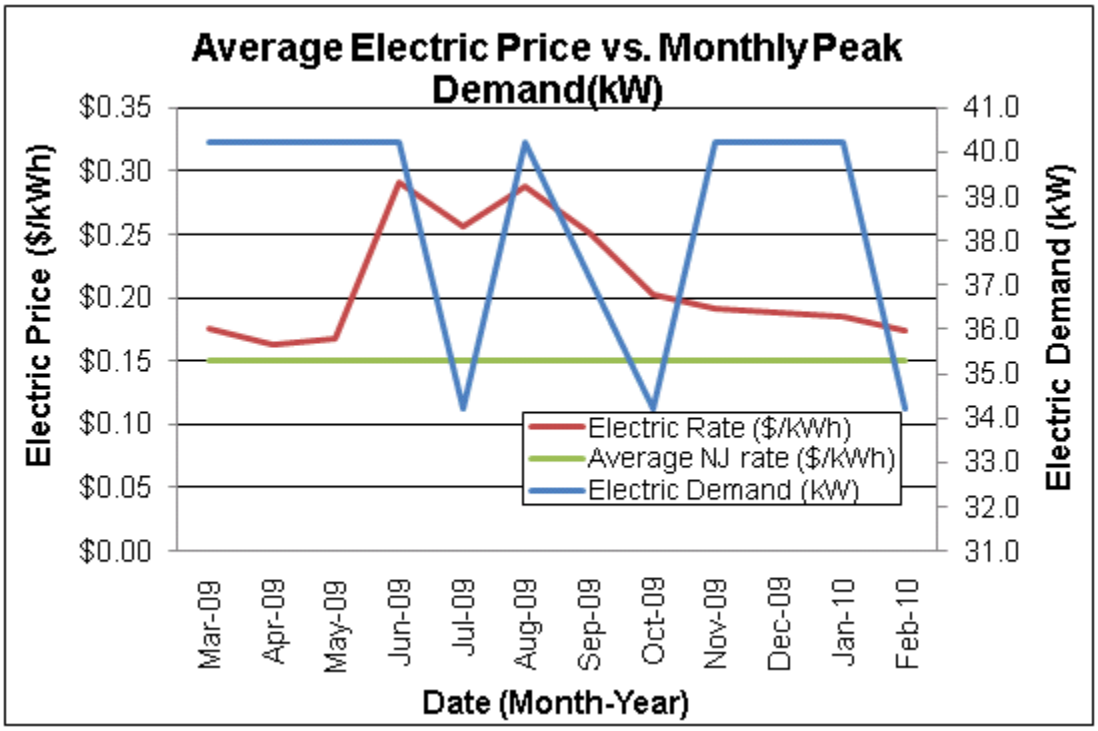
The supplier charges a market-rate price based on use, and the billing does not break down demand costs for all periods because usage and demand are included in the rate. Currently, the City of Elizabeth is paying a general service rate for natural gas. Demand is not broken out in the bill. Thus the building pays for fixed costs such as meter reading charges during the summer months. The building is direct metered and currently purchases electricity at a general service rate for usage with an additional charge for electrical demand factored into each monthly bill. The general service rate for electric charges is market-rate based on usage and demand.

Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

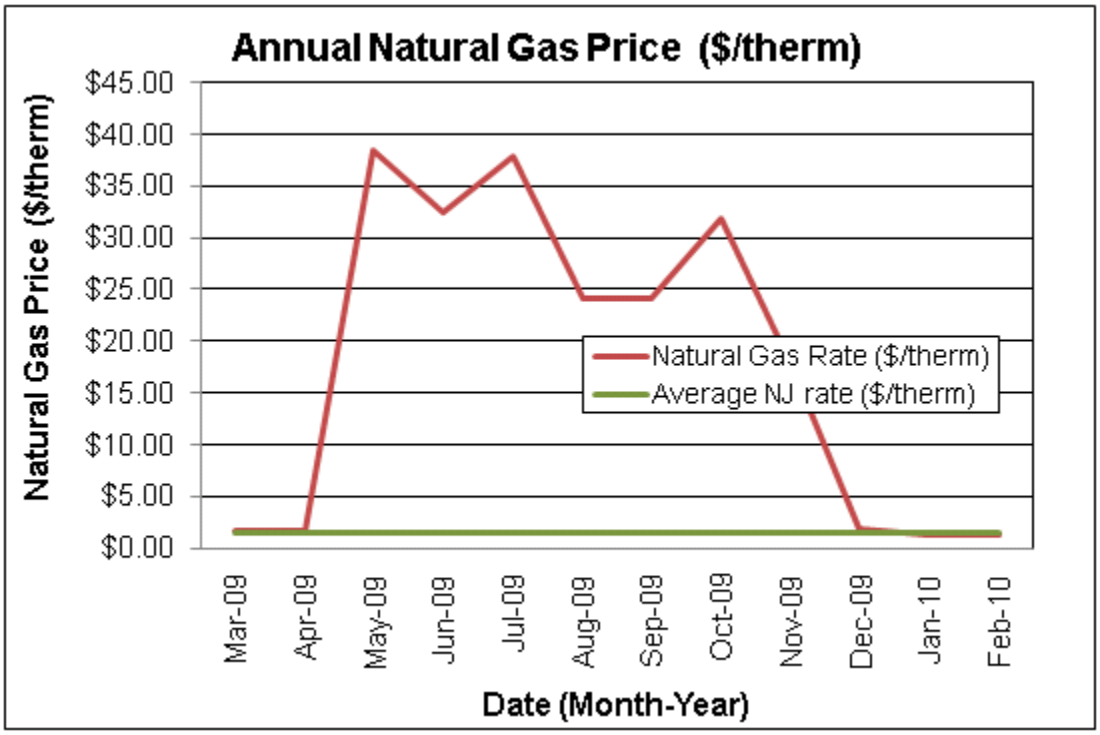
Energy Procurement strategies

Billing analysis is conducted using an average aggregated rate that is estimated based on the total cost divided by the total energy usage per utility per 12 month period. Average aggregated rates do not separate demand charges from usage, and instead provide a metric of inclusive cost per unit of energy. Average aggregated rates are used in order to equitably compare building utility rates to average utility rates throughout the state of New Jersey.

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while City of Elizabeth North Ave. Pump Station pays a rate of $0.206/kWh. The North Ave. Pump Station annual electric utility costs are $3,975 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 44% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while North Ave. Pump Station pays a rate of $1.749/therm. Natural gas bill analysis shows fluctuations up to 97% over the most recent 12 month period.



Utility rate fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusual high and recent escalating energy costs.

SWA recommends that the City of Elizabeth further explore opportunities of purchasing both natural gas and electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the North Ave. Pump Station. Appendix C contains a complete list of third-party energy suppliers for the City of Elizabeth service area.

EXISTING FACILITY AND SYSTEMS DESCRIPTION

This section gives an overview of the current state of the facility and systems. Please refer to the Proposed Further Recommendations section for recommendations for improvement.

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Based on visits from SWA on Tuesday, March 16, 2010 and Wednesday, March 17, 2010 the following data was collected and analyzed.

Building Characteristics

The single-story, (slab on grade, but with three partial basement levels), 1,023 square feet North Pump Station Building was originally constructed in the 1980s with no additions/alterations. It houses pump equipment.

Front and Left Side Façade

Rear and Right Side Façade

Building Occupancy Profiles

Its occupancy is usually 1 employee on a sporadic and as needed basis.

Building Envelope

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/outside and no/low wind), no exterior envelope infrared (IR) images were taken during the field audit.

General Note: All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews (if available) and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

Exterior Walls

The exterior wall envelope is mostly constructed of split-face concrete block and some precast concrete accents, No insulation was detected. The interior is mostly painted CMU (Concrete Masonry Unit).

Note: Wall insulation levels could visually be verified in the field by non-destructive methods.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall poor condition mostly due to assumed roof leaks.

The following specific exterior wall problem spots and areas were identified:

Rusted and deteriorated steel lintel with associated signs of water damage.

Deteriorating exterior and interior wall finishes due to water and moisture presence inside the wall cavity

Roof

The building's roof is predominantly a flat, no parapet type over steel decking, with a built-up asphalt finish and reflective coating. It is original and has never been replaced. Zero inches of detectable attic/ceiling insulation, and two inches of foam board roof insulation were recorded.

Note: Roof insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall poor, age-appropriate condition, with numerous signs of uncontrolled moisture, air-leakage and other energy-compromising issues on any roof areas.

Save roof access was not possible at the time of the field audit. However, most exterior wall moisture and water issues mentioned above may be coming from aged flashing and roofing material issues.

Base

The building's base is composed of a below grade slab floor with a perimeter footing with poured concrete foundation walls and no detectable slab edge/perimeter insulation.

Slab/perimeter insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be

in acceptable condition with no significant signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

Windows

The building contains no windows.

Exterior doors

The building contains only one type of exterior door:

1. Solid metal type exterior doors. They are original and have never been replaced.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in acceptable/ age appropriate condition with some signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Damaged metal door panel

Missing/worn weather-stripping

Warped/aged metal door frame

Building air-tightness

Overall the field auditors found the building to be reasonably air-tight with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

The air tightness of buildings helps maximize all other implemented energy measures and investments, and minimizes potentially costly long-term maintenance, repair and replacement expenses.

Mechanical Systems

Heating

Heating is provided by a Trane gas-fired outdoor unit heater. The unit is located on the roof and has an input capacity of 200 MBH and is rated at 80% efficiency. The Trane rooftop unit heats outside air and delivers it directly to the building via ductwork. The unit is controlled by a non-programmable thermostat, however since the Pump Station is operated sporadically, heat settings are kept at a low setting to prevent freezing and are increased for short periods of time, when necessary. The unit was installed in 2008 and is in good condition.

Trane gas-fired outdoor unit heater

Cooling

There are no cooling systems at this facility.

Ventilation

Ventilation is provided to the facility by four (4) exhaust fans, a supply fan and a ventilation hood, all located on the roof. A General Resource Group supply fan SF-5, rated at 1 HP, 807 RPM supplies 3,400 CFM of outside air to the screening room while 3,400 CFM of outside air is exhausted from the space by EF-2 that is equipped with a ¾ HP, 1,020 RPM motor.

Roof exhaust fan

A 13,000 CFM ventilation hood with a motorized damper is interlocked with EF-1 (8,000 CFM) and EF-3 (5,200 CFM). Each provides exhaust for the motor control room with EF-3 dedicated to the area around the emergency generator.

Domestic Hot Water

The restroom sink receives the only domestic hot water at the facility, and is served by a 15 gallon, 1.5 kW AO Smith electric water heater, installed in 1986. This heater has 0% estimated useful operating life remaining and appears to be in deteriorating condition.

Electrical systems

Lighting

See attached lighting schedule in Appendix B for a complete inventory of lighting throughout the building including estimated power consumption and proposed lighting recommendations.

A complete inventory of all interior, exterior and exit sign lighting fixtures were examined and documented in Appendix A of this report including an estimated total lighting power consumption. The facility consists primarily of T12 fluorescent fixtures with magnetic ballasts.

As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps will no longer be produced for commercial and industrial applications. Also, many T12 lamps will be phased out of production starting July 2012.

Appliances and process

There are no appliances at this location. The building does contain a generator and a system of pumps and motors used as process equipment.

Generator - Backup power is supplied by a 90-kW Onan natural gas backup generator, installed in 1986. The generator is connected to a remote rooftop Bear Ward radiator.

Process - A Dresser Roots blower, located on the lower level of the pump room serves the sludge tank; this blower is equipped with a 5 HP, 3,510 RPM, 87.5% efficient Elektrimax motor.

Three (3) 20 HP, 1,170 RPM, 3 phase Continental Electro-Power pumps are in the pumping room, and three (3) pumps manufactured by Cornell Pumps are in the lower level. All six pumps were installed in 1980.

Elevators

The North Ave. Pump Station does not have an installed elevator.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the North Ave. Pump Station.

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving, and the cost of installation is decreasing, due to both demand and the availability of state and federal government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Technology such as photovoltaic panels or wind turbines, use natural resources to generate electricity on the site. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Solar thermal collectors heat a specified volume of water, reducing the amount of energy required to heat water using building equipment. Cogeneration or CHP allows you to generate electricity locally, while also taking advantage of heat wasted during the generation process.

Existing systems

Currently there are no renewable energy systems installed in the building.

Evaluated Systems

Solar Photovoltaic

Photovoltaic panels convert light energy received from the sun into a usable form of electricity. Panels can be connected into arrays and mounted directly onto building roofs, as well as installed onto built canopies over areas such as parking lots, building roofs or other open areas. Electricity generated from photovoltaic panels is generally sold back to the utility company through a net meter. Net-metering allows the utility to record the amount of electricity generated in order to pay credits to the consumer that can offset usage and demand costs on the electric bill. In addition to generation credits, there are incentives available called Solar Renewable Energy Credits (SRECs) that are subsidized by the state government. Specifically, the New Jersey State government pays a market-rate SREC to facilities that generate electricity in an effort to meet state-wide renewable energy requirements.

Based on utility analysis and a study of roof conditions, the North Ave. Pump Station is not a good candidate for a Solar Panel installation. As a result of our study, the roof and grounds of the North Ave. Pump Station building have been identified as inappropriate for the application of a Photovoltaic (PV) system. There is not enough unobstructed southern exposure on the roof or the grounds at the property. Also, the area on the roof that has unobstructed exposure is too close to the edge of the building for a PV installation.

Solar Thermal Collectors

Solar thermal collectors are not cost-effective for this building and would not be recommended due to the insufficient and intermittent use of domestic hot water throughout the building to justify the expenditure.

Geothermal

The North Ave. Pump Station is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, of which already has minimal use due to the operation of the building.

Combined Heat and Power

The North Ave. Pump Station is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a high electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. Typical applications include buildings with an absorption chiller, where waste heat would be used efficiently. This building has no means to use waste heat generated by a CHP system.

PROPOSED ENERGY CONSERVATION MEASURES

Energy Conservation Measures (ECMs) are recommendations determined for the building based on improvements over current building conditions. ECMs have been determined for the building based on installed cost, as well as energy and cost-savings opportunities.

Recommendations: Energy Conservation Measures

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Install Point-of-Use tankless Water Heater
2	Lighting Upgrades
	Description of Recommended >10 Year Payback ECMs
3	Replace existing pumps with premium efficiency units

ECM#1: *Install Point-of-Use tankless Water Heater*

Domestic hot water is provided by an electric water heater with a 15-gallon tank, which was installed in 1986 and is well beyond its useful lifetime. Due to the fact that this unit only services one restroom sink, which is seldom used, replacing this unit with a small point-of-use tankless water heater will result in energy savings from no longer maintaining a temperature of a 15 gallon volume of water. The current unit keeps 15 gallons of water heated 24 hours per day; by comparison, a tankless water heater has a volume of only 2.75 gallons, and the unit would only heat the water when the sink is in use, which would be no more than the amount of time the building is occupied, 5 hours per week.

Installation cost:

Estimated installed cost: $200 (Estimated $60 labor)
Source of cost estimate: Similar Projects

ECM	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1	200	1,089	0.6	0	3.6	30	254	15	3,815	0.8	1808%	121%	127%	2,793	1,950

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. To calculate the savings from switching from electricity to gas, a spreadsheet created by Rheem was used. The temperature rise of the heated water was set at 77°F on the spreadsheet, and the energy factor (a unit that specifies the efficiency of water heaters) is specified as 0.94 for electric units with and without a tank. Weight of water was set at 8.33 pounds/gal. Using this data, the BTUs of output heat used for heating the water were calculated by the following equation:

$$BTUs_{output} = Vol. \times Wt._{Water} \times \Delta Temp.$$

Due to the fact that the tankless water heater would only operate during the five hours per week that the building is in use, the BTUs of output heat for the proposed unit had to be multiplied by $\frac{5}{24\times7}$. The actual BTUs purchased by each unit are calculated using these values and the energy factors:

$$BTUs_{input} = \frac{BTUs_{output}}{Energy\ Factor}$$

The annual costs for heating the water can now be calculated using this data:

Electric

Volume of Water Heated (gal)	Water Weight (lbs/gal)	Temperature Rise (°F)	BTUs Required to Heat Water	Energy Factor	BTUs Purchased to Heat Water	$/kWh	Daily Cost to Heat Water	Annual Cost to Heat Water
15	8.33	77	9,621	0.94	10,235	$0.21	$0.630	$229.87

Tankless

Volume of Water Heated	Water Weight (lbs/gal)	Temperature Rise (°F)	BTUs Required to Heat Water	Energy Factor	BTUs Purchased to Heat Water	$/kWh	Daily Cost to Heat Water	Annual Cost to Heat Water
2.75	8.33	77	52	0.94	56	$0.21	$0.003	$1.25

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart Prescriptive incentive - $300 for tankless water heater*

Please see Appendix F for more information on Incentive Programs.

ECM#2: *Lighting Upgrades*

On the days of the site visits, SWA/BSG-PMK completed a lighting inventory of the City of Elizabeth North Ave. Pump Station (see Appendix B). The existing lighting consists of mostly T12 fluorescent fixtures with magnetic ballasts. SWA/BSG-PMK recommends retrofitting the T12 fixtures with T8 lamps and electronic ballasts. The building also contained 1 fluorescent exit sign that should be retrofitted with a more efficient, LED exit sign. SWA/BSG-PMK also recommends replacing one exterior Probe Start Metal Halide fixture with Pulse Start Metal Halide technology. There are also several incandescent fixtures. Occupancy sensors are not recommended based on the small floor are of the building and minimal use that would prohibit energy savings. The labor in all these installations was evaluated using prevailing electrical contractor wages. The City of Elizabeth may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings.

Installation cost:

Estimated installed cost: $1,582 (estimated $474 labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

ECM	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
2	1,050	1,892	1.0	0	6.3	0	390	15	5,846	2.7	457%	30%	37%	3,536	3,388

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix B.

Rebates/financial incentives:

- *NJ Clean Energy – T8 fluorescent fixture ($15 per fixture)*
- *NJ Clean Energy – Metal Halide with Pulse Start ($25 per fixture)*
- *NJ Clean Energy – LED exit sign ($10/$20 per fixture)*

Please see Appendix F for more information on Incentive Programs.

ECM#3: *Replace existing pumps with premium efficiency units*

On the days of the site visits, SWA/BSG-PMK completed a lighting inventory of the City of Elizabeth Animal Shelter (see Appendix B). The existing lighting consists of mostly T12 fluorescent fixtures with magnetic ballasts. There are also several incandescent fixtures. SWA/BSG-PMK recommends retrofitting the T12 fixtures with T8 lamps and electronic ballasts as well as incandescent fixtures with compact fluorescent lamps. Occupancy sensors are not recommended based on the small floor are of the building and constant use that would prohibit energy savings. The labor in all these installations was evaluated using prevailing electrical contractor wages. The City of Elizabeth may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings.

Installation cost:

Estimated installed cost: $18,953 ($2,000 each for labor, additional 6% for shipping)
Source of cost estimate: Contractor

ECM	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
3	18,953	6,233	3.3	0	20.8	180	1,464	20	29,280	12.9	54%	3%	5%	2,430	11,160

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The horsepower ratings of the three motors were converted to kW by multiplying by a factor of 0.746. Each pump operates for 2920 hours per year. The savings were calculated using the following equations:

$$\text{Electric consumption(kWh)} = \frac{\text{HP} \times 0.746\frac{\text{kW}}{\text{HP}} \times \text{Diversity Factor} \times \frac{\text{Hours}}{\text{Year}}}{\text{Efficiency}}$$

Savings (kWh) = Current Electric Consumption (kWh)-Proposed Electric Consumption (kWh)

Rebates/financial incentives:

- *NJ Clean Energy – Custom Motor incentive ($113 per 20 HP motor)*

Please see Appendix F for more information on Incentive Programs.

PROPOSED FURTHER RECOMMENDATIONS

Capital Improvements

Capital Improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available, or if the installed costs can be shared with other improvements, such as major building renovations. SWA recommends the following capital improvements for the North Ave. Pump Station:

- Repair exterior masonry finishes – The building envelope was observed to be in poor condition, leading to water penetrating through the shell of the building. SWA recommends that the City of Elizabeth consider repairing the exterior finishes in order to prevent moisture penetration.

- Replace or repair rusted steel lintel above exterior door – SWA observed that the steel lintel located above the exterior door was rusted and deteriorated due to water damage. In addition, this deterioration is allowing water to seep into the building during inclement weather. SWA recommends replacing or repairing this lintel in to prevent water seepage.

- Replace all exhaust fans – SWA recommends replacing all exhaust fans with premium efficiency fans as the fans begin to fail. Currently, all exhaust fans are beyond their useful lifetime at a decreased efficiency, however energy savings alone would not justify replacing the exhaust fans at this time.

Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current building staff to handle. These measures typically require little investment, and they yield a short payback period. These measures may address equipment settings or staff operations that, when addressed will reduce energy consumption or costs.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining properly away from the building.

- Provide weather-stripping/air-sealing - SWA observed that exterior door weather-stripping was beginning to deteriorate in places. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected, and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Repair/seal wall cracks and penetrations - SWA recommends as part of the maintenance program installing weep holes, installing proper flashing and correct masonry efflorescence, and sealing wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.

Note: The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the City of Elizabeth. Based on the requirements of the LGEA program, the City of Elizabeth must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $345.

APPENDIX A: EQUIPMENT LIST

Inventory

North Avenue Pump Station							
Building System	Description	Locations	Model #	Fuel	Space Served	Year Installed	Estimtaed. Remaining Useful Life %
Heating	HV-1 Heating 200 MBH, 80% efficient 1600 cfm	Roof	Trane, M# GRAA20PFHF0N6CC102001, S# F08G06055	Natural gas	Entire building	2008	87%
Ventilation	SF-5: Supply Fan, 1 HP, 607 RPM 3400 cfm	Roof	General Resource Group, M# FC8 15XP	Electricity	Screening Room	1980	0%
Ventilation	EF-4: Exhaust fan, 1/2 HP, 1,700 RPM 900 cfm	Roof	General Resource Group, M# UB BRX 12LTE, S# 210737	Electricity	Pump Room	1980	0%
Ventilation	RV-1 Ventilation hood 13,000 cfm with motorized damper	Roof	No nameplate	Electricity	Motor Room	1980	0%
Ventilation	EF- 1 Exhaust fan 8000 cfm	Roof	No nameplate	Electricity	Motor Room	1980	0%
Ventilation	EF-2 Exhaust fan, 3/4 HP, 1,020 RPM 3400 cfm	Roof	General Resource Group, M# UB SBRX 20MEP, S# 210735	Electricity	Screening Room	1980	0%
Ventilation	EF- 3 1 HP, 740 RPM 5200 cfm	Roof	General Resource Group, M# UB BRX 24LTE, S# 213736	Electricity	Generator Area	1980	0%
DHW	Water heater, 15 gallons, 1.5 kW	Restroom	AO Smith, M# ELJ 15 910, S# MC86-55584-910	Electricity	Restroom sink	1986	0%
Backup Power	Backup generator, 90 kW	Pump room	Onan, M# 100G875TG/GC2, S# 189726	Natural gas	Entire Building	1986	70%
	Radiator	Roof	Bear Ward PN10001	Electricit	Generato	1986	70%

				y	r		
Blower	Blower	Pump room	Dresser Roots, M# 32 U-RAI, S# 0704947603	Electricity	Sludge tank	Process	N/A
	Blower motor, 3,510 RPM, 5 HP, 87.5% efficiency		Elektrimax, M# 33MFM-3-5-36, S# 38080274	Electricity	Blower	Process	N/A
Pumping	Pump #1: 20 HP, 1,170 RPM, 3 phase	Pump room	Continental Electro-Power, M# WV326UP, S# H86251	Electricity	Pumping system	1980	0%
Pumping	Pump #2: 20 HP, 1,170 RPM, 3 phase	Pump room	Continental Electro-Power, M# WV326UP, S# H86253	Electricity	Pumping system	1980	0%
Pumping	Pump #3: 20 HP, 1,170 RPM, 3 phase	Pump room	Continental Electro-Power, M# WV326UP, S# H86252	Electricity	Pumping system	1980	0%
Pumping	(3) pumps	Basement	Cornell Pumps, M# 6NHTA-VFG, S# 49912 13	Electricity	Pumping system	1980	0%

Note: The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

LIGHTING ANALYSIS

Township of Elizabeth
North Ave Pump Station
140 North Ave

BIRDSALL SERVICES GROUP
ENGINEERS & CONSULTANTS

Upgrade Code	Upgrade Description	Existing Fixture	Existing Watts	Proposed Fixture	Proposed Watts	Lighting Total # of Upgrades	Lighting Cost per Upgrade ($)	Lighting SmartStart Rebate per Upgrade
1	4' Wall Mounted Fixture with (2) T12 Lamps and a Magnetic Ballast in an Aluminum Casing with a Clear Lense / Retrofit with T8 Lamps and an Electronic Ballast.	2L4' EE/STD	80	2L4' T8/ELEC	61	10	$60.00	$15.00
2	4' Hanging Fixture with (2) T12 Lamps and a Magnetic Ballast covered by a wire guard / Retrofit with T8 Lamps and an Electronic Ballast.	2L4' EE/STD	80	2L4' T8/ELEC	61	12	$60.00	$15.00
3	Retrofit the Exit Sign by replacing the incandescent Lamp(s) with LED Technology	15W Exit	15	LED	2	2	$40.00	$10.00
4	150W Metal Halide Wall Pack	150W MH/BALLAST	195	No Upgrade	195	2	$0.00	$0.00
5						0	$0.00	$0.00
6						0	$0.00	$0.00
7						0	$0.00	$0.00
8						0	$0.00	$0.00
9						0	$0.00	$0.00
10						0	$0.00	$0.00
11						0	$0.00	$0.00
12						0	$0.00	$0.00

Summary

	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	$1,400.00	$0.00	$1,400.00
Rebate	$350.00	$0.00	$350.00
Net Cost	$1,050.00	$0.00	**$1,050.00**
Savings (kWh)	1,892	0	**1,892**
Savings ($)	$397.35	$0.00	**$397.35**
Payback	2.6		**2.6**

Variables:

$0.21	Avg. Electric Rate ($/kWh)
	Avg. Demand Rate ($/kW)
8760	Operating Hours/Year
24	Operating Hours/Work Day

Assumptions:

25%	Occupancy Sensor Savings (Avg)
40%	Occupancy Sensor Savings(>Avg)

Notes:

Seq. #	Upgrade Code	Room/Area	Hrs/ Work Day	Hrs/ Year	Existing Fixture	Existing Qty.	Existing Watts	Existing Foot Candles	Proposed Fixture	Proposed Qty.	Proposed Watts	kW Reduction	Lighting Energy Savings, kWh	Lighting Cost ($)	Lighting Savings ($)	Lighting Payback (yrs)	Controls Type	Controls Qty.	Occupancy Sensors (ONLY) Energy Savings, kWh	Occupancy Sensors (ONLY) Cost ($)	Occupancy Sensors (ONLY) Savings ($)	Occupancy Sensors (ONLY) Payback (yrs)	SmartStart Rebate Lighting	SmartStart Rebate Sensors	Lighting & Occupancy Sensors Energy Savings, kWh	Lighting & Occupancy Sensors Post-Rebate Cost ($)	Lighting & Occupancy Sensors Savings ($)	Lighting & Occupancy Sensors Payback (yrs)
		Totals:	2180								1736	0.444	1892	$1,400.00	$397.35	3.5			0	$0.00	$0.00		$350.00	$0.00	1892	$1,050.00	$397.35	2.6
1	1	Motor Room	6	2190	2L4' EE/STD	10	800		2L4' T8/ELEC	10	610	0.19	416	$600.00	$87.38	6.9			0	$0.00	$0.00		$150.00	$0.00	416	$450.00	$87.38	5.1
2	2	Sub Level 1	24	8760	2L4' EE/STD	3	240		2L4' T8/ELEC	3	183	0.057	499	$180.00	$104.86	1.7			0	$0.00	$0.00		$45.00	$0.00	499	$135.00	$104.86	1.3
3	2	Sub Level 2	24	8760	2L4' EE/STD	3	240		2L4' T8/ELEC	3	183	0.057	499	$180.00	$104.86	1.7			0	$0.00	$0.00		$45.00	$0.00	499	$135.00	$104.86	1.3
4	2	Sub Level 3	6	2190	2L4' EE/STD	6	480		2L4' T8/ELEC	6	366	0.114	250	$360.00	$52.43	6.9			0	$0.00	$0.00		$90.00	$0.00	250	$270.00	$52.43	5.1
5	3	Exit	24	8760	15W Exit	2	30		LED	2	4	0.026	228	$80.00	$47.83	1.7			0	$0.00	$0.00		$20.00	$0.00	228	$60.00	$47.83	1.3
6	4	Exit	7	2555	150W MH/BALLA	2	390		No Upgrade	2	390	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(212) 538-3124 www.creditsuisse.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc.	(800) 363-7499

112 Main St. Lebanon, NJ 08833	www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for Elizabethtown Gas Co. Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com

South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX D: GLOSSARY AND METHOD OF CALCULATIONS

Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expresses the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): 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 (assumes bond rate of 3.2%).

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

Gas Rate and Electric Rate ($/therm and $/kWh): The gas rate and electric rate used in the financial analysis is the total annual energy cost divided by the total annual energy usage for the 12 month billing period studied. The graphs of the monthly gas and electric rates reflect the total monthly energy costs divided by the monthly usage, and display how the average rate fluctuates throughout the year. The average annual rate is the only rate used in energy savings calculations.

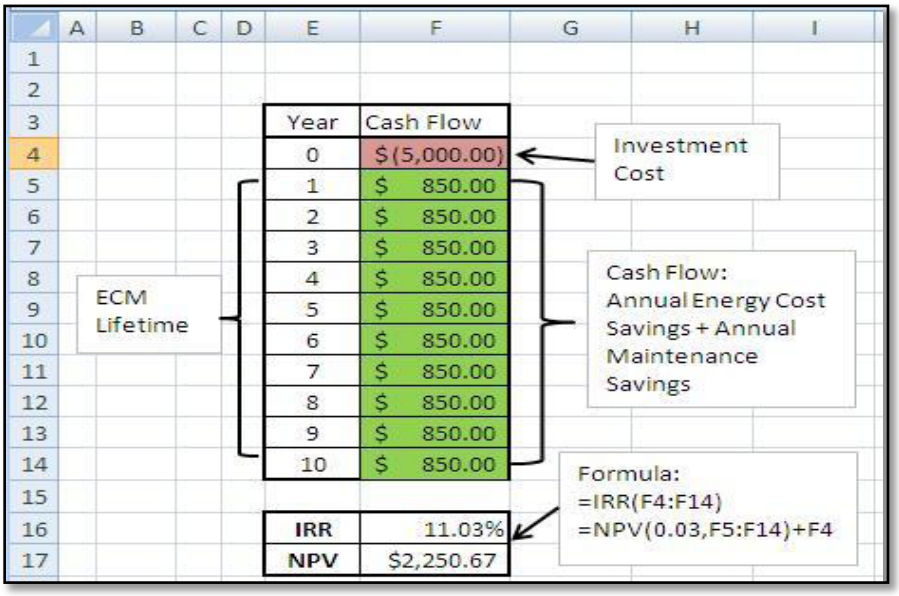
Calculation References

Term	Definition
ECM	Energy Conservation Measure
AOCS	Annual Operating Cost Savings
AECS	Annual Energy Cost Savings
LOCS*	Lifetime Operating Cost Savings
LECS	Lifetime Energy Cost Savings
LCS	Lifetime Cost Savings
NPV	Net Present Value
IRR	Internal Rate of Return
DR	Discount Rate
Net ECM Cost	Total ECM Cost – Incentive
LECS	AECS X ECM Lifetime
AOCS	LOCS / ECM Lifetime
LCS	LOCS+LECS
Simple Payback	Net ECM Cost / (AECS + AOCS)
Lifetime ROI	(LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI	(Lifetime ROI / Lifetime) = [(AECS + OCS) / Net ECM Cost – (1 / Lifetime)]

* The lifetime operating cost savings are all avoided operating, maintenance, and/or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Excel NPV and IRR Calculation

In Excel, function =IRR (values) and =NPV(rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $1/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $600/Megawatt hour /1000 * 15 years]

ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

Measure	Life Span
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Gas Furnace — New or Replacement	20
Small Commercial Gas Boiler — New or Replacement	20
Small Commercial Gas DHW — New or Replacement	10
C&I Gas Absorption Chiller — New or Replacement	25
C&I Gas Custom — New or Replacement (Engine Driven Chiller)	25
C&I Gas Custom — New or Replacement (Gas Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8

APPENDIX E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
City of Elizabeth - Sewer Pump Station

Building ID: 2250889
For 12-month Period Ending: January 31, 2010[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: May 26, 2010

Facility	Facility Owner	Primary Contact for this Facility
City of Elizabeth - Sewer Pump Station 140 North Avenue Elizabeth, NJ 07201	N/A	N/A

Year Built: 1980
Gross Floor Area (ft²): 1,023

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	232,512
Natural Gas (kBtu)[4]	475,099
Total Energy (kBtu)	707,611

Energy Intensity[5]	
Site (kBtu/ft²/yr)	692
Source (kBtu/ft²/yr)	1245

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	61

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	485%
Building Type	Other

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures and completion of a Post-Construction Benchmarking Report. Theincentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15%performance threshold savings has been achieved.

For further information, please see: http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings .

Direct Install 2010 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC and other equipment with energy efficient alternatives. The program pays **up to 80%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
    - Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
    - Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, South Jersey Gas

For the most up to date information on contractors in New Jersey who participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/direct-install

Smart Start

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government, and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and Equipment Replacement.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings.

Renewable Energy Incentive Program*

The Renewable Energy Incentive Program (REIP) provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current incentive levels, participation information, and application forms can be found at the website listed below.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/renewable-energy/home/home.

Utility Sponsored Programs

Check with your local utility companies for further opportunities that may be available.

Energy Efficiency and Conservation Block Grant Rebate Program

The Energy Efficiency and Conservation Block Grant (EECBG) Rebate Program provides supplemental funding up to $20,000 for eligible New Jersey local government entities to lower the cost of installing energy conservation measures. Funding for the EECBG Rebate Program is provided through the American Recovery and Reinvestment Act (ARRA).

For the most up to date information on how to participate in this program, go to: http://njcleanenergy.com/EECBG

Other Federal and State Sponsored Programs

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check http://www.dsireusa.org/.

*Subject to availability. Incentive program timelines might not be sufficient to meet the 25% in 12 months spending requirement outlined in the LGEA program.

APPENDIX G: ENERGY CONSERVATION MEASURES

Energy Conservation Measures																			
ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1	Install Point-of-Use Tankless Water Heater	Similar Projects	500	300	200	1,089	0.6	0	3.6	30	254	15	3,815	0.8	1808%	121%	127%	2,793	1,950
2	Lighting Upgrades	RS Means	1,400	350	1,050	1,892	1.0	0	6.3	0	390	15	5,846	2.7	457%	30%	37%	3,536	3,388
3	Replace existing pumps with premium efficiency units	Contractor	19,292	339	18,953	6,233	3.3	0	20.8	180	1,464	20	29,280	12.9	54%	3%	5%	2,430	11,160
	TOTALS		**21,192**	**989**	**20,203**	**9,214**	**4.9**	**0**	**30.7**	**210**	**2,108**	-	**38,941**	**9.6**	-	-	-	**8,759**	**16,498**

APPENDIX H: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tool:	Established/standard industry assumptions, eQUEST
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published and established specialized equipment material and labor costs Cost estimates also based on utility bill analysis and prior experience with similar projects

Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.