Local Government Energy Audit:
Energy Audit Report

Public Works Garage

Township of Woodbridge

225 Smith Street
Keasbey, NJ 08832

April 27, 2018

Final Report by:
TRC Energy Services

Disclaimer

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

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

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

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

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1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Public Works Garage.

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

This study was conducted by TRC Energy Services (TRC), as part of a comprehensive effort to assist New Jersey local governments in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

1.1 Facility Summary

Public Works Garage is a 122,800 square-foot facility originally built in 1950 and is comprised of various space types located between two connected buildings. They are metallic structure buildings with metal frames and no regular window types. Interior lighting is provided predominantly by T12 linear fixtures and lamps with electronic and magnetic ballasts as well as T8 linear fixtures, incandescent and metal halide lamps. Lighting control consists of manual wall switches. The building also has exterior lighting which consists of metal halide lamps that are controlled with photocells. Cooling is provided by window units and split system air conditioners. The heating system consists of hot water boilers, furnaces and warm air unit heaters.

A thorough description of the facility and our observations are located in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated 11 measures which together represent an opportunity for Public Works Garage to reduce annual energy costs by $109,538 and annual greenhouse gas emissions by 865,987 lbs CO_2e. We estimate that if all measures were implemented as recommended, the project would pay for itself in 2.2 years. The breakdown of existing and potential utility costs after project implementation are illustrated in Figure 1 and Figure 2, respectively. Together these measures represent an opportunity to reduce Public Works Garage's annual energy use by 17%.

Figure 1 – Previous 12 Month Utility Costs

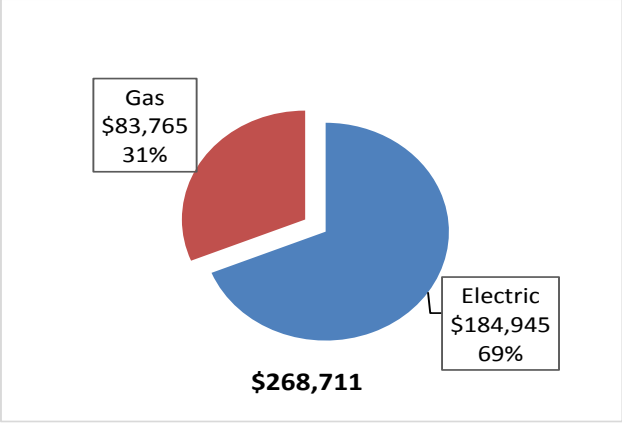
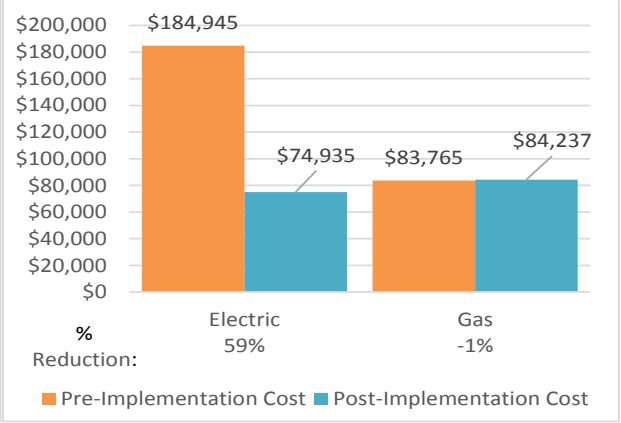


Figure 2 – Potential Post-Implementation Costs



A detailed description of Public Works Garage's existing energy use can be found in Section 3.

Estimates of the total cost, energy savings, and financial incentives for the proposed energy efficient upgrades are summarized below in Figure 3. A brief description of each category can be found below and a description of savings opportunities can be found in Section 4.

Figure 3 – Summary of Energy Reduction Opportunities

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**749,235**	**103.1**	**$94,984.51**	**$220,551.93**	**$2,900.00**	**$217,651.93**	**2.3**	**754,474**
ECM 1	Install LED Fixtures	Yes	646,272	81.1	$81,931.32	$196,733.48	$2,130.00	$194,603.48	2.4	650,791
ECM 2	Retrofit Fixtures with LED Lamps	Yes	101,696	21.9	$12,892.56	$22,097.57	$770.00	$21,327.57	1.7	102,407
ECM 3	Install LED Exit Signs	Yes	1,267	0.1	$160.63	$1,720.88	$0.00	$1,720.88	10.7	1,276
Lighting Control Measures			**72,621**	**8.3**	**$9,206.53**	**$2,106.00**	**$570.00**	**$1,536.00**	**0.2**	**73,129**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	72,621	8.3	$9,206.53	$2,106.00	$570.00	$1,536.00	0.2	73,129
Variable Frequency Drive (VFD) Measures			**6,655**	**2.0**	**$843.66**	**$11,473.01**	**$0.00**	**$11,473.01**	**13.6**	**6,701**
ECM 5	Install VFD on Variable Air Volume (VAV) HVAC	Yes	2,359	1.2	$299.12	$5,457.71	$0.00	$5,457.71	18.2	2,376
ECM 6	Install VFDs on Hot Water Pumps	Yes	4,295	0.8	$544.54	$6,015.30	$0.00	$6,015.30	11.0	4,325
Electric Unitary HVAC Measures			**3,692**	**2.2**	**$468.10**	**$4,899.42**	**$0.00**	**$4,899.42**	**10.5**	**3,718**
ECM 7	Install High Efficiency Electric AC	Yes	3,692	2.2	$468.10	$4,899.42	$0.00	$4,899.42	10.5	3,718
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**$275.42**	**$2,945.45**	**$400.00**	**$2,545.45**	**9.2**	**4,578**
ECM 8	Install High Efficiency Furnaces	Yes	0	0.0	$275.42	$2,945.45	$400.00	$2,545.45	9.2	4,578
Domestic Water Heating Upgrade			**33,598**	**2.7**	**$3,512.49**	**$7,297.65**	**$200.00**	**$7,097.65**	**2.0**	**21,419**
ECM 9	Install High Efficiency Gas Water Heater	Yes	31,073	2.7	$3,192.39	$7,261.80	$200.00	$7,061.80	2.2	18,876
ECM 10	Install Low-Flow Domestic Hot Water Devices	Yes	2,525	0.0	$320.10	$35.85	$0.00	$35.85	0.1	2,543
Plug Load Equipment Control - Vending Machine			**1,954**	**0.0**	**$247.76**	**$460.00**	**$0.00**	**$460.00**	**1.9**	**1,968**
ECM 11	Vending Machine Control	Yes	1,954	0.0	$247.76	$460.00	$0.00	$460.00	1.9	1,968
TOTALS			**867,755**	**118.3**	**$109,538.49**	**$249,733.46**	**$4,070.00**	**$245,663.46**	**2.2**	**865,987**

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

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

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

Lighting Controls measures generally involve the installation of automated controls to turn off lights or reduce light output when not needed. Automated control reduces reliance on occupant behavior for adjusting lights. These measures save energy by reducing the amount of time lights are on.

Variable Frequency Drives (VFDs) are motor control devices. These measures control the speed of a motor so that the motor spins at peak efficiency during partial load conditions. Sensors adapt the speed to flow, temperature, or pressure settings which is much more efficient that usage a valve or damper to control flow rates, or running the motor at full speed when only partial power is needed. These measures save energy by controlling motor usage more efficiently.

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

Gas Heating (HVAC/Process) measures generally involve replacing older inefficient hydronic heating systems with modern energy efficient systems. Gas heating systems can provide equivalent heating compared to older systems at a reduced energy cost. These measures save energy by reducing the fuel demands for heating, due to improved combustion and heat transfer efficiency.

Domestic Hot Water upgrade measures generally involve replacing older inefficient domestic water heating systems with modern energy efficient systems. New domestic hot water heating systems can provide equivalent, or greater, water heating capacity compared to older systems at a reduced energy cost. These measures save energy by reducing the fuel used for domestic hot water heating due to improved heating efficiency or reducing standby losses.

Plug Load Equipment control measures generally involve installing automated devices that limit the power usage or operation of equipment that is plugged into an electric outlet when not in use.

Energy Efficient Practices

TRC also identified 10 low cost or (no cost) energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral or operational adjustments and by performing better routine maintenance on building systems. These practices can extend equipment lifetime, improve occupant comfort, provide better health and safety, as well as reduce annual energy and O&M costs. Potential opportunities identified at Public Works Garage include:

- Reduce Air Leakage
- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Ensure Lighting Controls Are Operating Properly
- Perform Routine Motor Maintenance
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Perform Proper Boiler Maintenance
- Perform Proper Furnace Maintenance
- Perform Proper Water Heater Maintenance
- Water Conservation

For details on these energy efficient practices, please refer to Section 5.

On-Site Generation Measures

TRC evaluated the potential for installing on-site generation for Public Works Garage. Based on the configuration of the site and its loads there is a high potential for installing a photovoltaic (PV) array.

Figure 4 – Photovoltaic Potential

Potential	High	
System Potential	214	kW DC STC
Electric Generation	254,953	kWh/yr
Displaced Cost	$22,180	/yr
Installed Cost	$556,400	

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

1.3 Implementation Planning

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

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

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

- SmartStart
- Pay for Performance - Existing Building (P4P)
- Energy Savings Improvement Program (ESIP)

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

Larger facilities with an interest in a more comprehensive whole building approach to energy conservation should consider participating in the Pay for Performance (P4P) program. Projects eligible for this project program must meet minimum savings requirements. Final incentives are calculated based on actual measured performance achieved at the end of the project. The application process is more involved, and it requires working with a qualified P4P contractor, but the process may result in greater energy savings overall and more lucrative incentives, up to 50% of project's total cost.

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the Energy Savings Improvement Program (ESIP). Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. An LGEA report (or other approved energy audit) is required for participation in ESIP. Please refer to Section 8.4 for additional information on the ESIP Program.

Additional information on relevant incentive programs is located in Section 8 or: www.njcleanenergy.com/ci.

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 5 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Brian B. Burke	Building Superintendent	brian.burke@twp.woodbridge	(732) 634-4500
Designated Representative			
James Mulrooney	Facility Personel		(932) 675-2861
TRC Energy Services			
Moussa Traore	Auditor	mtraore@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On February 10, 2017, TRC performed an energy audit at Public Works Garage located in Keasbey, New Jersey. TRC's auditor met with James Mulrooney to review the facility operations and help focus our investigation on specific energy-using systems.

The metal structure is a 122,800 square-foot facility constructed in 1950 and is comprised of offices, garages, maintenance shops, and storage rooms. The building houses all of the township's public works departments (services related to sanitation and recycling, mechanics, parks, water/wastewater, etc.).

Exterior walls covering the metallic structure consist of a metal frame with no insulation. The building has a gable roof that was not accessible during the site visit but appeared to be in fair condition. This was confirmed by the site contact. There are no regular window types and the exterior doors consist of motorized movable doors.

Interior lighting is provided predominantly by T12 linear fixtures and lamps with electronic and magnetic ballasts, as well as linear T8 fixtures and lamps, incandescent and metal halide lamps. Lighting control is provided by manual wall switches. The building also has exterior lighting which consists of metal halide lamps. They are controlled with photocells.

Cooling is provided by window units and split system air conditioners. The heating system consists of three hot water boilers, furnaces and warm air unit heaters.

2.3 Building Occupancy

The entire facility is used year-round. During a typical day, the facility is occupied by approximately 100 workers. The typical schedule is presented in the table below.

Figure 6 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Public Works Garage	Weekday	4:00 AM - 11:00 PM
Public Works Garage	Weekend	4:00 AM - 11:00 PM

2.4 Building Envelope

The metal structure building has a gable roof and a heavy grade steel frame for the exterior walls. This facility has no insulation. There is no regular window type and exterior doors consists of motorized movable doors. Overall, the building envelope appeared to be in fair condition with some signs of outside air infiltration.

2.5 On-Site Generation

Public Works Garage does not have any on-site electric generation capacity.

2.6 Energy-Using Systems

Please see Appendix A: Equipment Inventory & Recommendations for an inventory of the facility's equipment.

Lighting System

Lighting consists predominantly of 40-Watt linear fluorescent T12 lamps with electronic and magnetic ballasts as well as 32-Watt linear T8 fixtures and lamps, incandescent and metal halide lamps. The offices, garage spaces and maintenance areas are all lit with a combination of T8 and T12 fixtures and lamps. Four-foot and eight-foot long strip fixtures with 2 and 3 lamps each are found in the garages and maintenance shops.

The tunnel building has 400-Watt metal halide lamps that are on 24 hours a day with no control system. The Public Works Director's office has already been retrofitted to LED tubes. The police bay, tire bay, body shop, main mechanical bay, swiper bay, and the well shop areas are all lit primarily with 400-Watt metal halide lamps. Lighting control is provided mainly by manual wall switches. Exterior lighting consists of six outdoor wall-mounted LED fixtures and 400-Watt metal halide lamps. They are controlled with photocells.

Significant energy savings could be achieved by continuing to retrofit the existing lighting system with LED linear tubes and LED lamps fixtures. Installing occupancy sensors in select areas will yield additional energy savings.

Hot Water Heating System

The heating hot water system consists of a HydroTherm modular gas-fired non-condensing boiler with an output capacity of 720 and an estimated nominal efficiency of 80%. The boiler is configured in constant flow primary distribution with two 3 hp hot water supply pumps. The pumps are running with constant speed. They are 15 years old and are functioning in good condition as mentioned by the site contact.

Space heating for the perimeter offices is provided with hot water baseboard radiators. Heating temperatures are controlled by local thermostats.

Gas Heating Furnaces and Heaters.

One Lennox gas fired furnace with an output capacity of 130 kBtu/hr and one Bryant gas fired furnace with an output capacity of 90 kBtu/hr provide heating to the Recycling Tower and the Sanitation Department. They are twenty-seven and six years old respectively. The Lennox furnace has reached the end of its useful life of service and is in need of replacement. Both of these units are controlled with local thermostats. Also, the garage and maintenance shops have a total of 34 gas air unit heaters.

Direct Expansion Air Conditioning System (DX)

There are four split system AC units ranging from 2.5 to 5-ton and four window units ranging from 2 to 2.5-ton that are used to condition the offices and data room. The split systems are manufactured by Lennox, Goodman, Mitsubishi, and Rheem. They all appeared in good condition and are controlled with programmable thermostats. Please note the window unit serving the Parks Department Office is in need of replacement.

The buildings are exhausted and ventilated by an assortment of commercial grade exhaust fans.

Plug Load and Vending Machines

There are approximately 30 computers with LCD monitors. There is one server closet with cooling provided by the Mitsubishi split AC unit and other control equipment. There is no centralized PC power management software installed. There is one refrigerated beverage vending machine and one non-refrigerated snack vending machine.

2.7 Water-Using Systems

There are several restrooms at this facility. A sampling of restrooms found that faucets are rated for 2.2 gallons per minute (gpm) or higher, the toilets are rated at 2.5 gallons per flush (gpf) and the urinals are rated at 2 gpf. There are two restrooms with showers that bicycle commuters use in the morning. The showerheads are rated at 5 gpm.

3 SITE ENERGY USE AND COSTS

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

3.1 Total Cost of Energy

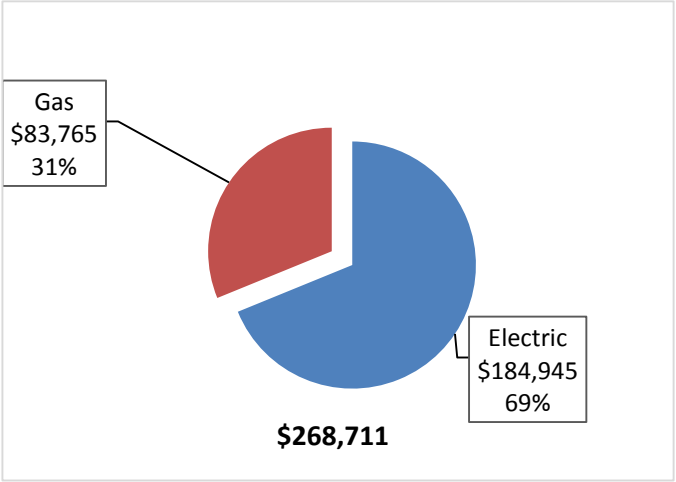
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 7 - Utility Summary

Utility Summary for Public Works Garage		
Fuel	**Usage**	**Cost**
Electricity	1,458,844 kWh	$184,945
Natural Gas	118,909 Therms	$83,765
Total		**$268,711**

The current annual energy cost for this facility is $268,711 as shown in the chart below.

Figure 8 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was $0.127/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 9 -Electric Usage & Demand

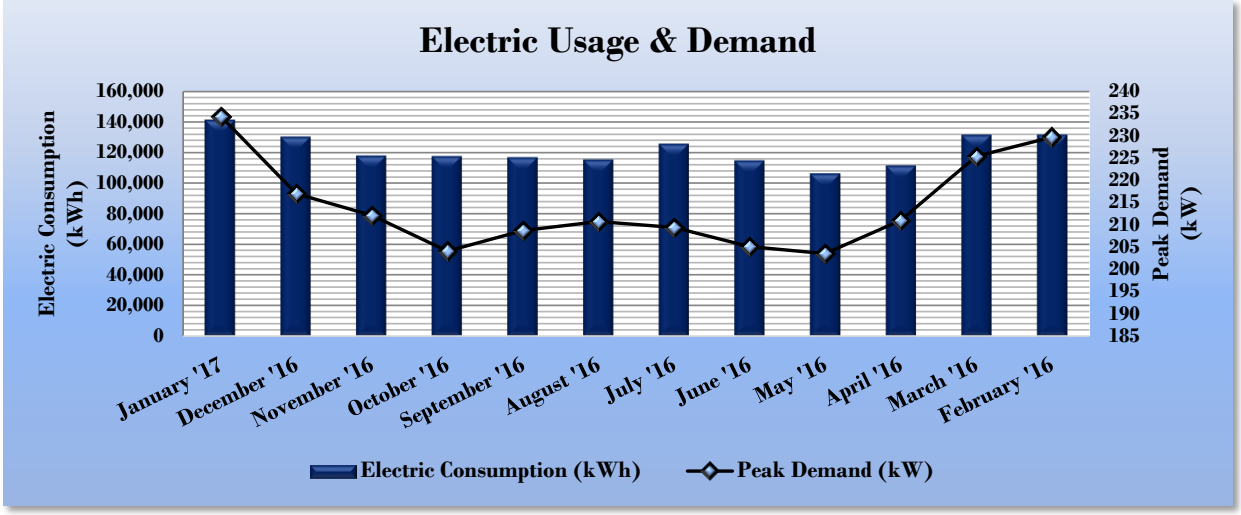


Figure 10 -Electric Usage & Demand

Electric Billing Data for Public Works Garage					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
1/25/17	33	141,166	234	$872	$16,990
12/23/16	31	130,167	217	$808	$16,406
11/22/16	29	117,831	212	$790	$14,131
10/24/16	31	117,351	204	$760	$14,101
9/23/16	30	116,677	209	$774	$16,096
8/24/16	29	115,148	211	$772	$15,924
7/26/16	32	125,526	209	$767	$17,005
6/24/16	30	114,691	205	$752	$15,762
5/25/16	29	106,066	204	$746	$13,055
4/26/16	29	111,323	211	$773	$13,665
3/28/16	32	131,449	225	$825	$15,876
2/25/16	30	131,449	230	$833	$15,934
Totals	**365**	**1,458,844**	**234.4**	**$9,472**	**$184,945**
Annual	**365**	**1,458,844**	**234.4**	**$9,472**	**$184,945**

3.3 Natural Gas Usage

Natural gas is provided by Elizabethtown Gas. The average gas cost for the past 12 months is $0.704/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

Figure 11 -Natural Gas Usage

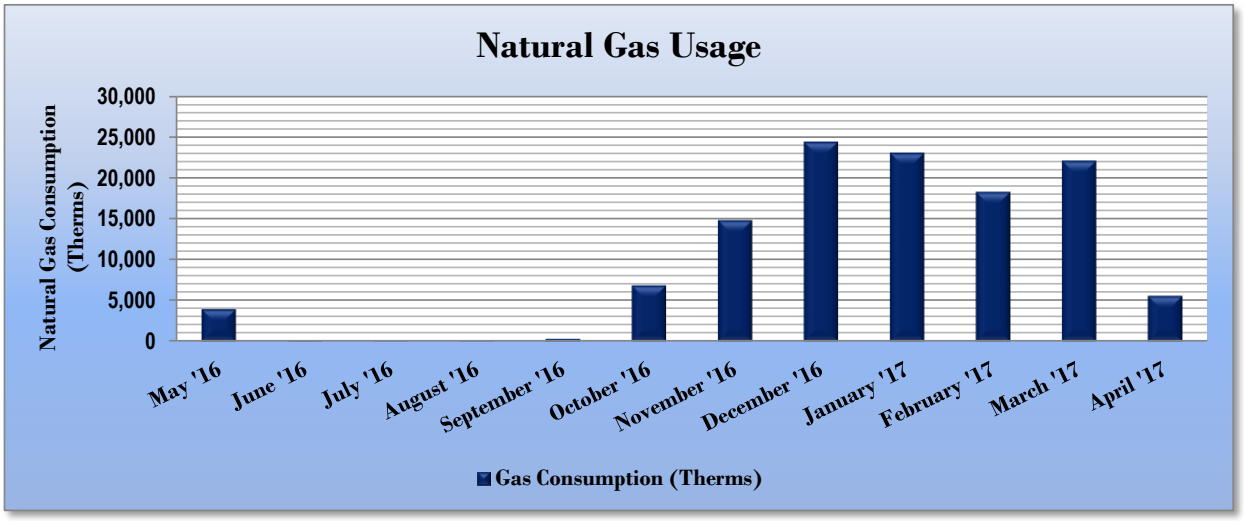


Figure 12 -Natural Gas Usage

Gas Billing Data for Public Works Garage			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
6/1/16	31	3,913	$3,798
7/1/16	30	63	$2,106
8/1/16	31	10	$2,108
9/1/16	31	9	$2,080
10/1/16	30	294	$2,217
11/1/16	31	6,807	$5,556
12/1/16	30	14,755	$9,624
1/1/17	31	24,315	$14,583
2/1/17	31	22,983	$13,817
3/1/17	28	18,205	$11,376
4/1/17	31	22,009	$13,319
5/1/17	30	5,547	$3,180
Totals	**365**	**118,909**	**$83,765**
Annual	**365**	**118,909**	**$83,765**

3.4 Benchmarking

This facility was benchmarked using Portfolio Manager, an online tool created and managed by the United States Environmental Protection Agency (EPA) through the ENERGY STAR® program. Portfolio Manager analyzes your building's consumption data, cost information, and operational use details and then compares its performance against a national median for similar buildings of its type. Metrics provided by this analysis are Energy Use Intensity (EUI) and an ENERGY STAR® score for select building types.

The EUI is a measure of a facility's energy consumption per square foot, and it is the standard metric for comparing buildings' energy performance. Comparing the EUI of a building with the national median EUI for that building type illustrates whether that building uses more or less energy than similar buildings of its type on a square foot basis. EUI is presented in terms of site energy and source energy. Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

Figure 13 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Public Works Garage	National Median Building Type: Garage
Source Energy Use Intensity (kBtu/ft^2)	228.9	123.1
Site Energy Use Intensity (kBtu/ft^2)	137.4	78.8

Implementation of all recommended measures in this report would improve the building's estimated EUI significantly, as shown in the table below:

Figure 14 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Public Works Garage	National Median Building Type: Garage
Source Energy Use Intensity (kBtu/ft^2)	153.8	123.1
Site Energy Use Intensity (kBtu/ft^2)	113.8	78.8

Many types of commercial buildings are also eligible to receive an ENERGY STAR® score. This score is a percentile ranking from 1 to 100. It compares your building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75 percent of all similar buildings nationwide and may be eligible for ENERGY STAR® certification. This building type does not currently qualify to receive a score.

A Portfolio Manager Statement of Energy Performance (SEP) was generated for this facility, see Appendix B: ENERGY STAR® Statement of Energy Performance.

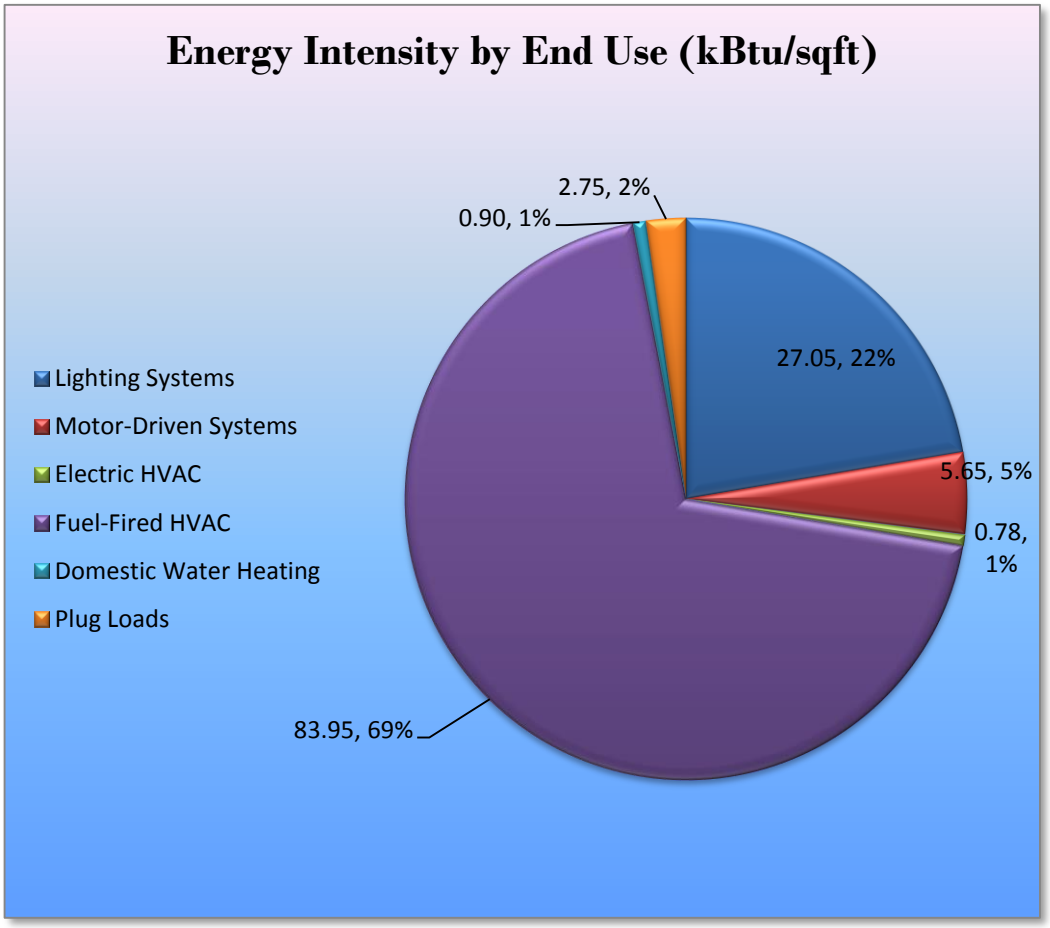
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

A Portfolio Manager account has been created online for your facility and you will be provided with the login information for the account. We encourage you to update your utility information in Portfolio Manager regularly, so that you can keep track of your building's performance. Free online training is available to help you use ENERGY STAR® Portfolio Manager to track your building's performance at: https://www.energystar.gov/buildings/training.

3.5 Energy End-Use Breakdown

In order to provide a complete overview of energy consumption across building systems, an energy balance was performed at this facility. An energy balance utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems found in a building to determine their proportional contribution to overall building energy usage. This chart of energy end uses highlights the relative contribution of each equipment category to total energy usage. This can help determine where the greatest benefits might be found from energy efficiency measures.

Figure 15 - Energy Balance (kBtu/SF, %)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the Public Works Garage regarding financial incentives for which they may qualify to implement the recommended measures. For this audit report, most measures have received only a preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to demonstrate project cost-effectiveness and help prioritize energy measures. Savings are based on the New Jersey Clean Energy Program Protocols to Measure Resource Savings dated June 29, 2016, approved by the New Jersey Board of Public Utilities. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances. A higher level of investigation may be necessary to support any custom SmartStart or Pay for Performance, or Direct Install incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJCEP prescriptive SmartStart program. Some measures and proposed upgrade projects may be eligible for higher incentives than those shown below through other NJCEP programs as described in Section 8.

The following sections describe the evaluated measures.

4.1 Recommended ECMs

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

Figure 16 – Summary of Recommended ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**749,235**	**103.1**	**0.0**	**$94,984.51**	**$220,551.93**	**$2,900.00**	**$217,651.93**	**2.3**	**754,474**
ECM 1	Install LED Fixtures	646,272	81.1	0.0	$81,931.32	$196,733.48	$2,130.00	$194,603.48	2.4	650,791
ECM 2	Retrofit Fixtures with LED Lamps	101,696	21.9	0.0	$12,892.56	$22,097.57	$770.00	$21,327.57	1.7	102,407
ECM 3	Install LED Exit Signs	1,267	0.1	0.0	$160.63	$1,720.88	$0.00	$1,720.88	10.7	1,276
Lighting Control Measures		**72,621**	**8.3**	**0.0**	**$9,206.53**	**$2,106.00**	**$570.00**	**$1,536.00**	**0.2**	**73,129**
ECM 4	Install Occupancy Sensor Lighting Controls	72,621	8.3	0.0	$9,206.53	$2,106.00	$570.00	$1,536.00	0.2	73,129
Variable Frequency Drive (VFD) Measures		**6,655**	**2.0**	**0.0**	**$843.66**	**$11,473.01**	**$0.00**	**$11,473.01**	**13.6**	**6,701**
ECM 5	Install VFD on Variable Air Volume (VAV) HVAC	2,359	1.2	0.0	$299.12	$5,457.71	$0.00	$5,457.71	18.2	2,376
ECM 6	Install VFDs on Hot Water Pumps	4,295	0.8	0.0	$544.54	$6,015.30	$0.00	$6,015.30	11.0	4,325
Electric Unitary HVAC Measures		**3,692**	**2.2**	**0.0**	**$468.10**	**$4,899.42**	**$0.00**	**$4,899.42**	**10.5**	**3,718**
ECM 7	Install High Efficiency Electric AC	3,692	2.2	0.0	$468.10	$4,899.42	$0.00	$4,899.42	10.5	3,718
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**39.1**	**$275.42**	**$2,945.45**	**$400.00**	**$2,545.45**	**9.2**	**4,578**
ECM 8	Install High Efficiency Furnaces	0	0.0	39.1	$275.42	$2,945.45	$400.00	$2,545.45	9.2	4,578
Domestic Water Heating Upgrade		**33,598**	**2.7**	**-106.0**	**$3,512.49**	**$7,297.65**	**$200.00**	**$7,097.65**	**2.0**	**21,419**
ECM 9	Install High Efficiency Gas Water Heater	31,073	2.7	-106.0	$3,192.39	$7,261.80	$200.00	$7,061.80	2.2	18,876
ECM 10	Install Low-Flow Domestic Hot Water Devices	2,525	0.0	0.0	$320.10	$35.85	$0.00	$35.85	0.1	2,543
Plug Load Equipment Control - Vending Machine		**1,954**	**0.0**	**0.0**	**$247.76**	**$460.00**	**$0.00**	**$460.00**	**1.9**	**1,968**
ECM 11	Vending Machine Control	1,954	0.0	0.0	$247.76	$460.00	$0.00	$460.00	1.9	1,968
TOTALS		**867,755**	**118.3**	**-66.9**	**$109,538.49**	**$249,733.46**	**$4,070.00**	**$245,663.46**	**2.2**	**865,987**

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

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

4.1.1 Lighting Upgrades

Recommended upgrades to existing lighting fixtures are summarized in Figure 17 below.

Figure 17 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**749,235**	**103.1**	**0.0**	**$94,984.51**	**$220,551.93**	**$2,900.00**	**$217,651.93**	**2.3**	**754,474**
ECM 1	Install LED Fixtures	646,272	81.1	0.0	$81,931.32	$196,733.48	$2,130.00	$194,603.48	2.4	650,791
ECM 2	Retrofit Fixtures with LED Lamps	101,696	21.9	0.0	$12,892.56	$22,097.57	$770.00	$21,327.57	1.7	102,407
ECM 3	Install LED Exit Signs	1,267	0.1	0.0	$160.63	$1,720.88	$0.00	$1,720.88	10.7	1,276

During lighting upgrade planning and design, we recommend a comprehensive approach that considers both the efficiency of the lighting fixtures and how they are controlled.

ECM 1: Install LED Fixtures

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	592,868	70.0	0.0	$75,160.97	$166,358.53	$1,435.00	$164,923.53	2.2	597,013
Exterior	53,404	11.1	0.0	$6,770.35	$30,374.95	$695.00	$29,679.95	4.4	53,778

Measure Description

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

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

ECM 2: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	101,696	21.9	0.0	$12,892.56	$22,097.57	$770.00	$21,327.57	1.7	102,407
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

We recommend retrofitting existing incandescent, HID or other lighting technologies with LED lamps. Many LED tube lamps are direct replacements for existing fluorescent lamps and can be installed while leaving the fluorescent fixture ballast in place. LED bulbs can be used in existing fixtures as a direct replacement for most other lighting technologies. This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space.

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

ECM 3: Install LED Exit Signs

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	1,267	0.1	0.0	$160.63	$1,720.88	$0.00	$1,720.88	10.7	1,276
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

We recommend replacing all incandescent or compact fluorescent exit signs with LED exit signs. LED exit signs require virtually no maintenance and have a life expectancy of at least 20 years. This measure saves energy by installing LED fixtures, which use less power than other technologies with an equivalent lighting output.

4.1.2 Lighting Control Measures

Figure 18 – Summary of Lighting Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**72,621**	**8.3**	**0.0**	**$9,206.53**	**$2,106.00**	**$570.00**	**$1,536.00**	**0.2**	**73,129**
ECM 4	Install Occupancy Sensor Lighting Controls	72,621	8.3	0.0	$9,206.53	$2,106.00	$570.00	$1,536.00	0.2	73,129

During lighting upgrade planning and design, we recommend a comprehensive approach that considers both the efficiency of the lighting fixtures and how they are controlled.

ECM 4: Install Occupancy Sensor Lighting Controls

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
72,621	8.3	0.0	$9,206.53	$2,106.00	$570.00	$1,536.00	0.2	73,129

Measure Description

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in all offices areas. Lighting sensors detect occupancy using ultrasonic and/or infrared sensors. For most spaces, we recommend lighting controls use dual technology sensors, which can eliminate the possibility of any lights turning off unexpectedly. Lighting systems are enabled when an occupant is detected. Fixtures are automatically turned off after an area has been vacant for a preset period. Some controls also provide dimming options and all modern occupancy controls can be easily over-ridden by room occupants to allow them to manually turn fixtures on or off, as desired. Energy savings results from only operating lighting systems when they are required.

Occupancy sensors may be mounted on the wall at existing switch locations, mounted on the ceiling, or in remote locations. In general, wall switch replacement sensors are recommended for single occupant offices and other small rooms. Ceiling-mounted or remote mounted sensors are used in locations without local switching or where wall switches are not in the line-of-sight of the main work area and in large spaces. We recommend a comprehensive approach to lighting design that upgrades both the lighting fixtures and the controls together for maximum energy savings and improved lighting for occupants.

4.1.3 Variable Frequency Drive Measures

Recommended variable frequency drive (VFD) measures are summarized in Figure 19 below.

Figure 19 – Summary of Variable Frequency Drive ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**6,655**	**2.0**	**0.0**	**$843.66**	**$11,473.01**	**$0.00**	**$11,473.01**	**13.6**	**6,701**
ECM 5	Install VFD on Variable Air Volume (VAV) HVAC	2,359	1.2	0.0	$299.12	$5,457.71	$0.00	$5,457.71	18.2	2,376
ECM 6	Install VFDs on Hot Water Pumps	4,295	0.8	0.0	$544.54	$6,015.30	$0.00	$6,015.30	11.0	4,325

ECM 5: Install VFD on Variable Air Volume (VAV) HVAC

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
2,359	1.2	0.0	$299.12	$5,457.71	$0.00	$5,457.71	18.2	2,376

Measure Description

We recommend replacing existing air volume control devices on air handling units (AHUs) located in the mechanical room and serving the recycling offices, such as inlet vanes and variable pitch fan blades, with variable frequency drives (VFDs). Inlet guide vanes and variable pitch fan blades are an inefficient means of controlling the air volume compared to VFDs. The existing volume control device would be removed, or permanently disabled, and the control signal would be redirected to the VFD to determine proper fan motor speed. Energy savings results from more efficient control of motor energy usage when fan motors are operated at partial load. The magnitude of energy savings is based on the estimated amount of time that fan motors would be operated at partial load.

Additional maintenance savings may result from this measure as well, since VFDs are solid state electronic device, which generally requires less maintenance than mechanical air volume control devices.

ECM 6: Install VFDs on Hot Water Pumps

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
4,295	0.8	0.0	$544.54	$6,015.30	$0.00	$6,015.30	11.0	4,325

Measure Description

We recommend installing a variable frequency drives (VFD) to control a hot water pumps located in the boiler room. This measure requires that a majority of the hot water coils be served by 2-way valves and that a differential pressure sensor is installed in the hot water loop. As the hot water valves close, the differential pressure increases. The VFD modulates pump speed to maintain a differential pressure setpoint. Energy savings results from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

4.1.4 Electric Unitary HVAC Measures

Recommended electric unitary HVAC measures are summarized in Figure 20 below.

Figure 20 - Summary of Unitary HVAC ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		**3,692**	**2.2**	**0.0**	**$468.10**	**$4,899.42**	**$0.00**	**$4,899.42**	**10.5**	**3,718**
ECM 7	Install High Efficiency Electric AC	3,692	2.2	0.0	$468.10	$4,899.42	$0.00	$4,899.42	10.5	3,718

ECM 7: Install High Efficiency Air Conditioning Units

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
3,692	2.2	0.0	$468.10	$4,899.42	$0.00	$4,899.42	10.5	3,718

Measure Description

We recommend replacing standard efficiency window air conditioning units with high efficiency window air conditioning units. There have been significant improvements in both compressor and fan motor efficiencies over the past several years. Therefore, electricity savings can be achieved by replacing older units with new high efficiency units. A higher EER or SEER rating indicates a more efficient cooling system. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average cooling load, and the estimated annual operating hours.

4.1.5 Gas-Fired Heating System Replacements

Recommended gas-fired heating system replacements are summarized in Figure 21 below.

Figure 21 - Summary of Gas-Fired Heating Replacement ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**39.1**	**$275.42**	**$2,945.45**	**$400.00**	**$2,545.45**	**9.2**	**4,578**
ECM 8	Install High Efficiency Furnaces	0	0.0	39.1	$275.42	$2,945.45	$400.00	$2,545.45	9.2	4,578

ECM 8: Install High Efficiency Furnaces

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
0	0.0	39.1	$275.42	$2,945.45	$400.00	$2,545.45	9.2	4,578

Measure Description

We recommend replacing the Lennox standard efficiency furnaces serving the first and second floor of the recycling tower with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases which can significantly improve furnace efficiency. Savings result from improved system efficiency.

4.1.6 Domestic Hot Water Heating System Upgrades

Recommendations for domestic water heating system improvements are summarized in Figure 22 below.

Figure 22 - Summary of Domestic Water Heating ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**33,598**	**2.7**	**-106.0**	**$3,512.49**	**$7,297.65**	**$200.00**	**$7,097.65**	**2.0**	**21,419**
ECM 9	Install High Efficiency Gas Water Heater	31,073	2.7	-106.0	$3,192.39	$7,261.80	$200.00	$7,061.80	2.2	18,876
ECM 10	Install Low-Flow Domestic Hot Water Devices	2,525	0.0	0.0	$320.10	$35.85	$0.00	$35.85	0.1	2,543

ECM 9: Install High Efficiency Gas-Fired Water Heater

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
31,073	2.7	-106.0	$3,192.39	$7,261.80	$200.00	$7,061.80	2.2	18,876

Measure Description

We recommend replacing the existing tank water heater with a high efficiency tank water heater. Improvements in combustion efficiency and reductions in heat losses have improved the overall efficiency of storage water heaters. Energy savings results from using less gas to heat water, due to higher unit efficiency, and fewer run hours to maintain the tank water temperature.

ECM 10: Install Low-Flow DHW Devices

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
2,525	0.0	0.0	$320.10	$35.85	$0.00	$35.85	0.1	2,543

Measure Description

We recommend installing low-flow domestic hot water devices to reduce overall hot water demand. Energy demand from domestic hot water heating systems can be reduced by reducing water usage in general. Faucet aerators can reduce hot water usage, relative to standard aerators, which saves energy. Low-flow devices reduce the overall water flow from the fixture, while still adequate pressure for washing. This reduces the amount of water used per day resulting in energy and water savings.

4.1.7 Plug Load Equipment Control - Vending Machines

Recommended plug load equipment control measures are summarized in Figure 23 below.

Figure 23 - Summary of Plug Load Equipment Control- Vending Machines ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	*Annual Natural Gas Savings (MMBtu)*	*Annual N/A Savings (MMBtu)*	*Annual N/A Savings (MMBtu)*	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending Machine		**1,954**	**0.0**	**0.0**	**0.0**	**0.0**	**$247.76**	**$460.00**	**$0.00**	**$460.00**	**1.9**	**1,968**
ECM 11	Vending Machine Control	1,954	0.0	0.0	0.0	0.0	$247.76	$460.00	$0.00	$460.00	1.9	1,968

ECM 11: Vending Machine Control

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
1,954	0.0	0.0	$247.76	$460.00	$0.00	$460.00	1.9	1,968

Measure Description

Vending machines operate continuously, even during non-business hours. It is recommended to install occupancy sensor controls to reduce the energy use. These controls power down vending machines when the vending machine area has been vacant for some time, then power up at regular intervals, as needed, to turn machine lights on or keep the product cool. Energy savings are a dependent on vending machine and activity level in the area surrounding the machines.

5 ENERGY EFFICIENT PRACTICES

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

Reduce Air Leakage

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

Perform Proper Lighting Maintenance

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

Develop a Lighting Maintenance Schedule

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

Ensure Lighting Controls Are Operating Properly

Lighting controls are very cost-effective energy efficient devices, when installed and operating correctly. As part of a lighting maintenance schedule, lighting controls should be tested annually to ensure proper functioning. For occupancy sensors, this requires triggering the sensor and verifying that the sensor's timer settings are correct. For daylight sensors, maintenance involves cleaning of sensor lenses and confirming setpoints and sensitivity are appropriately configured.

Perform Routine Motor Maintenance

Motors consist of many moving parts whose collective degradation can contribute to a significant loss of motor efficiency. In order to prevent damage to motor components, routine maintenance should be performed. This maintenance consists of cleaning surfaces and ventilation openings on motors to prevent overheating, lubricating moving parts to reduce friction, inspecting belts and pulleys for wear and to ensure they are at proper alignment and tension, and cleaning and lubricating bearings. Consult a licensed technician to assess these and other motor maintenance strategies.

Practice Proper Use of Thermostat Schedules and Temperature Resets

Ensure thermostats are correctly set back. By employing proper set back temperatures and schedules, facility heating and cooling costs can be reduced dramatically during periods of low or no occupancy. As such, thermostats should be programmed for a setback of 5-10°F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced further by increasing the facility's occupied setpoint temperature. In general, during the cooling season, thermostats should be set as high as possible without sacrificing occupant comfort.

Perform Proper Boiler Maintenance

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

Perform Proper Furnace Maintenance

Preventative furnace maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. Following the manufacturer's instructions, a yearly tune-up should include tasks such as checking for gas / carbon monoxide leaks; changing the air and fuel filters; checking components for cracks, corrosion, dirt, or debris build-up; ensuring the ignition system is working properly; testing and adjusting operation and safety controls; inspecting the electrical connections; and ensuring proper lubrication for motors and bearings.

Perform Proper Water Heater Maintenance

At least once a year, drain a few gallons out of the water heater using the drain valve. If there is a lot of sediment or debris, then a full flush is recommended. Turn the temperature down and then completely drain the tank. Once a year check for any leaks or heavy corrosion on the pipes and valves. For gas water heaters, check the draft hood and make sure it is placed properly, with a few inches of air space between the tank and where it connects to the vent. Look for any corrosion or wear on the gas line and on the piping. If you noticed any black residue, soot or charred metal, this is a sign you may be having combustion issues and you should have the unit serviced by a professional. For electric water heaters, look for any signs of leaking such as rust streaks or residue around the upper and lower panels covering the electrical components on the tank. For water heaters over three to four years old have a technician inspect the sacrificial anode annually.

Water Conservation

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

Installing dual flush or low-flow toilets and low-flow or waterless urinals are additional ways to reduce the sites water use, however, these devices do not provide energy savings at the site level. Any reduction in

water use does however ultimately reduce grid level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users. The EPA WaterSense™ ratings for urinals is 0.5 gpf and toilets that use as little as 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

Refer to Section 4.1.6 for any low-flow ECM recommendations.

6 On-Site Generation Measures

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

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

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

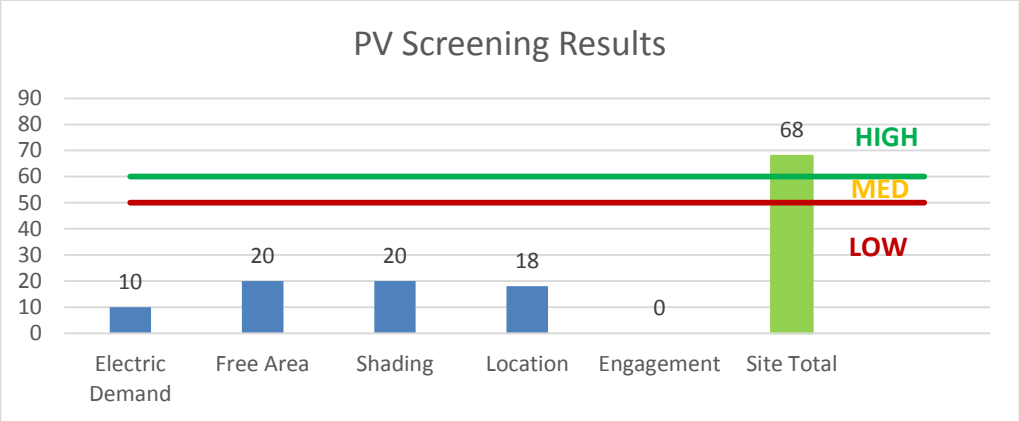
6.1 Photovoltaic

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

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

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the high potential for PV at the site. A PV array located on the roof of the main building/ground next to the building/over the main parking lot may be feasible. If Public Works Garage is interested in pursuing the installation of PV, we recommended a full feasibility study be conducted.

Figure 24 - Photovoltaic Screening



Potential	High	
System Potential	214	kW DC STC
Electric Generation	254,953	kWh/yr
Displaced Cost	$22,180	/yr
Installed Cost	$556,400	

Solar projects must register their projects in the SREC (Solar Renewable Energy Certificate) Registration Program (SRP) prior to the start of construction in order to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about developed new solar projects and insight into future SREC pricing. Refer to Section 8.3 for additional information.

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

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

6.2 Combined Heat and Power

Combined heat and power (CHP) is the on-site generation of electricity along with the recovery of heat energy, which is put to beneficial use. Common technologies for CHP include reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines. Electric generation from a CHP system is typically interconnected to local power distribution systems. Heat is recovered from exhaust and ancillary cooling systems and interconnected to the existing hot water (or steam) distribution systems.

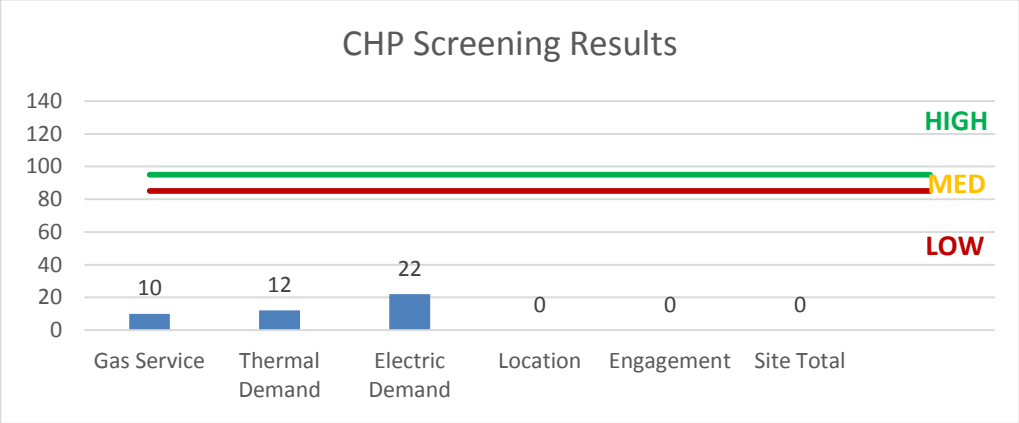
CHP systems are typically used to produce a portion of the electric power used onsite by a facility, with the balance of electric power needs supplied by grid purchases. The heat is used to supplement (or supplant) existing boilers for the purpose of space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for the purpose of space cooling. The key criteria used for screening, however, is the amount of time the system operates at full load and the facility's ability to use the recovered heat. Facilities with continuous use for large quantities of waste heat are the best candidates for CHP.

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

Low or infrequent thermal load, and lack of space near the existing boilers are the most significant factors contributing to the low potential for CHP at the site. In our opinion, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation.

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

Figure 25 - Combined Heat and Power Screening



7 DEMAND RESPONSE

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

By enabling grid operators to call upon Curtailment Service Providers and commercial facilities to reduce electric usage during times of peak demand, the grid is made more reliable and overall transmission costs are reduced for all ratepayers. Curtailment Service Providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary and participants receive payments whether or not their facility is called upon to curtail their electric usage.

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

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

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

The first step toward participation in a DR program is to contact a Curtailment Service Provider. A list of these providers is available on PJM's website and it includes contact information for each company, as well as the states where they have active business (http://www.pjm.com/markets-and-operations/demand-response/csps.aspx). PJM also posts training materials that are developed for program members interested in specific rules and requirements regarding DR activity (http://www.pjm.com/training/training%20material.aspx), along with a variety of other DR program information.

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

8 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and other benefits to ratepayers, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey's Electricity Restructuring Law (1999), which requires all customers of investor-owned electric and gas utilities to pay a surcharge on their monthly energy bills. As a customer of a state-regulated electric or gas utility and therefore a contributor to the fund your organization is eligible to participate in the LGEA program and also eligible to receive incentive payment for qualifying energy efficiency measures. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 26 for a list of the eligible programs identified for each recommended ECM.

Figure 26 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Pay For Performance Existing Buildings
ECM 1	Install LED Fixtures	x		x
ECM 2	Retrofit Fixtures with LED Lamps	x		x
ECM 3	Install LED Exit Signs			x
ECM 4	Install Occupancy Sensor Lighting Controls	x		x
ECM 5	Install VFD on Variable Air Volume (VAV) HVAC			x
ECM 6	Install VFDs on Hot Water Pumps			x
ECM 7	Install High Efficiency Electric AC			x
ECM 8	Install High Efficiency Furnaces	x		x
ECM 9	Install High Efficiency Gas Water Heater	x		x
ECM 10	Install Low-Flow Domestic Hot Water Devices			x
ECM 11	Vending Machine Control			x

SmartStart is generally well-suited for implementation of individual measures or small group of measures. It provides flexibility to install measures at your own pace using in-house staff or a preferred contractor. The Pay for Performance (P4P) program is a "whole-building" energy improvement program designed for larger facilities. It requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants.

Generally, the incentive values provided throughout the report assume the SmartStart program is utilized because it provides a consistent basis for comparison of available incentives for various measures, though in many cases incentive amounts may be higher through participation in other programs.

Brief descriptions of all relevant financing and incentive programs are located in the sections below. Further information, including most current program availability, requirements, and incentive levels can be found at: www.njcleanenergy.com/ci.

8.1 SmartStart

Overview

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

Equipment with Prescriptive Incentives Currently Available:

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

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

Incentives

The SmartStart prescriptive incentive program provides fixed incentives for specific energy efficiency measures, whereas the custom SmartStart program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentive offerings for specific devices.

Since your facility is an existing building, only the Retrofit incentives have been applied in this report. Custom Measure incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings, capped at 50% of the total installed incremental project cost, or a project cost buy down to a one-year payback (whichever is less). Program incentives are capped at $500,000 per electric account and $500,000 per natural gas account, per fiscal year.

How to Participate

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

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

8.2 Pay for Performance - Existing Buildings

Overview

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

Incentives

Incentives are calculated based on estimated and achieved energy savings ranging from $0.18-$0.22/kWh and $1.80-$2.50/therm, capped at the lesser of 50% total project cost, or $1 million per electric account and $1 million per natural gas account, per fiscal year, not to exceed $2 million per project. An incentive of $0.15/square foot is also available to offset the cost of developing the Energy Reduction Plan (see below) contingent on the project moving forward with measure installation.

How to Participate

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

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

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

8.3 SREC Registration Program

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

After the registration is accepted, construction is complete, and final paperwork has been submitted and is deemed complete, the project is issued a New Jersey certification number which enables it to generate New Jersey SRECs. SREC's are generated once the solar project has been authorized to be energized by the Electric Distribution Company (EDC).

Each time a solar installation generates 1,000 kilowatt-hours (kWh) of electricity, an SREC is earned. Solar project owners report the energy production to the SREC Tracking System. This reporting allows SREC's to be placed in the customer's electronic account. SRECs can then be sold on the SREC Tracking System, providing revenue for the first 15 years of the project's life.

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar RPS. One way they can meet the RPS requirements is by purchasing SRECs. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period can and will fluctuate depending on supply and demand.

Information about the SRP can be found at: www.njcleanenergy.com/srec.

8.4 Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) is an alternate method for New Jersey's government agencies to finance the implementation of energy conservation measures. An ESIP is a type of "performance contract," whereby school districts, counties, municipalities, housing authorities and other public and state entities enter in to contracts to help finance building energy upgrades. This is done in a manner that ensures that annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive in year one, and every year thereafter. ESIP provides government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources. NJCEP incentive programs can be leveraged to help further reduce the total project cost of eligible measures.

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

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

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

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

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

9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

9.1 Retail Electric Supply Options

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

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

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

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

9.2 Retail Natural Gas Supply Options

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

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

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

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

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Main Boiler Room	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,496	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,496	0.10	333	0.0	$42.19	$117.00	$0.00	2.77
Storage Area	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,872	Relamp	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,310	0.48	1,242	0.0	$157.47	$877.07	$180.00	4.43
Recycling Tower	6	Incandescent: 60W A Lamp	Wall Switch	100	4,680	Fixture Replacement	Yes	6	LED - Fixtures: Downlight Solid State Retrofit	Occupancy Sensor	15	3,276	0.44	2,840	0.0	$360.03	$497.91	$50.00	1.24
Stairwell	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,368	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,368	0.08	489	0.0	$61.95	$175.50	$30.00	2.35
Stairwell	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Director Office	4	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	3,120	Relamp	No	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,120	0.38	1,664	0.0	$210.96	$380.53	$0.00	1.80
Director Office	13	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	None	Yes	13	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,184	0.09	399	0.0	$50.55	$116.00	$20.00	1.90
Recycling Office	19	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	3,120	Relamp	Yes	19	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,184	2.09	9,070	0.0	$1,149.85	$1,923.53	$20.00	1.66
Tunnel Building	198	Metal Halide: (1) 400W Lamp	None	458	6,916	Fixture Replacement	Yes	198	LED - Fixtures: Downlight Pendant	Occupancy Sensor	146	4,841	57.32	550,560	0.0	$69,797.40	$120,748.84	$9,900.00	1.59
Road Dpt Office	12	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	3,120	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,184	1.32	5,728	0.0	$726.22	$1,257.60	$20.00	1.70
Road Dpt Office	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	3,120	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.10	416	0.0	$52.74	$117.00	$0.00	2.22
Storage	2	Linear Fluorescent - T12: 2' T12 (20W) - 2L	Wall Switch	50	1,872	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,310	0.05	126	0.0	$15.93	$233.00	$20.00	13.37
Mechanical Room	1	Incandescent: 60W A Lamp	Wall Switch	100	2,496	Fixture Replacement	No	1	LED - Fixtures: Downlight Solid State Retrofit	Wall Switch	15	2,496	0.07	240	0.0	$30.39	$63.65	$5.00	1.93
Main Hallway	4	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	4	LED Exit Signs: 2 W Lamp	None	6	8,760	0.03	317	0.0	$40.16	$430.22	$0.00	10.71
Main Hallway	27	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	4,680	Relamp	No	27	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	4,680	2.59	16,849	0.0	$2,136.02	$2,568.60	$0.00	1.20
Main Hallway	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,680	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,680	0.05	349	0.0	$44.25	$117.00	$20.00	2.19
Road Dpt Staff Room	6	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	3,744	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,621	0.33	1,719	0.0	$217.87	$467.00	$20.00	2.05
Vending Machine	1	Linear Fluorescent - T8: 2' T8 (17W) - 3L	None	53	6,916	Relamp	No	1	LED - Linear Tubes: (3) 2' Lamps	None	26	6,916	0.02	215	0.0	$27.25	$61.70	$15.00	1.71
Vending Machine	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	None	32	6,916	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	None	15	6,916	0.01	137	0.0	$17.34	$35.90	$5.00	1.78
Sanitation Office	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,120	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,184	0.36	1,553	0.0	$196.84	$686.80	$140.00	2.78
Sanitation Dept	16	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	3,744	Relamp	No	16	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,744	1.54	7,988	0.0	$1,012.63	$1,522.13	$0.00	1.50
Sanitation Dept	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,744	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,744	0.05	279	0.0	$35.40	$117.00	$20.00	2.74
Mechanical Room	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	2,496	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,496	0.10	333	0.0	$42.19	$95.13	$0.00	2.25
Mechanical Room	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Data Room	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	1,872	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,872	0.10	250	0.0	$31.64	$95.13	$0.00	3.01

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Storage	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	1,872	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,872	0.10	250	0.0	$31.64	$95.13	$0.00	3.01
Storage	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,872	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,872	0.10	250	0.0	$31.64	$117.00	$0.00	3.70
Women Restroom	2	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	2,496	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,747	0.22	764	0.0	$96.83	$306.27	$20.00	2.96
Women Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,496	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,496	0.09	316	0.0	$40.05	$190.27	$40.00	3.75
Parks Dept	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,744	None	No	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,744	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Parks Dept	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	3,744	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,744	0.05	250	0.0	$31.64	$58.50	$0.00	1.85
Restroom	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,872	Relamp	Yes	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,310	0.09	247	0.0	$31.30	$305.60	$20.00	9.13
Storage	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	1,872	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,872	0.10	250	0.0	$31.64	$95.13	$0.00	3.01
Men Restroom	8	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	1,872	Relamp	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,310	0.88	2,291	0.0	$290.49	$877.07	$20.00	2.95
Men Restroom	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,872	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,872	0.10	250	0.0	$31.64	$117.00	$0.00	3.70
Pump Room	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	2,496	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,496	0.02	82	0.0	$10.37	$63.20	$0.00	6.09
Custodian Closet	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	2,080	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,080	0.10	277	0.0	$35.16	$95.13	$0.00	2.71
Carpenter Shop	2	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	3,120	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,120	0.19	832	0.0	$105.48	$190.27	$0.00	1.80
Carpenter Shop	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,120	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.05	233	0.0	$29.50	$117.00	$20.00	3.29
Carpenter Shop	6	Incandescent: 60W A Lamp	Wall Switch	100	3,120	Fixture Replacement	No	6	LED - Fixtures: Downlight Solid State Retrofit	Wall Switch	15	3,120	0.41	1,798	0.0	$227.95	$381.91	$30.00	1.54
Carpenter Shop	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Carpenter Shop	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	3,120	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.24	1,040	0.0	$131.85	$292.50	$0.00	2.22
Carpenter Shop	1	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	3,120	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.10	455	0.0	$57.66	$58.50	$0.00	1.01
Police Bay	11	Metal Halide: (1) 400W Lamp	Wall Switch	458	3,120	Fixture Replacement	No	11	LED - Fixtures: Downlight Pendant	Wall Switch	146	3,120	2.79	12,100	0.0	$1,533.96	$6,694.38	$55.00	4.33
Police Bay	6	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	3,120	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.63	2,729	0.0	$345.95	$351.00	$60.00	0.84
Police Bay	1	Linear Fluorescent - T5: 4' T5 (28W) - 4L	Wall Switch	120	2,600	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,600	0.05	182	0.0	$23.09	$95.13	$20.00	3.25
Police Bay	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Break Room	4	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	3,744	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,621	0.45	2,330	0.0	$295.42	$350.00	$20.00	1.12
Tires Bay	14	Linear Fluorescent - T12: 4' T12 (40W) - 1L	Wall Switch	46	3,744	Relamp	No	14	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	3,744	0.36	1,866	0.0	$236.53	$502.60	$0.00	2.12
Tires Bay	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,744	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,744	0.05	279	0.0	$35.40	$117.00	$20.00	2.74

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Tires Bay	6	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	3,744	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,744	0.63	3,275	0.0	$415.14	$351.00	$0.00	0.85
Tires Bay	3	Metal Halide: (1) 400W Lamp	Wall Switch	458	3,744	Fixture Replacement	No	3	LED - Fixtures: Downlight Pendant	Wall Switch	146	3,744	0.76	3,960	0.0	$502.02	$1,825.74	$15.00	3.61
Tires Bay	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Body Shop	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,680	Relamp	No	20	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,680	0.54	3,490	0.0	$442.49	$1,170.00	$200.00	2.19
Body Shop	1	Linear Fluorescent - T5: 4' T5 (28W) - 4L	Wall Switch	120	4,680	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	4,680	0.05	328	0.0	$41.57	$95.13	$20.00	1.81
Body Shop	9	Metal Halide: (1) 400W Lamp	Wall Switch	458	4,680	Fixture Replacement	No	9	LED - Fixtures: Downlight Pendant	Wall Switch	146	4,680	2.28	14,850	0.0	$1,882.59	$5,477.22	$45.00	2.89
Main Mechanical Bay	20	Metal Halide: (1) 400W Lamp	Wall Switch	458	4,680	Fixture Replacement	No	20	LED - Fixtures: Downlight Pendant	Wall Switch	146	4,680	5.08	33,000	0.0	$4,183.54	$12,171.60	$100.00	2.89
Main Mechanical Bay	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Repair Parts Room	13	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	3,120	Relamp	No	13	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.62	2,704	0.0	$342.82	$760.50	$0.00	2.22
Repair Parts Room	6	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	3,120	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.63	2,729	0.0	$345.95	$351.00	$0.00	1.01
Repair Parts Room	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Office	3	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	2,600	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,820	0.33	1,193	0.0	$151.30	$401.40	$20.00	2.52
Swiper mechanical Bay	14	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	3,120	Relamp	No	14	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	1.47	6,367	0.0	$807.21	$819.00	$0.00	1.01
Swiper mechanical Bay	5	Metal Halide: (1) 400W Lamp	Wall Switch	458	3,120	Fixture Replacement	No	5	LED - Fixtures: Downlight Pendant	Wall Switch	146	3,120	1.27	5,500	0.0	$697.26	$3,042.90	$25.00	4.33
Swiper mechanical Bay	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Swiper Bay	16	Metal Halide: (1) 400W Lamp	Wall Switch	458	3,900	Fixture Replacement	No	16	LED - Fixtures: Downlight Pendant	Wall Switch	146	3,900	4.06	22,000	0.0	$2,789.02	$9,737.28	$80.00	3.46
Parks Dept Repair Office	6	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	3,120	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,184	0.66	2,864	0.0	$363.11	$686.80	$20.00	1.84
Parks Dept Repair Office	2	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	158	0.0	$20.08	$215.11	$0.00	10.71
Parks Dept Repair Bay	8	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	3,120	Relamp	No	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.84	3,638	0.0	$461.26	$468.00	$0.00	1.01
Parks Dept Repair Bay	14	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	3,120	Relamp	No	14	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.67	2,912	0.0	$369.19	$819.00	$0.00	2.22
Parks Dept Repair Bay	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,120	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Parks Dept Repair Bay	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Parks Dept Repair Office	6	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,600	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,820	0.33	1,193	0.0	$151.30	$467.00	$20.00	2.95
Parks Dept Repair Bay	2	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	2,600	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,600	0.21	758	0.0	$96.10	$117.00	$0.00	1.22
Traffic Maitenance Room	9	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,600	Relamp	No	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,600	0.43	1,560	0.0	$197.78	$526.50	$0.00	2.66

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Traffic Maitenance Room	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$10.04	$107.56	$0.00	10.71
Motor Manager Office	4	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	2,600	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,820	0.44	1,591	0.0	$201.73	$496.53	$20.00	2.36
Motor Manager Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,600	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,600	0.05	194	0.0	$24.58	$117.00	$20.00	3.95
Perimeter Light	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	45	3,458	None	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	45	3,458	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Perimeter Light (Bay Areas)	39	Metal Halide: (1) 400W Lamp	Daylight Dimming	458	3,458	Fixture Replacement	No	39	LED - Fixtures: Downlight Pendant	Daylight Dimming	146	3,458	9.90	47,547	0.0	$6,027.78	$23,734.62	$195.00	3.91
Perimeter Light	2	Metal Halide: (1) 250W Lamp	Daylight Dimming	295	3,458	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	45	3,458	0.41	1,954	0.0	$247.69	$781.35	$200.00	2.35
Garage	10	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	3,900	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,900	1.05	5,685	0.0	$720.72	$585.00	$0.00	0.81
Gate Area1	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	3,900	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,900	0.10	520	0.0	$65.93	$95.13	$0.00	1.44
Gate Area1	1	Metal Halide: (1) 175W Lamp	Wall Switch	150	3,900	Fixture Replacement	No	1	LED - Fixtures: Downlight Recessed	Wall Switch	15	3,900	0.11	595	0.0	$75.42	$271.12	$5.00	3.53
Gate Area2	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	3,900	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,900	0.10	520	0.0	$65.93	$95.13	$0.00	1.44
Gate Area2	1	Metal Halide: (1) 175W Lamp	Wall Switch	150	3,900	Fixture Replacement	No	1	LED - Fixtures: Downlight Recessed	Wall Switch	15	3,900	0.11	595	0.0	$75.42	$271.12	$5.00	3.53
Well Shop Building	9	Metal Halide: (1) 400W Lamp	Wall Switch	458	3,900	Fixture Replacement	No	9	LED - Fixtures: Downlight Pendant	Wall Switch	146	3,900	2.28	12,375	0.0	$1,568.83	$5,477.22	$45.00	3.46
Well Shop Building	1	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	3,900	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,900	0.10	569	0.0	$72.07	$58.50	$0.00	0.81
Restroom	1	Incandescent: 60W A Lamp	Wall Switch	100	3,900	Fixture Replacement	No	1	LED - Fixtures: Downlight Solid State Retrofit	Wall Switch	15	3,900	0.07	375	0.0	$47.49	$63.65	$5.00	1.24
Parking Lot	3	Metal Halide: (1) 400W Lamp	Daylight Dimming	458	3,458	Fixture Replacement	No	3	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Daylight Dimming	125	3,458	0.81	3,904	0.0	$494.88	$5,858.98	$300.00	11.23

Motor Inventory & Recommendations

		Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Annual Operating Hours	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Main Boiler Room	Main Garage Building	2	Heating Hot Water Pump	3.0	82.5%	No	1,820	No	82.5%	Yes	2	0.82	4,295	0.0	$544.54	$6,015.30	$0.00	11.05
Mechanical Room	Air Handler	2	Supply Fan	2.0	82.0%	No	1,820	No	82.0%	Yes	2	1.22	2,359	0.0	$299.12	$5,457.71	$0.00	18.25
Garage	Garage	12	Other	0.8	77.0%	No	1,820	No	77.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Garage	17	Exhaust Fan	2.0	80.0%	No	1,820	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Garage	7	Other	10.0	82.0%	No	1,820	No	82.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Garage	6	Air Compressor	7.5	84.0%	No	1,820	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Garage	12	Other	3.0	82.0%	No	1,820	No	82.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Garage (Heavy Duty Tire Changers)	3	Other	2.0	82.0%	No	1,820	No	82.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Garage (Heavy Duty Tire Changers)	3	Other	1.5	82.0%	No	1,820	No	82.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Garage (Truck Tire Changer)	2	Other	1.5	82.0%	No	1,820	No	82.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Electric HVAC Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Rear Building	Recycling Tower 1sr and 2nd Floor	1	Split-System AC	2.60		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rear Building	Recycling Tower 1sr and 2nd Floor	1	Split-System AC	5.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Road Dept Staff Room	Road Dept Staff Room	1	Window AC	2.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Sanitation Room	Sanitation Room	1	Window AC	2.50		Yes	1	Window AC	1.50		12.00		No	1.36	2,295	0.0	$290.98	$1,633.14	$0.00	5.61
Data Room	Data Room	1	Split-System AC	1.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Park Dept Repair Office	Park Dept Repair Office	1	Window AC	3.00		Yes	1	Window AC	3.00		12.00		No	0.83	1,397	0.0	$177.12	$3,266.28	$0.00	18.44
Repair Shop Parts	Repair Shop Parts	1	Split-System AC	4.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Well Shop	1	Window AC	2.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Main Boiler Room	Garage's Offices	2	Non-Condensing Hot Water Boiler	720.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Main Boiler Room	Garage's Offices	1	Non-Condensing Hot Water Boiler	720.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Main Boiler Room	Main Boiler Room	1	Warm Air Unit Heater	150.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Recycling Tower	Recycling Tower 1st and 2nd Floor	2	Furnace	130.00	Yes	1	Furnace	130.00	95.00%	AFUE	0.00	0	39.1	$275.42	$2,945.45	$400.00	9.24
Mechanical Room	Sanitation	2	Furnace	90.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Garage	2	Warm Air Unit Heater	180.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Garage	Garage	34	Infrared Unit Heater	150.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Main Boiler Room	Main Garage Building	1	Storage Tank Water Heater (> 50 Gal)	Yes	1	Storage Tank Water Heater (≤ 50 Gal)	Natural Gas	80.00%	EF	1.35	11,870	-40.5	$1,219.50	$2,812.80	$50.00	2.27
Men Restroom	Garage	1	Storage Tank Water Heater (> 50 Gal)	Yes	1	Storage Tank Water Heater (> 50 Gal)	Natural Gas	80.00%	EF	1.35	19,203	-65.5	$1,972.89	$4,449.00	$150.00	2.18
Well Shop Building	Well Shop Building	1	Storage Tank Water Heater (≤ 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Low-Flow Device Recommendations

	Recommedation Inputs				Energy Impact & Financial Analysis						
Location	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Garage Restrooms	5	Faucet Aerator (Lavatory)	2.20	1.00	0.00	2,525	0.0	$320.10	$35.85	$0.00	0.11

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Garage	8	Copy Machine	1,250.0	Yes
Garage	30	Desktop Computer	191.0	Yes
Garage	8	Water Fountain	250.0	No
Garage	11	Microwave	1,000.0	No
Garage	7	Refrigerator	275.0	No
Garage	4	Small Printer	45.0	Yes
Garage	4	Coffee Machine	1,050.0	No
Garage	2	Garage	3,750.0	No
Garage	12	Garage	125.0	No
Garage	5	Electri Unit Heater	5,000.0	No

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Road Dept Staff Room	1	Refrigerated	Yes	0.00	1,612	0.0	$204.34	$230.00	$0.00	1.13
Road Dept Staff Room	1	Non-Refrigerated	Yes	0.00	343	0.0	$43.42	$230.00	$0.00	5.30

Appendix B: ENERGY STAR® Statement of Energy Performance

ENERGY STAR® Statement of Energy Performance

LEARN MORE AT energystar.gov

N/A

ENERGY STAR® Score[1]

Publics Works Garage

Primary Property Type: Repair Services (Vehicle, Shoe, Locksmith, etc.)
Gross Floor Area (ft²): 122,800
Built: 1955

For Year Ending: March 31, 2017
Date Generated: June 09, 2017

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Publics Works Garage 225 Smith St Keasbey, New Jersey 08832	_____ , (___)___-_____	___ _____ , (___)___-_____ _____

Property ID: 5880913

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
141.5 kBtu/ft²

Source EUI
234.7 kBtu/ft²

Annual Energy by Fuel		National Median Comparison	
Electric - Grid (kBtu)	5,062,421 (29%)	National Median Site EUI (kBtu/ft²)	60.5
Natural Gas (kBtu)	12,313,653 (71%)	National Median Source EUI (kBtu/ft²)	100.4
		% Diff from National Median Source EUI	134%
		Annual Emissions	
		Greenhouse Gas Emissions (Metric Tons CO2e/year)	1,235

Signature & Stamp of Verifying Professional

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

Signature: _____ Date: _____

Licensed Professional

___ _____
,
(___)___-_____
_____

Professional Engineer Stamp (if applicable)