Local Government Energy Audit:
Energy Audit Report

Main Library

Township of Woodbridge

1 George Fredrick Plaza
Woodbridge, NJ 07095

April 26, 2018

Final Report by:
TRC Energy Services

Disclaimer

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

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

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

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

Table of Contents

1 Executive Summary 1

1.1 Facility Summary 1
1.2 Your Cost Reduction Opportunities 1

Energy Conservation Measures 1
Energy Efficient Practices 3
On-Site Generation Measures 3

1.3 Implementation Planning 4

2 Facility Information and Existing Conditions 6

2.1 Project Contacts 6
2.2 General Site Information 6
2.3 Building Occupancy 6
2.4 Building Envelope 6
2.5 On-Site Generation 7
2.6 Energy-Using Systems 7

Lighting System 7
Hot Water / Steam System 8
Air Conditioning Systems (CHW) 8
Domestic Hot Water 9
Plug load & Vending Machines 10

2.7 Water-Using Systems 10

3 Site Energy Use and Costs 11

3.1 Total Cost of Energy 11
3.2 Electricity Usage 12
3.3 Natural Gas Usage 13
3.4 Benchmarking 14
3.5 Energy End-Use Breakdown 15

4 Energy Conservation Measures 16

4.1 Recommended ECMs 16
4.1.1 Lighting Upgrades 17

ECM 1: Install LED Fixtures 17
ECM 2: Retrofit Fixtures with LED Lamps 18

4.1.2 Lighting Control Measures 18

ECM 3: Install Occupancy Sensor Lighting Controls 19

4.1.3 Variable Frequency Drive Measures 20

ECM 4: Install VFDs on Constant Volume HVAC 20
ECM 5: Install VFDs on Hot Water Pumps 21

4.1.4 Electric Chiller Replacement 22

ECM 6: Install High Efficiency Chillers 22

4.1.5 HVAC System Improvements 22
ECM 7: Install Programmable Thermostats 23
4.1.6 Plug Load Equipment Control - Vending Machine 24
ECM 8: Vending Machine Control 24
4.1.7 Custom Measures 25
ECM 9: Install Building Automation System 25
5 Energy Efficient Practices 26
Reduce Air Leakage 26
Close Doors and Windows 26
Use Window Treatments/Coverings 26
Ensure Lighting Controls Are Operating Properly 26
Practice Proper Use of Thermostat Schedules and Temperature Resets 26
Assess Chillers & Request Tune-Ups 27
Perform Proper Boiler Maintenance 27
Perform Proper Water Heater Maintenance 27
Plug Load Controls 27
Water Conservation 28
6 On-Site Generation Measures 29
6.1 Photovoltaic 29
6.2 Combined Heat and Power 30
7 Demand Response 31
8 Project Funding / Incentives 32
8.1 SmartStart 33
8.2 Direct Install 34
8.3 Energy Savings Improvement Program 35
9 Energy Purchasing and Procurement Strategies 36
9.1 Retail Electric Supply Options 36
9.2 Retail Natural Gas Supply Options 36

Appendix A: Equipment Inventory & Recommendations

Appendix B: ENERGY STAR® Statement of Energy Performance

Table of Figures

Figure 1 – Previous 12 Month Utility Costs 2
Figure 2 – Potential Post-Implementation Costs 2
Figure 3 – Summary of Energy Reduction Opportunities 2
Figure 4 – Project Contacts 6
Figure 5 - Building Schedule 6
Figure 6 - Utility Summary 11
Figure 7 - Energy Cost Breakdown 11
Figure 8 -Electric Usage & Demand 12
Figure 9 -Electric Usage & Demand 12
Figure 10 -Natural Gas Usage 13
Figure 11 -Natural Gas Usage 13
Figure 12 - Energy Use Intensity Comparison – Existing Conditions 14
Figure 13 - Energy Use Intensity Comparison – Following Installation of Recommended Measures 14
Figure 14 - Energy Balance (kBtu/SF, %) 15
Figure 15 – Summary of Recommended ECMs 16
Figure 16 – Summary of Lighting Upgrade ECMs 17
Figure 17 – Summary of Lighting Control ECMs 18
Figure 18 – Summary of Variable Frequency Drive ECMs 20
Figure 19 - Summary of Electric Chiller Replacement ECMs 22
Figure 20 - Summary of HVAC System Improvements ECMs 22
Figure 21 - Summary of Plug Load Equipment Control ECMs 24
Figure 22 - Summary of Custom ECMs 25
Figure 23 - ECM Incentive Program Eligibility 32

1 EXECUTIVE SUMMARY

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

The goal of a LGEA is to provide you with information on how your facility uses energy, identify energy conservation measures (ECMs) that can reduce your energy use, and put you in a position to implement the ECMs. The LGEA also sets you on the path to receive financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing the ECMs.

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

1.1 Facility Summary

Main Library is a 52,000 square-foot, four-story facility. It includes the book shelving area on the ground floor, individual offices on the top two floors and a day care center with offices in the basement. The building is open to the public from 9:00 AM–9:00 PM on the weekdays and 9:00 AM-5:00 PM on the weekends throughout the year.

There is onsite generation capacity at the building using solar PV on the roof top. Space heating in the building is provided by condensing hot water boilers. Space cooling is provided by a centrifugal chiller using an air handler to distribute air to the various spaces. The lighting includes linear T8 fixtures while smaller spaces have compact fluorescent bulbs.

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 projects which represent an opportunity for Main Library to reduce annual energy costs by $47,556 and annual greenhouse gas emissions by 348,222 lbs CO_2e. The measures would pay for themselves in 8.4 years. The breakdown of existing and potential utility costs is illustrated in Figure 1 and Figure 2, respectively. These projects represent an opportunity to reduce Main Library's annual energy use by 24.3%.

Figure 1 – Previous 12 Month Utility Costs

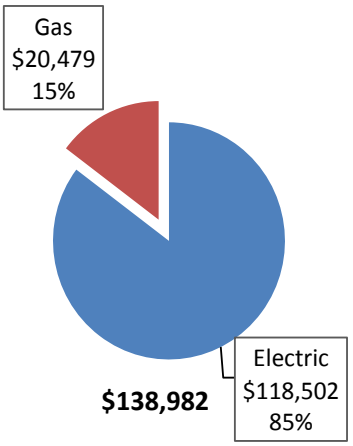
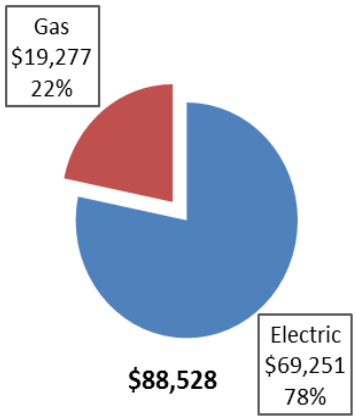


Figure 2 – Potential Post-Implementation Costs



A detailed description of Main Library's existing energy use can be found in Section 3.

The evaluated measures have been listed and grouped into major categories as shown in Figure 3. Brief descriptions of the categories can be found below and descriptions of the individual 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_2e Emissions Reduction (lbs)
Lighting Upgrades			**105,778**	**20.3**	**0.0**	**$13,512.25**	**$51,739.32**	**$9,635.00**	**$42,104.32**	**3.12**	**106,517**
ECM 1	Install LED Fixtures	Yes	4,627	0.8	0.0	$591.00	$7,813.54	$2,000.00	$5,813.54	9.84	4,659
ECM 2	Retrofit Fixtures with LED Lamps	Yes	101,151	19.5	0.0	$12,921.25	$43,925.78	$7,635.00	$36,290.78	2.81	101,859
Lighting Control Measures			**1,010**	**0.2**	**0.0**	**$129.04**	**$502.00**	**$75.00**	**$427.00**	**3.31**	**1,017**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	1,010	0.2	0.0	$129.04	$502.00	$75.00	$427.00	3.31	1,017
Variable Frequency Drive (VFD) Measures			**42,754**	**9.9**	**0.0**	**$5,461.42**	**$17,372.10**	**$1,800.00**	**$15,572.10**	**2.85**	**43,053**
ECM 4	Install VFDs on Constant Volume (CV) HVAC	Yes	29,483	8.2	0.0	$3,766.23	$10,820.40	$1,800.00	$9,020.40	2.40	29,689
ECM 5	Install VFDs on Hot Water Pumps	Yes	13,270	1.7	0.0	$1,695.19	$6,551.70	$0.00	$6,551.70	3.86	13,363
Electric Chiller Replacement			**100,368**	**49.4**	**0.0**	**$12,821.20**	**$191,966.45**	**$6,750.00**	**$185,216.45**	**14.45**	**101,070**
ECM 6	Install High Efficiency Chillers	Yes	100,368	49.4	0.0	$12,821.20	$191,966.45	$6,750.00	$185,216.45	14.45	101,070
HVAC System Improvements			**17,626**	**0.0**	**130.2**	**$3,453.63**	**$2,638.96**	**$0.00**	**$2,638.96**	**0.76**	**32,995**
ECM 7	Install Programmable Thermostats	Yes	17,626	0.0	130.2	$3,453.63	$2,638.96	$0.00	$2,638.96	0.76	32,995
Plug Load Equipment Control - Vending Machine			**1,612**	**0.0**	**0.0**	**$205.90**	**$718.80**	**$0.00**	**$718.80**	**3.49**	**1,623**
ECM 8	Vending Machine Control	Yes	1,612	0.0	0.0	$205.90	$718.80	$0.00	$718.80	3.49	1,623
Custom Measures			**61,517**	**21.4**	**444.0**	**$11,972.26**	**$153,000.00**	**$0.00**	**$153,000.00**	**12.78**	**61,947**
ECM 9	Install Building Automation System	Yes	61,517	21.4	444.0	$11,972.26	$153,000.00	$0.00	$153,000.00	12.78	61,947
TOTALS			**330,664**	**101.3**	**574.2**	**$47,555.71**	**$417,937.62**	**$18,260.00**	**$399,677.62**	**8.40**	**348,222**

* - 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 conditions allow. Automated control reduces reliance on occupant behavior for adjusting lights. These measures save energy by reducing the amount of time lights are on.

Variable Frequency Drives measures generally involve controlling the speed of a motor to achieve a flow or temperature rather than using a valve, damper, or no means at all. These measures save energy by slowing a motor which is an extremely efficient method of control.

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

Plug Load Equipment control measures generally involve installing automation that limits the power use or operation of equipment plugged into an electrical receptacle based on occupancy.

Energy Efficient Practices

TRC also identified 10 low cost (or no cost) energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral and operational adjustments as well as performing routine maintenance on building systems. Through these practices equipment lifetime can be extended; occupant comfort, health and safety can be improved; and annual energy, operation, and maintenance costs can be reduced. Opportunities identified at Main Library include:

- Reduce Air Leakage
- Close Doors and Windows
- Use Window Treatments/Coverings
- Ensure Lighting Controls Are Operating Properly
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Assess Chillers & Request Tune-Ups
- Perform Proper Boiler Maintenance
- Perform Proper Water Heater Maintenance
- Install Plug Load Controls
- Water Conservation

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

On-Site Generation Measures

TRC evaluated the potential for installing on-site generation sources for Main Library. 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 the self-generation potential, please refer to Section 6.

1.3 Implementation Planning

To realize the energy savings from the ECMs listed in this report, the equipment changes outlined for each ECM need to be selected and installed through project implementation. One of the first considerations is if there is capital available for project implementation. Another consideration is whether to pursue individual ECMs, a group of ECMs, or a comprehensive approach wherein all ECMs are pursued, potentially in conjunction with other facility projects or improvements.

Rebates, incentives, and financing are available from the NJBPU, NJCEP, as well as some of the state's investor-owned utilities, to help reduce the costs associated with the implementation of energy efficiency projects. Prior to implementing any project, please review the appropriate incentive program guidelines before proceeding. This is important because in most cases you will need to submit an application for the incentives before purchasing materials and beginning installation.

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

- SmartStart
- Direct Install
- Energy Savings Improvement Program (ESIP)

For facilities with capital available for implementation of selected individual measures or phasing 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 design the ECM(s), select the equipment and apply for the incentive(s). Program pre-approval is required for some SmartStart incentives, so only after receiving approval may the ECM(s) be installed. The incentive values listed above in Figure 3 represent the SmartStart program and will be explained further in Section 8, as well as the other programs as mentioned below.

This facility also qualifies for the Direct Install program which, through an authorized network of participating contractors, can assist with the implementation of a group of measures versus installing individual measures or phasing implementation. This program is designed to be turnkey and will provide an incentive up to 70% of the cost of the project identified by the designated contractor.

For facilities without capital available 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 external project development, design, and implementation services as well as financing for implementing ECMs. This LGEA report is the first step for participating in ESIP and should help you determine next steps. Refer to Section 8.3 for additional information on the ESIP Program.

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

Additional descriptions of all relevant incentive programs are located in Section 8 or: www.njcleanenergy.com/ci.

To ensure projects are implemented such that maximum savings and incentives are achieved, bids and specifications should be reviewed by your procurement personnel and/or consultant(s) to ensure that selected equipment coincides with LGEA recommendations, as well as applicable incentive program guidelines and requirements.

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 4 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Brian Burke	Superintendent of Building Maintenance	brian.burke@twp.woodbridge.nj.us	732-675-4619
Mike Petz	Custodian	petzmike87@yahoo.com	732-397-6628
TRC Energy Services			
Smruti Srinivasan	Auditor	ssrinivasan@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On August 31, 2016, TRC performed an energy audit at Main Library located in Woodbridge, New Jersey. TRC's auditor met with Mike Petz to review the facility operations and focus the investigation on specific energy-using systems.

Main Library is a 52,000 square-foot, four-story facility. It includes the book shelving area on the ground floor, individual offices on the top two floors and a day care center with offices in the basement. The building is open to the public from 9:00 AM–9:00 PM on the weekdays and 9:00 AM-5:00 PM on the weekends throughout the year.

There is onsite generation capacity at the building using solar PV on the roof top. Space heating in the building is provided by condensing hot water boilers. Space cooling is provided by a centrifugal chiller which uses air handler to distribute the air to the respective spaces. The lighting includes linear T8 tubes and smaller spaces have compact fluorescent bulbs. These are deemed inefficient and are recommended for replacement.

2.3 Building Occupancy

The typical schedule is presented in the table below. The building is occupied for 80 hours a week. During a typical day, the facility is occupied by approximately 50 full-time staff.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Main Library	Weekday	9AM - 9PM
Main Library	Weekend	9AM - 5PM

2.4 Building Envelope

The core construction of the building is concrete and steel with a pebbledash façade. The dividing walls in the building consists of concrete blocks in some spaces and sheetrock between the offices. The building has a flat roof with asphalt shingle layer which was found to be in good condition. The windows in the building are tinted and single pane and are a part of the façade at the main entrance. We suggest that these windows be changed to double pane windows with lower U-factors. The doors are aluminum framed glass doors. These are single pane and show signs of excessive infiltration.

Image 1 Building envelope images

2.5 On-Site Generation

The Main Library has installed solar PV on the roof of the building. There are approximately 645 PV panels in total and the building has a bidirectional meter which sends the excess generation back to the grid. Information regarding the array size and ownership of the panels were not available at the time of the audit.

2.6 Energy-Using Systems

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

Lighting System

Lighting is predominately 32-Watt linear fluorescent T8 lamps with electronic ballasts as well as compact fluorescent lamps (CFL). Most of the building spaces use 2-lamp or 4-lamp, 2x2 or 2x4 foot troffers. Areas such as the reception area and hallways have a 26-Watt compact fluorescent lamps in recessed fixtures.

Lighting control is provided by both manual switches and occupancy sensors. The occupancy sensors are used to control lights in spaces like restrooms and offices. Stairwells, elevator lobbies and main lobby areas do not contain any occupancy sensors.

The exterior lighting primarily consists of fixtures with high pressure sodium and mercury vapor lamps.

Image 2 Typical lighting fixtures

Hot Water / Steam System

The heating hot water system consists of two AERCO condensing hot water boilers with an output capacity of 1880 MBh per unit. The boilers have a combustion efficiency of 94%.

Each boiler is supplied by a dedicated 5 hp hot water pump. These pumps have constant speed motors. Hot water is supplied at 180°F when the outside air temperature is below 50°F and modulated accordingly at higher temperatures until the outside air is above 65°F. Above this temperature, the boilers are shut down. The boilers provide hot water to air handlers which then distribute air to the ceiling ducts in the respective zones.

The boilers operate in a lead/lag configuration. Both boilers may be required during cold weather. The boilers are about a year old, in good condition and well maintained.

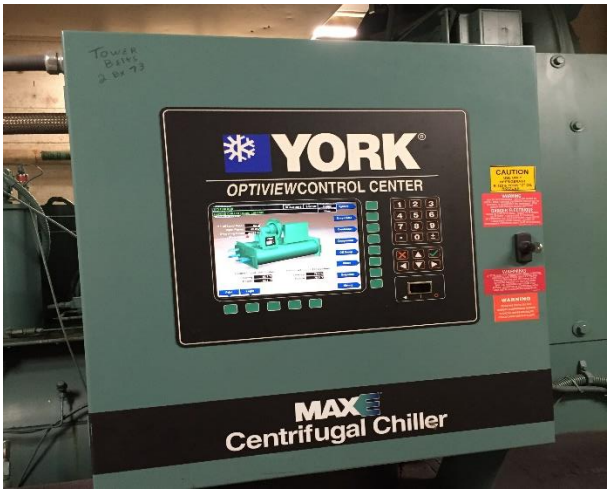
Image 3 Boilers and terminal units

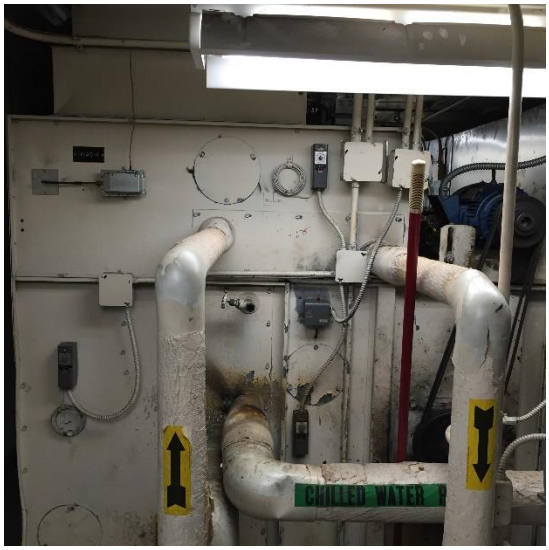
Air Conditioning Systems (CHW)

The building has a water cooled centrifugal chiller from York. The chiller is 225 tons and is a variable speed chiller. There are three single zone air handlers at the facility with supply fan capacities of 7.5 hp (each) serving each floor. The chilled water is provided to these air handlers which distribute the cooled air to the respective spaces. The supply fan in the air handlers are constant speed fans and recommended for

additional controls. The AHUs are approximately 40 years-old. The chiller at the facility functions during the months of April through October.

The temperature in the spaces are controlled using non-programmable thermostats. It is recommended to have programmable thermostats in these zones. Programmable thermostats can be set to maintain different temperature settings for different times of day and days of the week. By setting the heating temperature setpoint down and the cooling temperature setpoint up, for times that the conditioned space is not occupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures during unoccupied periods.





Domestic Hot Water

The domestic hot water system for the facility consists of one electric domestic hot water heater from AO Smith with and input capacity of 6kW. The tank capacity of the water heater is 119 gallons and serves all the restrooms and sinks in the building.

Plug load & Vending Machines

There are 85 computer work stations throughout the facility. 90% of the computers are desktop units with LCD monitors. Other plug loads at the facility include printers (small and large with scanners), and kitchenette equipment like refrigerators, microwave ovens, coffee machines, toaster and toaster ovens etc., There is no centralized PC power management software installed.

There is one refrigerated vending machine at the facility that does not have any controls installed.

2.7 Water-Using Systems

A sampling of restrooms found that faucets are rated for 2.0 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/ft^2 and energy use/ft^2. These energy use indices are indicative of the relative energy effectiveness of this building. There are a number of factors that could cause the energy use of this building to vary from the "typical" energy use for other facilities identified as: Library. Specific local climate conditions, daily occupancy hours of the facility, seasonal fluctuations in occupancy, daily operating hours of energy use systems, and the behavior of the occupants with regard to operating systems that impact energy use such as turning off appliances and leaving windows open. Please refer to the Benchmarking section within Section 3.4 for additional information.

3.1 Total Cost of Energy

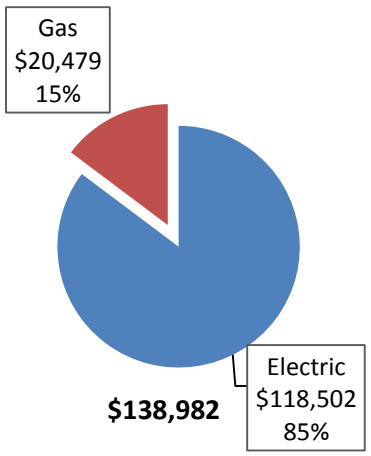
The following energy consumption and cost data is based on the last 12-month period of utility usage data that was provided for each utility. The annual consumption and cost was developed from this information.

Figure 6 - Utility Summary

Utility Summary for Main Library		
Fuel	**Usage**	**Cost**
Electricity	869,924 kWh	$118,502
Natural Gas	22,183 Therms	$20,479
Total		**$138,982**

The current utility cost for this site is $138,982 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 (combined for commodity, transmission and distribution) for the past 12 months is $0.128/kWh, which is the blended rate used throughout the analyses in this report. The monthly electricity consumption and peak demand is represented graphically in the chart below.

Figure 8 -Electric Usage & Demand

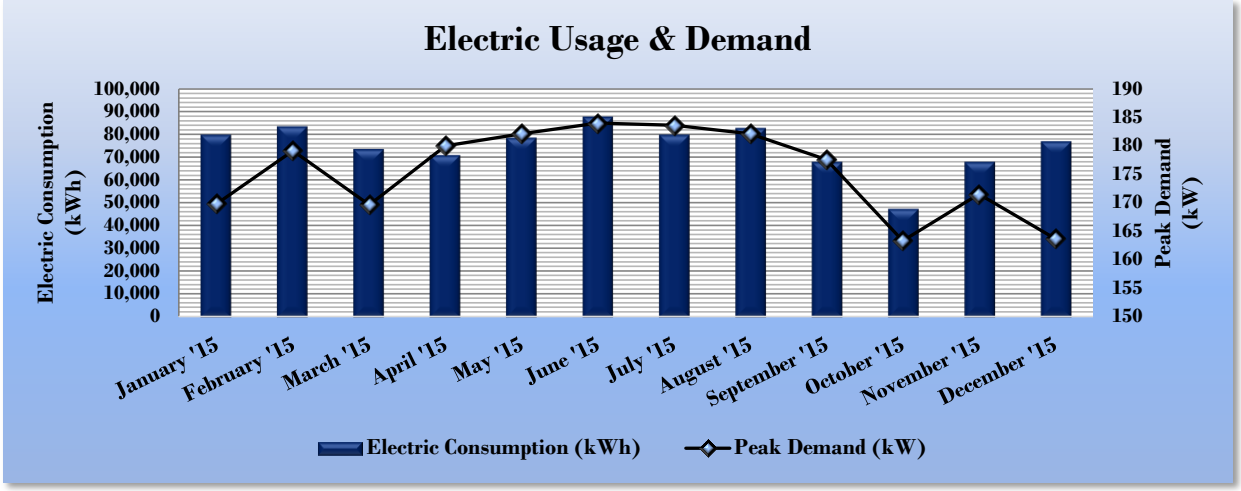


Figure 9 -Electric Usage & Demand

Electric Billing Data for Main Library					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
2/2/15	30	79,535	170	$584	$9,317
3/13/15	39	83,174	179	$645	$10,049
4/14/15	32	73,269	170	$611	$9,457
5/13/15	29	70,671	180	$649	$9,351
6/12/15	30	78,235	182	$656	$11,777
7/14/15	32	87,391	184	$663	$13,082
8/12/15	29	79,594	184	$662	$12,339
9/11/15	30	82,506	182	$658	$12,199
10/12/15	31	67,787	178	$644	$8,664
11/10/15	29	47,200	163	$592	$7,200
12/11/15	31	67,765	172	$622	$8,903
1/13/16	33	76,631	164	$593	$9,413
Totals	**375**	**893,758**	**184**	**$7,579**	**$121,749**
Annual	**365**	**869,924**	**184**	**$7,377**	**$118,502**

3.3 Natural Gas Usage

Natural gas is provided by Elizabethtown Gas. The average gas cost for the past 12 months is $0.923/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is represented graphically in the chart below.

Figure 10 -Natural Gas Usage

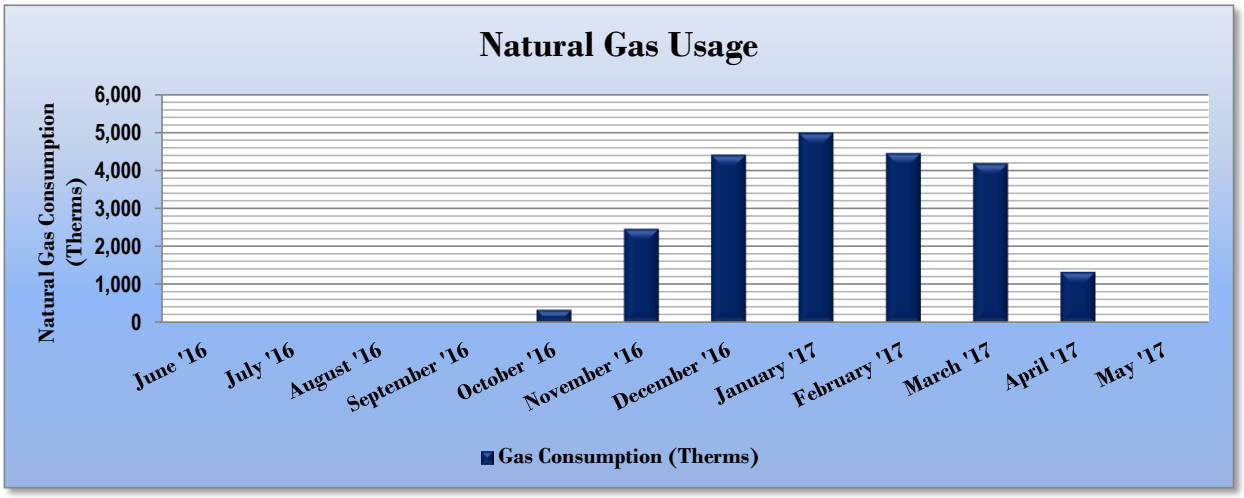


Figure 11 -Natural Gas Usage

Gas Billing Data for Main Library			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
6/24/16	30	0	$278
7/26/16	32	0	$278
8/25/16	30	0	$278
9/26/16	32	0	$278
10/25/16	29	331	$524
11/23/16	29	2,459	$2,061
12/22/16	29	4,401	$3,611
1/24/17	33	4,980	$4,410
2/22/17	29	4,445	$3,854
3/23/17	29	4,178	$3,304
4/24/17	32	1,327	$1,269
5/24/17	30	0	$278
Totals	**364**	**22,122**	**$20,423**
Annual	**365**	**22,183**	**$20,479**

3.4 Benchmarking

This facility was benchmarked through 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 compares its performance against a yearly baseline, national medians, or similar buildings in your portfolio. Metrics used in this comparison are the Energy Use Intensity (EUI) and ENERGY STAR® score.

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 energy than similar buildings on a square foot basis or if that building performs better than the median. EUI is presented in both 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 is the raw fuel consumed to generate the energy consumed at the site, factoring in energy production and distribution losses.

Figure 12 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Main Library	National Median Building Type: Library
Source Energy Use Intensity (kBtu/ft^2)	224.0	235.6
Site Energy Use Intensity (kBtu/ft^2)	99.7	91.6

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

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

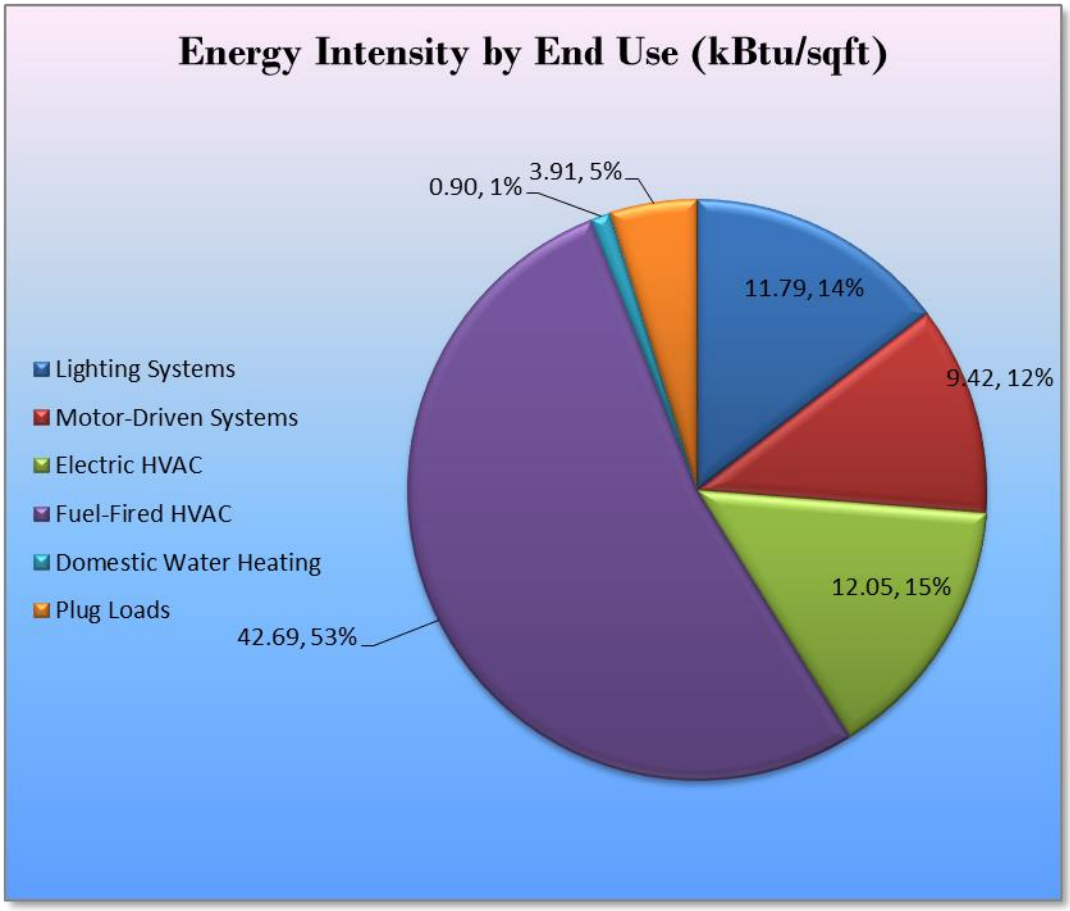
Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Main Library	National Median Building Type: Library
Source Energy Use Intensity (kBtu/ft^2)	153.3	235.6
Site Energy Use Intensity (kBtu/ft^2)	75.5	91.6

Many buildings can also receive a 1–100 ENERGY STAR® score. This score 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 type does not qualify to receive a score. However, we have provided a Portfolio Manager Statement of Energy Performance that is attached in Appendix B: ENERGY STAR® Statement of Energy Performance.

3.5 Energy End-Use Breakdown

In order to provide a complete overview of energy consumption across building systems, an energy balance was performed at this facility. An energy balance utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems found in a building and determine their proportional contribution to overall building energy usage. This visual representation of energy end uses highlights systems that may benefit most from energy efficiency projects.

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 Main Library 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_2e Emissions Reduction (lbs)
Lighting Upgrades			**105,778**	**20.3**	**0.0**	**$13,512.25**	**$51,739.32**	**$9,635.00**	**$42,104.32**	**3.12**	**106,517**
ECM 1	Install LED Fixtures	Yes	4,627	0.8	0.0	$591.00	$7,813.54	$2,000.00	$5,813.54	9.84	4,659
ECM 2	Retrofit Fixtures with LED Lamps	Yes	101,151	19.5	0.0	$12,921.25	$43,925.78	$7,635.00	$36,290.78	2.81	101,859
Lighting Control Measures			**1,010**	**0.2**	**0.0**	**$129.04**	**$502.00**	**$75.00**	**$427.00**	**3.31**	**1,017**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	1,010	0.2	0.0	$129.04	$502.00	$75.00	$427.00	3.31	1,017
Variable Frequency Drive (VFD) Measures			**42,754**	**9.9**	**0.0**	**$5,461.42**	**$17,372.10**	**$1,800.00**	**$15,572.10**	**2.85**	**43,053**
ECM 4	Install VFDs on Constant Volume (CV) HVAC	Yes	29,483	8.2	0.0	$3,766.23	$10,820.40	$1,800.00	$9,020.40	2.40	29,689
ECM 5	Install VFDs on Hot Water Pumps	Yes	13,270	1.7	0.0	$1,695.19	$6,551.70	$0.00	$6,551.70	3.86	13,363
Electric Chiller Replacement			**100,368**	**49.4**	**0.0**	**$12,821.20**	**$191,966.45**	**$6,750.00**	**$185,216.45**	**14.45**	**101,070**
ECM 6	Install High Efficiency Chillers	Yes	100,368	49.4	0.0	$12,821.20	$191,966.45	$6,750.00	$185,216.45	14.45	101,070
HVAC System Improvements			**17,626**	**0.0**	**130.2**	**$3,453.63**	**$2,638.96**	**$0.00**	**$2,638.96**	**0.76**	**32,995**
ECM 7	Install Programmable Thermostats	Yes	17,626	0.0	130.2	$3,453.63	$2,638.96	$0.00	$2,638.96	0.76	32,995
Plug Load Equipment Control - Vending Machine			**1,612**	**0.0**	**0.0**	**$205.90**	**$718.80**	**$0.00**	**$718.80**	**3.49**	**1,623**
ECM 8	Vending Machine Control	Yes	1,612	0.0	0.0	$205.90	$718.80	$0.00	$718.80	3.49	1,623
Custom Measures			**61,517**	**21.4**	**444.0**	**$11,972.26**	**$153,000.00**	**$0.00**	**$153,000.00**	**12.78**	**61,947**
ECM 9	Install Building Automation System	Yes	61,517	21.4	444.0	$11,972.26	$153,000.00	$0.00	$153,000.00	12.78	61,947
TOTALS			**330,664**	**101.3**	**574.2**	**$47,555.71**	**$417,937.62**	**$18,260.00**	**$399,677.62**	**8.40**	**348,222**

* - 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_2e Emissions Reduction (lbs)
Lighting Upgrades		**105,778**	**20.3**	**0.0**	**$13,512.25**	**$51,739.32**	**$9,635.00**	**$42,104.32**	**3.12**	**106,517**
ECM 1	Install LED Fixtures	4,627	0.8	0.0	$591.00	$7,813.54	$2,000.00	$5,813.54	9.84	4,659
ECM 2	Retrofit Fixtures with LED Lamps	101,151	19.5	0.0	$12,921.25	$43,925.78	$7,635.00	$36,290.78	2.81	101,859

ECM 1: Install LED Fixtures

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
4,627	0.8	0.0	$591.00	$7,813.54	$2,000.00	$5,813.54	9.84	4,659

Measure Description

This measure evaluates replacing existing fixtures containing HID lamps on the building exterior with new high-performance LED light fixtures. This measure saves energy by installing LED sources which use less power than other technologies with a comparable light output.

Maintenance savings are anticipated since LED sources have burn hours which are generally more than twice that of a fluorescent source and more than 10 times incandescent sources. Maintenance savings may be partially offset by the higher material costs associated with LED sources.

During planning and design for the installation of new fixtures, we recommend a holistic approach that considers both the technology of the lighting sources and how they are controlled.

ECM 2: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	101,151	19.5	0.0	$12,921.25	$43,925.78	$7,635.00	$36,290.78	2.81	101,859
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.00	0

Measure Description

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

Maintenance savings are anticipated since LED sources have burn hours which are more than twice that of a fluorescent source and more than 10 times incandescent sources. LED lamps that use the existing fluorescent fixture ballast will be constrained by the remaining hours of the ballast. Maintenance savings may be partially offset by the higher material costs associated with LED sources.

During retrofit planning and design, we recommend a holistic approach that considers both the technology of the lighting sources and how they are controlled.

4.1.2 Lighting Control Measures

Recommended upgrades to lighting control measures are summarized in Figure 17 below.

Figure 17 – Summary of Lighting Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**1,010**	**0.2**	**0.0**	**$129.04**	**$502.00**	**$75.00**	**$427.00**	**3.31**	**1,017**
ECM 3	Install Occupancy Sensor Lighting Controls	1,010	0.2	0.0	$129.04	$502.00	$75.00	$427.00	3.31	1,017

ECM 3: 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)
1,010	0.2	0.0	$129.04	$502.00	$75.00	$427.00	3.31	1,017

Measure Description

Most relevant spaces in the library are already controlled using occupancy sensors. This measure evaluates installing occupancy sensors to control light fixtures that are currently manually controlled in rooms like the play room, storage and staff lounge. Sensors detect occupancy using ultrasonic and/or infrared wave technologies. Lighting systems are enabled when an occupant is detected. Fixtures are automatically turned off after an area has been vacant for a preset period. Occupants will also be able to manually turn off fixtures. Energy savings result from only operating lighting systems when they are required.

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

Maintenance savings are anticipated due to reduced lamp operation however, additional maintenance costs may be incurred because the occupancy sensors may require periodic adjustment; it is anticipated that the net effect on maintenance costs will be negligible.

4.1.3 Variable Frequency Drive Measures

Recommended upgrades to variable frequency drive (VFD) are summarized in Figure 18 below.

Figure 18 – Summary of Variable Frequency Drive 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_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures			**42,754**	**9.9**	**0.0**	**$5,461.42**	**$17,372.10**	**$1,800.00**	**$15,572.10**	**2.85**	**43,053**
ECM 4	Install VFDs on Constant Volume (CV) HVAC	Yes	29,483	8.2	0.0	$3,766.23	$10,820.40	$1,800.00	$9,020.40	2.40	29,689
ECM 5	Install VFDs on Hot Water Pumps	Yes	13,270	1.7	0.0	$1,695.19	$6,551.70	$0.00	$6,551.70	3.86	13,363

ECM 4: Install VFDs on Constant Volume HVAC

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
29,483	8.2	0.0	$3,766.23	$10,820.40	$1,800.00	$9,020.40	2.40	29,689

Measure Description

This measure evaluates installing a variable frequency drive (VFD) to control supply fan motor speed and converting the constant-volume, single-zone air handling system into a variable-air-volume (VAV) system. These are recommended to be installed on the air handler supply fans motors that supply hot and chilled air to the respective spaces in the library. A separate VFD is required to control the return fan motor or dedicated exhaust fan motor if the air handler has one. The zone thermostats will modulate the VFD speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature. Energy savings result from reducing fan speed (and power) when there is a reduced load in the zone. The magnitude of energy savings is based on the amount of time at reduced loads.

VAV systems should not be controlled such that the supply air temperature is raised at the expense of the fan power. A common mistake is to reset the supply air temperature to achieve chiller energy savings, which can lead to additional air flow requirements. Supply air temperature should be kept low, e.g. 55°F, until the minimum fan speed (typically about 50%) is met. At this point, it is efficient to raise the supply air temperature as the load decreases, but not such that additional air flow and thus fan energy is required.

ECM 5: Install VFDs on Hot Water Pumps

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
13,270	1.7	0.0	$1,695.19	$6,551.70	$0.00	$6,551.70	3.86	13,363

Measure Description

This measure evaluates installing a variable frequency drive (VFD) to control the 5 hp hot water pumps supplying the boilers. This measure requires that a majority of the hot water coils be served by 2-way valves and that a differential pressure sensor is installed in the hot water loop. As the hot water valves close, the differential pressure increases. The VFD modulates pump speed to maintain a differential pressure setpoint. Energy savings result from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the amount of time at reduced loads.

4.1.4 Electric Chiller Replacement

Recommended for electric chiller replacements are summarized in Figure 19 below.

Figure 19 - Summary of Electric Chiller Replacement 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_2e Emissions Reduction (lbs)
Electric Chiller Replacement			**100,368**	**49.4**	**0.0**	**$12,821.20**	**$191,966.45**	**$6,750.00**	**$185,216.45**	**14.45**	**101,070**
ECM 6	Install High Efficiency Chillers	Yes	100,368	49.4	0.0	$12,821.20	$191,966.45	$6,750.00	$185,216.45	14.45	101,070

ECM 6: Install High Efficiency Chillers

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)
100,368	49.4	0.0	$12,821.20	$191,966.45	$6,750.00	$185,216.45	14.45	101,070

Measure Description

We recommend replacing older inefficient electric chillers of 225-ton capacity with new high efficiency chillers. The type of chiller to be installed depends on the magnitude of the cooling load and variability of the cooling load profile. Positive displacement chillers are usually under 600-tons of cooling capacity and centrifugal chillers generally start at 150-tons of cooling capacity. Constant speed chillers should be used to meet cooling loads with little or no variation while variable speed chillers are more efficient for variable cooling load profiles. Water cooled chillers are more efficient than air cooled chillers but require cooling towers and additional pumps to circulate the cooling water. In any given size range variable speed chillers tend to have better partial load efficiency, but worse full load efficiency, than constant speed chillers.

The savings result from the improvement in chiller efficiency and matching the right type of chiller to the cooling load. The energy savings associated with this measure is based on the cooling capacity of the new chiller, the improvement in efficiency compared with the base case equipment, the cooling load profile, and the estimated annual operating hours of the chiller before and after the upgrade. Energy savings are maximized by proper selection of new equipment based on the cooling load profile.

4.1.5 HVAC System Improvements

Our recommendations for HVAC system improvements are summarized in Figure 20 below.

Figure 20 - Summary of HVAC System Improvements 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_2e Emissions Reduction (lbs)
HVAC System Improvements			**17,626**	**0.0**	**130.2**	**$3,453.63**	**$2,638.96**	**$0.00**	**$2,638.96**	**0.76**	**32,995**
ECM 7	Install Programmable Thermostats	Yes	17,626	0.0	130.2	$3,453.63	$2,638.96	$0.00	$2,638.96	0.76	32,995

ECM 7: Install Programmable Thermostats

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
17,626	0.0	130.2	$3,453.63	$2,638.96	$0.00	$2,638.96	0.76	32,995

Measure Description

This measure evaluates replacing manual thermostats with programmable thermostats in the private offices on the top floors. Manual thermostats are generally adjusted to a single heating and cooling setpoint and left at that setting regardless of occupancy in the area served by the HVAC equipment. As a result, the same level of heating and cooling is provided regardless of the occupancy in the space. Programmable thermostats can be set to maintain different temperature settings for different times of day and days of the week. By setting the heating temperature setpoint down and the cooling temperature setpoint up, for times that the conditioned space is not occupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures during unoccupied periods.

The thermostat provides savings by reducing heating and cooling energy when a room is unoccupied.

4.1.6 Plug Load Equipment Control - Vending Machine

Our recommendations for plug load equipment controls are summarized in Figure 21 below.

Figure 21 - Summary of Plug Load Equipment 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_2e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending Machine			**1,612**	**0.0**	**0.0**	**$205.90**	**$718.80**	**$0.00**	**$718.80**	**3.49**	**1,623**
ECM 8	Vending Machine Control	Yes	1,612	0.0	0.0	$205.90	$718.80	$0.00	$718.80	3.49	1,623

ECM 8: 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	$205.90	$718.80	$0.00	$718.80	3.49	1,623

Measure Description

The vending machine at the facility operates continuously, even during non-business hours. It is recommended to install occupancy sensor based controls on the refrigerated vending machine located in the staff lounge to reduce the energy use. These controls power down the machine when the surrounding area is vacant, then monitor the surrounding temperature and power up the cooling system at regular intervals to keep the product cool. Savings are a function of the activity level around the vending machine.

4.1.7 Custom Measures

Additional custom measure energy saving opportunities are addressed in this section. Recommended custom measures are summarized in Figure 22 below.

Figure 22 - Summary of Custom 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_2e Emissions Reduction (lbs)
Custom Measures			**61,517**	**21.4**	**444.0**	**$11,972.26**	**$153,000.00**	**$0.00**	**$153,000.00**	**12.78**	**61,947**
ECM 9	Install Building Automation System	Yes	61,517	21.4	444.0	$11,972.26	$153,000.00	$0.00	$153,000.00	12.78	61,947

ECM 9: Install Building Automation System

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)
61,517	21.4	444.0	$11,972.26	$153,000.00	$0.00	$153,000.00	12.78	61,947

Measure Description

HVAC and lighting are the two largest users of energy in commercial building. A significant portion of the HVAC and lighting energy consumed in buildings is wasted because of the lack of controls or the inability to use existing building automation systems (BAS) properly. Much of the waste occurs because of the inability to manage and control buildings efficiently using manual controls such as a thermostat or ON/OFF switches.

A building automation system (BAS) offers benefits in many areas including saving on energy costs, limiting environmental impact and improving building security and safety. Additionally, proper control of outside air provides necessary air changes for occupant comfort and health, minimizes energy costs by space pre-conditioning, allows for free cooling when applicable, and reduces the use of outside air when it is not needed.

It is estimated that a BAS can save between 5% and 20% on utility costs by managing HVAC and lighting systems. A BAS system can monitor every zone of the building and make instant adjustments to maintain comfort while lowering energy usage. Lighting can be reduced in areas of the building that are not occupied which also cuts energy costs.

The energy savings and cost estimates presented above are based on rule of thumb estimates and could vary significantly based on the functionality of the control systems chosen and equipment being controlled. A controls contractor should be consulted to firm up the numbers presented.

5 ENERGY EFFICIENT PRACTICES

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

Reduce Air Leakage

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

Close Doors and Windows

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

Use Window Treatments/Coverings

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

Ensure Lighting Controls Are Operating Properly

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

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.

Assess Chillers & Request Tune-Ups

Chillers are responsible for a substantial portion of a commercial building's overall energy usage. When components of a chiller are not optimized, this can quickly result in a noticeable increase in energy bills. Chiller diagnostics can produce a 5% to 10% cost avoidance potential from discovery and implementation of low/no cost optimization strategies.

Perform Proper Boiler Maintenance

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

Perform Proper Water Heater Maintenance

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

Plug Load Controls

There are a variety of ways to limit the energy use of plug loads including increasing occupant awareness, removing under-utilized equipment, installing hardware controls, and using software controls. Some control steps to take are to enable the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips. For additional information refer to "Plug Load Best Practices Guide" http://www.advancedbuildings.net/plug-load-best-practices-guide-offices.

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).

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.

The facility already has solar PV system installed in the roof with bidirectional meters. There is no scope for the expansion of the current array size as it is installed to maximum capacity of roof area.

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

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

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

6.2 Combined Heat and Power

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

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

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

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

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

7 DEMAND RESPONSE

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

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

Typically, an electric customer needs to be capable of reducing their electric demand, within minutes, by at least 100 kW or more in order to participate in a DR program. Customers with a greater capability to quickly curtail their demand during peak hours will receive higher payments. Customers with 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 program often find it to be a valuable source of revenue for their facility because the payments can significantly offset annual utility costs.

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

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

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

In our assessment this facility 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 23 for a list of the eligible programs identified for each recommended ECM.

Figure 23 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install
ECM 1	Install LED Fixtures	x		x
ECM 2	Retrofit Fixtures with LED Lamps	x		x
ECM 3	Install Occupancy Sensor Lighting Controls	x		x
ECM 4	Install VFDs on Constant Volume (CV) HVAC	x		x
ECM 5	Install VFDs on Hot Water Pumps		x	x
ECM 6	Install High Efficiency Chillers	x		x
ECM 7	Install Programmable Thermostats		x	x
ECM 8	Vending Machine Control			x
ECM 9	Install Building Automation System		x	

SmartStart is generally well suited for implementation of individual or small sets of measures, with the flexibility to install projects at your own pace using in-house staff or a preferred contractor. Direct Install caters to small to mid-size facilities to bundle measures and simplify participation, but requires the use of pre-approved contractors.

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

Brief descriptions of all relevant alternative financing and incentive programs are located in the sections below. You may also check the following website for further information, including most current program availability, requirements, and incentive levels: 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 SmartStart custom program provides incentives for new and innovative technologies, or process improvements not defined through one of the prescriptive incentives listed above.

Although your facility is an existing building, and only the prescriptive incentives have been applied in the calculations, the SmartStart custom measure path is recommended for ECM 5 (Install VFDs on Hot Water Pumps). These incentives are calculated utilizing a number of factors, including project cost, energy savings and comparison to existing conditions or a defined standard. To qualify, the proposed measure(s) must be at least 2% more efficient than current energy code or recognized industry standard, and save at least 75,000 kWh or 1,500 therms annually.

SmartStart 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 in the SmartStart program (inclusive of prescriptive and custom) 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 prescriptive program you will need to submit an application for the specific equipment installed or 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. Please note that SmartStart custom application requirements are different from the prescriptive applications and will most likely require additional effort to complete.

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 mid-sized facilities with a peak electric demand that did not exceed 200 kW in any of the preceding 12 months. You will work directly with a pre-approved contractor who will perform a free energy assessment at your facility, identify specific eligible measures, and install those 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 county where your facility is located; a complete list is provided on the Direct Install website identified below. The contractor will be paid the program incentive directly 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 mentioned above, and the remaining 30% of the cost is your responsibility to the contractor.

Since Direct Install offers a free assessment, LGEA applicants that do not meet the audit program eligibility requirements, but do meet the Direct Install requirements, may be moved directly into this program.

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

8.3 Energy Savings Improvement Program

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

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

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

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

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

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

9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

9.1 Retail Electric Supply Options

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

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

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

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

9.2 Retail Natural Gas Supply Options

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

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

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

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

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Level 1 - Book circle office	48	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	48	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	1.29	4,952	0.0	$632.53	$2,808.00	$480.00	3.68
Level 1 - Book circle office	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.01	50	0.0	$6.39	$48.20	$10.00	5.98
Level 1 - Bathroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.01	71	0.0	$9.13	$48.20	$10.00	4.19
Main Library Area	129	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	3,952	Relamp	No	129	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,952	5.20	28,516	0.0	$3,642.70	$9,700.80	$1,935.00	2.13
Wall hanging fixtures in the reception area	4	Compact Fluorescent: Wall hanging fixture - 4 lamps	Wall Switch	26	3,952	Relamp	No	4	LED Screw-In Lamps: 4 Lamps	Wall Switch	8	3,952	0.06	322	0.0	$41.07	$430.02	$0.00	10.47
Rack lights	177	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	3,952	Relamp	No	177	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	3,952	2.52	13,833	0.0	$1,767.01	$6,354.30	$885.00	3.10
Rack lights	17	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	22	3,952	Relamp	No	17	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	3,952	0.19	1,025	0.0	$130.92	$542.30	$85.00	3.49
Playroom	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.41	2,235	0.0	$285.46	$972.00	$155.00	2.86
Women's room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.05	206	0.0	$26.36	$117.00	$20.00	3.68
Women's room	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.03	143	0.0	$18.25	$96.40	$20.00	4.19
Men's room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.05	206	0.0	$26.36	$117.00	$20.00	3.68
Men's room	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.01	71	0.0	$9.13	$48.20	$10.00	4.19
Entrance	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.11	589	0.0	$75.30	$234.00	$40.00	2.58
Level 2 - Hallway	7	Linear Fluorescent - T8: 2' T8 (17W) - 3L	Wall Switch	53	3,952	Relamp	No	7	LED - Linear Tubes: (3) 2' Lamps	Wall Switch	26	3,952	0.16	860	0.0	$109.81	$431.90	$105.00	2.98
Level 2 - Meeting room	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.03	143	0.0	$18.25	$96.40	$20.00	4.19
Storage	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.03	100	0.0	$12.78	$96.40	$20.00	5.98
Book keeper	3	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.04	150	0.0	$19.17	$144.60	$30.00	5.98
Office	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.03	100	0.0	$12.78	$96.40	$20.00	5.98
Office	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.05	200	0.0	$25.56	$192.80	$40.00	5.98
Office	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.05	200	0.0	$25.56	$192.80	$40.00	5.98
Office	5	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	5	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.07	250	0.0	$31.95	$241.00	$50.00	5.98
Secretary Director	11	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	11	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.14	550	0.0	$70.28	$530.20	$110.00	5.98
Hallway - Admin office	18	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	18	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.23	900	0.0	$115.01	$867.60	$180.00	5.98
Director's office	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.27	1,032	0.0	$131.78	$585.00	$100.00	3.68
Director's office	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.03	100	0.0	$12.78	$96.40	$20.00	5.98

	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
Bathroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.01	71	0.0	$9.13	$48.20	$10.00	4.19
Breakroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.05	206	0.0	$26.36	$117.00	$20.00	3.68
BAthroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.01	71	0.0	$9.13	$48.20	$10.00	4.19
Book examination center	13	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	13	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.35	1,916	0.0	$244.73	$760.50	$130.00	2.58
Floor 3 - Mechanical Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.11	589	0.0	$75.30	$234.00	$40.00	2.58
Stairwell	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.19	1,032	0.0	$131.78	$409.50	$70.00	2.58
Level 0 - Hallway	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	12	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.32	1,768	0.0	$225.90	$702.00	$120.00	2.58
Level 0 - Hallway	3	Compact Fluorescent: Recessed fixture - 2 lamps	Wall Switch	36	3,952	Relamp	No	3	LED Screw-In Lamps: 2 lamps	Wall Switch	8	3,952	0.07	375	0.0	$47.92	$322.52	$0.00	6.73
Women's room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.05	206	0.0	$26.36	$117.00	$20.00	3.68
Women's room	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.03	143	0.0	$18.25	$96.40	$20.00	4.19
Men's room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.05	206	0.0	$26.36	$117.00	$20.00	3.68
Men's room	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.01	71	0.0	$9.13	$48.20	$10.00	4.19
Kid's Library	64	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	64	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	1.72	9,432	0.0	$1,204.82	$3,744.00	$640.00	2.58
Kid's Library	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	4	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.05	286	0.0	$36.51	$192.80	$40.00	4.19
Kid's Library	5	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	22	3,952	Relamp	No	5	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	3,952	0.05	301	0.0	$38.51	$159.50	$25.00	3.49
Pantry	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.24	928	0.0	$118.60	$526.50	$90.00	3.68
Meeting room B	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	20	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.54	2,947	0.0	$376.51	$1,170.00	$200.00	2.58
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.03	147	0.0	$18.83	$58.50	$10.00	2.58
Hallway	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.11	589	0.0	$75.30	$234.00	$40.00	2.58
Offices	73	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	73	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	1.96	10,758	0.0	$1,374.25	$4,270.50	$730.00	2.58
Back office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.11	413	0.0	$52.71	$234.00	$40.00	3.68
Hallway office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.05	295	0.0	$37.65	$117.00	$20.00	2.58
Garage	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.43	2,358	0.0	$301.21	$936.00	$160.00	2.58
Hallway	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.13	737	0.0	$94.13	$292.50	$50.00	2.58
Bathroom	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.03	143	0.0	$18.25	$96.40	$20.00	4.19

	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
Office	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.48	1,857	0.0	$237.20	$1,053.00	$180.00	3.68
Hallway	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.24	1,326	0.0	$169.43	$526.50	$90.00	2.58
Records	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	2,766	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.16	619	0.0	$79.07	$351.00	$60.00	3.68
Office	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	12	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.32	1,768	0.0	$225.90	$702.00	$120.00	2.58
Men's room	3	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.04	150	0.0	$19.17	$144.60	$30.00	5.98
Janitor closet	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	3,952	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	3,952	0.01	71	0.0	$9.13	$48.20	$10.00	4.19
Women's room	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	2,766	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	2,766	0.03	100	0.0	$12.78	$96.40	$20.00	5.98
Hallway	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.05	295	0.0	$37.65	$117.00	$20.00	2.58
Hallway	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,952	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,952	0.05	250	0.0	$31.95	$95.13	$20.00	2.35
Stairwell	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,952	0.11	589	0.0	$75.30	$234.00	$40.00	2.58
Staff lounge	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,952	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,766	0.36	1,967	0.0	$251.23	$686.80	$140.00	2.18
Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,952	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,766	0.07	372	0.0	$47.58	$233.00	$40.00	4.06
Exterior	4	High-Pressure Sodium: (1) 200W Lamp	Wall Switch	250	3,952	Fixture Replacement	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	135	3,952	0.37	2,054	0.0	$262.41	$1,562.71	$400.00	4.43
Exterior	16	Mercury Vapor: (1) 100W Lamp	Wall Switch	125	3,952	Fixture Replacement	No	16	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	89	3,952	0.47	2,572	0.0	$328.59	$6,250.83	$1,600.00	14.15

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
Boiler Room	Other	1	Other	1.5	86.5%	No	2,745	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Boilers	1	Heating Hot Water Pump	5.0	89.5%	No	2,745	No	89.5%	Yes	1	0.84	6,635	0.0	$847.60	$3,275.85	$0.00	3.86
Boiler Room	Boilers	1	Heating Hot Water Pump	5.0	89.5%	No	2,745	No	89.5%	Yes	1	0.84	6,635	0.0	$847.60	$3,275.85	$0.00	3.86
Boiler Room	Chiller	2	Chilled Water Pump	15.0	92.4%	Yes	3,391	No	92.4%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
AHU (roof and other rooms)	AHU	3	Supply Fan	7.5	91.7%	No	3,391	No	91.7%	Yes	3	8.20	29,483	0.0	$3,766.23	$10,820.40	$1,800.00	2.40

Electric Chiller Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Chiller Quantity	System Type	Cooling Capacity per Unit (Tons)	Install High Efficiency Chillers?	Chiller Quantity	System Type	Constant/ Variable Speed	Cooling Capacity (Tons)	Full Load Efficiency (kW/Ton)	IPLV Efficiency (kW/Ton)	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	Main Library	1	Water-Cooled Centrifugal Chiller	225.00	Yes	1	Water-Cooled Centrifugal Chiller	Variable	225.00	0.64	0.39	49.45	100,368	0.0	$12,821.20	$191,966.45	$6,750.00	14.45

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler room	Main Library	2	Condensing Hot Water Boiler	1,880.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Programmable Thermostat Recommendations

		Recommendation Inputs				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	Thermostat Quantity	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Multiple Zones	Main Library	8	225.00		2,000.00	0.00	17,626	130.2	$3,453.63	$2,638.96	$0.00	0.76

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Sinks and restrooms	1	Storage Tank Water Heater (> 50 Gal)	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?
Main Library	85	Computer	150.0	Yes
Main Library	21	Printer - Small	20.0	Yes
Main Library	8	Printer - Big	200.0	Yes
Main Library	1	Paper shredder	150.0	Yes
Main Library	7	Microwave	1,000.0	No
Main Library	2	Refrigerator - medium	40.0	Yes
Main Library	4	Refrigerator - large	218.0	Yes
Main Library	7	Coffee machine	900.0	Yes
Main Library	1	Toaster	850.0	Yes
Main Library	1	Toaster oven	1,200.0	Yes
Main Library	6	Kettle	1,200.0	Yes

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
Main Library	1	Refrigerated	Yes	0.00	1,612	0.0	$205.90	$718.80	$0.00	3.49

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]

Main Library

Primary Property Type: Library
Gross Floor Area (ft²): 52,000
Built: 1974

For Year Ending: July 31, 2017
Date Generated: September 15, 2017

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Main Library 1 George Frederick Plaza Woodbridge, New Jersey 07095	_____ , (___)___-_____	___ _____ , (___)___-_____ _____

Property ID: 5880904

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
108.4 kBtu/ft²

Source EUI
229.1 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	2,212,240 (39%)
Electric - Solar (kBtu)	541,078 (10%)
Electric - Grid (kBtu)	2,881,649 (51%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	111.5
National Median Source EUI (kBtu/ft²)	235.6
% Diff from National Median Source EUI	-3%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	437

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)