



Local Government Energy Audit: Energy Audit Report



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Fire House (South Broad)

714-716 South Broad Street

Trenton, New Jersey 08611

City of Trenton

December 31, 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.

Table of Contents

1	Executive Summary	1
1.1	Facility Summary	1
1.2	Your Cost Reduction Opportunities.....	1
	Energy Conservation Measures.....	1
	Energy Efficient Practices	4
	On-Site Generation Measures.....	4
1.3	Implementation Planning	5
2	Facility Information and Existing Conditions	6
2.1	Project Contacts	6
2.2	General Site Information.....	6
2.3	Building Occupancy	6
2.4	Building Envelope	7
2.5	Energy-Using Systems	8
	Lighting System	8
	Hot Water Heating System.....	8
	Direct Expansion Air Conditioning System (DX)	9
	Domestic Hot Water Heating System.....	9
	Food Service Equipment	10
	Building Plug Load	10
3	Site Energy Use and Costs	11
3.1	Total Cost of Energy	11
3.2	Electricity Usage	12
3.3	Natural Gas Usage	13
3.4	Benchmarking.....	14
3.5	Energy End-Use Breakdown	15
4	Energy Conservation Measures.....	16
4.1	Recommended ECMs	16
4.1.1	Lighting Upgrades.....	17
	ECM 1: Install LED Fixtures	17
	ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers.....	18
	ECM 3: Retrofit Fixtures with LED Lamps.....	18
4.1.2	Lighting Control Measures	19
	ECM 4: Install Occupancy Sensor Lighting Controls	19
	ECM 5: Install High/Low Lighting Controls	20
4.1.3	HVAC System Upgrades.....	21
	ECM 6: Install Programmable Thermostats.....	21
4.1.4	Plug Load Equipment Control - Vending Machines.....	22
	ECM 7: Vending Machine Control	22
4.2	ECMs Evaluated But Not Recommended	23

Premium Efficiency Motors.....	23
Install VFDs on Constant Volume (CV) HVAC	24
Install VFDs on Hot Water Pumps	24
Install High Efficiency Air Conditioning Units	25
Install High Efficiency Heat Pumps	25
Install High Efficiency Hot Water Boilers.....	26
5 Energy Efficient Practices	27
Perform Proper Lighting Maintenance.....	27
Develop a Lighting Maintenance Schedule	27
Clean Evaporator/Condenser Coils on AC Systems	27
Perform Proper Boiler Maintenance	27
Perform Proper Water Heater Maintenance	28
Water Conservation	28
6 On-Site Generation Measures	29
6.1 Photovoltaic.....	29
6.2 Combined Heat and Power	30
7 Demand Response	31
8 Project Funding / Incentives	32
8.1 SmartStart	33
8.2 Direct Install	34
8.3 Energy Savings Improvement Program	35
9 Energy Purchasing and Procurement Strategies	36
9.1 Retail Electric Supply Options.....	36
9.2 Retail Natural Gas Supply Options	36

Appendix A: Equipment Inventory & Recommendations

Appendix B: ENERGY STAR® Statement of Energy Performance

Table of Figures

Figure 1 – Previous 12 Month Utility Costs.....	2
Figure 2 – Potential Post-Implementation Costs (High Priority Measures).....	2
Figure 3 – Potential Post-Implementation Costs (All Evaluated Measures)	2
Figure 4 – Summary of Energy Reduction Opportunities	3
Figure 5 – Project Contacts	6
Figure 6 - Building Schedule.....	6
Figure 7 – Building Envelope.....	7
Figure 8 – Lighting Technologies.....	8
Figure 9 – Hot Water Heating Equipment.....	8
Figure 10 – Air-Conditioning Equipment	9
Figure 11 – Domestic Hot Water Equipment.....	9
Figure 12 – Food Service Equipment	10
Figure 13 – Plug Load Appliances.....	10
Figure 14 - Utility Summary	11
Figure 15 - Energy Cost Breakdown	11
Figure 16 - Electric Usage & Demand.....	12
Figure 17 - Electric Usage & Demand.....	12
Figure 18 - Natural Gas Usage.....	13
Figure 19 - Natural Gas Usage.....	13
Figure 20 - Energy Use Intensity Comparison – Existing Conditions.....	14
Figure 21 - Energy Use Intensity Comparison – Following Installation of Recommended Measures	14
Figure 22 - Energy Balance (% and kBtu/SF)	15
Figure 23 – Summary of Recommended ECMs.....	16
Figure 24 – Summary of Lighting Upgrade ECMs.....	17
Figure 25 – Summary of Lighting Control ECMs	19
Figure 26 - Summary of HVAC System Improvement ECMs	21
Figure 27 - Summary of HVAC System Improvement ECMs	22
Figure 28 – Summary of Measures Evaluated, But Not Recommended	23
Figure 29 - ECM Incentive Program Eligibility	32

I EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPUB) has sponsored this Local Government Energy Audit (LGEA) Report for the Fire House (South Broad).

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.

I.1 Facility Summary

The Fire House (South Broad) is an 8,762 square foot facility comprised of various space types within a single building. The Fire House is two floors with a basement and an attic and includes restrooms, a gym area, dorm areas, a break/meeting area, a small kitchen area and large truck bay space.

Lighting at the Fire House (South Broad) primarily consists of T12 and T8 linear fluorescent fixtures, some compact fluorescent, and some metal halide lighting. Cooling is provided by split-system air conditioners, window air conditioning units, and a ductless mini-split heat pump. Heating is primarily provided by warm air units throughout the facility which are supplied with hot water from a boiler in the basement. Supplemental heating is provided by the mini-split heat pump and electric resistance heaters in air handlers that are paired with the split-system air conditioners. A thorough description of the facility and our observations are located in Section 2.

I.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated 13 measures and recommends seven which together represent an opportunity for Fire House (South Broad) to reduce annual energy costs by roughly \$3,350 and annual greenhouse gas emissions by 25,929 lbs CO₂e. We estimate that if all measures were implemented as recommended, the project would pay for itself in 5.6 years. The breakdown of existing and potential utility costs after project implementation are illustrated in Figure 1, Figure 2 and Figure 3, respectively. Together these measures represent an opportunity to reduce the Fire House (South Broad)'s annual energy use by 11%.

Figure 1 – Previous 12 Month Utility Costs

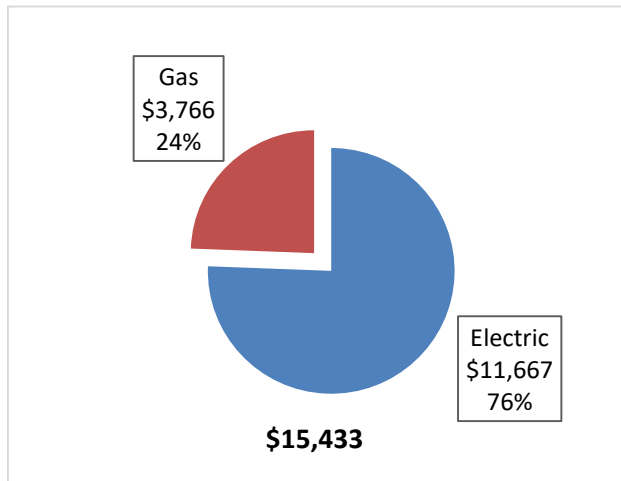


Figure 2 – Potential Post-Implementation Costs (High Priority Measures)

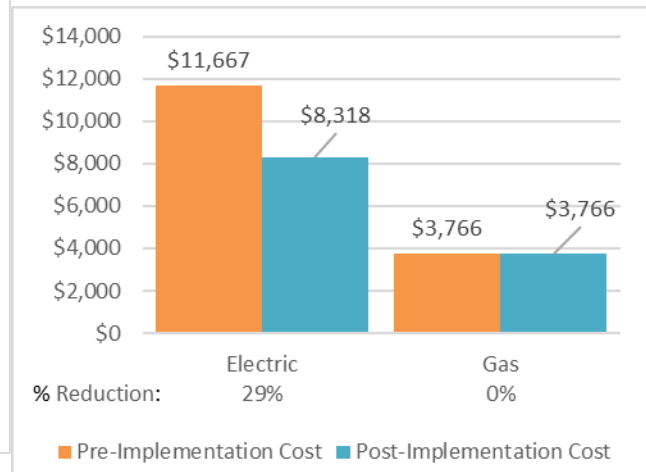
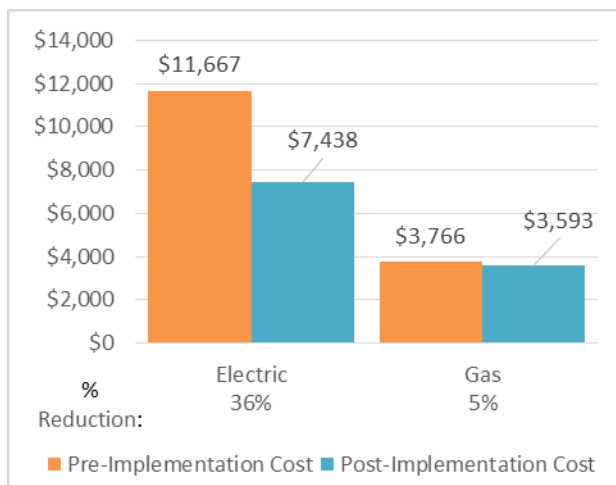


Figure 3 – Potential Post-Implementation Costs (All Evaluated Measures)



A detailed description of the Fire House (South Broad)'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 4. A brief description of each category can be found below and a description of savings opportunities can be found in Section 4.

Figure 4 – Summary of Energy Reduction Opportunities

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades			21,006	3.6	0.0	\$2,732.52	\$15,245.90	\$1,905.00	\$13,340.90	4.9	21,153
ECM 1	Install LED Fixtures	Yes	4,871	0.6	0.0	\$633.61	\$7,727.72	\$800.00	\$6,927.72	10.9	4,905
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	12,874	2.5	0.0	\$1,674.70	\$5,758.63	\$835.00	\$4,923.63	2.9	12,964
ECM 3	Retrofit Fixtures with LED Lamps	Yes	3,261	0.6	0.0	\$424.20	\$1,759.54	\$270.00	\$1,489.54	3.5	3,284
Lighting Control Measures			2,445	0.5	0.0	\$318.02	\$4,790.00	\$595.00	\$4,195.00	13.2	2,462
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	2,240	0.5	0.0	\$291.44	\$4,590.00	\$595.00	\$3,995.00	13.7	2,256
ECM 5	Install High/Low Lighting Controls	Yes	204	0.0	0.0	\$26.58	\$200.00	\$0.00	\$200.00	7.5	206
Motor Upgrades			484	0.1	0.0	\$62.98	\$4,524.11	\$0.00	\$4,524.11	71.8	488
	Premium Efficiency Motors	No	484	0.1	0.0	\$62.98	\$4,524.11	\$0.00	\$4,524.11	71.8	488
Variable Frequency Drive (VFD) Measures			4,428	1.7	0.0	\$576.07	\$16,631.15	\$744.00	\$15,887.15	27.6	4,459
	Install VFDs on Constant Volume (CV) HVAC	No	3,866	1.3	0.0	\$502.86	\$11,366.23	\$744.00	\$10,622.23	21.1	3,893
	Install VFDs on Hot Water Pumps	No	563	0.4	0.0	\$73.20	\$5,264.92	\$0.00	\$5,264.92	71.9	567
Electric Unitary HVAC Measures			1,846	0.7	0.0	\$240.16	\$5,775.87	\$88.17	\$5,687.70	23.7	1,859
	Install High Efficiency Electric AC	No	1,472	0.5	0.0	\$191.50	\$4,155.43	\$0.00	\$4,155.43	21.7	1,482
	Install High Efficiency Heat Pumps	No	374	0.2	0.0	\$48.66	\$1,620.44	\$88.17	\$1,532.27	31.5	377
Gas Heating (HVAC/Process) Replacement			0	0.0	22.4	\$173.28	\$25,299.61	\$2,318.80	\$22,980.81	132.6	2,622
	Install High Efficiency Hot Water Boilers	No	0	0.0	22.4	\$173.28	\$25,299.61	\$2,318.80	\$22,980.81	132.6	2,622
HVAC System Improvements			1,090	0.0	0.0	\$141.73	\$989.61	\$0.00	\$989.61	7.0	1,097
ECM 6	Install Programmable Thermostats	Yes	1,090	0.0	0.0	\$141.73	\$989.61	\$0.00	\$989.61	7.0	1,097
Plug Load Equipment Control - Vending Machine			1,209	0.0	0.0	\$157.26	\$230.00	\$0.00	\$230.00	1.5	1,217
ECM 7	Vending Machine Control	Yes	1,209	0.0	0.0	\$157.26	\$230.00	\$0.00	\$230.00	1.5	1,217
TOTALS FOR HIGH PRIORITY MEASURES			25,749	4.1	0.0	\$3,349.52	\$21,255.51	\$2,500.00	\$18,755.51	5.6	25,929
TOTALS FOR ALL EVALUATED MEASURES			32,508	6.6	22.4	\$4,402.02	\$73,486.24	\$5,650.97	\$67,835.27	15.4	35,357

* - 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.

Motor Upgrades generally involve replacing older standard efficiency motors with high efficiency standard (NEMA Premium®). Motors replacements generally assume the same size motors, just higher efficiency. Although occasionally additional savings can be achieved by downsizing motors to better meet current load requirements. This measure saves energy by reducing the power used by the motors, due to improved electrical efficiency.

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.

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

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 six 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 Fire House (South Broad) include:

- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Clean Evaporator/Condenser Coils on AC Systems
- Perform Proper Boiler 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 Fire House (South Broad). Based on the configuration of the site and its loads there is a low potential for installing any PV and combined heat and power self-generation measures.

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

I.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
- Direct Install
- 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 4 are based on the SmartStart program. More details on this program and others are available in Section 8.

This facility may also qualify for the Direct Install program which can provide turnkey installation of multiple measures, through an authorized network of participating contractors. This program can provide substantially higher incentives than SmartStart, up to 70% of the cost of selected measures, although measure eligibility will have to be assessed and be verified by the designated Direct Install contractor and, in most cases, they will perform the installation work.

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the Energy Savings Improvement Program (ESIP). Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. An LGEA report (or other approved energy audit) is required for participation in ESIP. Please refer to Section 8.3 for additional information on the ESIP Program.

The Demand Response Energy Aggregator is a (non-NJCEP) program designed to reduce electric loads at commercial facilities, when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak power demand. Demand Response (DR) service providers (a.k.a. Curtailment Service Providers) are registered with PJM, the independent system operator (ISO) for mid-Atlantic state region that is charged with maintaining electric grid reliability. By enabling grid operators to call upon commercial facilities to reduce their electric usage during times of peak demand, the grid is made more reliable and overall transmission costs are reduced for all ratepayers. Curtailment Service Providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary and facilities receive payments whether or not they are called upon to curtail their load during times of peak demand. Refer to Section 7 for additional information on this program.

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

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 5 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Hoggarth Stephen	Principal Engineer	hstephen@trentonnj.org	609-989-3612
TRC Energy Services			
Aimee Lalonde	Auditor	Alalonde@trcsolutions.com	732-855-0033

2.2 General Site Information

On August 12, 2017, TRC performed an energy audit at the Fire House (South Broad) located in Trenton, New Jersey. TRC's team met with Hoggarth Stephen to review the facility operations and help focus our investigation on specific energy-using systems.

The Fire House (South Broad) is an 8,762 square foot facility comprised of various space types within a single building. The fire house is two floors with a basement and an attic and includes restrooms, a gym area, dorm areas, a break/meeting area, a small kitchen area and large truck bay space.

Lighting at the Fire House (South Broad) primarily consists of T12 and T8 linear fluorescent fixtures, some compact fluorescent, and some metal halide lighting. Cooling is provided by split-system air conditioners, window air conditioning units, and a ductless mini-split heat pump. Heating is primarily provided by warm air units throughout the facility which are supplied with hot water from a boiler in the basement. Supplemental heating is provided by the mini-split heat pump and electric resistance heaters in air handlers that are paired with the split-system air conditioners.

The building was constructed in 1903.

2.3 Building Occupancy

The building is open every day, 24 hours a day. The typical schedule is presented in the table below. The entire facility is used year-round. During a typical day, the facility is on a four-shift schedule and so is continuously occupied by approximately eight crew.

Figure 6 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Fire House (South Broad)	Weekday	12:00 AM - 12:00 AM
Fire House (South Broad)	Weekend	12:00 AM - 12:00 AM

2.4 Building Envelope

The building is constructed of brick, concrete masonry and structural steel. The building has a flat roof covered with a membrane. The building has single pane windows that appear to be in good condition and show little sign of excessive infiltration. The exterior doors are constructed of aluminum, one with a large glass pane, and are in good condition. There are also large aluminum truck bay doors which are not always closed and are a significant source of infiltration when open.



Figure 7 – Building Envelope

2.5 Energy-Using Systems

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

Lighting System

Interior lighting at the facility is provided mostly by 40-Watt linear fluorescent T12 and 32 Watt T8 lamps, as well as some compact fluorescent lamps (CFL). Most of the fixtures are 2-lamp 4-foot long suspended high or low bay. Lighting control in most spaces is provided by wall switches with a couple of occupancy sensors in the watch desk and 2nd floor office areas.

The building's exterior lighting consists primarily of metal halide and efficient LED fixtures that are controlled by photocells. There are also a few CFL fixtures controlled by switches.

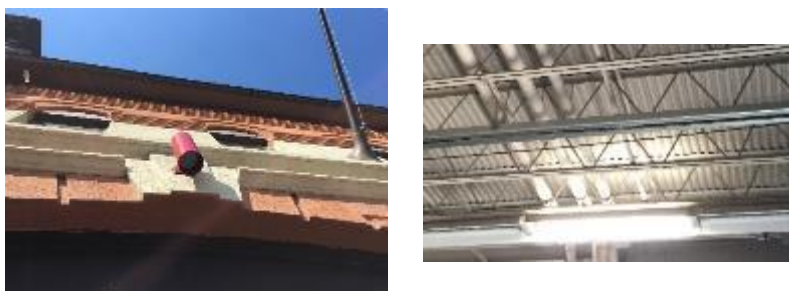


Figure 8 – Lighting Technologies

Hot Water Heating System

The hot water system consists of one HB Smith 1,054 kBtu/hr output, non-condensing boiler. The boiler has a nominal combustion efficiency of 84%. The hot water system has two 1.5 hp constant flow distribution pumps. The boiler provides hot water to ceiling mounted warm air units throughout the facility. The boiler is in good condition and was last inspected June 2016.



Figure 9 – Hot Water Heating Equipment

Direct Expansion Air Conditioning System (DX)

Three 3.5-ton Goodman split-system air conditioning units, Frigidaire and Fedder window air-conditioners that are roughly 2.5 and 1.5 tons respectively, and a 1 ton Daikin mini-split heat pump are used to cool the building. Split systems are located in a mechanical area outside the building.

The split-system units are controlled by individual thermostats located in the zones they serve. Window air conditioners and the ductless mini-split heat pump are controlled by thermostats on the units themselves.

Ventilation is provided by McQuay and Goodman air handlers located in mechanical closets. Larger units are driven by 3.0 hp supply fans. The Goodman air handlers have electric resistance heater to provide supplemental heating.

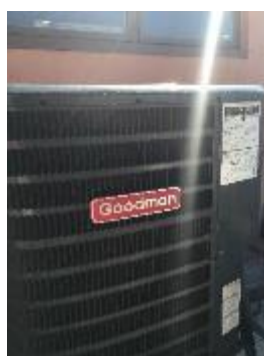


Figure 10 – Air-Conditioning Equipment

Domestic Hot Water Heating System

The domestic hot water heating system consists of one Bradford White gas fired storage tank hot water heater with an input rating of 76 kBtu/hr and a State instantaneous gas fired hot water heater with an input rating of 237 kBtu/hr. The Bradford White hot water heater has a storage tank capacity of 75 gallons and a nominal efficiency of 80%. The instantaneous hot water heater has a flow rate capacity of about 333 gallons per minute and a nominal efficiency of 84%. The State instantaneous gas fired hot water heater replaced an old State storage tank hot water heater about two years ago.



Figure 11 – Domestic Hot Water Equipment

Food Service Equipment

The facility has a small kitchen area with a Vulcan gas combination range, griddle and oven.



Figure 12 – Food Service Equipment

Building Plug Load

There are various plug load appliances throughout the facility, including refrigerators, a CRT television, a coffee maker and a microwave.



Figure 13 – Plug Load Appliances

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

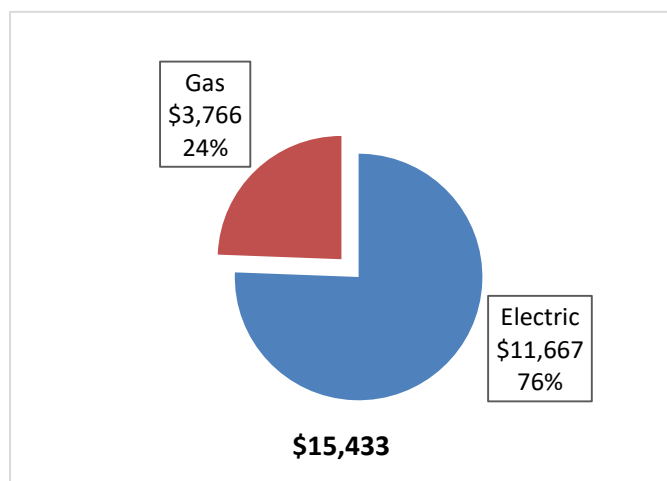
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 14 - Utility Summary

Utility Summary for Fire House (South Broad)		
Fuel	Usage	Cost
Electricity	89,689 kWh	\$11,667
Natural Gas	4,867 Therms	\$3,766
Total		\$15,433

The current annual energy cost for this facility is \$15,433 as shown in the chart below.

Figure 15 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was \$0.130/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. Electric demand and consumption are slightly lower during winter months than in summer, but are not significantly lower because of the supplemental heating provided by electric heating equipment. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 16 - Electric Usage & Demand

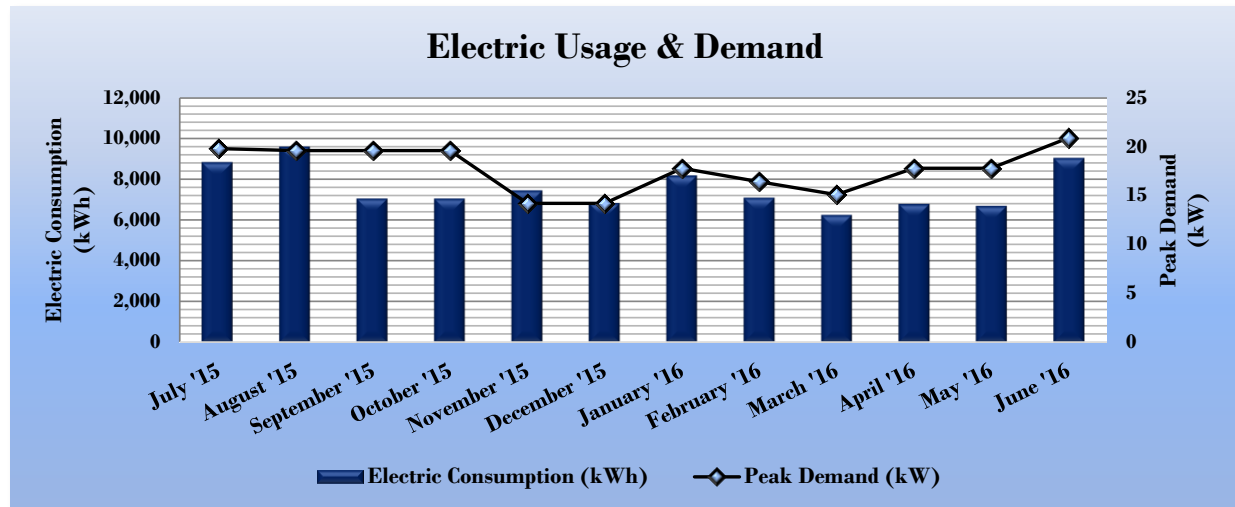


Figure 17 - Electric Usage & Demand

Electric Billing Data for Fire House (South Broad)						
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost	TRC Estimated Usage?
8/10/15	31	8,820	20	\$86	\$1,403	No
9/9/15	30	9,576	20	\$85	\$1,449	No
10/8/15	29	7,038	20	\$86	\$917	Yes
11/6/15	29	7,038	20	\$86	\$917	Yes
12/9/15	33	7,434	14	\$62	\$927	No
1/13/16	35	6,822	14	\$62	\$830	No
2/10/16	28	8,172	18	\$78	\$941	No
3/11/16	30	7,074	16	\$72	\$666	No
4/13/16	33	6,234	15	\$67	\$626	No
5/12/16	29	6,768	18	\$78	\$816	No
6/13/16	32	6,678	18	\$78	\$997	No
7/13/16	30	9,018	21	\$92	\$1,306	No
Totals	369	90,672	20.9	\$931	\$11,795	
Annual	365	89,689	20.9	\$921	\$11,667	

3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average gas cost for the past 12 months is \$0.774/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below, and indicates that seasonal space heating is the primary load

Figure 18 - Natural Gas Usage

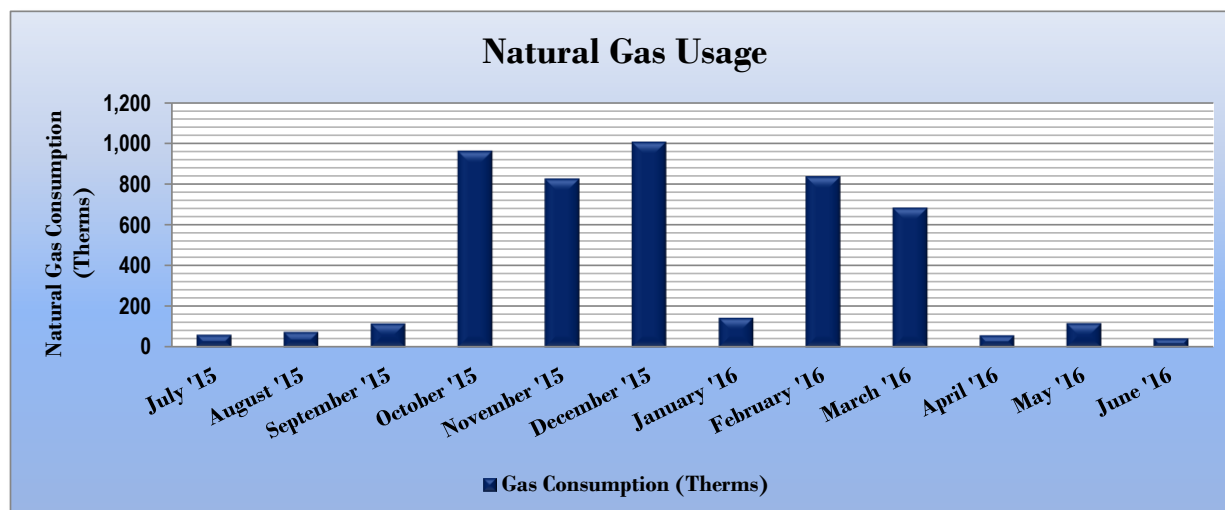


Figure 19 - Natural Gas Usage

Gas Billing Data for Fire House (South Broad)			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
8/10/15	31	61	\$59
9/9/15	30	76	\$71
10/8/15	29	116	\$100
11/6/15	29	959	\$784
12/9/15	33	824	\$669
1/13/16	35	1,003	\$840
2/10/16	28	144	\$125
3/11/16	30	834	\$561
4/13/16	33	681	\$420
5/12/16	29	59	\$50
6/13/16	32	119	\$89
7/13/16	30	44	\$40
Totals	369	4,920	\$3,808
Annual	365	4,867	\$3,766

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 20 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Fire House (South Broad)	National Median Building Type: Fire/Police Station
Source Energy Use Intensity (kBtu/ft ²)	168.0	154.4
Site Energy Use Intensity (kBtu/ft ²)	90.5	88.3

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

Figure 21 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Fire House (South Broad)	National Median Building Type: Fire/Police Station
Source Energy Use Intensity (kBtu/ft ²)	139.5	154.4
Site Energy Use Intensity (kBtu/ft ²)	81.4	88.3

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

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

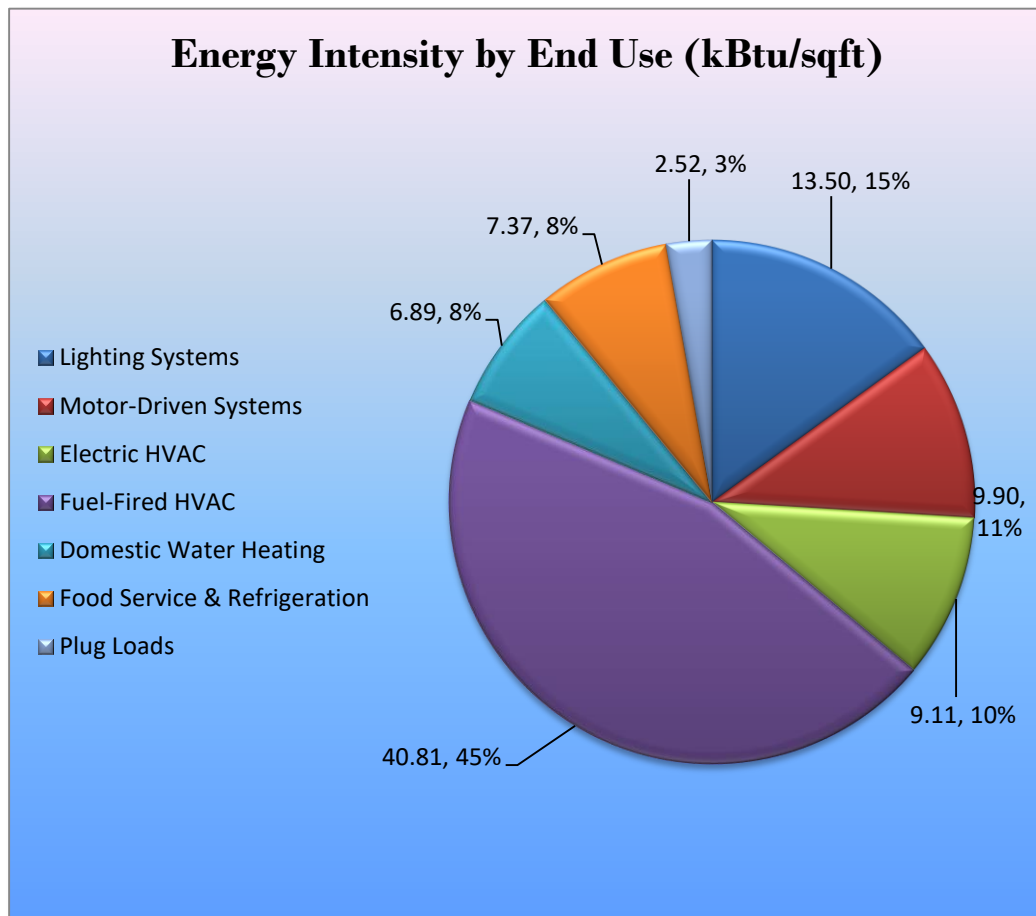
For more information on ENERGY STAR® certification go to: <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1>.

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 22 - Energy Balance (% and kBtu/SF)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the Fire House (South Broad) 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 23 – 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 ₂ e Emissions Reduction (lbs)
Lighting Upgrades		21,006	3.6	0.0	\$2,732.52	\$15,245.90	\$1,905.00	\$13,340.90	4.9	21,153
ECM 1	Install LED Fixtures	4,871	0.6	0.0	\$633.61	\$7,727.72	\$800.00	\$6,927.72	10.9	4,905
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	12,874	2.5	0.0	\$1,674.70	\$5,758.63	\$835.00	\$4,923.63	2.9	12,964
ECM 3	Retrofit Fixtures with LED Lamps	3,261	0.6	0.0	\$424.20	\$1,759.54	\$270.00	\$1,489.54	3.5	3,284
Lighting Control Measures		2,445	0.5	0.0	\$318.02	\$4,790.00	\$595.00	\$4,195.00	13.2	2,462
ECM 4	Install Occupancy Sensor Lighting Controls	2,240	0.5	0.0	\$291.44	\$4,590.00	\$595.00	\$3,995.00	13.7	2,256
ECM 5	Install High/Low Lighting Controls	204	0.0	0.0	\$26.58	\$200.00	\$0.00	\$200.00	7.5	206
HVAC System Improvements		1,090	0.0	0.0	\$141.73	\$989.61	\$0.00	\$989.61	7.0	1,097
ECM 6	Install Programmable Thermostats	1,090	0.0	0.0	\$141.73	\$989.61	\$0.00	\$989.61	7.0	1,097
Plug Load Equipment Control - Vending Machine		1,209	0.0	0.0	\$157.26	\$230.00	\$0.00	\$230.00	1.5	1,217
ECM 7	Vending Machine Control	1,209	0.0	0.0	\$157.26	\$230.00	\$0.00	\$230.00	1.5	1,217
TOTALS		25,749	4.1	0.0	\$3,349.52	\$21,255.51	\$2,500.00	\$18,755.51	5.6	25,929

* - 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

Our recommendations for upgrades to existing lighting fixtures are summarized in Figure 24 below.

Figure 24 – 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 ₂ e Emissions Reduction (lbs)
Lighting Upgrades		21,006	3.6	0.0	\$2,732.52	\$15,245.90	\$1,905.00	\$13,340.90	4.9	21,153
ECM 1	Install LED Fixtures	4,871	0.6	0.0	\$633.61	\$7,727.72	\$800.00	\$6,927.72	10.9	4,905
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	12,874	2.5	0.0	\$1,674.70	\$5,758.63	\$835.00	\$4,923.63	2.9	12,964
ECM 3	Retrofit Fixtures with LED Lamps	3,261	0.6	0.0	\$424.20	\$1,759.54	\$270.00	\$1,489.54	3.5	3,284

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 ₂ e Emissions Reduction (lbs)
Interior	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	0.0	0
Exterior	4,871	0.6	0.0	\$633.61	\$7,727.72	\$800.00	\$6,927.72	10.9	4,905

Measure Description

We recommend replacing exterior fixtures containing metal halide 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 nearly twice those of the fixtures recommended for replacement.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO ₂ e Emissions Reduction (lbs)
Interior	12,874	2.5	0.0	\$1,674.70	\$5,758.63	\$835.00	\$4,923.63	2.9	12,964
Exterior	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	0.0	0

Measure Description

We recommend retrofitting T12 linear fluorescent fixtures by removing fluorescent tubes and ballasts and replacing them with LEDs and LED drivers (if necessary), which are designed to use retrofitted fluorescent fixtures. The measure uses the existing fixture housing but replaces the rest of the components with more efficient lighting technology. 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 fluorescent tubes.

ECM 3: 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 ₂ e Emissions Reduction (lbs)
Interior	3,261	0.6	0.0	\$424.20	\$1,759.54	\$270.00	\$1,489.54	3.5	3,284
Exterior	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	0.0	0

Measure Description

We recommend retrofitting CFLs and linear T8 fluorescent 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 fluorescent sources.

4.1.2 Lighting Control Measures

Our recommendations for lighting control measures are summarized in Figure 25 below.

Figure 25 – 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 ₂ e Emissions Reduction (lbs)
Lighting Control Measures		2,445	0.5	0.0	\$318.02	\$4,790.00	\$595.00	\$4,195.00	13.2	2,462
ECM 4	Install Occupancy Sensor Lighting Controls	2,240	0.5	0.0	\$291.44	\$4,590.00	\$595.00	\$3,995.00	13.7	2,256
ECM 5	Install High/Low Lighting Controls	204	0.0	0.0	\$26.58	\$200.00	\$0.00	\$200.00	7.5	206

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 ₂ e Emissions Reduction (lbs)
2,240	0.5	0.0	\$291.44	\$4,590.00	\$595.00	\$3,995.00	13.7	2,256

Measure Description

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in restrooms, dorm spaces, offices areas, the truck bays, and common areas such as the kitchen and break spaces. 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.

ECM 5: Install High/Low 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 ₂ e Emissions Reduction (lbs)
204	0.0	0.0	\$26.58	\$200.00	\$0.00	\$200.00	7.5	206

Measure Description

We recommend installing occupancy sensors to provide dual level lighting control for lighting fixtures in spaces that are infrequently occupied but may require some level of continuous lighting for safety or security reasons. Recommended areas for such lighting control are the second-floor hallways.

Lighting fixtures with these controls operate at default low levels when the area is not occupied to provide minimal lighting to meet security or safety requirements. Sensors detect occupancy using ultrasonic and/or infrared sensors. The lighting systems are switched to full lighting levels whenever an occupant is detected. Fixtures are automatically switched back to low level after an area has been vacant for a preset period of time. Energy savings results from only providing full lighting levels when it is required.

For this type of measure the occupancy sensors will generally be ceiling or fixture mounted. Sufficient sensor coverage needs to be provided to ensure that lights turn on in each area as an occupant approaches.

Additional savings from reduced lighting maintenance may also result from this measure, due to reduced lamp operation.

4.1.3 HVAC System Upgrades

Our recommendation for HVAC system improvement are summarized in Figure 26 below.

Figure 26 - Summary of HVAC System Improvement ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO ₂ e Emissions Reduction (lbs)
HVAC System Improvements		1,090	0.0	0.0	\$141.73	\$989.61	\$0.00	\$989.61	7.0	1,097
ECM 6	Install Programmable Thermostats	1,090	0.0	0.0	\$141.73	\$989.61	\$0.00	\$989.61	7.0	1,097

ECM 6: Install Programmable Thermostats

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 ₂ e Emissions Reduction (lbs)
1,090	0.0	0.0	\$141.73	\$989.61	\$0.00	\$989.61	7.0	1,097

Measure Description

We recommend replacing manual thermostats controlling the split-system air conditioning units with programmable thermostats. Manual thermostats are generally adjusted to a single heating and cooling setpoint and left at that setting regardless of occupancy in the area served by the HVAC equipment. As a result, the same level of heating and cooling is provided regardless of the occupancy in the space. Programmable thermostats can be set to maintain different temperature settings for different times of day and for different days of the week. By reducing heating temperature setpoints and raising cooling temperature setpoints when spaces are unoccupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures for building usage at all times.

Programmable thermostats provide energy savings by reducing heating and cooling energy usage when a room is unoccupied.

4.1.4 Plug Load Equipment Control - Vending Machines

Our recommendations for plug load equipment control measures are summarized in Figure 27 below.

Figure 27 - Summary of HVAC System Improvement ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending Machine		1,209	0.0	0.0	\$157.26	\$230.00	\$0.00	\$230.00	1.5	1,217
ECM 7	Vending Machine Control	1,209	0.0	0.0	\$157.26	\$230.00	\$0.00	\$230.00	1.5	1,217

ECM 7: 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 ₂ e Emissions Reduction (lbs)
1,209	0.0	0.0	\$157.26	\$230.00	\$0.00	\$230.00	1.5	1,217

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.

4.2 ECMs Evaluated But Not Recommended

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

Figure 28 – Summary of Measures Evaluated, But Not Recommended

Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Motor Upgrades	484	0.1	0.0	\$62.98	\$4,524.11	\$0.00	\$4,524.11	71.8	488
Premium Efficiency Motors	484	0.1	0.0	\$62.98	\$4,524.11	\$0.00	\$4,524.11	71.8	488
Variable Frequency Drive (VFD) Measures	4,428	1.7	0.0	\$576.07	\$16,631.15	\$744.00	\$15,887.15	27.6	4,459
Install VFDs on Constant Volume (CV) HVAC	3,866	1.3	0.0	\$502.86	\$11,366.23	\$744.00	\$10,622.23	21.1	3,893
Install VFDs on Hot Water Pumps	563	0.4	0.0	\$73.20	\$5,264.92	\$0.00	\$5,264.92	71.9	567
Electric Unitary HVAC Measures	1,846	0.7	0.0	\$240.16	\$5,775.87	\$88.17	\$5,687.70	23.7	1,859
Install High Efficiency Electric AC	1,472	0.5	0.0	\$191.50	\$4,155.43	\$0.00	\$4,155.43	21.7	1,482
Install High Efficiency Heat Pumps	374	0.2	0.0	\$48.66	\$1,620.44	\$88.17	\$1,532.27	31.5	377
Gas Heating (HVAC/Process) Replacement	0	0.0	22.4	\$173.28	\$25,299.61	\$2,318.80	\$22,980.81	132.6	2,622
Install High Efficiency Hot Water Boilers	0	0.0	22.4	\$173.28	\$25,299.61	\$2,318.80	\$22,980.81	132.6	2,622
TOTALS	6,759	2.5	22.4	\$1,052.49	\$52,230.73	\$3,150.97	\$49,079.77	46.6	9,428

* - 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).

Premium Efficiency Motors

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO ₂ e Emissions Reduction (lbs)
484	0.1	0.0	\$62.98	\$4,524.11	\$0.00	\$4,524.11	71.8	488

Measure Description

We evaluated replacing standard efficiency motors with NEMA Premium® efficiency motors. Our evaluation assumes that existing motors will be replaced with motors of equivalent size and type. Although occasionally additional savings can be achieved by downsizing motors to better meet the motor's current load requirements. The base case motor efficiencies are estimated from nameplate information and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the *New Jersey's Clean Energy Program Protocols to Measure Resource Savings (2016)*. Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours.

Reasons for not Recommending

The payback for replacing the motors is longer than the effective useful life of the replacement equipment.

Install VFDs on Constant Volume (CV) 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 ₂ e Emissions Reduction (lbs)
3,866	1.3	0.0	\$502.86	\$11,366.23	\$744.00	\$10,622.23	21.1	3,893

Measure Description

We evaluated installing variable frequency drives (VFDs) to control supply fan motor speeds to convert the constant-volume, single-zone air handling system into a variable-air-volume (VAV) system. A separate VFD is usually required to control the return fan motor or dedicated exhaust fan motor, if the air handler has one. Zone thermostats will cause the VFD to modulate fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature. Energy savings results from reducing fan speed (and power) when there is a reduced load required for the zone. The magnitude of energy savings is based on the estimated amount of time that fan motors operate at partial load.

Reasons for not Recommending

The payback for these new drives is longer than the effective useful life of the proposed equipment.

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 ₂ e Emissions Reduction (lbs)
563	0.4	0.0	\$73.20	\$5,264.92	\$0.00	\$5,264.92	71.9	567

Measure Description

We evaluated installing variable frequency drives (VFD) to control a hot water pumps. 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.

Reasons for not Recommending

The payback for these new drives is longer than the effective useful life of the proposed equipment.

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 ₂ e Emissions Reduction (lbs)
1,472	0.5	0.0	\$191.50	\$4,155.43	\$0.00	\$4,155.43	21.7	1,482

Measure Description

We evaluated replacing standard efficiency window air conditioning units with high efficiency 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.

Reasons for not Recommending

The payback for replacing these units is longer than the effective useful life of the replacement equipment.

Install High Efficiency Heat 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 ₂ e Emissions Reduction (lbs)
374	0.2	0.0	\$48.66	\$1,620.44	\$88.17	\$1,532.27	31.5	377

Measure Description

We evaluated replacing the standard efficiency mini-split ductless heat pump with a high efficiency system. 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 and a higher HPSF rating indicates more efficient heating mode. 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 heating and cooling loads, and the estimated annual operating hours.

Reasons for not Recommending

The payback for replacing these units is longer than the effective useful life of the replacement equipment.

Install High Efficiency Hot Water Boilers

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 ₂ e Emissions Reduction (lbs)
0	0.0	22.4	\$173.28	\$25,299.61	\$2,318.80	\$22,980.81	132.6	2,622

Measure Description

We evaluated replacing the older non-condensing hot water boiler with high efficiency condensing hot water boiler. Significant improvements have been made in combustion technology resulting in increased overall boiler efficiency. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

The most notable efficiency improvement is condensing hydronic boilers that can achieve over 90% efficiency under the proper conditions. Condensing hydronic boilers typically operate at efficiencies between 85% and 87% (comparable to other high efficiency boilers) when the return water temperature is above 130°F. The boiler efficiency increases as the return water temperature drops below 130°F. Therefore, condensing hydronic boilers were only evaluated when the return water temperature is less than 130°F during most of the operating hours. As a result, a condensing hydronic boiler is not recommended for this site.

Reasons for not Recommending

The payback for replacing this boiler is significantly longer than the effective useful life of the replacement equipment.

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.

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.

Clean Evaporator/Condenser Coils on AC Systems

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

Perform Proper Boiler Maintenance

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

Perform Proper Water Heater Maintenance

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

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 gallons per minute (gpm) for bathroom faucets, 2.0 gpm for showerheads, and 1.28 gpm for pre-rinse spray valves.

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

6 ON-SITE GENERATION MEASURES

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

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

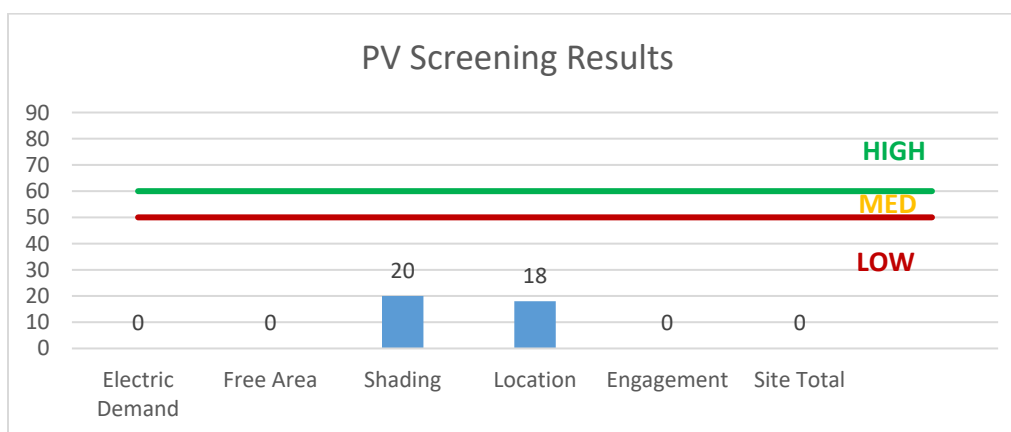
Preliminary screenings were performed to determine the potential that a generation project could provide a cost-effective solution for your facility. Before making a decision to implement, a feasibility study should be conducted that would take a detailed look at existing energy profiles, siting, interconnection,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

6.1 Photovoltaic

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

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

In order to be cost-effective, a solar PV array needs certain minimum criteria, such as flat or south-facing rooftop or other unshaded space on which to place the PV panels. In our opinion, the facility does appear not meet these minimum criteria for cost-effective PV installation.



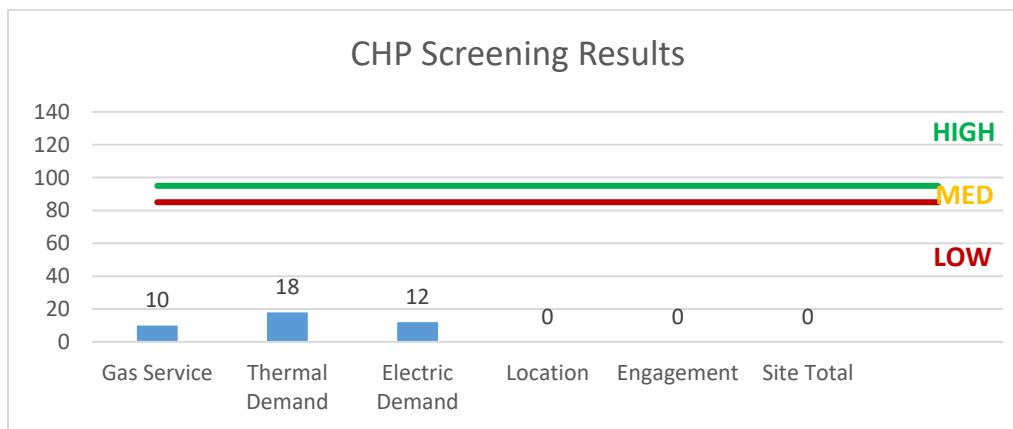
6.2 Combined Heat and Power

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 and infrequent thermal load, and lack of space near the existing boilers, are the most significant factors contributing to the 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.



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.

In our opinion, DR is not a viable option for this facility.

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

Figure 29 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings	Large Energy Users Program	Combined Heat & Power and Fuel Cell
ECM 1	Install LED Fixtures	X		X			
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	X		X			
ECM 3	Retrofit Fixtures with LED Lamps	X		X			
ECM 4	Install Occupancy Sensor Lighting Controls	X		X			
ECM 5	Install High/Low Lighting Controls			X			
ECM 6	Install Programmable Thermostats			X			
ECM 7	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. Direct Install caters to small to mid-size facilities that can bundle multiple ECMs together. This can greatly simplify participation and may lead to higher incentive amounts, but requires the use of pre-approved contractors. The Pay for Performance (P4P) program is a “whole-building” energy improvement program designed for larger facilities. It requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants. The Large Energy Users Program (LEUP) is available to New Jersey's largest energy users giving them flexibility to install as little or as many measures, in a single facility or several facilities, with incentives capped based on the entity's annual energy consumption. LEUP applicants can use in-house staff or a preferred contractor.

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 Direct Install

Overview

Direct Install is a turnkey program available to existing small to medium-sized facilities with a peak electric demand that does not exceed 200 kW for a recent 12-month period. You will work directly with a pre-approved contractor who will perform a free energy assessment at your facility, identify specific eligible measures, and provide a clear scope of work for installation of selected measures. Energy efficiency measures may include lighting and lighting controls, refrigeration, HVAC, motors, variable speed drives and controls.

Incentives

The program pays up to 70% of the total installed cost of eligible measures, up to \$125,000 per project. Direct Install participants will also be held to a fiscal year cap of \$250,000 per entity.

How to Participate

To participate in the Direct Install program you will need to contact the participating contractor who the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the Direct Install website linked below. The contractor will be paid the measure incentives directly by the program which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

Since Direct Install offers a free assessment of eligible measures, Direct Install is also available to small businesses and other commercial facilities too that may not be eligible for the more detailed facility audits provided by LGEA.

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

8.3 Energy Savings Improvement Program

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

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

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

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

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

Please note that ESIP is a program delivered directly by the NJBPU and is not an NJCEP incentive program. As mentioned above, you may utilize 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	
Basement	2	Compact Fluorescent: CFL - 23W	Wall Switch	23	2,500	Relamp	No	2	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	16	2,500	0.01	35	0.0	\$4.55	\$34.45	\$0.00	7.57	
Basement	2	Incandescent: INC - 60W	Wall Switch	60	2,500	Relamp	No	2	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	9	2,500	0.06	288	0.0	\$37.48	\$34.45	\$10.00	0.65	
2nd floor Mechanical Room	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,500	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,500	0.03	167	0.0	\$21.68	\$68.77	\$10.00	2.71	
2nd floor Hallway	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	6,000	Relamp	No	3	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	6,000	0.05	590	0.0	\$76.73	\$217.38	\$0.00	2.83	
2nd floor Hallway	1	Linear Fluorescent - T12: 4' T12 (40W) - 1L	Wall Switch	46	6,000	Relamp & Reballast	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	6,000	0.02	214	0.0	\$27.78	\$50.52	\$5.00	1.64	
Locker room	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,500	Relamp	No	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,500	0.13	653	0.0	\$84.89	\$255.61	\$70.00	2.19	
Mop Closet	1	Compact Fluorescent: CFL - 13W	Wall Switch	13	1,000	Relamp	No	1	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	9	1,000	0.00	5	0.0	\$0.59	\$17.23	\$0.00	29.30	
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.04	75	0.0	\$9.70	\$73.03	\$20.00	5.47	
Restroom	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,000	Relamp & Reballast	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.07	133	0.0	\$17.35	\$137.55	\$20.00	6.78	
Restroom	2	Compact Fluorescent: CFL - 13W	Wall Switch	13	1,000	Relamp	No	2	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	9	1,000	0.00	9	0.0	\$1.18	\$34.45	\$0.00	29.30	
Kitchen/Break Area	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	2,500	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,500	0.03	164	0.0	\$21.31	\$144.92	\$0.00	6.80	
Kitchen/Break Area	4	Compact Fluorescent: CFL - 13W	Wall Switch	13	2,500	Relamp	No	4	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	9	2,500	0.01	45	0.0	\$5.88	\$68.90	\$0.00	11.72	
Kitchen/Break Area	6	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,500	Relamp & Reballast	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,500	0.20	1,000	0.0	\$130.09	\$412.64	\$60.00	2.71	
Break Room	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,500	Relamp & Reballast	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,500	0.07	333	0.0	\$43.36	\$137.55	\$20.00	2.71	
2nd Floor Office Area	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,500	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,500	0.07	373	0.0	\$48.51	\$146.06	\$40.00	2.19	
Restroom	1	Compact Fluorescent: CFL - 13W	Wall Switch	13	1,000	Relamp	No	1	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	9	1,000	0.00	5	0.0	\$0.59	\$17.23	\$0.00	29.30	
Captain's Dorm	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.02	37	0.0	\$4.85	\$36.52	\$10.00	5.47	
Captain's Dorm	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.02	37	0.0	\$4.85	\$36.52	\$10.00	5.47	
Dorm Area	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.06	112	0.0	\$14.55	\$109.55	\$30.00	5.47	
Stairwell	1	Compact Fluorescent: CFL - 13W	Wall Switch	13	6,000	Relamp	No	1	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	9	6,000	0.00	27	0.0	\$3.53	\$17.23	\$0.00	4.88	
Weight Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,500	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,500	0.11	559	0.0	\$72.76	\$219.09	\$60.00	2.19	
Weight Room	5	Compact Fluorescent: CFL - 23W	Wall Switch	23	2,500	Relamp	No	5	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	16	2,500	0.02	99	0.0	\$12.86	\$86.13	\$0.00	6.70	
Attic	1	Compact Fluorescent: CFL - 13W	Wall Switch	13	500	Relamp	No	1	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	9	500	0.00	2	0.0	\$0.29	\$17.23	\$0.00	58.59	
Restroom	1	Compact Fluorescent: CFL - 23W	Wall Switch	23	1,000	Relamp	No	1	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	16	1,000	0.00	8	0.0	\$1.03	\$17.23	\$0.00	16.74	
Back Stairwell	3	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	6,000	Relamp & Reballast	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	6,000	0.10	1,200	0.0	\$156.11	\$206.32	\$30.00	1.13	

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
Truck Bay 2	32	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,500	Relamp & Reballast	No	32	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,500	1.07	5,334	0.0	\$693.82	\$2,200.72	\$320.00	2.71
Truck Bay 2	1	Compact Fluorescent: CFL - 23W	Wall Switch	23	2,500	Relamp	No	1	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	16	2,500	0.00	20	0.0	\$2.57	\$17.23	\$0.00	6.70
Watch Desk	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	6,000	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,000	0.04	447	0.0	\$58.21	\$73.03	\$20.00	0.91
Watch Desk	1	Compact Fluorescent: CFL - 13W	Occupancy Sensor	13	6,000	Relamp	No	1	LED Screw-In Lamps: LED Screw-in fixture	Occupancy Sensor	9	6,000	0.00	27	0.0	\$3.53	\$17.23	\$0.00	4.88
Truck Bay 1	37	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,500	Relamp & Reballast	No	37	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,500	1.23	6,167	0.0	\$802.23	\$2,544.58	\$370.00	2.71
Front Exterior	9	LED - Fixtures: Architectural Flood/Spot Luminaire	Daylight Dimming	50	4,368	None	No	9	LED - Fixtures: Architectural Flood/Spot Luminaire	Daylight Dimming	50	4,368	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Side Exterior	3	Metal Halide: (1) 250W Lamp	Daylight Dimming	295	4,368	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	89	4,368	0.35	3,058	0.0	\$397.77	\$2,897.90	\$300.00	6.53
Back Exterior	1	Metal Halide: (1) 250W Lamp	Daylight Dimming	295	4,368	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	89	4,368	0.12	1,019	0.0	\$132.59	\$965.97	\$100.00	6.53
Back Exterior	2	Metal Halide: (1) 70W Lamp	Daylight Dimming	95	4,368	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	29	4,368	0.08	656	0.0	\$85.40	\$1,931.93	\$200.00	20.28
Rear Exterior	1	Metal Halide: (1) 70W Lamp	Daylight Dimming	95	4,368	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	29	4,368	0.04	328	0.0	\$42.70	\$965.97	\$100.00	20.28
Restroom	1	Compact Fluorescent: CFL - 13W	Wall Switch	13	1,000	Relamp	No	1	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	9	1,000	0.00	5	0.0	\$0.59	\$17.23	\$0.00	29.30
Front Exterior	1	Metal Halide: (1) 100W Lamp	Daylight Dimming	128	4,368	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	38	4,368	0.05	442	0.0	\$57.53	\$965.97	\$100.00	15.05
Truck Bay	3	Compact Fluorescent: CFL - 23W	Wall Switch	23	2,500	Relamp	No	3	LED Screw-In Lamps: LED Screw-in fixture	Wall Switch	16	2,500	0.01	59	0.0	\$7.72	\$51.68	\$0.00	6.70

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
Basement	Condensate water system	2	Heating Hot Water Pump	1.5	84.0%	No	500	Yes	86.5%	Yes	2	0.42	589	0.0	\$76.58	\$6,760.31	\$0.00	88.27
Closet	Goodman Airhandlers	3	Supply Fan	3.0	86.5%	No	2,745	Yes	89.5%	Yes	3	1.30	4,189	0.0	\$544.88	\$11,652.03	\$720.00	20.06
Mechanical Area	Air Distribution	1	Supply Fan	0.3	72.4%	No	2,745	Yes	69.5%	Yes	1	0.05	135	0.0	\$17.59	\$2,742.92	\$24.00	154.59
Multiple Locations	Vehicle Exhaust System	3	Exhaust Fan	0.3	84.0%	No	2,745	No	84.0%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Multiple Locations	Various	5	Supply Fan	0.3	70.0%	No	2,745	No	70.0%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Ceiling	Truck Bay	20	Other	0.1	69.5%	No	2,745	No	69.5%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

Electric HVAC Inventory & Recommendations

		Existing Conditions				Proposed Conditions							Energy Impact & Financial Analysis							
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Exterior	Entire Facility	3	Split-System AC	3.50		No							No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Exterior	Entire Facility	1	Ductless Mini-Split HP	0.96	11.50	Yes	1	Split-System Air Source HP	0.96	11.50	14.00	3.80	No	0.21	374	0.0	\$48.66	\$1,620.44	\$88.17	31.49
Interior	Open Area	1	Window AC	2.38		Yes	1	Window AC	2.38		12.00		No	0.39	1,108	0.0	\$143.88	\$2,585.81	\$0.00	17.97
Interior	Open Area	1	Window AC	1.44		Yes	1	Window AC	1.44		12.00		No	0.13	366	0.0	\$47.62	\$1,569.63	\$0.00	32.95
Interior	Goodman V.I.U.s	3	Electric Resistance Heat		17.08	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
Basement	Entire Facility	1	Non-Condensing Hot Water Boiler	1,054.00	Yes	1	Condensing Hot Water Boiler	1,054.00	91.00%	Et	0.00	0	22.4	\$173.28	\$25,299.61	\$2,318.80	132.62

Programmable Thermostat Recommendations

Location	Area(s)/System(s) Affected	Recommendation Inputs				Energy Impact & Financial Analysis						
		Thermostat Quantity	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Multiple Areas	Split AC Systems	3	10.50			0.00	983	0.0	\$127.91	\$989.61	\$0.00	7.74
Watch Desk	Split System HP	0	0.96	11.50		0.00	106	0.0	\$13.82	\$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
Basement	Entire Facility	1	Storage Tank Water Heater (> 50 Gal)	No						0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Closet	Entire Facility	1	Tankless Water Heater	No						0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

Cooking Equipment Inventory & Recommendations

		Existing Conditions			Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type		High Efficiency Equipment?	Install High Efficiency Equipment?	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
Kitchen	1	Gas Convection Oven (Half Size)		No	No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00


Plug Load Inventory

Existing Conditions				
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Firehouse	1	Portable Fan	40.0	No
Firehouse	1	Coffee Maker	900.0	No
Firehouse	3	Microwave	800.0	No
Firehouse	1	Toaster	850.0	No
Firehouse	5	CRT TV 20-inch	120.0	No
Firehouse	1	Medium Refrigerator	1,800.0	No
Firehouse	1	CRT TV 27-inch	120.0	No
Firehouse	2	Freezer	1,800.0	No

Vending Machine Inventory & Recommendations

Location	Existing Conditions		Proposed Conditions	Energy Impact & Financial Analysis						
	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
Firehouse	1	Glass Fronted Refrigerated	Yes	0.00	1,209	0.0	\$157.26	\$230.00	\$0.00	1.46

Appendix B: ENERGY STAR® Statement of Energy Performance



ENERGY STAR® Statement of Energy Performance



**ENERGY STAR®
Score¹**

Fire House (South Broad)

Primary Property Type: Fire Station
Gross Floor Area (ft²): 8,762
Built: 1903

For Year Ending: June 30, 2016
Date Generated: October 09, 2018

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 Fire House (South Broad) 714-718 South Broad Street Trenton, New Jersey 08611	Property Owner City of Trenton 319 East State Street Trenton, NJ 08618 () -	Primary Contact Hoggarth Stephen 319 East State Street Trenton, NJ 08618 6099893615 hstephen@trentonnj.org	
Property ID: 8569411			
Energy Consumption and Energy Use Intensity (EUI)			
Site EUI 96.2 kBtu/ft²	Annual Energy by Fuel Natural Gas (kBtu) 492,632 (58%) Electric - Grid (kBtu) 350,637 (42%)	National Median Comparison National Median Site EUI (kBtu/ft²) 70.2 National Median Source EUI (kBtu/ft²) 124.9 % Diff from National Median Source EUI 37%	
Source EUI 171.1 kBtu/ft²		Annual Emissions Greenhouse Gas Emissions (Metric Tons CO2e/year) 62	

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)