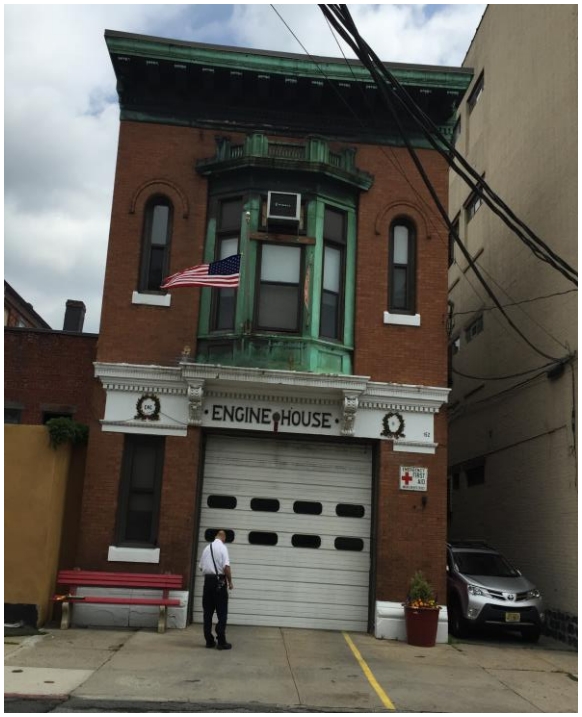
# Local Government Energy Audit:
## Energy Audit Report




**Firehouse**

**City of Jersey City**

152 Lincoln Street

Jersey City, NJ 07307

February 19, 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

# Table of Figures

# 1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for the Firehouse at 152 Lincoln Street, Jersey City, New Jersey. The goal of an LGEA report is to provide local government agencies with information on how their facilities uses energy, identify energy conservation measures (ECMs) that can help reduce energy usage, and provide information on incentives and other assistance to help facilities implement ECMs.

This study was conducted by TRC Energy Services (TRC), as part of a comprehensive effort to help New Jersey local government facilities in controlling energy costs and protecting our environment by offering a full spectrum of energy management options.

## 1.1 Facility Summary

The Firehouse located at 152 Lincoln Street is a 5,000 square foot, two-story building. Construction was completed in the early 1900's. The Firehouse is home to the Engine Company 11 of the Fire Department of Jersey City.

The building consists of offices, firetruck bays, a bunk room, a basement mechanical room, a locker room, and a kitchen room. As an emergency service facility, the Firehouse is open 24 hours a day, seven (7) days a week.

The building would benefit from significant upgrades to its insulation in the basement mechanical space and upgrades to its lighting system.

Interior lighting of the facility is provided by a combination of linear fluorescent T12 fixtures and incandescent lamps. Heating and cooling are provided by three (3) window air conditioning units and one gas fired Weil-McLain non-condensing hot water boiler.

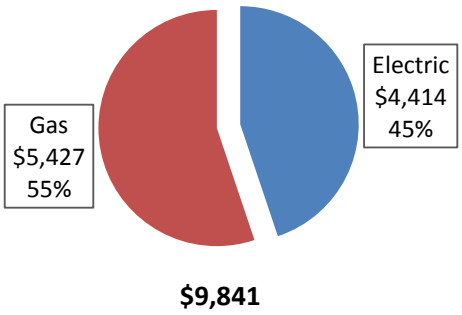
A thorough description of the facility and our observations are located in Section 2.

## 1.2 Your Cost Reduction Opportunities

### Energy Conservation Measures

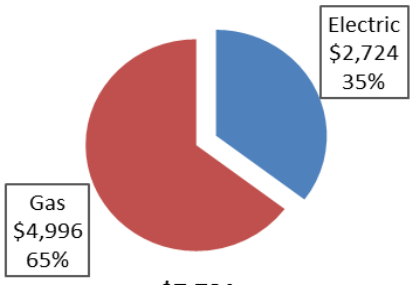
TRC recommends installing six (6) measures which represent an opportunity to reduce annual energy costs by $1,688 and annual greenhouse gas emissions by 16,768 lbs $CO_2e$. The measures would likely pay for themselves in energy savings in about 4.5 years. The breakdown of current versus future estimated utility costs is shown in Figure 1 and Figure 2, respectively. These measures together would reduce annual energy usage at the Firehouse by 21%.

*Figure 1 – Previous 12 Month Utility Costs*




**$9,841**

*Figure 2 – Potential Post-Implementation Costs*




**$7,721**

A detailed description of existing energy usage for the Firehouse can be found in Section 3.

The recommended measures have been grouped by category below in Figure 3. Brief descriptions of the categories can be found below and descriptions of the individual ECMs can be found in Section 4.

*Figure 3 – Summary of Energy Reduction Opportunities*

| Energy Conservation Measure | | Recommend? | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | *Annual Natural Gas Savings (MMBtu)* | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | | **7,487** | **1.3** | **0.0** | **0.0** | **$843.72** | **$2,785.89** | **$0.00** | **$2,785.89** | **3.30** | **7,540** |
| ECM 1 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 4,192 | 0.6 | 0.0 | 0.0 | $472.41 | $2,273.29 | $0.00 | $2,273.29 | 4.81 | 4,222 |
| ECM 2 | Retrofit Fixtures with LED Lamps | Yes | 3,295 | 0.7 | 0.0 | 0.0 | $371.31 | $512.60 | $0.00 | $512.60 | 1.38 | 3,318 |
| **Lighting Control Measures** | | | **622** | **0.1** | **0.0** | **0.0** | **$70.14** | **$464.00** | **$80.00** | **$384.00** | **5.48** | **627** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | Yes | 622 | 0.1 | 0.0 | 0.0 | $70.14 | $464.00 | $80.00 | $384.00 | 5.48 | 627 |
| **Electric Unitary HVAC Measures** | | | **3,055** | **2.1** | **0.0** | **0.0** | **$344.29** | **$4,355.04** | **$0.00** | **$4,355.04** | **12.65** | **3,077** |
| ECM 4 | Install High Efficiency Electric AC | Yes | 3,055 | 2.1 | 0.0 | 0.0 | $344.29 | $4,355.04 | $0.00 | $4,355.04 | 12.65 | 3,077 |
| **Domestic Water Heating Upgrade** | | | **0** | **0.0** | **47.2** | **47.2** | **$430.61** | **$35.85** | **$0.00** | **$35.85** | **0.08** | **5,525** |
| ECM 5 | Install Low-Flow Domestic Hot Water Devices | Yes | 0 | 0.0 | 47.2 | 47.2 | $430.61 | $35.85 | $0.00 | $35.85 | 0.08 | 5,525 |
| **TOTALS** | | | **11,165** | **3.4** | **47.2** | **47.2** | **$1,688.75** | **$7,640.78** | **$80.00** | **$7,560.78** | **4.48** | **16,768** |

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

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

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

**Lighting Controls** measures generally involve the installation of automated controls to turn off lights or reduce light output when conditions allow. Automated control reduces reliance on occupant behavior for adjusting lights. These measures save energy by reducing the amount of time lights are on.

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

**Gas Heating** (HVAC/Process) measures generally involve replacing old inefficient hydronic heating systems with modern energy efficient systems. Gas heating systems can provide heating equivalent to older systems, but use less energy. These measures save energy by reducing the fuel used by the 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 when conditions allow. These measures could encompass changing temperature set points, using outside air for free cooling, or limiting excessive outside air during extreme outdoor air temperatures. These measures save energy by reducing the demand on the systems and the amount of time systems operate.

**Domestic Water Heating** upgrade measures generally involve replacing old inefficient domestic water heating systems with modern energy efficient systems. New domestic water heating systems can provide equivalent or greater capacity as older systems, but use less energy. These measures save energy by reducing the fuel used by the domestic water heating systems due to improved efficiency or the removal of standby losses.

### Energy Efficient Practices

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

- Reduce Air Leakage
- Close Doors and Windows
- Use Window Treatments/Coverings
- Perform Proper Lighting Maintenance
- Ensure Lighting Controls Are Operating Properly
- Perform Routine Motor Maintenance
- Use Fans to Reduce Cooling Load
- Clean and/or Replace HVAC Filters
- Perform Proper Boiler Maintenance
- Perform Proper Water Heater Maintenance
- Install Plug Load Controls
- 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 measures for the Firehouse. Based on the configuration of the site and its electric and thermal loads, we estimate that there is a low potential for installing a cost-effective solar photovoltaic (PV) system and no potential combined heat and power self-generation measures.

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

## 1.3 Implementation Planning

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

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

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

- SmartStart
- 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 Figure 3 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 that 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 (or for energy efficiency upgrades at multiple buildings), 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.

# 2 FACILITY INFORMATION AND EXISTING CONDITIONS

## 2.1 Project Contacts

*Figure 4 – Project Contacts*

| Name | Role | E-Mail | Phone # |
|---|---|---|---|
| **Customer** | | | |
| John Mercer | Assistant Business Administrator | jmercer@jcnj.org | 201-547-4417 |
| **Designated Representative** | | | |
| Micheal Comforti | Chief Battalion | mconforti@njjcps.org | 732-687-2798 |
| **TRC Energy Services** | | | |
| Moussa Traore | Auditor | mtraore@trcsolutions.com | 732-855-2879 |

## 2.2 General Site Information

On July 15, 2016, TRC performed an energy audit for the Firehouse at 152 Lincoln Street. TRCs' team met with Chief Battalion Michael Conforti to review the facility operations and focus the investigation on specific energy-using systems.

The Firehouse is a 5,000 square foot two-story building comprised of various space types. The facility was constructed in the early 1900's. The Firehouse is home to Engine Company 11 of the Fire Department of Jersey City. The building consists of offices, firetruck bays, a bunk room, a basement mechanical room, a locker room, and a kitchen.

## 2.3 Building Occupancy

The Fire House is an emergency facility operating 24 hours, seven (7) days a week. The typical schedule is presented in the table below.

*Figure 5 - Building Schedule*

| Building Name | Weekday/Weekend | Operating Schedule |
|---|---|---|
| Fire House 152 Lincoln Street | Weekday | 12:00 AM - 12:00 AM |
| Fire House 152 Lincoln Street | Weekend | 12:00 AM - 12:00 AM |

## 2.4 Building Envelope

The building foundations consists of masonry perimeter wall footings with masonry foundation walls. The foundation system include masonry piers and column pads to support the upper floor and the roofs. The exterior walls are finished with brick.

The building has flat roofs covered with a metallic sheet surface that is in fair condition. There is no heating or cooling equipment on the roof.

The facility has aluminum-framed double-pane glazed window units.

The building exterior perimeter walls, ceiling and roof were inspected for signs of air-leakage and other energy-comprising issues. Overall, they were find to be in fair condition with signs of uncontrolled air-leakage and other energy-compromising issues.

## 2.5 On-site Generation

The Firehouse at 152 Lincoln Street does not have any on-site electric generation capacity.

## 2.6 Energy-Using Systems

### Lighting System

Lighting is provided predominately by 40-Watt linear fluorescent T12 lamps with electronic or magnetic ballasts, typically with 2-lamp, 4-foot troffers. Garage lighting is provided by 8-foot, linear fluorescent T12 lamps (75 watts each) with magnetic ballasts. Lighting control is provided by manual light switches. There is no exterior lighting.

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

### Heating, Ventilation, And Air –Conditioning (HVAC)

Cooling is provided by three (3) window air conditioning units. We are proposing the replacement of two (2) units (kitchen & gym room unit) with high efficiency ENERGY STAR® units. Replacement of the third unit is not cost effective at this time, given the remaining useful life of the unit.

Heating is provided by a gas-fired, low pressure steam boiler (Peerless Series 64, model 64-10-SPRK) with output capacity of 419,000 BTU/hr located in the basement. There are several cast-iron steam radiators located throughout the interior spaces that are supplied with low pressure steam. A dial-type manual thermostat located in the bunk room controls the heating system.

The engine bay has supplemental heating provided by three (3) gas-fired unit heaters which are in good condition.

Manually switched exhaust fans ventilate the engine bay area. Exhaust from the fire truck engines is removed through the roof by Plymovent direct venting system.

### Domestic Hot Water

The domestic hot water system consists of two (2) Reliance gas fired condensing hot water heaters with an input rating of 35.5 kBtu/hr each and a nominal efficiency of 75%. Each water heater has a 50 gallon storage tank and is in good condition.

## Food Service & Laundry Equipment

The facility has a non-commercial kitchen that is used to prepare breakfast and lunch for the firefighters. The ovens, range tops and griddle are all gas fired. The engine bay area has small electric laundry equipment (washing & dryer machines) used also by the firefighters.

## Refrigeration

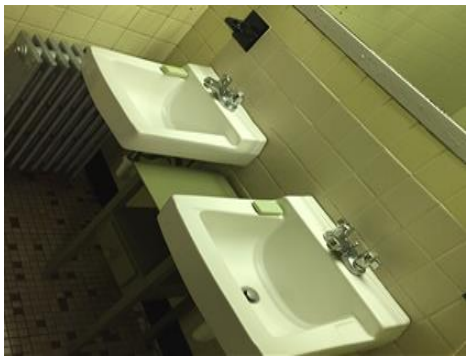
The kitchen has one (1) two-section stand-up refrigerator that is used to store fresh food. The refrigerator has stainless steel exterior and aluminum interior.

## Plug Load & Vending Machines

There are two (2) desktop computer with LCD monitors and there is no server. The site has no vending machine.

# 2.7 Water-Using Systems

There are two (2) restrooms at this facility. Faucets are rated for 2.5 gallons per minute (gpm) or higher, the toilets are rated at 2.5 gallons per flush (gpf) and the urinals are rated at 2 gpf. The kitchen and the garage faucets are rated 3.5 gpm.



# 3 SITE ENERGY USE AND COSTS

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

## 3.1 Total Cost of Energy

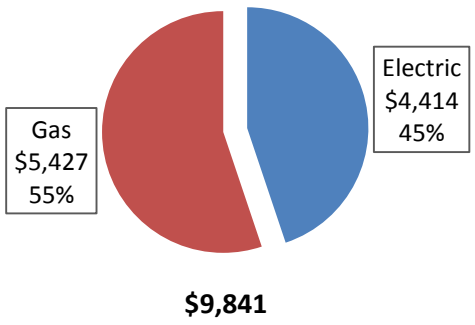
The following energy consumption and cost data is based on the most recent 12-month period of utility billing data that was available. A profile of the annual energy consumption and costs for the facility was developed from this information.

*Figure 6 - Utility Summary*

| Utility Summary for Firehouse 152 Lincoln St. | | |
|---|---|---|
| **Fuel** | **Usage** | **Cost** |
| Electricity | 34,944 kWh | $4,414 |
| Natural Gas | 5,947 Therms | $5,427 |
| **Total** | | **$9,841** |

The current utility cost for this site is $9,841 as shown in the chart below.

*Figure 7 - Energy Cost Breakdown*




**$9,841**

## 3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was $0.113/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The monthly electricity consumption and peak demand is shown in the chart below.

*Figure 8 - Electric Usage & Demand*

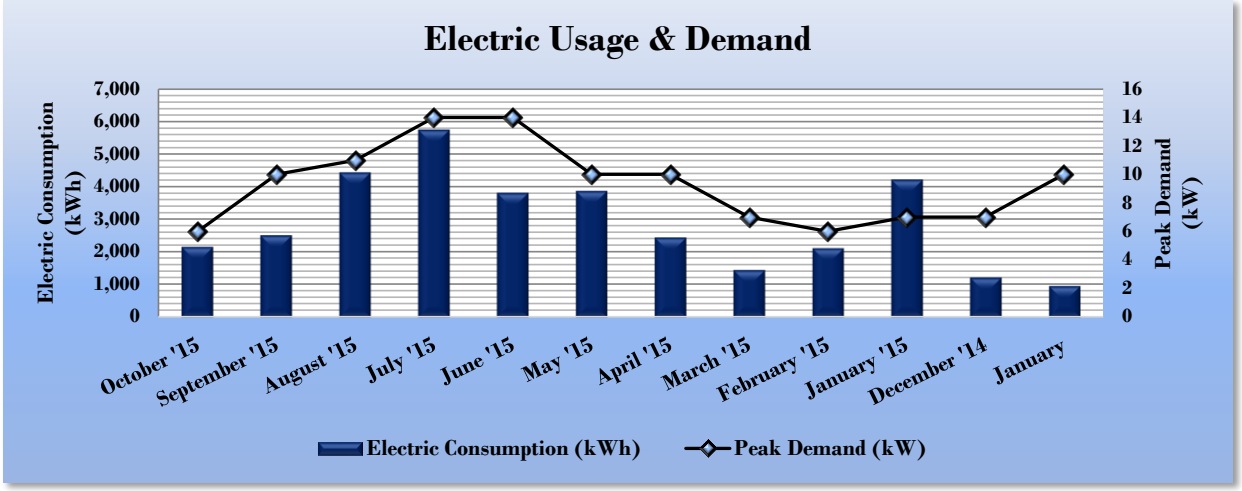



*Figure 9 - Electric Usage & Demand*

| Electric Billing Data for Firehouse 152 Lincoln St. | | | | | |
|---|---|---|---|---|---|
| Period Ending | Days in Period | Electric Usage (kWh) | Demand (kW) | Demand Cost | Total Electric Cost |
| 11/6/15 | 29 | 2,154 | 6 | $26 | $270 |
| 10/8/15 | 29 | 2,514 | 10 | $41 | $234 |
| 9/9/15 | 30 | 4,440 | 11 | $47 | $595 |
| 8/10/15 | 31 | 5,748 | 14 | $59 | $793 |
| 7/10/15 | 30 | 3,816 | 14 | $60 | $665 |
| 6/10/15 | 30 | 3,870 | 10 | $44 | $580 |
| 5/11/15 | 31 | 2,442 | 10 | $44 | $261 |
| 4/10/15 | 30 | 1,446 | 7 | $28 | $162 |
| 3/11/15 | 30 | 2,112 | 6 | $26 | $200 |
| 2/9/15 | 28 | 4,218 | 7 | $31 | $346 |
| 1/12/15 | 34 | 1,224 | 7 | $28 | $149 |
| 12/9/014 | 33 | 960 | 10 | $42 | $159 |
| **Totals** | **365** | **34,944** | **14** | **$476** | **$4,414** |
| **Annual** | **365** | **34,944** | **14** | **$476** | **$4,414** |

## 3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average gas cost for the past 12 months is $0.913/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is represented in the chart below.

*Figure 10 - Natural Gas Usage*

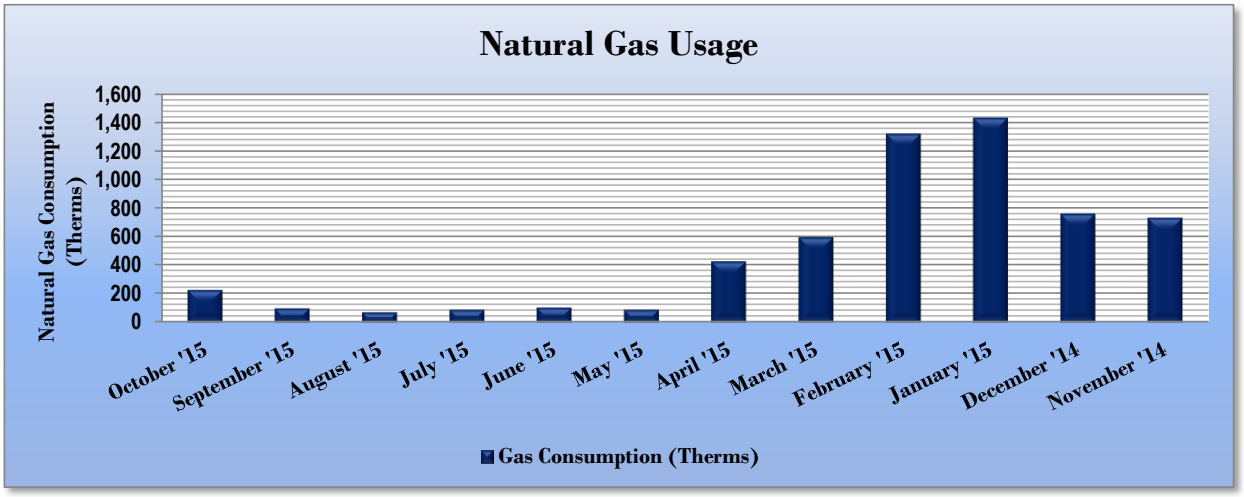



*Figure 11 - Natural Gas Usage*

| Gas Billing Data for Firehouse 152 Lincoln St. | | | |
|---|---|---|---|
| Period Ending | Days in Period | Natural Gas Usage (Therms) | Natural Gas Cost |
| 11/6/15 | 29 | 227 | $188 |
| 10/8/15 | 29 | 97 | $86 |
| 9/9/15 | 30 | 71 | $67 |
| 8/10/15 | 31 | 88 | $80 |
| 7/10/15 | 30 | 103 | $92 |
| 6/10/15 | 30 | 87 | $78 |
| 5/11/15 | 31 | 427 | $338 |
| 4/10/15 | 30 | 598 | $488 |
| 3/11/15 | 30 | 1,322 | $1,181 |
| 2/9/15 | 28 | 1,433 | $1,325 |
| 1/12/15 | 34 | 761 | $769 |
| 12/9/14 | 33 | 733 | $735 |
| **Totals** | **365** | **5,947** | **$5,427** |
| **Annual** | **365** | **5,947** | **$5,427** |

## 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 12 - Energy Use Intensity Comparison – Existing Conditions*

| Energy Use Intensity Comparison - Existing Conditions | | |
|---|---|---|
| | Firehouse 152 Lincoln St. | National Median<br>Building Type: Emergency Services |
| Source Energy Use Intensity (kBtu/ft$^2$) | 199.8 | 154.4 |
| Site Energy Use Intensity (kBtu/ft$^2$) | 142.8 | 88.3 |

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

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

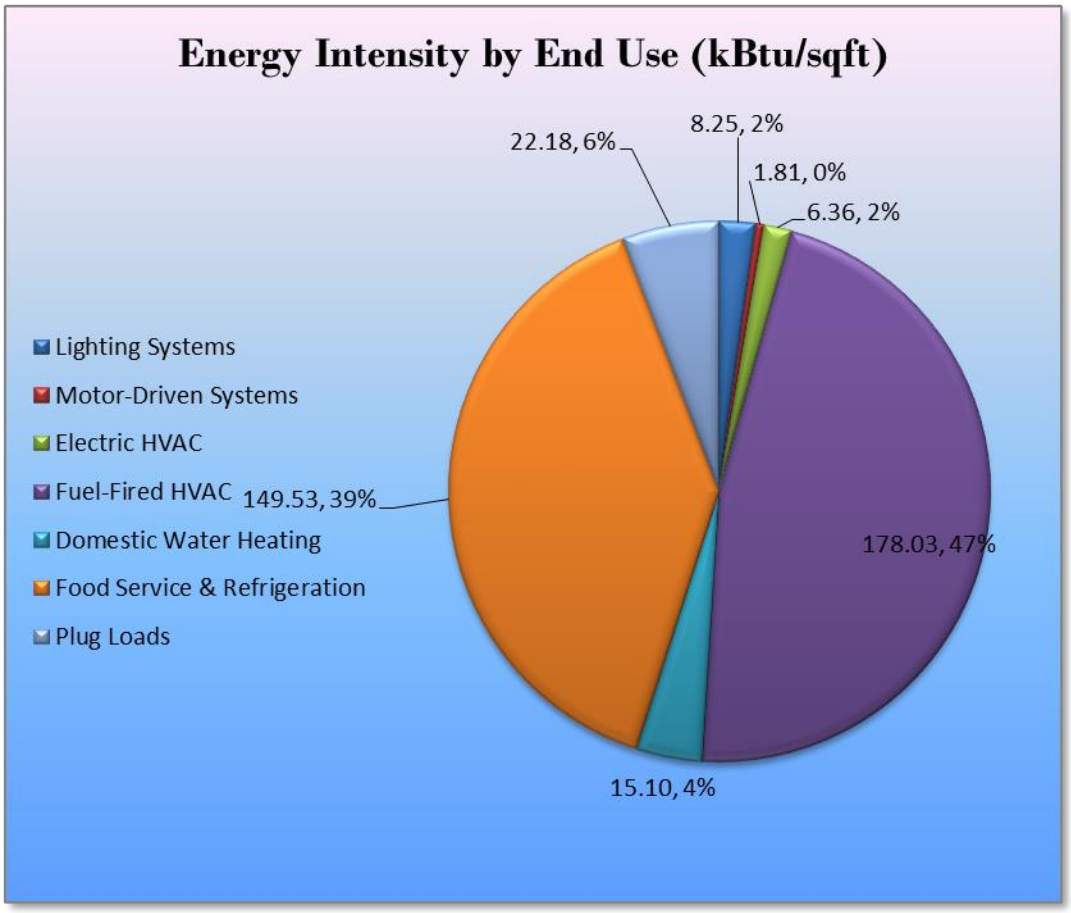
| Energy Use Intensity Comparison - Following Installation of Recommended Measures | | |
|---|---|---|
| | Firehouse 152 Lincoln St. | National Median<br>Building Type: Emergency Services |
| Source Energy Use Intensity (kBtu/ft$^2$) | 165.9 | 154.4 |
| Site Energy Use Intensity (kBtu/ft$^2$) | 125.7 | 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 building type is currently not eligible for an ENERGY STAR® score. However, a Portfolio Manager "Statement of Energy Performance" was developed for this site and can be found in Appendix B: ENERGY STAR® Statement of Energy Performance.

## 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 14 - Energy Balance (% and kBtu/SF)*



# 4 ENERGY CONSERVATION MEASURES

*Level of Analysis*

The goal of this audit report is to identify potential energy projects, help prioritize specific measures for implementation, and set Firehouse 152 Lincoln St. on the path to receive financial incentives. For this audit report, most measures have received only a preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is considered sufficient to make decisions and to prioritize energy projects. Savings are based on the New Jersey Board of Public Utilities New Jersey Clean Energy Program Protocols to Measure Resource Savings dated June 29, 2016. Further analysis or investigation may be required to calculate more accurate savings to support any custom SmartStart, Pay for Performance, or Large Energy Users incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJ prescriptive SmartStart program. Depending on your implementation strategy, the project may be eligible for more lucrative incentives through other programs as identified in Section 7.

The following sections describe the evaluated measures.

## 4.1 Recommended ECMs

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

***Figure 15 – Summary of Recommended ECMs***

| Energy Conservation Measure | | Recommend? | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | *Annual Natural Gas Savings (MMBtu)* | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | | **7,487** | **1.3** | **0.0** | **0.0** | **$843.72** | **$2,785.89** | **$0.00** | **$2,785.89** | **3.30** | **7,540** |
| ECM 1 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 4,192 | 0.6 | 0.0 | 0.0 | $472.41 | $2,273.29 | $0.00 | $2,273.29 | 4.81 | 4,222 |
| ECM 2 | Retrofit Fixtures with LED Lamps | Yes | 3,295 | 0.7 | 0.0 | 0.0 | $371.31 | $512.60 | $0.00 | $512.60 | 1.38 | 3,318 |
| **Lighting Control Measures** | | | **622** | **0.1** | **0.0** | **0.0** | **$70.14** | **$464.00** | **$80.00** | **$384.00** | **5.48** | **627** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | Yes | 622 | 0.1 | 0.0 | 0.0 | $70.14 | $464.00 | $80.00 | $384.00 | 5.48 | 627 |
| **Electric Unitary HVAC Measures** | | | **3,055** | **2.1** | **0.0** | **0.0** | **$344.29** | **$4,355.04** | **$0.00** | **$4,355.04** | **12.65** | **3,077** |
| ECM 4 | Install High Efficiency Electric AC | Yes | 3,055 | 2.1 | 0.0 | 0.0 | $344.29 | $4,355.04 | $0.00 | $4,355.04 | 12.65 | 3,077 |
| **Domestic Water Heating Upgrade** | | | **0** | **0.0** | **47.2** | **47.2** | **$430.61** | **$35.85** | **$0.00** | **$35.85** | **0.08** | **5,525** |
| ECM 5 | Install Low-Flow Domestic Hot Water Devices | Yes | 0 | 0.0 | 47.2 | 47.2 | $430.61 | $35.85 | $0.00 | $35.85 | 0.08 | 5,525 |
| **TOTALS** | | | **11,165** | **3.4** | **47.2** | **47.2** | **$1,688.75** | **$7,640.78** | **$80.00** | **$7,560.78** | **4.48** | **16,768** |

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

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

### 4.1.1 Lighting Upgrades

Recommended Lighting Upgrades are summarized in Figure 16 below.

*Figure 16 – Summary of Lighting Upgrade ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **7,487** | **1.3** | **0.0** | **$843.72** | **$2,785.89** | **$0.00** | **$2,785.89** | **3.30** | **7,540** |
| ECM 1 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 4,192 | 0.6 | 0.0 | $472.41 | $2,273.29 | $0.00 | $2,273.29 | 4.81 | 4,222 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 3,295 | 0.7 | 0.0 | $371.31 | $512.60 | $0.00 | $512.60 | 1.38 | 3,318 |

## ECM 1: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

*Measure Description*

We recommend replacing linear T12 fluorescent lamps and ballasts with LED tube lamps and drivers specifically designed for existing linear fluorescent fixtures. The retrofit uses the existing fixture housing but replaces the rest of the components with an efficient source and reflectors designed for LEDs. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output and efficiently projects the light into the space.

Additional maintenance savings are anticipated since LEDs have a rated lifetime which is more than twice that of a fluorescent tubes.

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

## ECM 2: Retrofit Fixtures with LED Lamps

*Measure Description*

We recommend replacing linear fluorescent T8 tubes with LED tube lamps and replacing incandescent and halogen screw-in or plug-in based lamps with LED lamps. Many LED tube lamps are direct replacements for existing fluorescent lamps and can be installed although there is a fluorescent fixture ballast in place. Other tube lamps require that fluorescent fixture ballasts be removed or replaced with LED drivers. Screw-in/plug-in LED lamps can be used as a direct replacement for most other types of screw-in or plug-in lamps. This measure saves energy by installing LED sources which use less power than other technologies with a comparable light output.

Additional maintenance savings may also be anticipated since LEDs have rated lifetimes which are more than twice that of a fluorescent tube and more than ten (10) times incandescent bulbs.

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

## 4.1.2 Lighting Control Measures

Recommended Lighting Control Measures are summarized in Figure 17 below.

*Figure 17 – Summary of Lighting Control ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Control Measures** | | **622** | **0.1** | **0.0** | **$70.14** | **$464.00** | **$80.00** | **$384.00** | **5.48** | **627** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 622 | 0.1 | 0.0 | $70.14 | $464.00 | $80.00 | $384.00 | 5.48 | 627 |

### ECM 3: Install Occupancy Sensor Lighting Controls

*Measure Description*

We recommend installing occupancy sensors to control light fixtures that are currently manually controlled in restrooms and offices. Sensors detect occupancy using ultrasonic and/or infrared technologies. Lighting systems are enabled when an occupant is detected. Fixtures are automatically turned off after an area has been vacant for a preset period. Occupants will also be able to manually turn off fixtures. Energy savings result from only operating lighting systems when they are the room is occupied.

Occupancy sensors may be mounted on the wall at existing switch locations, mounted on the ceiling, or in remote locations. Ceiling-mounted or remote-mounted sensors require the use of low voltage switching relays or a wireless signal to the switch. In general, use wall switch replacement sensors for single occupant offices and other small rooms. Install ceiling-mounted or remote mounted sensors in locations without local switching, in situations where the existing wall switches are not in the line-of-sight of the main work area, and in large spaces.

## 4.1.3 Electric Unitary HVAC Measures

Recommended Unitary HVAC measures are summarized in **Error! Reference source not found.** below.

*Figure 18 - Summary of Unitary HVAC ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Electric Unitary HVAC Measures** | | **3,055** | **2.1** | **0.0** | **$344.29** | **$4,355.04** | **$0.00** | **$4,355.04** | **12.65** | **3,077** |
| ECM 4 | Install High Efficiency Electric AC | 3,055 | 2.1 | 0.0 | $344.29 | $4,355.04 | $0.00 | $4,355.04 | 12.65 | 3,077 |

### ECM 4: Install High Efficiency Electric AC

*Measure Description*

We recommend replacing window air conditioning units with high efficiency window air conditioning units. There have been significant improvements in both compressor and fan motor efficiencies in the past several years. Therefore, electricity savings can be achieved by replacing 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 versus the new unit, the estimated cooling load for your facility type, and the annual operating hours.

## 4.1.4 Domestic Hot Water Heating System Upgrade

Recommended upgrades to the domestic hot water heating system are summarized in Figure 20 below.

*Figure 19- Summary of Domestic Water Heating ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Domestic Water Heating Upgrade** | | **0** | **0.0** | **47.2** | **$430.61** | **$35.85** | **$0.00** | **$35.85** | **0.08** | **5,525** |
| ECM 7 | Install Low-Flow Domestic Hot Water Devices | 0 | 0.0 | 47.2 | $430.61 | $35.85 | $0.00 | $35.85 | 0.08 | 5,525 |

### ECM 5: Install Low-Flow DHW Devices

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.0 | 47.2 | $430.61 | $35.85 | $0.00 | $35.85 | 0.08 | 5,525 |

*Measure Description*

We recommend installing low-flow domestic water devices to reduce overall water flow per usage, leading to reduced hot water demand. Low flow showerheads and faucet aerators reduce the water flow, relative to standard showerheads and aerators, from the fixture.

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 Water Sense™ (http://www3.epa.gov/watersense/products) labeled devices are 1.5 gpm for bathroom faucets, 2.0 gpm for showerheads, and 1.28 gpm for pre-rinse spray valves.

# 5 ENERGY EFFICIENT PRACTICES

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

## Reduce Air Leakage

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

## Close Doors and Windows

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

## Use Window Treatments/Coverings

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

## Perform Proper Lighting Maintenance

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

## Ensure Lighting Controls Are Operating Properly

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

## Perform Routine Motor Maintenance

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

## Use Fans to Reduce Cooling Load

Utilizing ceiling fans to supplement cooling is a low cost strategy to reduce cooling load considerably. Thermostat settings can be increased by 4°F with no change in overall occupant comfort when the wind chill effect of moving air is employed for cooling.

## Clean and/or Replace HVAC Filters

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

## 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.

## Plug Load Controls

There are a variety of ways to limit the energy use of plug loads including increasing occupant awareness, removing under-utilized equipment, installing hardware controls, and using software controls. Some

control steps to take are to enable the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips.

## 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 Water Sense™ (http://www3.epa.gov/watersense/products) labeled devices are 1.5 gpm for bathroom faucets, 2.0 gpm for showerheads, and 1.28 gpm for pre-rinse spray valves.

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

Refer to Section 4.1.4 for any low-flow ECM recommendations.

# 6 On-Site Generation Measures

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

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

Preliminary screenings were performed to determine the potential that on-site power generation 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.

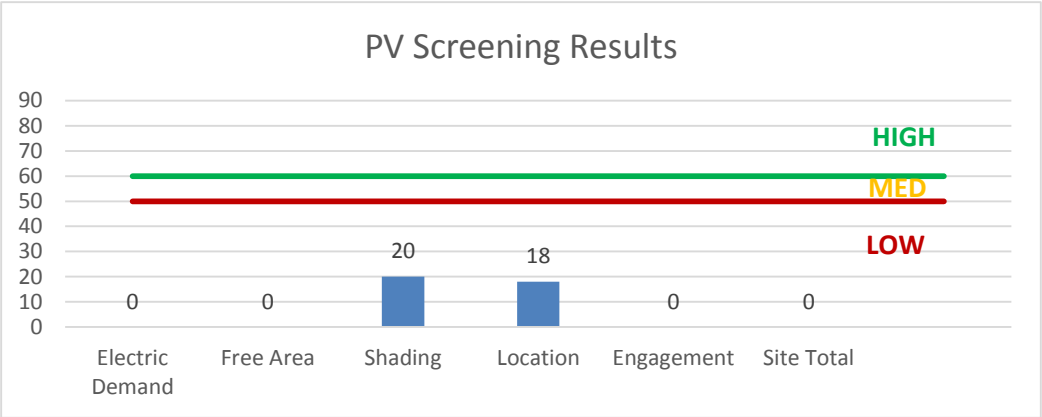
## 6.1 Photovoltaic

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

*Figure 20- Photovoltaic Screening*



Owners of solar projects must register their solar PV projects in the SREC Registration Program prior to the start of construction in order to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing.

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

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

## 6.2 Combined Heat and Power

In non-industrial settings, combined heat and power (CHP) is the on-site generation of electricity and recovery of heat which is put to beneficial use. Common prime movers in CHP applications include reciprocating engines, micro turbines, fuel cells, and (at large facilities) gas turbines. Electricity is typically interconnected to the sites local distribution system. Heat is recovered from the exhaust stream and the ancillary cooling system and interconnected to the existing hot water (or steam) distribution system.

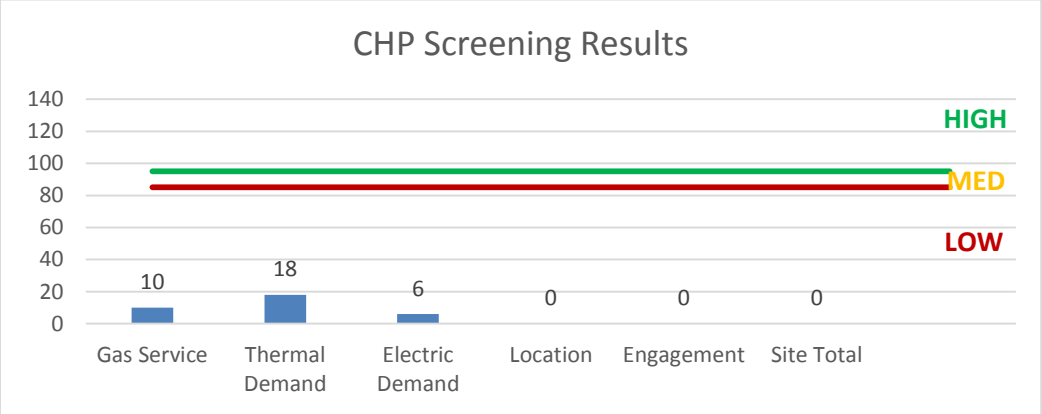
CHP systems are typically used to produce a portion of the electricity needed by a facility, with the balance of electric needs satisfied by purchase from the grid. The heat is used to supplement (or supplant) existing boilers for the purpose of space heating and/or domestic hot water heating. Waste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

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

Lack of gas service, low or infrequent thermal load, and lack of space near the existing thermal generation are the most significant factors contributing to the low potential for CHP at the site. In our opinion, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation, due to low or inconsistent demand for hot water.

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

*Figure 21- Combined Heat and Power Screening*



# 7 DEMAND RESPONSE

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

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

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

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

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

The first step toward participation in a DR program is to contact a Curtailment Service Provider. Curtailment Service Providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding the program rules and requirements for metering and controls, a facility's ability to temporarily reduce electric load, as well as the payments involved in participating in the program. Also, these providers usually offer multiple options for DR to larger facilities and may also install controls or remote monitoring equipment to help ensure compliance of all terms and conditions of a DR contract.

# 8 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and others, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey's Electricity Restructuring Law (1999), which requires all customers of investor-owned electric and gas utilities to pay this charge on their monthly energy bills. As a contributor to the fund you were able to participate in the LGEA program and are also eligible to utilize the equipment incentive programs. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to **Error! Reference source not found.**for a list of the eligible programs identified for each recommended ECM.

*Figure 22- ECM Incentive Program Eligibility*

| Energy Conservation Measure | | SmartStart Prescriptive | SmartStart Custom | Direct Install |
|---|---|---|---|---|
| ECM 1 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | x | | x |
| ECM 2 | Retrofit Fixtures with LED Lamps | x | | x |
| ECM 3 | Install Occupancy Sensor Lighting Controls | | | x |
| ECM 4 | Install High Efficiency Electric AC | | | x |
| ECM 5 | Install Low-Flow Domestic Hot Water Devices | | | x |

SmartStart is generally well suited for implementation of individual or small sets of measures, with the flexibility to install projects at your own pace using in-house staff or a preferred contractor. Direct Install caters to small to mid-size facilities to bundle measures and simplify participation, but requires the use of pre-approved contractors. The Pay for Performance (P4P) program is a "whole-building" energy improvement program designed for larger facilities and requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants. The Large Energy Users Program (LEUP) is available to New Jersey's largest energy users giving them flexibility to install as little or as many measures, in a single facility or several facilities, with incentives capped based on the entity's annual energy consumption; applicants can use in-house staff or preferred contractor.

Generally, the incentive values provided throughout the report assume the SmartStart program is used because it provides a consistent comparison of available incentives.

Brief descriptions of all relevant alternative financing and incentive programs are located in the sections below or: www.njcleanenergy.com/ci.

## 8.1 SmartStart

**Overview**

The SmartStart program is comprised of new construction and retrofit components that offer incentives for installing prescriptive and custom energy efficiency measures at your facility. Routinely the program adds, removes or modifies incentives for various energy efficiency equipment based on national/market trends, new technologies or changes in efficiency baselines.

**Prescriptive Equipment Incentives 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*

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

**Incentives**

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

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

**How to Participate**

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

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

## 8.2 Direct Install

**Overview**

Direct Install 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**

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.

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

## 8.3 Energy Savings Improvement Program

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

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

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

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

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

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

# 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 |
| Garage Bay | 6 | Linear Fluorescent - T12: 8' T12 (75W) - 2L | Wall Switch | 127 | 6,000 | LED Retrofit | No | 6 | LED - Linear Tubes: (2) 8' Lamps | Wall Switch | 72 | 6,000 | 0.27 | 2,237 | 0.0 | $252.12 | $1,093.26 | $0.00 | 4.34 |
| Bathroom | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,000 | LED Retrofit | No | 1 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,000 | 0.04 | 244 | 0.0 | $27.50 | $83.43 | $0.00 | 3.03 |
| Kitchen | 4 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 5,000 | LED Retrofit | Yes | 4 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 3,500 | 0.15 | 1,071 | 0.0 | $120.71 | $449.72 | $20.00 | 3.56 |
| Boiler Room | 2 | Incandescent: 100W A Lamp | Wall Switch | 100 | 2,000 | LED Retrofit | No | 2 | LED Screw-In Lamps: LED 19W A9 Light Bulb | Wall Switch | 19 | 2,000 | 0.13 | 366 | 0.0 | $41.26 | $102.52 | $0.00 | 2.48 |
| 2nd Floor Capitain's Office | 1 | Linear Fluorescent - T12: 8' T12 (75W) - 1L | Wall Switch | 64 | 4,000 | LED Retrofit | Yes | 1 | LED - Linear Tubes: (1) 8' Lamp | Occupancy Sensor | 36 | 2,800 | 0.03 | 175 | 0.0 | $19.76 | $227.91 | $20.00 | 10.52 |
| 2nd Floor Capitain's Office | 1 | Incandescent: 100W | Wall Switch | 100 | 4,000 | LED Retrofit | No | 1 | LED Screw-In Lamps: LED 19W A9 Light Bulb | Wall Switch | 19 | 4,000 | 0.07 | 366 | 0.0 | $41.26 | $51.26 | $0.00 | 1.24 |
| Office Bathroom | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 1L | Wall Switch | 46 | 4,000 | LED Retrofit | No | 1 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 4,000 | 0.03 | 142 | 0.0 | $16.04 | $62.52 | $0.00 | 3.90 |
| Gym Bathroom | 3 | Incandescent: 100W | Wall Switch | 100 | 4,000 | LED Retrofit | Yes | 3 | LED Screw-In Lamps: LED 19W A9 Light Bulb | Occupancy Sensor | 19 | 2,800 | 0.21 | 1,176 | 0.0 | $132.48 | $269.78 | $20.00 | 1.89 |
| Gym Bathroom | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,000 | LED Retrofit | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,000 | 0.05 | 267 | 0.0 | $30.05 | $83.43 | $0.00 | 2.78 |
| Gym Room | 2 | Linear Fluorescent - T12: 8' T12 (75W) - 2L | Wall Switch | 127 | 4,000 | LED Retrofit | No | 2 | LED - Linear Tubes: (2) 8' Lamps | Wall Switch | 72 | 4,000 | 0.09 | 497 | 0.0 | $56.03 | $505.02 | $0.00 | 9.01 |
| Gym Room | 4 | Incandescent: 100W | Wall Switch | 100 | 4,000 | LED Retrofit | Yes | 4 | LED Screw-In Lamps: LED 19W A9 Light Bulb | Occupancy Sensor | 19 | 2,800 | 0.28 | 1,568 | 0.0 | $176.64 | $321.04 | $20.00 | 1.70 |

## 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 |
| Garage | Garage | 1 | Exhaust Fan | 0.3 | 62.0% | No | 2,745 | No | 62.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Garage | Garage | 1 | Exhaust Fan | 0.3 | 62.0% | No | 2,745 | No | 62.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Boiler Room | Boiler Room | 1 | Exhaust Fan | 0.3 | 58.0% | No | 2,745 | No | 58.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Garage | Garage | 1 | Other | 0.3 | 55.0% | No | 2,745 | No | 55.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## Electric HVAC Inventory & Recommendations

| | | Existing Conditions | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (kBtu/hr) | Install High Efficiency System? | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (kBtu/hr) | Cooling Mode Efficiency (SEER/EER) | Heating Mode Efficiency (COP) | Install Dual Enthalpy Economizer? | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Kitchen | Kitchen | 1 | Window AC | 1.50 | | Yes | 1 | Window AC | 1.50 | | 12.00 | | No | 0.41 | 605 | 0.0 | $68.21 | $1,633.14 | $0.00 | 23.94 |
| Capitaine Office | Capitaine Office | 1 | Window AC | 1.50 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Gym Room | Gym Room | 1 | Window AC | 2.50 | | Yes | 1 | Window AC | 2.50 | | 12.00 | | No | 1.68 | 2,450 | 0.0 | $276.08 | $2,721.90 | $0.00 | 9.86 |

## Fuel Heating Inventory & Recommendations

| | | Existing Conditions | | | Proposed Conditions | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Output Capacity per Unit (MBh) | Install High Efficiency System? | System Quantity | System Type | Output Capacity per Unit (MBh) | Heating Efficiency | Heating Efficiency Units | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Boiler Room | Fire House | 1 | Non-Condensing Hot Water Boiler | 419.00 | No | | | | | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Garage Bay | Garage Bay | 1 | Infrared Unit Heater | 3.00 | No | | | | | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Garage Bay | Garage Bay | 2 | Warm Air Unit Heater | 180.00 | Yes | 2 | Infrared Unit Heater | 5.00 | 93.00% | Et | 0.00 | 0 | 113.2 | $1,033.47 | $294.21 | $1,000.00 | -0.68 |

## DHW Inventory & Recommendations

| | | Existing Conditions | | Proposed Conditions | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Replace? | System Quantity | System Type | Fuel Type | System Efficiency | Efficiency Units | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Boiler Room | Fire House | 2 | Storage Tank Water Heater (≤ 50 Gal) | No | | | | | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## Low-Flow Device Recommendations

| | Recommedation Inputs | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Device Quantity | Device Type | Existing Flow Rate (gpm) | Proposed Flow Rate (gpm) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Garage Bay | 1 | Faucet Aerator (Lavatory) | 3.50 | 1.00 | 0.00 | 0 | 14.2 | $129.70 | $7.17 | $0.00 | 0.06 |
| Bathroom | 2 | Faucet Aerator (Lavatory) | 2.50 | 1.00 | 0.00 | 0 | 17.1 | $155.64 | $14.34 | $0.00 | 0.09 |
| Kitchen | 1 | Faucet Aerator (Kitchen) | 3.50 | 2.20 | 0.00 | 0 | 7.4 | $67.45 | $7.17 | $0.00 | 0.11 |
| Capitaine Office | 1 | Faucet Aerator (Lavatory) | 2.50 | 1.00 | 0.00 | 0 | 8.5 | $77.82 | $7.17 | $0.00 | 0.09 |

## Cooking Equipment Inventory & Recommendations

| | Existing Conditions | | | Proposed Conditions | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Quantity | Equipment Type | High Efficiency Equipement? | 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 |
| Garage | 1 | Electric Combination Oven/Steam Cooker (<15 Pans) | Yes | No | 0.00 | 0 | 0.0 | $0.00 | $15,789.30 | $1,000.00 | 0.00 |
| Garage | 1 | Gas Combination Oven/Steam Cooker (>28 Pans) | Yes | No | 0.00 | 0 | 0.0 | $0.00 | $37,148.99 | $750.00 | 0.00 |

## Plug Load Inventory

| | Existing Conditions | | | |
|---|---|---|---|---|
| Location | Quantity | Equipment Description | Energy Rate (W) | ENERGY STAR Qualified? |
| Garage | 1 | Office Printer | 670.0 | Yes |
| Garage | 1 | Small Freezer | 45.0 | Yes |
| Garage | 1 | Washing Machine | 500.0 | Yes |
| Garage | 2 | Washing Machine | 500.0 | Yes |
| Garage | 1 | Water Fountaine | 65.0 | Yes |
| Kitchen | 1 | Microwave | 1,000.0 | No |
| Kitchen | 1 | Flat Screen Wall TV | 128.0 | Yes |
| Kitchen | 1 | Toater | 800.0 | Yes |
| Kitchen | 1 | Desktop | 110.0 | Yes |
| Kitchen | 1 | Coffee Maker | 700.0 | Yes |
| Kitchen | 1 | Ceiling Fan | 40.0 | Yes |
| Capitaine Office | 1 | Flat Screen Wall TV | 128.0 | Yes |
| Capitaine Office | 1 | Desktop | 110.0 | Yes |
| Capitaine Office | 1 | Office Printer | 1,440.0 | Yes |
| Gym Room | 2 | Ceiling Fan | 40.0 | Yes |
| Captain's Office2 bath | 1 | Ceiling Fan | 40.0 | Yes |
| Kitchen | 1 | Refrigerator | 155.0 | Yes |

# *Appendix B: ENERGY STAR® Statement of Energy Performance*

## ENERGY STAR® Statement of Energy Performance

LEARN MORE AT energystar.gov

**N/A**

**ENERGY STAR® Score**[1]

### Firehouse - 152 Lincoln Street

**Primary Property Type:** Fire Station
**Gross Floor Area (ft²):** 5,000
**Built:** 1900

**For Year Ending:** October 31, 2015
**Date Generated:** October 23, 2016

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

### Property & Contact Information

| Property Address | Property Owner | Primary Contact |
|---|---|---|
| Firehouse - 152 Lincoln Street<br>152 Lincoln St<br>Jersey City, New Jersey 07307 | _____<br>,<br>(___)___-_____ | ___ _____<br>,<br>(___)___-_____<br>_____ |

**Property ID**: 5082930

### Energy Consumption and Energy Use Intensity (EUI)

**Site EUI**
142.7 kBtu/ft²

**Source EUI**
199.6 kBtu/ft²

| Annual Energy by Fuel | |
|---|---|
| Natural Gas (kBtu) | 594,651 (83%) |
| Electric - Grid (kBtu) | 119,017 (17%) |

| National Median Comparison | |
|---|---|
| National Median Site EUI (kBtu/ft²) | 110.4 |
| National Median Source EUI (kBtu/ft²) | 154.4 |
| % Diff from National Median Source EUI | 29% |
| **Annual Emissions** | |
| Greenhouse Gas Emissions (Metric Tons CO2e/year) | 48 |

### 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)**