



Local Government Energy Audit: Energy Audit Report



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Elmora Library Branch

740 West Grand Street

Elizabeth, NJ 07202

Elizabeth Public Library

February 28, 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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I EXECUTIVE SUMMARY

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

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

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

I.1 Facility Summary

Elmora Branch is a 4,500 square foot, single story facility comprised of book keeping areas, offices, restrooms and a small mechanical space. The building is open to the public from 9:00 AM to 9:00 PM on weekdays, 9:00 AM to 5:00 PM on Saturdays and remains closed on Sundays. The building is heated using a gas-fired, non-condensing hot water boiler and cooled using air-source heat pumps and a packaged unit. The interior lighting consists of linear T8 tubes and the exterior lighting uses fixtures with high pressure sodium lamps. A thorough description of the facility and our observations are located in Section 2.

I.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated six (6) measures which together represent an opportunity for Elmora Branch to reduce annual energy costs by roughly \$4,749 and annual greenhouse gas emissions by 29,168 lbs CO₂e. We estimate that if all measures were implemented as recommended, the project would pay for itself in roughly 7.0 years. The breakdown of existing and potential utility costs after project implementation are illustrated in Figure 1 and Figure 2, respectively. Together these measures represent an opportunity to reduce Elmora Branch’s annual energy use by 29%.

Figure 1 – Previous 12 Month Utility Costs

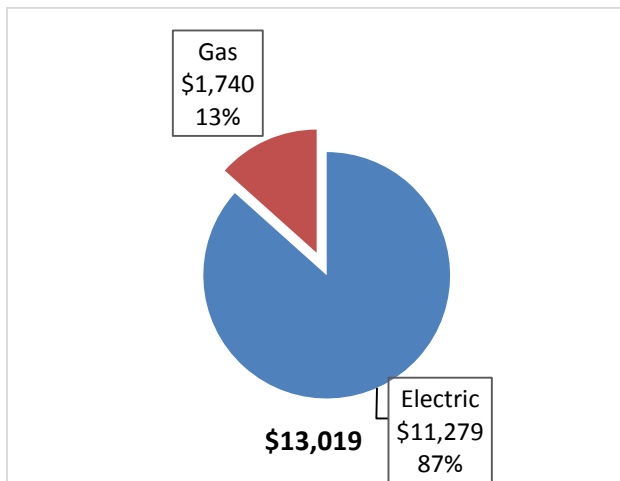
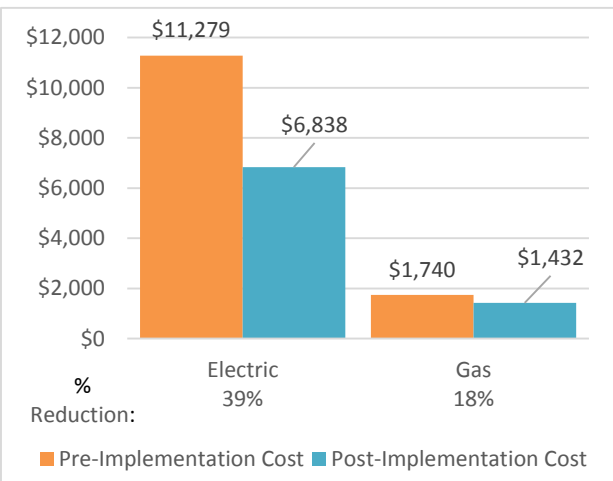


Figure 2 – Potential Post-Implementation Costs



A detailed description of Elmora Branch’s existing energy use can be found in Section 3.

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

Figure 3 – Summary of Energy Reduction Opportunities

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Reduction (lbs)
Lighting Upgrades			19,358	3.5	0.0	\$3,413.76	\$8,470.15	\$1,715.00	\$6,755.15	2.0	19,494
ECM 1	Install LED Fixtures	Yes	2,133	0.4	0.0	\$376.18	\$1,562.71	\$400.00	\$1,162.71	3.1	2,148
ECM 2	Retrofit Fixtures with LED Lamps	Yes	16,592	3.1	0.0	\$2,925.86	\$6,477.23	\$1,315.00	\$5,162.23	1.8	16,708
ECM 3	Install LED Exit Signs	Yes	634	0.1	0.0	\$111.72	\$430.22	\$0.00	\$430.22	3.9	638
Lighting Control Measures			448	0.1	0.0	\$79.05	\$464.00	\$80.00	\$384.00	4.9	451
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	448	0.1	0.0	\$79.05	\$464.00	\$80.00	\$384.00	4.9	451
Electric Unitary HVAC Measures			4,124	3.0	0.0	\$727.18	\$17,821.06	\$730.00	\$17,091.06	23.5	4,152
	Install High Efficiency Electric AC	No	4,124	3.0	0.0	\$727.18	\$17,821.06	\$730.00	\$17,091.06	23.5	4,152
Gas Heating (HVAC/Process) Replacement			0	0.0	32.5	\$308.45	\$10,081.44	\$1,000.00	\$9,081.44	29.4	3,810
	Install High Efficiency Hot Water Boilers	No	0	0.0	32.5	\$308.45	\$10,081.44	\$1,000.00	\$9,081.44	29.4	3,810
Domestic Water Heating Upgrade			1,551	0.0	0.0	\$273.52	\$21.51	\$0.00	\$21.51	0.1	1,562
ECM 5	Install Low-Flow Domestic Hot Water Devices	Yes	1,551	0.0	0.0	\$273.52	\$21.51	\$0.00	\$21.51	0.1	1,562
TOTAL OF ALL EVALUATED ECMS			25,481	6.6	32.5	\$4,801.96	\$36,858.16	\$3,525.00	\$33,333.16	6.9	29,469
TOTAL OF ALL RECOMMENDED ECMS			21,358	4	0	3,766	8,956	1,795	7,161	1.9	21,507

* - 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 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.

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

Energy Efficient Practices

TRC also identified seven (7) 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 Elmora Branch include:

- Reduce Air Leakage
- Close Doors and Windows
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Perform Proper Boiler Maintenance
- Perform Proper Furnace Maintenance
- Perform Proper Water Heater Maintenance
- Water Conservation

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

On-Site Generation Measures

TRC evaluated the potential for installing on-site generation for Elmora Branch. Based on the configuration of the site and its loads there is a low potential for installing any PV and combined heat and power self-generation measures.

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

I.3 Implementation Planning

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

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

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

- SmartStart
- Direct Install

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

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 DI 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 or: www.njcleanenergy.com/ci.

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 4 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Mary Faith Chmiel	Library Director	mfchmiel@elizpl.org	908-354-6060 x Extn: 7253
TRC Energy Services			
Smruti Srinivasan	Auditor	ssrinivasan@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On January 4, 2017, TRC performed an energy audit at Elmora Branch located in Elizabeth, New Jersey. TRC’s auditor met with the head of maintenance to review the facility operations and help focus our investigation on specific energy-using systems.

Elmora Branch is a 4,500 square foot, single story facility comprised of book keeping areas, offices, restrooms and a small mechanical space. The building was constructed in 1953. The building is open to the public from 9:00 AM to 9:00 PM in the weekdays (different on Fridays), 9:00 AM to 5:00 PM on Saturdays and remains closed on Sundays. The building is heated using a gas-fired, non-condensing hot water boiler and cooled using air-source heat pumps and a packaged unit. The interior lighting consists of linear T8 tubes and the exterior lighting uses fixtures with high pressure sodium lamps

2.3 Building Occupancy

The typical schedule is presented in the table below. During a typical day, the facility is occupied by approximately three (3) to four (4) full time staff members and a varying amount of public.

Figure 5 - Building Schedule

Building Occupancy Schedule		
Building Name	Weekday/Weekend	Operating Schedule
Elmora Branch	Weekday	Monday and Wednesday - 9AM - 9PM
		Tuesday and Thursday - 9AM - 5PM
		Friday: 10AM - 5PM
Elmora Branch	Weekend	Saturday: 9AM - 5PM
		Sunday: 12PM - 4PM

2.4 Building Envelope

The building is constructed of concrete masonry block with a brick facade. Parts of the building also has poured concrete. The dividing walls inside the building consist of sheetrock. The building has a combination of a pitched and flat roof. The portion of the pitched roof has tiles and the flat roof has a white PVC membrane as layering. The building has single pane windows and glass (with aluminum frame) doors that are old and show signs of excessive outside air infiltration.



Image 1 Building envelope images

2.5 On-Site Generation

Elmora Branch does not have any on-site electric generation systems currently installed.

2.6 Energy-Using Systems

Lighting System

Lighting is provided mostly by 32-Watt linear fluorescent T8 lamps with electronic ballasts as well as incandescent lamps. Most of the fixtures are 3-lamp or 4-lamp, 4-foot long troffers. A small area of the building such as entrance exterior and the boiler rooms are lit using 100-Watt incandescent lamps. Lighting control in all spaces are provided by manual wall switches. It was mentioned by the site contact that the exit signs at the facility were 22-Watt fluorescent lamp fixtures.

The building's exterior lighting is minimal and consists of high pressure sodium (HPS) fixtures that are controlled by timers.



Image 2 Typical lighting fixtures

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

Hot Water Heating System

The hot water system consists of one (1) gas-fired, non-condensing hot water boiler with an output capacity of 420 MBh. This boiler has a combustion efficiency of 75%. The boiler water is circulated using four (4) 0.1 hp pumps to the public areas through ceiling ducts. Hot water is supplied at 180°F when the outside air temperature is below 50°F and the setpoint is reset to 155°F when the outside air is above

65°F. Above this temperature, the boiler is shut off. The boiler is 30 years old and was evaluated for replacement.

There is one (1) packaged unit on the roof which is a forced air furnace. This unit is fed using the hot water from the boiler which supports heat pumps for the reference room and computer room at lower temperatures. The terminal units are the ceiling ducts that distribute the conditioned air to the respective spaces. The temperatures are controlled using programmable thermostats in the respective zones.

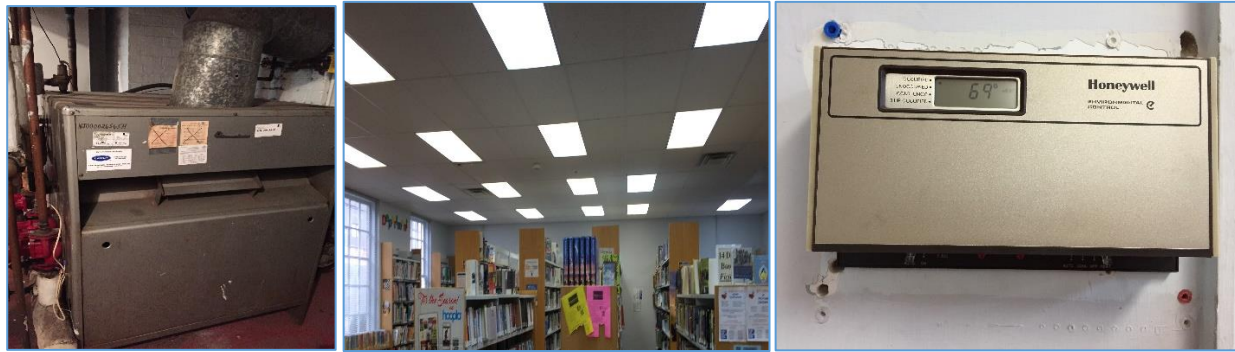


Image 3 Boiler, terminal units and controls

Direct Expansion Air Conditioning System (DX)

There is one (1) 10- ton packaged unit (AAON) and two (2) 1.5 ton heat pumps of (Carrier) that serve the public areas and library offices. The temperature is controlled using the thermostats in the respective spaces. The packaged unit is 20 years old and the split units are 14 years old. The packaged unit was evaluated for potential improvement.



Image 4 Space cooling equipment with a sample thermostat

Domestic Hot Water Heating System

The domestic hot water heating system consists of one (1) electric water heater of input capacity 4.5 kW. The water heater has a tank capacity of 40 gallons. This unit serves the restroom and sinks in the area. The unit is six (6) years old, well maintained and in good condition.

Building Plug Load

There are roughly 13 computer work stations and one (1) medium printer. There are also other kitchenette equipment such as the microwave, refrigerator, coffee machine, and toaster oven. There is no centralized PC power management software installed.

2.7 Water-Using Systems

A sampling of restrooms found that the faucets are rated for 2.2 gallons per minute (gpm) or higher, the toilets are rated at 2.5 gallons per flush (gpf) and the urinals are rated at 2 gpf.

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

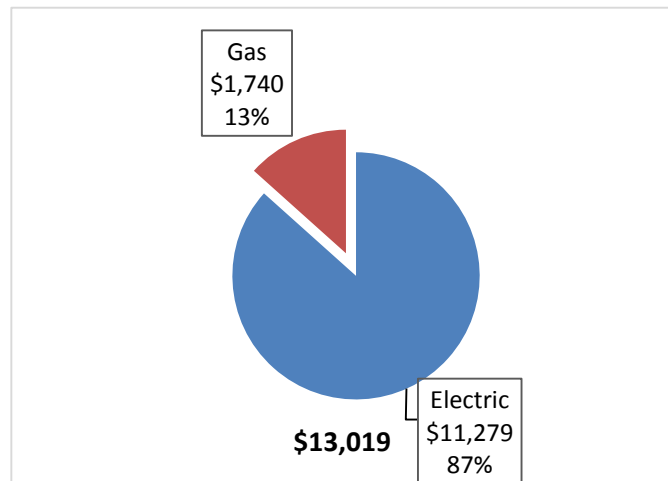
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 6 - Utility Summary

Utility Summary for Elmora Branch		
Fuel	Usage	Cost
Electricity	63,960 kWh	\$11,279
Natural Gas	1,836 Therms	\$1,740
Total		\$13,019

The current annual energy cost for this facility is \$13,019 as shown in the chart below.

Figure 7 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was \$0.176/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 8 - Electric Usage & Demand

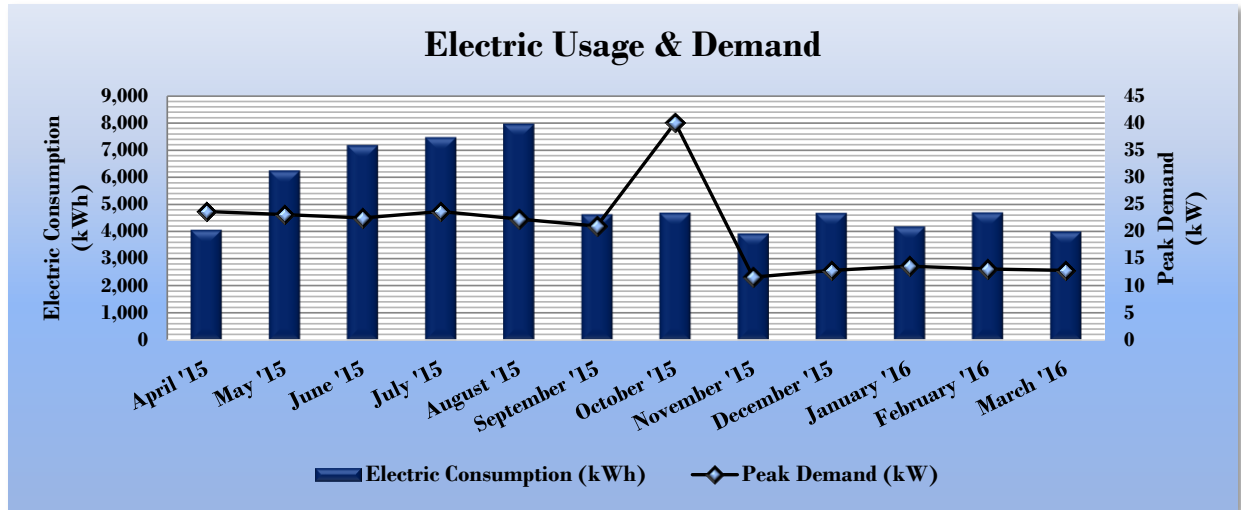


Figure 9 - Electric Usage & Demand

Electric Billing Data for Elmora Branch					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
5/13/15	31	4,064	24	\$103	\$825
6/15/15	30	6,255	23	\$282	\$1,258
7/15/15	31	7,186	23	\$274	\$1,373
8/12/15	31	7,472	24	\$289	\$1,408
9/11/15	30	7,970	22	\$271	\$1,408
10/12/15	31	4,633	21	\$92	\$816
11/10/15	30	4,693	40	\$175	\$824
12/11/15	31	3,927	12	\$51	\$715
1/13/16	31	4,687	13	\$56	\$783
2/11/16	28	4,193	14	\$59	\$587
3/14/16	30	4,706	13	\$57	\$641
4/13/16	30	3,999	13	\$56	\$608
Totals	364	63,785	40.1	\$1,765	\$11,248
Annual	365	63,960	40.1	\$1,770	\$11,279

3.3 Natural Gas Usage

Natural gas is provided by Elizabethtown Gas. The average gas cost for the past 12 months is \$0.948/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

Figure 10 - Natural Gas Usage

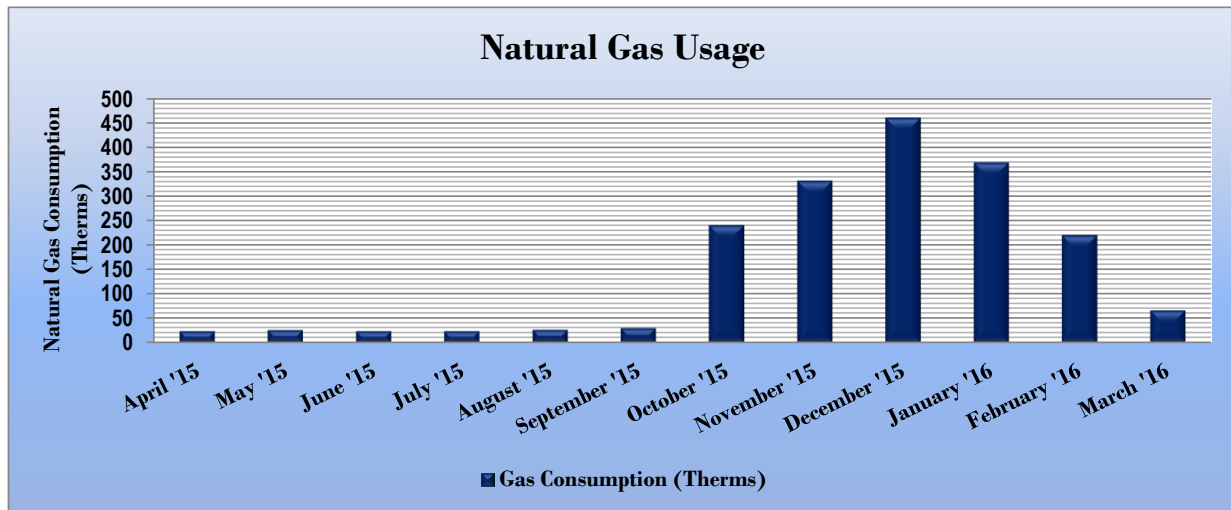


Figure 11 - Natural Gas Usage

Gas Billing Data for Elmora Branch			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
5/13/15	31	23	\$63
6/15/15	30	25	\$64
7/15/15	31	23	\$62
8/12/15	31	23	\$62
9/11/15	30	26	\$64
10/12/15	31	29	\$66
11/10/15	30	240	\$208
12/11/15	31	331	\$270
1/13/16	31	460	\$345
2/11/16	28	368	\$272
3/14/16	30	220	\$176
4/13/16	30	65	\$85
Totals	364	1,831	\$1,735
Annual	365	1,836	\$1,740

3.4 Benchmarking

This facility was benchmarked using Portfolio Manager, an online tool created and managed by the United States U.S. 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		
	Elmora Branch	National Median Building Type: Library
Source Energy Use Intensity (kBtu/ft ²)	195.1	235.6
Site Energy Use Intensity (kBtu/ft ²)	89.3	91.6

Implementation of all recommended measures in this report would improve the building’s estimated EUI significantly, 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		
	Elmora Branch	National Median Building Type: Library
Source Energy Use Intensity (kBtu/ft ²)	135.2	235.6
Site Energy Use Intensity (kBtu/ft ²)	70.2	91.6

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. Your building is not is one of the building categories that are eligible to receive a score.

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

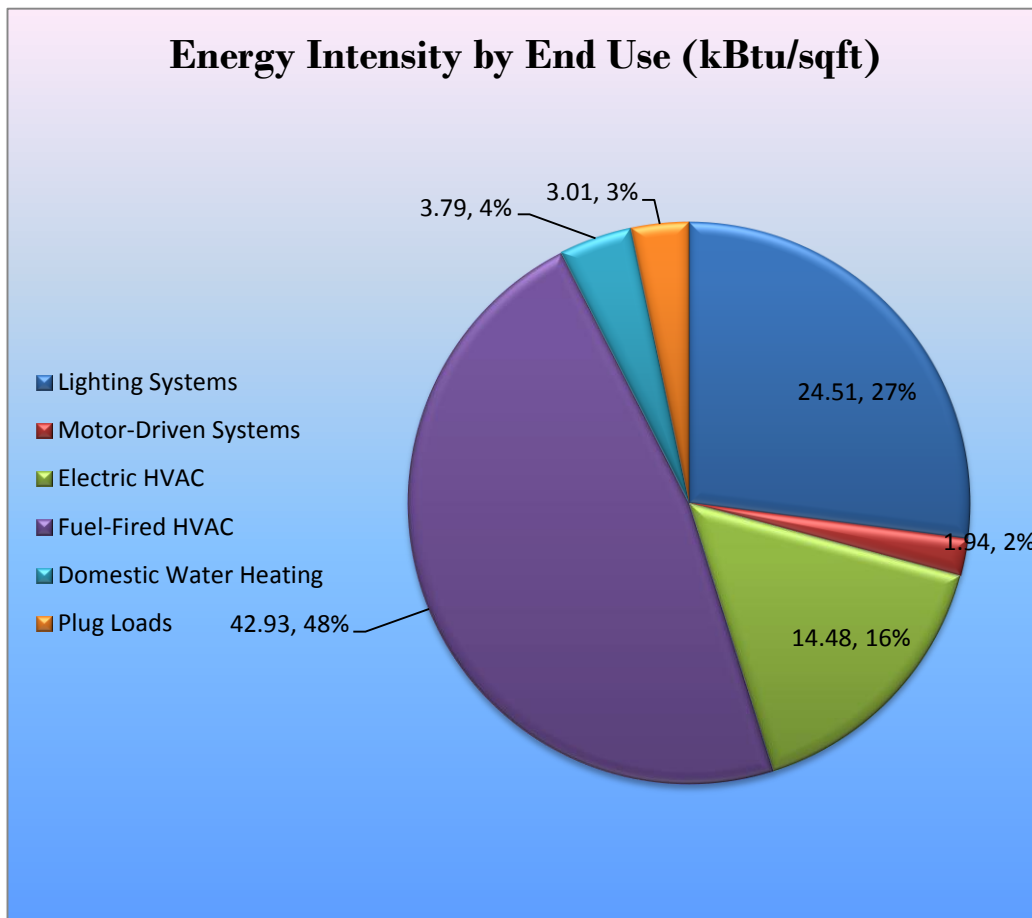
For more information on ENERGY STAR® certification go to: <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1>.

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

3.5 Energy End-Use Breakdown

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

Figure 14 - Energy Balance (kBtu/SF, %)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the Elmora Branch 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 15 – Summary of Recommended ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades			19,358	3.5	0.0	\$3,413.76	\$8,470.15	\$1,715.00	\$6,755.15	2.0	19,494
ECM 1	Install LED Fixtures	Yes	2,133	0.4	0.0	\$376.18	\$1,562.71	\$400.00	\$1,162.71	3.1	2,148
ECM 2	Retrofit Fixtures with LED Lamps	Yes	16,592	3.1	0.0	\$2,925.86	\$6,477.23	\$1,315.00	\$5,162.23	1.8	16,708
ECM 3	Install LED Exit Signs	Yes	634	0.1	0.0	\$111.72	\$430.22	\$0.00	\$430.22	3.9	638
Lighting Control Measures			149	0.0	0.0	\$26.35	\$232.00	\$40.00	\$192.00	7.3	150
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	149	0.0	0.0	\$26.35	\$232.00	\$40.00	\$192.00	7.3	150
Electric Unitary HVAC Measures			4,124	3.0	0.0	\$727.18	\$17,821.06	\$730.00	\$17,091.06	23.5	4,152
	Install High Efficiency Electric AC	No	4,124	3.0	0.0	\$727.18	\$17,821.06	\$730.00	\$17,091.06	23.5	4,152
Gas Heating (HVAC/Process) Replacement			0	0.0	32.5	\$308.45	\$10,081.44	\$1,000.00	\$9,081.44	29.4	3,810
	Install High Efficiency Hot Water Boilers	No	0	0.0	32.5	\$308.45	\$10,081.44	\$1,000.00	\$9,081.44	29.4	3,810
Domestic Water Heating Upgrade			1,551	0.0	0.0	\$273.52	\$21.51	\$0.00	\$21.51	0.1	1,562
ECM 5	Install Low-Flow Domestic Hot Water Devices	Yes	1,551	0.0	0.0	\$273.52	\$21.51	\$0.00	\$21.51	0.1	1,562
TOTAL OF ALL RECOMMENDED ECMS			21,059	4	0	3,714	8,724	1,755	6,969	1.9	21,206

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

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

4.1.1 Lighting Upgrades

Recommended upgrades to existing lighting fixtures are summarized in Figure 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 ₂ e Emissions Reduction (lbs)
Lighting Upgrades		19,358	3.5	0.0	\$3,413.76	\$8,470.15	\$1,715.00	\$6,755.15	2.0	19,494
ECM 1	Install LED Fixtures	2,133	0.4	0.0	\$376.18	\$1,562.71	\$400.00	\$1,162.71	3.1	2,148
ECM 2	Retrofit Fixtures with LED Lamps	16,592	3.1	0.0	\$2,925.86	\$6,477.23	\$1,315.00	\$5,162.23	1.8	16,708
ECM 3	Install LED Exit Signs	634	0.1	0.0	\$111.72	\$430.22	\$0.00	\$430.22	3.9	638

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

ECM 1: Install LED Fixtures

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO ₂ e Emissions Reduction (lbs)
Interior	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	0.0	0
Exterior	2,133	0.4	0.0	\$376.18	\$1,562.71	\$400.00	\$1,162.71	3.1	2,148

Measure Description

We recommend replacing existing fixtures containing HID lamps (High pressure sodium lamps) on exterior wall packs with new high performance LED light fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output.

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

ECM 2: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO ₂ e Emissions Reduction (lbs)
Interior	15,089	2.9	0.0	\$2,660.89	\$6,088.53	\$1,280.00	\$4,808.53	1.8	15,195
Exterior	1,503	0.3	0.0	\$264.97	\$388.69	\$35.00	\$353.69	1.3	1,513

Measure Description

We recommend retrofitting existing incandescent and linear T8 tubes with LED lamps and tubes. Many LED tube lamps are direct replacements for existing fluorescent lamps and can be installed while leaving the fluorescent fixture ballast in place. LED bulbs can be used in existing fixtures as a direct replacement for most other lighting technologies. This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space.

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

ECM 3: Install LED EXIT Signs

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO ₂ e Emissions Reduction (lbs)
Interior	634	0.1	0.0	\$111.72	\$430.22	\$0.00	\$430.22	3.9	638
Exterior	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	0.0	0

Measure Description

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

4.1.2 Lighting Control Measures

Figure 17 – Summary of Lighting Control ECMs

Energy Conservation Measure	Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Control Measures		448	0.1	0.0	\$79.05	\$464.00	\$80.00	\$384.00	4.9	451
ECM 4 Install Occupancy Sensor Lighting Controls	Yes	448	0.1	0.0	\$79.05	\$464.00	\$80.00	\$384.00	4.9	451

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

ECM 4: Install Occupancy Sensor Lighting Controls

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO ₂ e Emissions Reduction (lbs)
448	0.1	0.0	\$79.05	\$464.00	\$80.00	\$384.00	4.9	451

Measure Description

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

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

4.1.3 Domestic Hot Water Heating System Upgrades

Our recommendations for domestic water heating system improvements are summarized in Figure 18 below.

Figure 18 - 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 ₂ e Emissions Reduction (lbs)
Domestic Water Heating Upgrade	1,551	0.0	0.0	\$273.52	\$21.51	\$0.00	\$21.51	0.1	1,562
ECM 6 Install Low-Flow Domestic Hot Water Devices	1,551	0.0	0.0	\$273.52	\$21.51	\$0.00	\$21.51	0.1	1,562

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 ₂ e Emissions Reduction (lbs)
1,551	0.0	0.0	\$273.52	\$21.51	\$0.00	\$21.51	0.1	1,562

Measure Description

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

4.2 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 19 – Summary of Measures Evaluated, But Not Recommended

Energy Conservation Measure	Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		4,124	3.0	0.0	\$727.18	\$17,821.06	\$730.00	\$17,091.06	23.5	4,152
Install High Efficiency Electric AC	No	4,124	3.0	0.0	\$727.18	\$17,821.06	\$730.00	\$17,091.06	23.5	4,152
Gas Heating (HVAC/Process) Replacement		0	0.0	32.5	\$308.45	\$10,081.44	\$1,000.00	\$9,081.44	29.4	3,810
Install High Efficiency Hot Water Boilers	No	0	0.0	32.5	\$308.45	\$10,081.44	\$1,000.00	\$9,081.44	29.4	3,810
TOTAL OF ALL EVALUATED ECMs		25,481	6.6	32.5	\$4,801.96	\$36,858.16	\$3,525.00	\$33,333.16	6.9	29,469

* - 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 ₂ e Emissions Reduction (lbs)
4,124	3.0	0.0	\$727.18	\$17,821.06	\$730.00	\$17,091.06	23.5	4,152

Measure Description

We evaluated replacing standard efficiency ten (10) ton packaged air conditioning unit (serving the book keeping areas of the library) with high efficiency packaged air conditioning unit. 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

Although the unit is 20 years old and was evaluated for replacement (as a single measure), the payback period on replacing the unit is 23.5 years which is typically higher than the useful life of the equipment itself. However, please note that when we evaluated the replacement along with other suggested measures (as shown in Figure 3), this payback is only 6.9 years.

Install High Efficiency Hot Water Boilers

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO ₂ e Emissions Reduction (lbs)
0	0.0	32.5	\$308.45	\$10,081.44	\$1,000.00	\$9,081.44	29.4	3,810

Measure Description

We evaluated replacing older inefficient, non-condensing hot water boiler (with an output capacity 420 MBh) with high efficiency 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.

Reasons for not Recommending

Although the unit is 20 years old and was evaluated for replacement (as a single measure), the payback period on replacing the unit is 29.4 years which is typically higher than the useful life of the equipment itself. However, please note that when we evaluated the replacement along with other suggested measures (as shown in Figure 3), this payback is only 6.9 years.

5 ENERGY EFFICIENT PRACTICES

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

Reduce Air Leakage

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

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.

Practice Proper Use of Thermostat Schedules and Temperature Resets

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

Perform Proper Boiler Maintenance

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

Perform Proper Furnace Maintenance

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

adjusting operation and safety controls; inspecting the electrical connections; and ensuring proper lubrication for motors and bearings.

Perform Proper Water Heater Maintenance

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

Water Conservation

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

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

Refer to Section 4.1.3 for any low-flow ECM recommendations.

6 ON-SITE GENERATION MEASURES

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

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

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

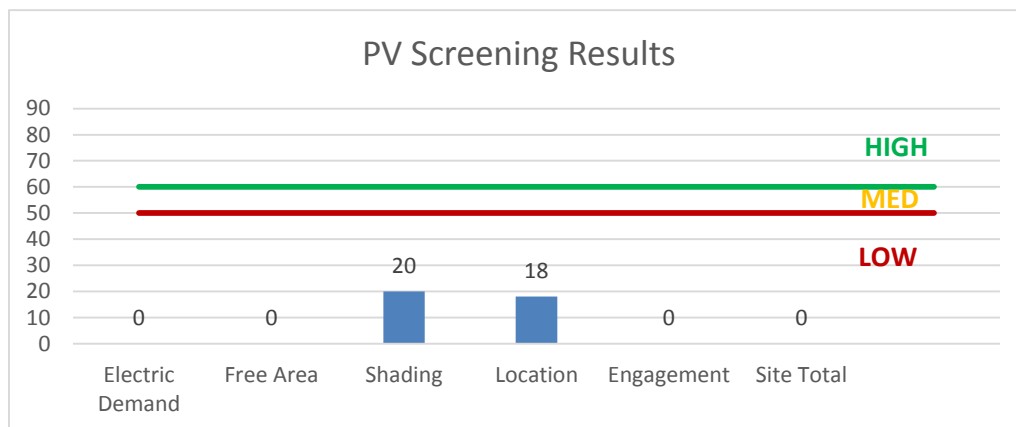
6.1 Photovoltaic

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

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

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

Figure 20 - Photovoltaic Screening



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-fags>
- **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.

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

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, this building is not a good candidate for the demand response program.

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

Figure 21 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	Direct Install
ECM 1	Install LED Fixtures	x	x
ECM 2	Retrofit Fixtures with LED Lamps	x	x
ECM 3	Install LED Exit Signs		x
ECM 4	Install Occupancy Sensor Lighting Controls	x	x
ECM 5	Install Low-Flow Domestic Hot Water Devices		x

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

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

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

8.1 SmartStart

Overview

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

Equipment with Prescriptive Incentives Currently Available:

Electric Chillers

Electric Unitary HVAC

Gas Cooling

Gas Heating

Gas Water Heating

Ground Source Heat Pumps

Lighting

Lighting Controls

Refrigeration Doors

Refrigeration Controls

Refrigerator/Freezer Motors

Food Service Equipment

Variable Frequency Drives

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

Incentives

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

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

How to Participate

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

Detailed program descriptions, instructions for applying and applications can be found at:

www.njcleanenergy.com/SSB.

8.2 Direct Install

Overview

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

Incentives

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

How to Participate

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

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

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

8.3 Energy Savings Improvement Program

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

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

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

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

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

www.njcleanenergy.com/ESIP.

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

9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

9.1 Retail Electric Supply Options

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

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

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

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

9.2 Retail Natural Gas Supply Options

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

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

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

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

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

Location	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
	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
Entrance exterior	3	Incandescent: Recessed fixture - 1 lamp	Wall Switch	100	4,380	Relamp	No	3	LED Screw-In Lamps: Recessed fixture - 1 lamp	Wall Switch	15	4,380	0.21	1,262	0.0	\$222.56	\$293.56	\$15.00	1.25
Entrance exterior	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,800	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,800	0.05	240	0.0	\$42.40	\$95.13	\$20.00	1.77
Book floor	41	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,800	Relamp	No	41	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,800	1.87	9,859	0.0	\$1,738.59	\$3,900.47	\$820.00	1.77
Meeting room	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,800	Relamp	No	12	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,800	0.55	2,886	0.0	\$508.86	\$1,141.60	\$240.00	1.77
Women's restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,800	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,800	0.05	240	0.0	\$42.40	\$95.13	\$20.00	1.77
Men's restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,800	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,800	0.05	240	0.0	\$42.40	\$95.13	\$20.00	1.77
Kitchen	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,800	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,800	0.05	240	0.0	\$42.40	\$95.13	\$20.00	1.77
Computer room	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,800	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,660	0.12	630	0.0	\$111.16	\$306.27	\$60.00	2.22
Reference room	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,800	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,660	0.12	630	0.0	\$111.16	\$306.27	\$60.00	2.22
Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	3,800	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,660	0.09	450	0.0	\$79.36	\$306.27	\$60.00	3.10
Boiler Room	2	Incandescent: Wall hanging fixture - 1 lamp	Wall Switch	100	3,800	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,800	0.07	361	0.0	\$63.61	\$190.27	\$40.00	2.36
Book floor	2	Exit Signs: Fluorescent	Wall Switch	22	8,760	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	Wall Switch	6	8,760	0.03	317	0.0	\$55.86	\$215.11	\$0.00	3.85
Meeting room	2	Exit Signs: Fluorescent	Wall Switch	22	8,760	Fixture Replacement	Yes	2	LED Exit Signs: 2 W Lamp	Occupancy Sensor	6	8,760	0.03	317	0.0	\$55.86	\$331.11	\$20.00	5.57
Exterior wall packs	3	High-Pressure Sodium: (1) 70W Lamp	Wall Switch	95	4,380	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	18	4,380	0.19	1,143	0.0	\$201.62	\$1,172.03	\$300.00	4.33
Exterior wall packs	1	High-Pressure Sodium: (1) 200W Lamp	Wall Switch	250	4,380	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	50	4,380	0.16	990	0.0	\$174.56	\$390.68	\$100.00	1.67

Motor Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
		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
Boiler room	Boiler	4	Heating Hot Water Pump	0.1	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Roof	Roof top packed unit	2	Supply Fan	0.5	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

Electric HVAC Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions				Proposed Conditions							Energy Impact & Financial Analysis							
		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
Condensing units are on the roof top	Reference room and computer room cooling	2	Packaged Air-Source HP	1.50	17.00	No							No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Roof top	Book floors and other areas	1	Packaged AC	10.00		Yes	1	Packaged AC	10.00		13.00		No	2.95	4,124	0.0	\$727.18	\$17,821.06	\$730.00	23.50

Fuel Heating Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
		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	Elmora branch library	1	Non-Condensing Hot Water Boiler	420.00	Yes	1	Condensing Hot Water Boiler	420.00	95.00%	Et	0.00	0	32.5	\$308.45	\$10,081.44	\$1,000.00	29.44

DHW Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis					
		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
Kitchen	Kitchen and restrooms	1	Storage Tank Water Heater (≤ 50 Gal)	No						0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

Low-Flow Device Recommendations

Location	Recommendation Inputs				Energy Impact & Financial Analysis						
	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
Women's restroom	1	Faucet Aerator (Lavatory)	3.00	1.00	0.00	721	0.0	\$127.22	\$7.17	\$0.00	0.06
Men's restroom	1	Faucet Aerator (Lavatory)	3.00	1.00	0.00	721	0.0	\$127.22	\$7.17	\$0.00	0.06
Kitchen	1	Faucet Aerator (Kitchen)	2.50	2.20	0.00	108	0.0	\$19.08	\$7.17	\$0.00	0.38

Plug Load Inventory

Existing Conditions				
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Elmora branch	13	Computer	75.0	Yes
Elmora branch	1	Printer - medium	40.0	Yes
Elmora branch	2	Microwave	900.0	No
Elmora branch	1	Refrigerator - large	100.0	No
Elmora branch	2	Coffee machine	400.0	Yes
Elmora branch	1	Toaster oven	1,200.0	No
Elmora branch	1	Space heater	1,500.0	No

Appendix B: ENERGY STAR[®] Statement of Energy Performance

ENERGY STAR[®] Statement of Energy Performance

LEARN MORE AT energystar.gov

N/A

Elmora Library

Primary Property Type: Library
Gross Floor Area (ft²): 4,500
Built: 1953

For Year Ending: May 31, 2016
Date Generated: September 01, 2017

ENERGY STAR[®] Score¹

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
Elmora Library 740 West Grand Street Elizabeth, New Jersey 07202	_____ () - _____	_____ () - _____ _____
Property ID: 6028184		

Energy Consumption and Energy Use Intensity (EUI)			
Site EUI	Annual Energy by Fuel	National Median Comparison	
80.2 kBtu/ft ²	Electric - Grid (kBtu) 177,883 (49%)	National Median Site EUI (kBtu/ft ²)	113.3
	Natural Gas (kBtu) 183,123 (51%)	National Median Source EUI (kBtu/ft ²)	235.6
		% Diff from National Median Source EUI	-29%
Source EUI			
166.9 kBtu/ft ²	Annual Emissions		
	Greenhouse Gas Emissions (Metric Tons CO ₂ e/year)		30

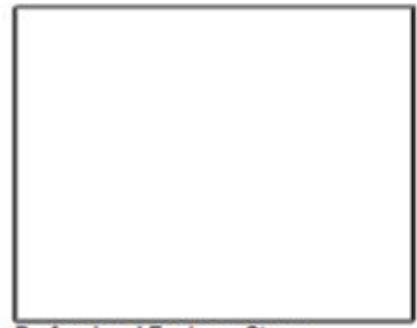
Signature & Stamp of Verifying Professional

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)