# Local Government Energy Audit:
## Energy Audit Report


***Fire House (Hamilton)***

502 Hamilton Avenue

Trenton, New Jersey 08609-2612

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.

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# 1 EXECUTIVE SUMMARY

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

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

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

## 1.1 Facility Summary

Fire House (Hamilton) is a 3,033 square foot facility comprised of various space types within a single building. The fire house is two floors and a basement and includes restrooms, a gym area, a break/meeting area, a small kitchen area, dorms, and a large truck bay space.

Lighting at the Fire House (Hamilton) consists primarily of T8 and T12 linear fluorescent lighting, as well as a few compact fluorescent, incandescent and metal halide fixtures. Cooling is provided by three window air-conditioners. One of the units is old and may need replacement in the next couple of years. Heating is provided by hot water radiators which are supplied by a natural gas boiler located in the basement. A thorough description of the facility and our observations are located in Section 2.

## 1.2 Your Cost Reduction Opportunities

### Energy Conservation Measures

TRC evaluated nine measures and recommends seven measures which together represent an opportunity for the Fire House (Hamilton) to reduce annual energy costs by roughly $2,379 and annual greenhouse gas emissions by 16,210 lbs $CO_2e$. We estimate that if all measures were implemented as recommended, the project would pay for itself in 2.3 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 (Hamilton)'s annual energy use by 13%.

*Figure 1 – Previous 12 Month Utility Costs*

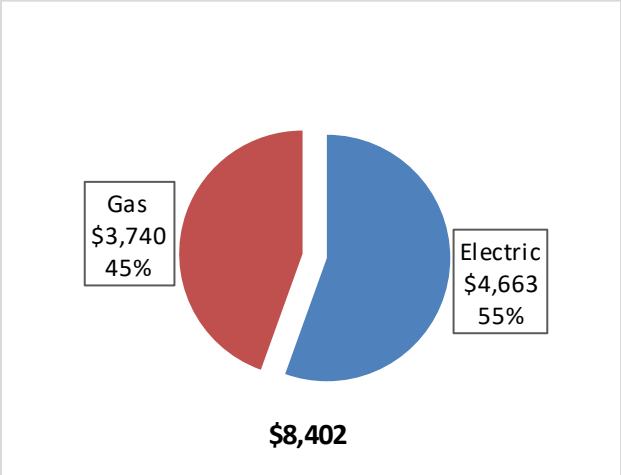



*Figure 2 – Potential Post-Implementation Costs (High Priority Measures)*

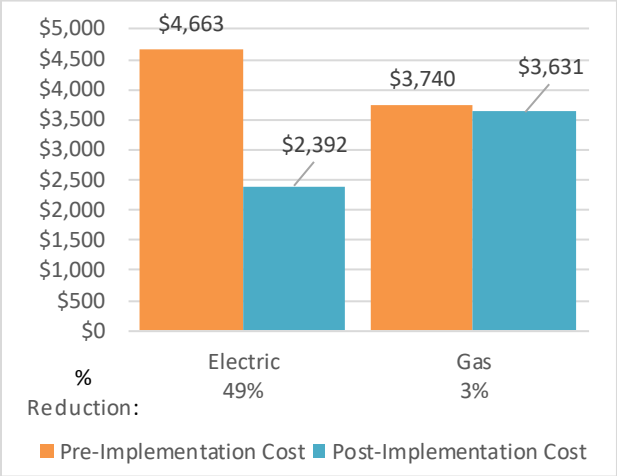
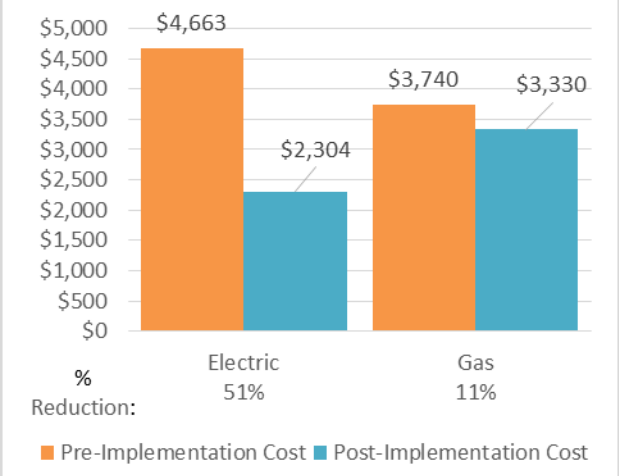



*Figure 3 – Potential Post-Implementation Costs (All Evaluated Measures)*



A detailed description of the Fire House (Hamilton)'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)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | | **11,609** | **1.4** | **0.0** | **$1,773.13** | **$4,314.26** | **$385.00** | **$3,929.26** | **2.2** | **11,690** |
| ECM 1 | Install LED Fixtures | Yes | 503 | 0.1 | 0.0 | $76.78 | $1,931.93 | $200.00 | $1,731.93 | 22.6 | 506 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 7,182 | 0.9 | 0.0 | $1,096.94 | $1,518.32 | $130.00 | $1,388.32 | 1.3 | 7,232 |
| ECM 3 | Retrofit Fixtures with LED Lamps | Yes | 3,925 | 0.5 | 0.0 | $599.41 | $864.00 | $55.00 | $809.00 | 1.3 | 3,952 |
| **Lighting Control Measures** | | | **1,645** | **0.2** | **0.0** | **$251.28** | **$1,126.00** | **$125.00** | **$1,001.00** | **4.0** | **1,657** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | Yes | 1,489 | 0.2 | 0.0 | $227.36 | $926.00 | $125.00 | $801.00 | 3.5 | 1,499 |
| ECM 5 | Install High/Low Lighitng Controls | Yes | 157 | 0.0 | 0.0 | $23.92 | $200.00 | $0.00 | $200.00 | 8.4 | 158 |
| **Electric Unitary HVAC Measures** | | | **576** | **0.4** | **0.0** | **$88.01** | **$2,268.25** | **$0.00** | **$2,268.25** | **25.8** | **580** |
| | Install High Efficiency Electric AC | No | 576 | 0.4 | 0.0 | $88.01 | $2,268.25 | $0.00 | $2,268.25 | 25.8 | 580 |
| **Gas Heating (HVAC/Process) Replacement** | | | **0** | **0.0** | **29.4** | **$301.08** | **$8,297.68** | **$1,000.00** | **$7,297.68** | **24.2** | **3,439** |
| | Install High Efficiency Hot Water Boilers | No | 0 | 0.0 | 29.4 | $301.08 | $8,297.68 | $1,000.00 | $7,297.68 | 24.2 | 3,439 |
| **HVAC System Improvements** | | | **0** | **0.0** | **10.6** | **$108.57** | **$261.00** | **$0.00** | **$261.00** | **2.4** | **1,240** |
| ECM 6 | Install Pipe Insulation | Yes | 0 | 0.0 | 10.6 | $108.57 | $261.00 | $0.00 | $261.00 | 2.4 | 1,240 |
| **Plug Load Equipment Control - Vending Machine** | | | **1,612** | **0.0** | **0.0** | **$246.18** | **$230.00** | **$0.00** | **$230.00** | **0.9** | **1,623** |
| ECM 7 | Vending Machine Control | Yes | 1,612 | 0.0 | 0.0 | $246.18 | $230.00 | $0.00 | $230.00 | 0.9 | 1,623 |
| **TOTALS FOR HIGH PRIORITY MEASURES** | | | **14,866** | **1.6** | **10.6** | **$2,379.16** | **$5,931.26** | **$510.00** | **$5,421.26** | **2.3** | **16,210** |
| **TOTALS FOR ALL EVALUATED MEASURES** | | | **15,442** | **2.0** | **40.0** | **$2,768.25** | **$16,497.19** | **$1,510.00** | **$14,987.19** | **5.4** | **20,229** |

* - 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.

**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 five 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 the Fire House (Hamilton) include:

- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- 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 the Fire House (Hamilton). 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.

## 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 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.

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 (Hamilton) 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.

Fire House (Hamilton) is a 3,033 square foot facility comprised of various space types within a single building. The fire house is two floors and a basement and includes restrooms, a gym area, a break/meeting area, a small kitchen area, dorms and a large truck bay space.

Lighting at the Fire House (Hamilton) consists primarily of T8 and T12 linear fluorescent lighting, as well as a few compact fluorescent, incandescent and metal halide fixtures. Cooling is provided by three window air-conditioners. One of the units is old and may need replacement in the next couple of years. Heating is provided by hot water radiators throughout the facility supplied by a natural gas boiler in the basement.

The building was constructed in 1948.

## 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 continuously occupied by the crew.

*Figure 6 - Building Schedule*

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

## 2.4 Building Envelope

The building is constructed of brick and structural steel. The building has pitched roof sections covered with asphalt shingles. The buildings have double pane windows and are in good condition and show little sign of excessive infiltration. The exterior doors are constructed of aluminum, one with a large glass pane, and 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 lamps as well as some 32-Watt T8 lamps and incandescent lamps. Most of the linear fixtures are 2-lamp or 4-lamp, 4-foot long troffers with diffusers. The incandescent lamps are mounted in screw-based ceiling mounted bare porcelain socket fixtures. Lighting control in spaces is provided by wall switches.

The building's exterior lighting is minimal and consists of metal halide wallpack fixtures and a compact fluorescent can or decorative fixtures.

*Figure 8 – Lighting Technologies*

### Hot Water Heating System

The hot water system consists of a Burnham 212 kBtu/hr output boiler. The boiler has a nominal combustion efficiency of 80%. The boiler provides hot water to radiators for space heating. Heating hot water piping was recently replaced, but without insulation. The boiler is in good condition and was last serviced in June 2016.

*Figure 9 – Heating Hot Water Equipment*

## Direct Expansion Air Conditioning System (DX)

Air-conditioning for the facility is provide by three window air-conditioning units. The units are controlled by individual thermostats located on the units.

*Figure 10 – Air-Conditioning Equipment*

## Domestic Hot Water Heating System

The domestic hot water heating system for the facility consists of a RUUD gas fired hot water heater with an input rating of 54 kBtu/hr and a nominal efficiency of 80%. The water heater has a 50-gallon storage tank.

*Figure 11 – Domestic Hot Water Equipment*

## Food Service Equipment

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

## Building Plug Load

There are various plug load appliances throughout the facility, including refrigerators, LCD televisions, and a refrigerated vending machine.


*Figure 12 – 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

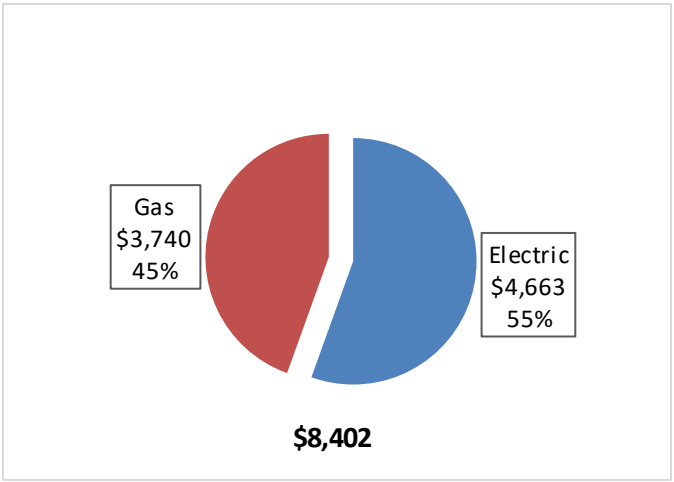
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

*Figure 13 - Utility Summary*

| Utility Summary for Fire House (Hamilton) | | |
|---|---|---|
| **Fuel** | **Usage** | **Cost** |
| Electricity | 30,528 kWh | $4,663 |
| Natural Gas | 3,648 Therms | $3,740 |
| **Total** | | **$8,402** |

The current annual energy cost for this facility is $8,402 as shown in the chart below.

*Figure 14 - Energy Cost Breakdown*



## 3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was $0.153/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. Electricity consumption and demand noticeably increase in the summer months due to the cooling requirements of the facility. The monthly electricity consumption and peak demand are shown in the chart below.

*Figure 15 - Electric Usage & Demand*

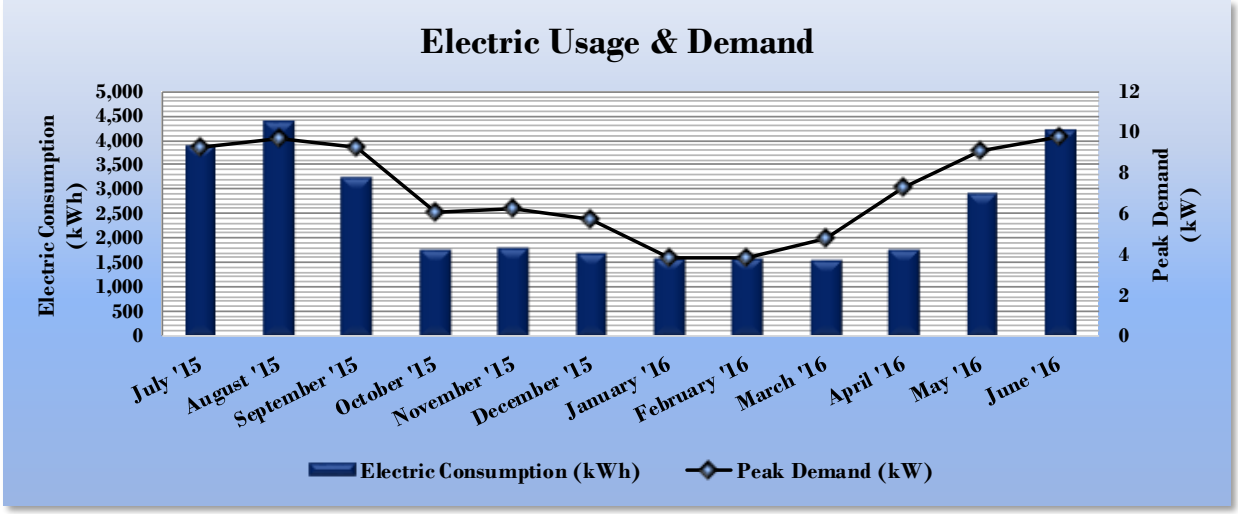



*Figure 16 - Electric Usage & Demand*

| Electric Billing Data for Fire House (Hamilton) | | | | | | |
|---|---|---|---|---|---|---|
| Period Ending | Days in Period | Electric Usage (kWh) | Demand (kW) | Demand Cost | Total Electric Cost | TRC Estimated Usage? |
| 8/7/15 | 29 | 3,906 | 9 | | $647 | No |
| 9/4/15 | 28 | 4,410 | 10 | | $697 | No |
| 10/6/15 | 32 | 3,240 | 9 | | $439 | No |
| 11/4/15 | 29 | 1,758 | 6 | | $295 | No |
| 12/7/15 | 33 | 1,818 | 6 | | $301 | No |
| 1/7/16 | 31 | 1,686 | 6 | | $228 | No |
| 2/5/16 | 29 | 1,587 | 4 | | $214 | Yes |
| 3/8/16 | 32 | 1,587 | 4 | | $271 | Yes |
| 4/7/16 | 30 | 1,542 | 5 | | $354 | No |
| 5/6/16 | 29 | 1,770 | 7 | | $210 | No |
| 6/7/16 | 32 | 2,922 | 9 | | $499 | No |
| 7/7/16 | 30 | 4,218 | 10 | | $496 | No |
| **Totals** | **364** | **30,444** | **9.8** | **$0** | **$4,650** | |
| **Annual** | **365** | **30,528** | **9.8** | **$0** | **$4,663** | |

## 3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average gas cost for the past 12 months is $1.025/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

*Figure 17 - Natural Gas Usage*

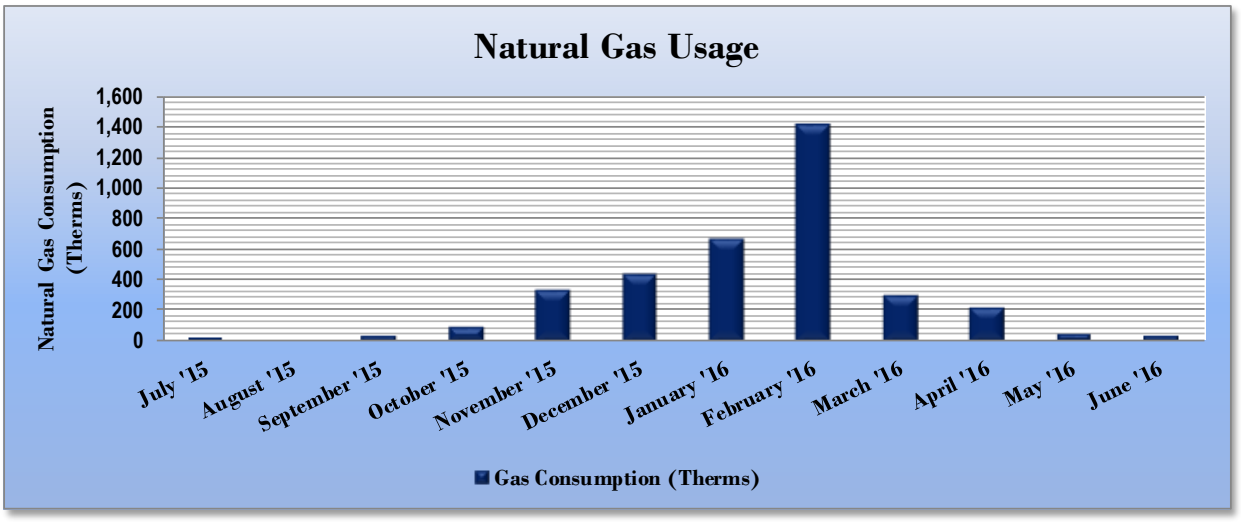



*Figure 18 - Natural Gas Usage*

| Gas Billing Data for Fire House (Hamilton) | | | |
|---|---|---|---|
| Period Ending | Days in Period | Natural Gas Usage (Therms) | Natural Gas Cost |
| 8/7/15 | 29 | 23 | $29 |
| 9/4/15 | 28 | 0 | $11 |
| 10/6/15 | 32 | 39 | $41 |
| 11/4/15 | 29 | 101 | $92 |
| 12/7/15 | 33 | 335 | $460 |
| 1/7/16 | 31 | 437 | $609 |
| 2/5/16 | 29 | 669 | $618 |
| 3/8/16 | 32 | 1,423 | $1,309 |
| 4/7/16 | 30 | 308 | $270 |
| 5/6/16 | 29 | 220 | $196 |
| 6/7/16 | 32 | 47 | $51 |
| 7/7/16 | 30 | 37 | $42 |
| **Totals** | **364** | **3,638** | **$3,730** |
| **Annual** | **365** | **3,648** | **$3,740** |

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

| Energy Use Intensity Comparison - Existing Conditions | | |
|---|---|---|
| | Fire House (Hamilton) | National Median<br>Building Type: Fire/Police Station |
| Source Energy Use Intensity (kBtu/ft$^2$) | 234.1 | 154.4 |
| Site Energy Use Intensity (kBtu/ft$^2$) | 154.6 | 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 20 - Energy Use Intensity Comparison – Following Installation of Recommended Measures*

| Energy Use Intensity Comparison - Following Installation of Recommended Measures | | |
|---|---|---|
| | Fire House (Hamilton) | National Median<br>Building Type: Fire/Police Station |
| Source Energy Use Intensity (kBtu/ft$^2$) | 178.0 | 154.4 |
| Site Energy Use Intensity (kBtu/ft$^2$) | 134.4 | 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 currently does not 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.

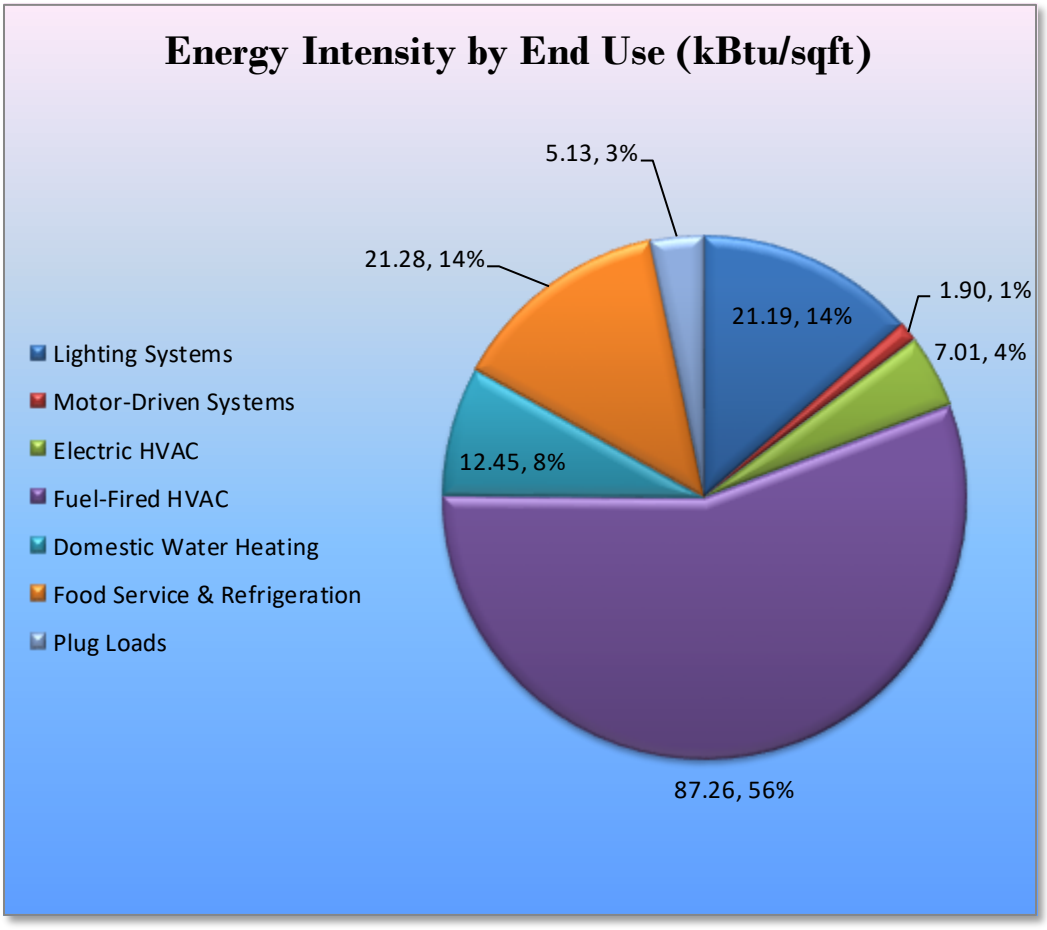
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

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 21 - 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 (Hamilton) 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 22 – Summary of Recommended ECMs***

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **11,609** | **1.4** | **0.0** | **$1,773.13** | **$4,314.26** | **$385.00** | **$3,929.26** | **2.2** | **11,690** |
| ECM 1 | Install LED Fixtures | 503 | 0.1 | 0.0 | $76.78 | $1,931.93 | $200.00 | $1,731.93 | 22.6 | 506 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 7,182 | 0.9 | 0.0 | $1,096.94 | $1,518.32 | $130.00 | $1,388.32 | 1.3 | 7,232 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 3,925 | 0.5 | 0.0 | $599.41 | $864.00 | $55.00 | $809.00 | 1.3 | 3,952 |
| **Lighting Control Measures** | | **1,645** | **0.2** | **0.0** | **$251.28** | **$1,126.00** | **$125.00** | **$1,001.00** | **4.0** | **1,657** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | 1,489 | 0.2 | 0.0 | $227.36 | $926.00 | $125.00 | $801.00 | 3.5 | 1,499 |
| ECM 5 | Install High/Low Lighitng Controls | 157 | 0.0 | 0.0 | $23.92 | $200.00 | $0.00 | $200.00 | 8.4 | 158 |
| **HVAC System Improvements** | | **0** | **0.0** | **10.6** | **$108.57** | **$261.00** | **$0.00** | **$261.00** | **2.4** | **1,240** |
| ECM 6 | Install Pipe Insulation | 0 | 0.0 | 10.6 | $108.57 | $261.00 | $0.00 | $261.00 | 2.4 | 1,240 |
| **Plug Load Equipment Control - Vending Machine** | | **1,612** | **0.0** | **0.0** | **$246.18** | **$230.00** | **$0.00** | **$230.00** | **0.9** | **1,623** |
| ECM 7 | Vending Machine Control | 1,612 | 0.0 | 0.0 | $246.18 | $230.00 | $0.00 | $230.00 | 0.9 | 1,623 |
| **TOTALS** | | **14,866** | **1.6** | **10.6** | **$2,379.16** | **$5,931.26** | **$510.00** | **$5,421.26** | **2.3** | **16,210** |

* - 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 23 below.

*Figure 23 – 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** | | **11,609** | **1.4** | **0.0** | **$1,773.13** | **$4,314.26** | **$385.00** | **$3,929.26** | **2.2** | **11,690** |
| ECM 1 | Install LED Fixtures | 503 | 0.1 | 0.0 | $76.78 | $1,931.93 | $200.00 | $1,731.93 | 22.6 | 506 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 7,182 | 0.9 | 0.0 | $1,096.94 | $1,518.32 | $130.00 | $1,388.32 | 1.3 | 7,232 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 3,925 | 0.5 | 0.0 | $599.41 | $864.00 | $55.00 | $809.00 | 1.3 | 3,952 |

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

### ECM 1: Install LED Fixtures

*Summary of Measure Economics*

| Interior/ Exterior | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| Interior | 0 | 0.0 | 0.0 | $0.00 | $0.00 | $0.00 | $0.00 | 0.0 | 0 |
| Exterior | 503 | 0.1 | 0.0 | $76.78 | $1,931.93 | $200.00 | $1,731.93 | 22.6 | 506 |

*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. The measure payback is projected to be relatively long. TRC notes that pricing for LED fixtures continues to drop, and our payback estimates are accordingly conservative for this measure.

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) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| Interior | 7,182 | 0.9 | 0.0 | $1,096.94 | $1,518.32 | $130.00 | $1,388.32 | 1.3 | 7,232 |
| Exterior | 0 | 0.0 | 0.0 | $0.00 | $0.00 | $0.00 | $0.00 | 0.0 | 0 |

*Measure Description*

We recommend retrofitting interior linear fluorescent T12 fixtures by removing fluorescent tubes and ballasts and replacing them with LEDs and LED drivers (if necessary), which are designed to be used 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) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| Interior | 3,903 | 0.5 | 0.0 | $596.13 | $846.78 | $55.00 | $791.78 | 1.3 | 3,930 |
| Exterior | 22 | 0.0 | 0.0 | $3.28 | $17.23 | $0.00 | $17.23 | 5.2 | 22 |

*Measure Description*

We recommend retrofitting interior and exterior compact fluorescent, incandescent and T8 linear 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 and more than ten times longer than many incandescent lamps.

## 4.1.2 Lighting Control Measures

Our recommendations for lighting control measures are summarized in Figure 24 below.

*Figure 24 – 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** | | **1,645** | **0.2** | **0.0** | **$251.28** | **$1,126.00** | **$125.00** | **$1,001.00** | **4.0** | **1,657** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | 1,489 | 0.2 | 0.0 | $227.36 | $926.00 | $125.00 | $801.00 | 3.5 | 1,499 |
| ECM 5 | Install High/Low Lighitng Controls | 157 | 0.0 | 0.0 | $23.92 | $200.00 | $0.00 | $200.00 | 8.4 | 158 |

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

### ECM 4: Install Occupancy Sensor Lighting Controls

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 1,489 | 0.2 | 0.0 | $227.36 | $926.00 | $125.00 | $801.00 | 3.5 | 1,499 |

*Measure Description*

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in restrooms, the truck bay, offices areas, and common spaces such as meeting areas, the kitchen, or the break area. 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) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 157 | 0.0 | 0.0 | $23.92 | $200.00 | $0.00 | $200.00 | 8.4 | 158 |

*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 interior corridors.

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 25 below.

*Figure 25 - 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) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **HVAC System Improvements** | | **0** | **0.0** | **10.6** | **$108.57** | **$261.00** | **$0.00** | **$261.00** | **2.4** | **1,240** |
| ECM 6 | Install Pipe Insulation | 0 | 0.0 | 10.6 | $108.57 | $261.00 | $0.00 | $261.00 | 2.4 | 1,240 |

### ECM 6: Install Pipe Insulation

*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 | 10.6 | $108.57 | $261.00 | $0.00 | $261.00 | 2.4 | 1,240 |

*Measure Description*

We recommend installing insulation on heating system piping. Distribution system losses are dependent on heating water system temperature, the size of the distribution system, and the level of insulation of the piping. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is exposed to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated system efficiency can be significantly reduced.

This measure saves energy by reducing heat losses from the heating distribution system.

## 4.1.4 Plug Load Equipment Control - Vending Machines

Our recommendations for plug load equipment control measures are summarized in Figure 26 below.

***Figure 26 - Summary of Plug Load Equipment 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Plug Load Equipment Control - Vending Machine** | | **1,612** | **0.0** | **0.0** | **$246.18** | **$230.00** | **$0.00** | **$230.00** | **0.9** | **1,623** |
| ECM 7 | Vending Machine Control | 1,612 | 0.0 | 0.0 | $246.18 | $230.00 | $0.00 | $230.00 | 0.9 | 1,623 |

## 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) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 1,612 | 0.0 | 0.0 | $246.18 | $230.00 | $0.00 | $230.00 | 0.9 | 1,623 |

*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 27 – 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)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| **Electric Unitary HVAC Measures** | **576** | **0.4** | **0.0** | **$88.01** | **$2,268.25** | **$0.00** | **$2,268.25** | **25.8** | **580** |
| Install High Efficiency Electric AC | 576 | 0.4 | 0.0 | $88.01 | $2,268.25 | $0.00 | $2,268.25 | 25.8 | 580 |
| **Gas Heating (HVAC/Process) Replacement** | **0** | **0.0** | **29.4** | **$301.08** | **$8,297.68** | **$1,000.00** | **$7,297.68** | **24.2** | **3,439** |
| Install High Efficiency Hot Water Boilers | 0 | 0.0 | 29.4 | $301.08 | $8,297.68 | $1,000.00 | $7,297.68 | 24.2 | 3,439 |
| **TOTALS** | **576** | **0.4** | **29.4** | **$389.09** | **$10,565.93** | **$1,000.00** | **$9,565.93** | **24.6** | **4,019** |

* - 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).

### Install High Efficiency Air Conditioning Units

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 576 | 0.4 | 0.0 | $88.01 | $2,268.25 | $0.00 | $2,268.25 | 25.8 | 580 |

*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 this measure is longer than the effective useful life of the proposed 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) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.0 | 29.4 | $301.08 | $8,297.68 | $1,000.00 | $7,297.68 | 24.2 | 3,439 |

*Measure Description*

We evaluated replacement of the existing non-condensing hot water boiler with a more efficient 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 these units is 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.

## 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 significant 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.

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

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

## 6.2 Combined Heat and Power

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

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

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

Low and infrequent thermal load and lack of space near the existing boiler 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.

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

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

*Figure 28 - 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 Lighitng Controls | | | X | | | |
| ECM 6 | Install Pipe Insulation | | | 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 assigned to 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 | 6 | Incandescent: 60 Watt Lamp | Wall Switch | 60 | 6,000 | Relamp | No | 6 | LED Screw-In Lamps: 1 lamp LED fixture | Wall Switch | 9 | 6,000 | 0.22 | 1,836 | 0.0 | $280.42 | $103.35 | $30.00 | 0.26 |
| Truck Bay | 6 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 6,000 | Relamp & Reballast | Yes | 6 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 4,200 | 0.33 | 2,754 | 0.0 | $420.64 | $682.64 | $95.00 | 1.40 |
| Truck Bay | 4 | Linear Fluorescent - T12: 8' T12 (75W) - 2L | Wall Switch | 158 | 6,000 | Relamp & Reballast | Yes | 4 | LED - Linear Tubes: (2) 8' Lamps | Occupancy Sensor | 72 | 4,200 | 0.35 | 2,918 | 0.0 | $445.70 | $784.77 | $35.00 | 1.68 |
| Equip Room | 1 | Linear Fluorescent - T12: 8' T12 (75W) - 2L | Wall Switch | 158 | 6,000 | Relamp & Reballast | Yes | 1 | LED - Linear Tubes: (2) 8' Lamps | Occupancy Sensor | 72 | 4,200 | 0.09 | 730 | 0.0 | $111.42 | $244.69 | $20.00 | 2.02 |
| Equip Room | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 6,000 | Relamp | Yes | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 4,200 | 0.03 | 283 | 0.0 | $43.18 | $36.52 | $30.00 | 0.15 |
| 2nd floor hallway | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 6,000 | Relamp | Yes | 1 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 4,200 | 0.03 | 283 | 0.0 | $43.18 | $236.52 | $10.00 | 5.25 |
| 2nd floor hallway | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 4L | Wall Switch | 176 | 6,000 | Relamp & Reballast | Yes | 1 | LED - Linear Tubes: (4) 4' Lamps | High/Low Control | 58 | 4,200 | 0.11 | 918 | 0.0 | $140.21 | $118.36 | $20.00 | 0.70 |
| Restroom | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 6,000 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 6,000 | 0.05 | 400 | 0.0 | $61.10 | $68.77 | $10.00 | 0.96 |
| Restroom | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 6,000 | Relamp | No | 1 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 6,000 | 0.01 | 119 | 0.0 | $18.12 | $18.26 | $5.00 | 0.73 |
| 2nd Floor Doorway | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 6,000 | Relamp & Reballast | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 6,000 | 0.10 | 800 | 0.0 | $122.19 | $137.55 | $20.00 | 0.96 |
| 2nd Floor Weight Room | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 6,000 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 6,000 | 0.05 | 400 | 0.0 | $61.10 | $68.77 | $10.00 | 0.96 |
| Captain's Quarters | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 6,000 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 6,000 | 0.05 | 400 | 0.0 | $61.10 | $68.77 | $10.00 | 0.96 |
| 1st Floor Restroom | 1 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | 62 | 6,000 | Relamp | No | 1 | LED - Linear Tubes: (2) U-Lamp | Wall Switch | 33 | 6,000 | 0.02 | 197 | 0.0 | $30.03 | $72.46 | $0.00 | 2.41 |
| Kitchen | 8 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | 62 | 6,000 | Relamp | Yes | 8 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 4,200 | 0.25 | 2,110 | 0.0 | $322.26 | $849.68 | $35.00 | 2.53 |
| Front Exterior | 1 | Metal Halide: (1) 50W Lamp | Wall Switch | 72 | 4,300 | Fixture Replacement | No | 1 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Wall Switch | 22 | 4,300 | 0.04 | 245 | 0.0 | $37.40 | $965.97 | $100.00 | 23.15 |
| Front Exterior | 1 | Compact Fluorescent: 1 lamp CFL fixture | Wall Switch | 17 | 4,300 | Relamp | No | 1 | LED Screw-In Lamps: Outdoor Wall-Mounted Area Fixture | Wall Switch | 12 | 4,300 | 0.00 | 24 | 0.0 | $3.71 | $17.23 | $0.00 | 4.64 |
| Back Exterior | 1 | Metal Halide: (1) 70W Lamp | Wall Switch | 95 | 4,300 | Fixture Replacement | No | 1 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Wall Switch | 29 | 4,300 | 0.05 | 323 | 0.0 | $49.35 | $965.97 | $100.00 | 17.55 |

## 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 | Heating Hot Water System | 1 | Heating Hot Water Pump | 0.5 | 76.2% | No | 1,500 | No | 76.2% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Multiple Locations | Entire Facility Cooling | 3 | Supply Fan | 0.3 | 66.6% | No | 1,500 | No | 66.6% | 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 |
| Interior | Entire Facility | 1 | Window AC | 2.08 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Interior | Entire Facility | 1 | Window AC | 0.83 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Interior | Entire Facility | 1 | Window AC | 2.08 | | Yes | 1 | Window AC | 2.08 | | 12.00 | | No | 0.39 | 576 | 0.0 | $88.01 | $2,268.25 | $0.00 | 25.77 |

## 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 | 212.00 | Yes | 1 | Condensing Hot Water Boiler | 212.00 | 93.00% | AFUE | 0.00 | 0 | 29.4 | $301.08 | $8,297.68 | $1,000.00 | 24.24 |

## Pipe Insulation Recommendations

| | | Recommendation Inputs | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Affected | Length of Uninsulated Pipe (ft) | Pipe Diameter (in) | 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 | Boiler | 60 | 1.25 | 0.00 | 0 | 10.6 | $108.57 | $261.00 | $0.00 | 2.40 |

## 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 |

## 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 |
| 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? |
| Break Area | 1 | Microwave | 1,000.0 | No |
| Break Area | 1 | 35" LCD TV | 120.0 | No |
| Break Area | 1 | Refrigerator | 600.0 | No |
| Break Area | 1 | Coffee Maker | 400.0 | No |

## Vending Machine Inventory & Recommendations

| | Existing Conditions | | Proposed Conditions | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Quantity | Vending Machine Type | Install Controls? | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Break Area | 1 | Refrigerated | Yes | 0.00 | 1,612 | 0.0 | $246.18 | $230.00 | $0.00 | 0.93 |

# *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]

### Fire House (Hamilton)

**Primary Property Type:** Fire Station
**Gross Floor Area (ft²):** 3,033
**Built:** 1948

**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 | Property Owner | Primary Contact |
|---|---|---|
| Fire House (Hamilton)<br>502 Hamilton Avenue<br>Trenton, New Jersey 08609 | City of Trenton<br>319 East State Street<br>Trenton, NJ 08618<br>(____)____-_____ | Hoggarth Stephen<br>319 East State Street<br>Trenton, NJ 08618<br>6099893615<br>hstephen@trentonnj.org |

**Property ID:** 5992162

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

**Site EUI**
154.5 kBtu/ft²

**Source EUI**
222.7 kBtu/ft²

| Annual Energy by Fuel | |
|---|---|
| Natural Gas (kBtu) | 363,703 (78%) |
| Electric - Grid (kBtu) | 104,835 (22%) |

| National Median Comparison | |
|---|---|
| National Median Site EUI (kBtu/ft²) | 86.6 |
| National Median Source EUI (kBtu/ft²) | 124.9 |
| % Diff from National Median Source EUI | 78% |
| **Annual Emissions** | |
| Greenhouse Gas Emissions (Metric Tons CO2e/year) | 30 |

### 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)**