Local Government Energy Audit:
Energy Audit Report

***Library** (#3)*

Ocean County College

1 College Drive

Toms River, New Jersey 08754

October 18, 2018

Final Report by:

TRC Energy Services

Disclaimer

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

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

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

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

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1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Library, Building Three, at Ocean County College.

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

This study was conducted by TRC Energy Services (TRC), as part of a comprehensive effort to assist local governments and public facilities with controlling their energy costs and help protect our environment by increasing energy efficiency statewide.

1.1 Facility Summary

The Library at Ocean County College is a 59,923-square foot brick building. It was built in 1966 and renovated in 1992. It has three (3) floors. The lower level contains the Center for Academic Services and other administrative offices. There are also a few classrooms and a testing center there. The first and second floors contains library offices and the main library area. On the third floor is reading room and a mechanical room. The building has a tall clock tower above the reading room at the southern corner of the building.

Lighting at the Library consists mostly of 4-ft linear fluorescent and 2-ft U-Bend fixtures, and there are also many compact fluorescent (CFL) recessed cans and wall sconces throughout the building. The ceiling lighting fixtures in the Tower Reading Room were recently retrofitted with LEDs. Metal halide and CFL fixtures light the exterior.

Heat to the building is provided by a campus-wide hot water distribution loop. Three (3) McQuay air handling units distribute conditioned air throughout the building. Hot water is generated at the CHP building. The Library is supplied with cooling from a 180-ton water-cooled Trane chiller on-site.

Electric power is distributed to the Library (and other campus buildings) from the CHP building. The electric power distributed to campus buildings from the CHP building comes from JCP&L and by a 1.1-MW Waukesha reciprocating engine CHP system. The Library has no separate utility accounts for electric or gas service. Heating hot water usage is not metered at the building level. New E-mon electric submeters were added to campus buildings.

A thorough description of the building and all major equipment can be found in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC recommends eight (8) energy conservation measures that together represent an opportunity to reduce its annual energy costs for the Library by $32,963.56 and its greenhouse gas emissions by 202,684 lbs CO_2e per year. We estimate that if all measures are implemented as recommended, then the project would likely pay for itself in energy savings alone in about 3.5 years. The estimated breakdown of existing utility costs for the building is shown in Figure 1. The estimated cost savings, following project implementation, is shown in Figure 2. Together these measures represent an opportunity to reduce the Library's total energy usage by about 8% overall.

Please Note: While the building has no utility natural gas service, the heat provided to the building comes from gas-fired boilers and a combined heat and power (CHP) system at the CHP building (which is supplied by New Jersey Natural Gas). The campus CHP system also provides some portion of the power used by the Library. For this study, we estimated the portion of each utility service supplied to CHP Building that is ultimately used by each campus building in the form of thermal energy or electric power. We assigned associated costs from main utility accounts to each campus building, based on estimates of end-usage. In this way, energy costs and estimated savings for recommended ECMs could be attributed to each building.

Figure 1 – Previous 12 Month Utility Costs

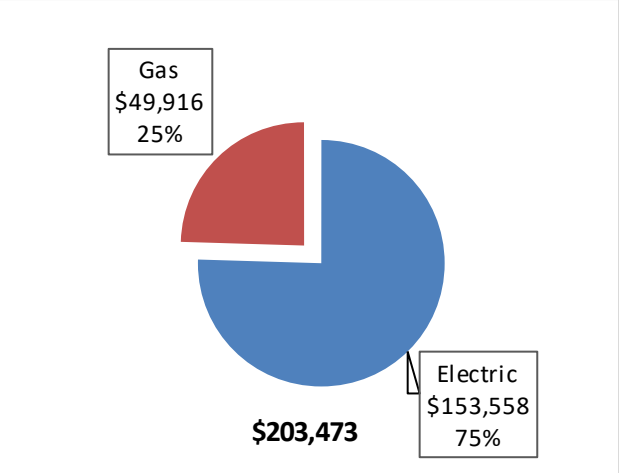
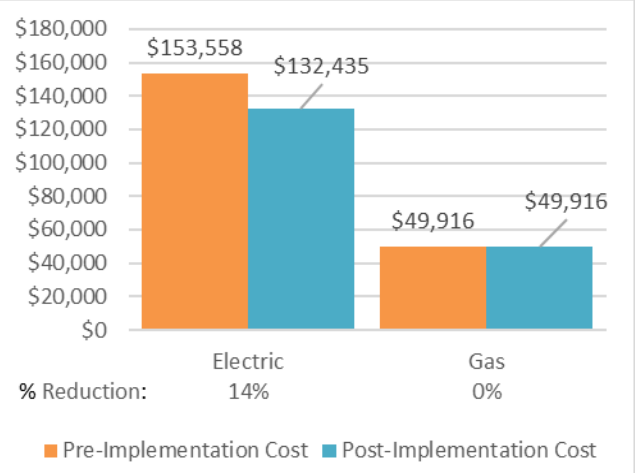


Figure 2 – Potential Post-Implementation Costs



A detailed description of Library's existing energy use can be found in Section 3. Estimates of the total cost, energy savings, and financial incentives for the proposed energy efficient upgrades are summarized below in Figure 3.

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			111,280	18.8	0.0	$18,224.61	$88,711.73	$5,965.00	$82,746.73	4.5	112,058
ECM 1	Install LED Fixtures	Yes	25,747	3.6	0.0	$4,216.57	$16,541.13	$100.00	$16,441.13	3.9	25,927
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and	Yes	81,582	14.7	0.0	$13,360.83	$70,653.85	$5,850.00	$64,803.85	4.9	82,152
ECM 3	Retrofit Fixtures with LED Lamps	Yes	3,952	0.5	0.0	$647.22	$1,516.75	$15.00	$1,501.75	2.3	3,980
Lighting Control Measures			1,868	0.2	0.0	$305.89	$1,412.00	$585.00	$827.00	2.7	1,881
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	1,868	0.2	0.0	$305.89	$1,412.00	$585.00	$827.00	2.7	1,881
Motor Upgrades			8,538	1.6	0.0	$1,398.36	$14,350.26	$0.00	$14,350.26	10.3	8,598
ECM 5	Premium Efficiency Motors	Yes	8,538	1.6	0.0	$1,398.36	$14,350.26	$0.00	$14,350.26	10.3	8,598
Variable Frequency Drive (VFD) Measures			74,070	4.9	0.0	$12,130.58	$16,940.60	$0.00	$16,940.60	1.4	74,588
ECM 6	Install VFDs on Chilled Water Pumps	Yes	64,117	3.6	0.0	$10,500.58	$10,388.90	$0.00	$10,388.90	1.0	64,565
ECM 7	Install VFDs on Hot Water Pumps	Yes	9,953	1.3	0.0	$1,630.00	$6,551.70	$0.00	$6,551.70	4.0	10,022
Plug Load Equipment Control - Vending Machine			5,521	0.0	0.0	$904.11	$1,150.00	$0.00	$1,150.00	1.3	5,559
ECM 8	Vending Machine Control	Yes	5,521	0.0	0.0	$904.11	$1,150.00	$0.00	$1,150.00	1.3	5,559
TOTALS			201,277	25.5	0.0	$32,963.56	$122,564.59	$6,550.00	$116,014.59	3.5	202,684

* - 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).

A description of each measure category is provided below. For a more thorough description of each proposed ECM see Section 4.

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

Lighting Controls measures generally involve the installation of automated controls to turn off lights or reduce light output when not needed. Automated control reduces reliance on occupant behavior for adjusting lights. These measures save energy by reducing the amount of time lights are on.

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

Variable Frequency Drives (VFDs) are motor control devices. These measures control the speed of a motor so that the motor spins at peak efficiency during partial load conditions. Sensors adapt the speed to flow, temperature, or pressure settings which is much more efficient that usage a valve or damper to control flow rates or running the motor at full speed when only partial power is needed. These measures save energy by controlling motor usage more efficiently.

Plug Load Equipment control measures generally involve installing automated devices that limit the power usage or operation of equipment that is plugged into an electric outlet when not in use.

Energy Efficient Practices

TRC also identified six (6) low cost or no cost energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral or operational adjustments and by performing better routine maintenance on building systems. These practices can extend equipment lifetime, improve occupant comfort, provide better health and safety, as well as reduce annual energy and O&M costs. Potential opportunities identified at Library include:

- Close Doors and Windows
- Ensure Lighting Controls Are Operating Properly
- Perform Routine Motor Maintenance
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Assess Chillers & Request Tune-Ups
- Install Plug Load Controls

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

On-Site Generation Measures

TRC evaluated the potential for installing for rooftop solar photovoltaic (PV) generation for Library and other campus buildings. Based on the configuration of the site and its electric loads, we believe that there may be potential for installing cost-effective solar power generation on campus. The campus already has a large combined heat and power (CHP) power generation which provides a significant portion of the campus' power needs.

For details on our evaluation of on-site solar power generation potential, please see Section 6.

1.3 Implementation Planning

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

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

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

- SmartStart
- Pay for Performance (P4P)
- SREC (Solar Renewable Energy Certificate) Registration Program (SRP)

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

Larger facilities with an interest in a more comprehensive whole building approach to energy conservation should consider participating in the Pay for Performance (P4P) program. Projects eligible for this project program must meet minimum savings requirements. Final incentives are calculated based on actual measured performance achieved at the end of the project. The application process is more involved, and it requires working with a qualified P4P contractor, but the process may result in greater energy savings overall and more lucrative incentives, up to 50% of project's total cost.

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the Energy Savings Improvement Program (ESIP). Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. An LGEA report (or other approved energy audit) is required for participation in ESIP. Please refer to Section 8.4 for additional information on the ESIP Program.

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

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

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 4 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
James Calamia	Director of Facilities	jcalamia@ocean.edu	732-255-0400 x-2066
Lenny Mannino	Assoc Dir of Bldg Maint	lmannino@ocean.edu	732-255-0410
TRC Energy Services			
Tom Page	Auditor	tpage@TRCsolutions.com	(732) 855-0033

2.2 General Site Information

On June 08, 2016, TRC conducted an energy audit of the Library and other campus buildings at Ocean County College in Toms River, New Jersey. TRC met with James Calamia and Lenny Mannino to review the facility operations and help focus our investigation on specific energy-using systems.

The Library at Ocean County College is a 59,923-square foot brick building. It was built in 1966 and renovated in 1995. It has three floors. The lower level contains the Center for Academic Services and other administrative offices. There are also a few classrooms and a testing center there. The first and second floors contains library offices and the main library area. On the third floor is reading room and a mechanical room. The building has a tall clock tower above the reading room at the southern corner of the building.

2.3 Building Occupancy

The building is staffed year-round by approximately 100 staff and Ocean County College students on weekdays from 7:00 AM to 10:00 PM and from 9:00 AM to 6:00 PM on weekends.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Library	Weekday	7AM - 10PM
Library	Weekend	9AM - 6PM

2.4 Building Envelope

The building is constructed primarily of concrete masonry block with brick façade. The roof was covered with a thermoplastic membrane, which appeared to be in good shape. The building has aluminum framed, double-paned windows and glass doors throughout. All door and window seals appeared to be tight. No excessive air infiltration was noted.

Figure 6: South Corner of Library Exterior

2.5 On-Site Generation

The campus has a Waukesha gas-fired, 1.1-MW, reciprocating-engines combined heat and power (CHP) system at the CHP Building (#21). The CHP plant generates a significant portion of the power used by the Library and other central campus buildings.

2.6 Energy-Using Systems

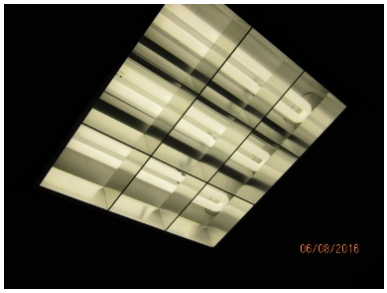
Please see Appendix A: Equipment Inventory & Recommendations for an inventory of the building's equipment and our recommendations for upgrades to building lighting fixtures and controls.

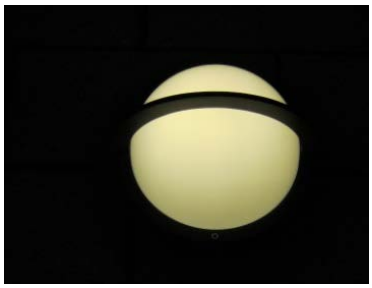
Lighting System

Lighting at Library consists mostly of 4-foot linear fluorescent and 2-foot U-Bend fixtures. There are also many compact fluorescent (CFL) recessed cans and wall sconces throughout the building. Metal halide and CFL fixtures light the exterior. The ceiling lighting fixtures in the Tower Reading Room were recently retrofitted with LEDs. We recommend upgrading all interior and exterior lighting at the Library to LEDs. Estimates of costs and savings are provided in Section 4.

In most cases, we estimated the costs and savings for a replacement LED tube or new fixtures that matches the existing light levels. However, lighting levels in parts of the main library, particularly near the front area, appeared to be higher than necessary for those spaces. Lighting levels were measured at over 80 foot-candles (FC), though 20-50 FC is recommended for most libraries. Additional savings, beyond what we have estimated, might be possible by reducing overall lighting levels in this and other areas. The College should work with lighting contractors to verify lighting levels and choose the most appropriate lighting for each space in order to maximize energy savings and meet the needs of building occupants. Most interior spaces already have occupancy sensors to control lighting, although a few areas remain where sensors could be cost-effectively installed for additional energy savings.

Figure 7- Lighting Fixtures at the Library



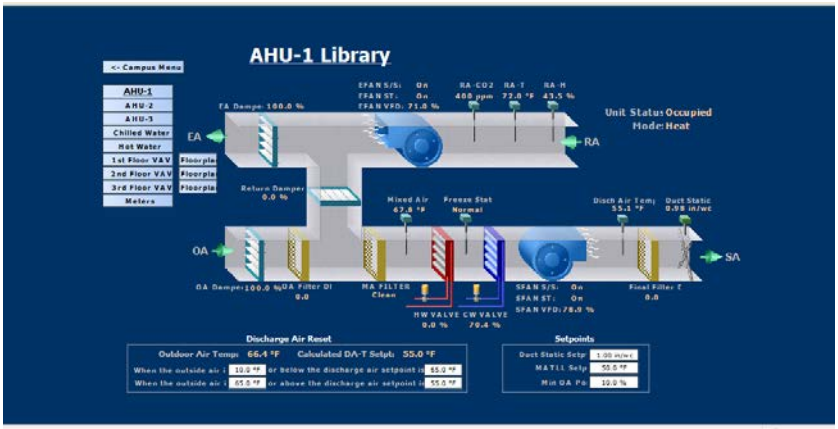


Hot and Chilled Water HVAC System

The building has a 180-ton water-cooled screw-type Trane chiller (model # RTHDUB1FCH0UAB1A2) and along with a BAC cooling tower on the rooftop, which has a 20-HP fan that is controlled by a variable frequency drive (VFD).

All heating is provided to the Library by the CHP Building. Hot water generated at the CHP Building is distributed to the Library and ten (10) other campus buildings via thermal distribution loop. Hot water is generated at the CHP Building by a high efficiency gas-fired AERCO BMK-6000 boiler system. A gas-fired Waukesha reciprocating engine CHP system at the CHP Building also provides heat to the thermal distribution system and provides some of the power used by the Library and other campus buildings that receive power through the college's main electric account.

Figure 8-Schematics Showing Library AHUs



Hot and chilled water is supplies to (3) McQuay air handling units (AHUs), which distribute conditioned air throughout the building. The Library's hot water and chilled water pump distribute heated and chilled water to 57 heating/cooling coils, located above the ceiling in each room.

The chiller, cooling tower, and AHUs all appeared to be in good condition and are operating efficiently.

The supply and return air fans are on variable frequency drive (VFD) controls to reduce their electric demand. The chilled water pumps are also controlled by VFDs. The heating hot water (HHW) and condenser water pump motors run at constant speeds.

Figure 9 - Chilled Water Pumps

Domestic Hot Water Heating System

The building has a minimal demand for domestic hot water. Domestic hot water is provided by one (1) 30-gallon A.O. Smith hot water heaters (model: ECL30). The equipment appeared to be in good condition. No domestic hot water upgrades are recommended at this time.

Building Plug Load

The building has approximately 100 computers and monitors that are used daily, plus servers, and some larger photocopiers and printers. The computers, monitors, and printers seemed to be all recent models designed with power with management software to power them when the sit idle for more than a few minutes.

Devices or software to manage power usage of plug load equipment as it sits idle can save a lot of energy over the long term. We recommend adding Vending Miser™ power management equipment to (3) drink and (2) snack vending machines (located to the left of the front entrance) to power them down when the building is unoccupied.

2.7 Water-Using Systems

The building's restrooms contain modern water-conserving low-flow fixtures for all sinks, toilets, and urinals.

3 SITE ENERGY USE AND COSTS

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

3.1 Total Cost of Energy

The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. Sub-meter data was not available for a full 12-month period. So, we had to use our best estimate of consumption for each building to divide up the energy purchases through the mater electric and gas accounts.

Annual electric usage for each building on the main account was estimated from the partial year submeter data that was available. Thermal load for each building on the central heating and cooling loops was apportioned according to building square footage. These estimates were complicated by the fact that the amount of electricity produced by the Central Plant's CHP system could not be determined precisely for the billing period for which we had utility bills and we only had a few months of electric submeter data. So, our usage estimates may vary from current actual energy usage for some campus buildings supplied by master metered electric and gas accounts.

Please Note: Though the building has no utility natural gas service, the heat provided to the building comes from gas-fired boilers. A portion of the heat and power used at the Library also comes from the combined heat and power system at the CHP Building. For this study, we estimated the portion of gas service to the CHP Building that is supplied to the Library as heat and/or electric power and the associated costs for that gas service. The Library receives all electricity and heat from the campus' main electric and gas accounts.

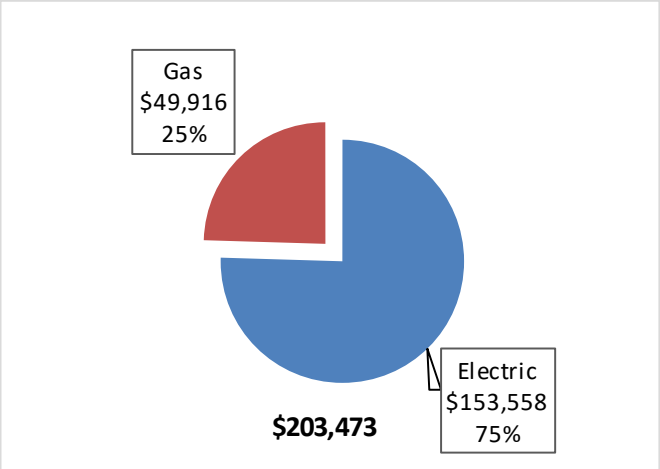
On the next page is our estimate of the Library's portion of end-use energy consumption and the utility costs associated with usage.

Figure 10 - Utility Summary

Utility Summary for Library		
Fuel	Usage	Cost
Electricity	937,629 kWh	$153,558
Natural Gas	56,564 Therms	$49,916
Total		$203,473

The estimated annual energy cost for this facility is $203,473 as shown in the chart below.

Figure 11 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by JCP&L via the campus' main electric account and by a gas-fired combined heat and power system at CHP Building. Power is distributed from the CHP Building to the Library. The average electric rate for a recent 12-month period for electric service to the main account was found to be $0.164/kWh. This is a blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 12 - Electric Usage & Demand

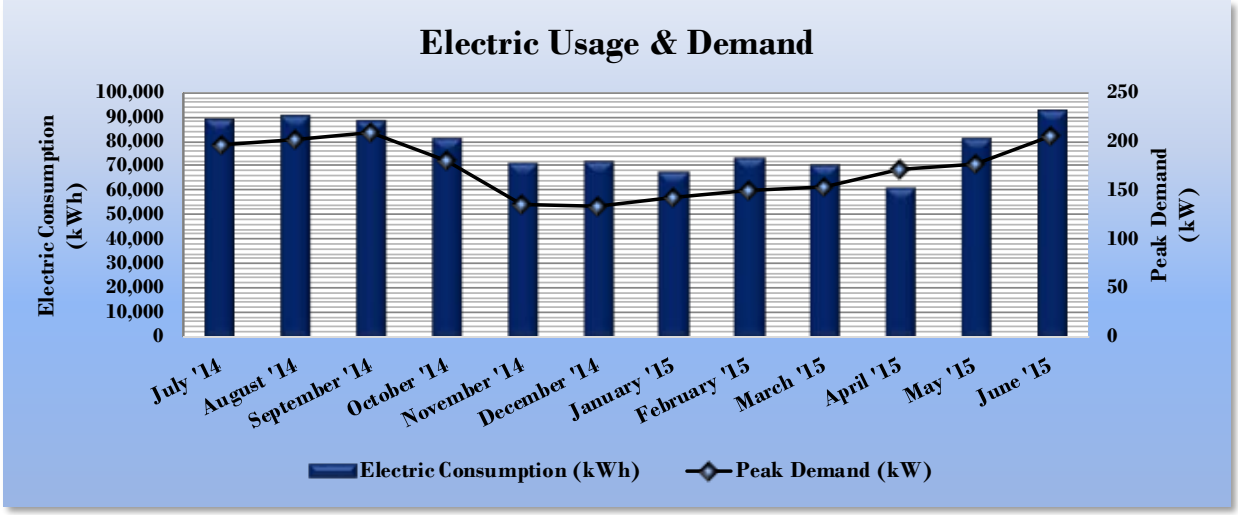


Figure 13 - Electric Usage & Demand

Electric Billing Data for Library					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost	TRC Estimated Usage?
8/6/2014	31	89,031.7	196	$10,293	Yes
9/5/2014	29	91,067.6	202	$14,056	Yes
10/3/2014	29	88,949.2	209	$14,417	Yes
11/4/2014	32	81,630.4	180	$13,942	Yes
12/5/2014	31	71,252.6	136	$12,514	Yes
1/6/2015	32	72,270.8	134	$11,970	Yes
2/5/2015	30	68,101.5	142	$12,497	Yes
3/6/2015	29	73,789.9	150	$17,223	Yes
4/7/2015	32	70,648.8	153	$11,170	Yes
5/7/2015	30	61,644.1	172	$10,265	Yes
6/8/2015	32	81,259.8	176	$13,074	Yes
7/8/2015	30	93,120.6	205	$12,979	Yes
Totals	367	942,767	209	$154,399	12
Annual	365	937,629	209	$153,558	

3.3 Natural Gas Usage

Natural gas is provided by NJ Natural Gas. It is supplied to the boilers and the CHP system at the Central Plant. The gas fires the main boilers there and distributes hot water to 11 campus buildings, including the Library. Gas from the main account is also used to generate a portion of the campus' electric supply via the Plant's CHP system (and to provide chilled water via an absorption chiller to other campus buildings). This makes it very difficult to assign a final end-use gas consumption accurately for each building. From the main gas account, we determined the average gas rate for a recent 12-month billing period was found to be $0.882/therm. We estimated the portion of gas from the main account that is used by the Library and assigned those costs to that building. This is the blended rate used throughout the analyses in this report. Estimated monthly gas consumption for the building is shown in the chart below.

Figure 14 - Natural Gas Usage

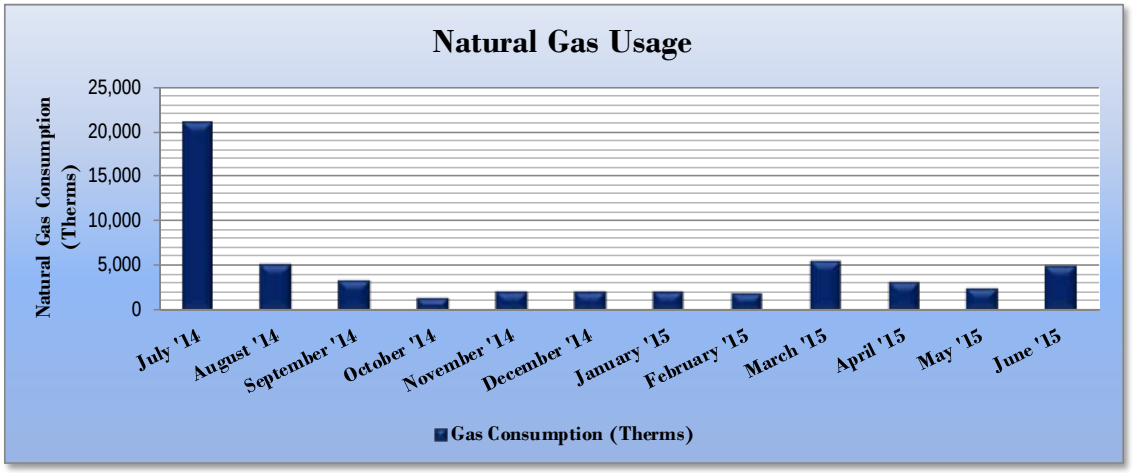


Figure 15 - Natural Gas Usage

Gas Billing Data for Library				
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost	TRC Estimated Usage?
8/1/2014	31	21,075.5	$18,598.22	Yes
9/1/2014	31	5,221.4	$4,607.68	Yes
10/1/2014	30	3,438.1	$3,033.95	Yes
11/1/2014	31	1,545.8	$1,364.09	Yes
12/1/2014	30	2,180.3	$1,924.01	Yes
1/1/2015	31	2,180.3	$1,924.01	Yes
2/1/2015	31	2,180.3	$1,924.01	Yes
3/1/2015	28	2,073.5	$1,829.77	Yes
4/1/15	31	5,687.2	$5,018.72	Yes
5/1/15	30	3,285.7	$2,899.44	Yes
6/1/15	31	2,522.0	$2,225.59	Yes
7/1/15	30	5,174.3	$4,566.04	Yes
Totals	365	56,564	$49,916	12
Annual	365	56,564	$49,916	

3.4 Benchmarking

This facility was benchmarked using *Portfolio Manager®*, an online tool created and managed by the United States Environmental Protection Agency (EPA) through the ENERGY STAR® program. Portfolio Manager® analyzes your building's consumption data, cost information, and operational use details and then compares its performance against a national median for similar buildings of its type. Metrics provided by this analysis are Energy Use Intensity (EUI) and an ENERGY STAR® score for select building types.

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 can be used to indicate whether that building uses more or less energy than similar buildings of its type on a square foot basis. EUI is presented in terms of "site energy" and "source energy." Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

Due to the many uncertainties regarding electric and gas end-usage for buildings on master metered accounts (as discussed in Sections 3.2 and 3.3 above), we have provided a combined benchmarking (in kBTU/sq-ft) for all campus buildings that are served by master electric and gas accounts.

Figure 16 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Library	National Median Building Type: Library
Source Energy Use Intensity (kBtu/ft^2)	266.8	235.6
Site Energy Use Intensity (kBtu/ft^2)	147.8	91.6

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

Figure 17 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Library	National Median Building Type: Library
Source Energy Use Intensity (kBtu/ft^2)	217.9	235.6
Site Energy Use Intensity (kBtu/ft^2)	132.2	91.6

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

Because final end-usage of energy could not be precisely apportioned for each building, we have provided a combined benchmarking score for the whole campus. While this does not qualify is not eligible for an ENERGY STAR® score, it may be useful to compare this average campus score to EUI scores available for similar college campuses.

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

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

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

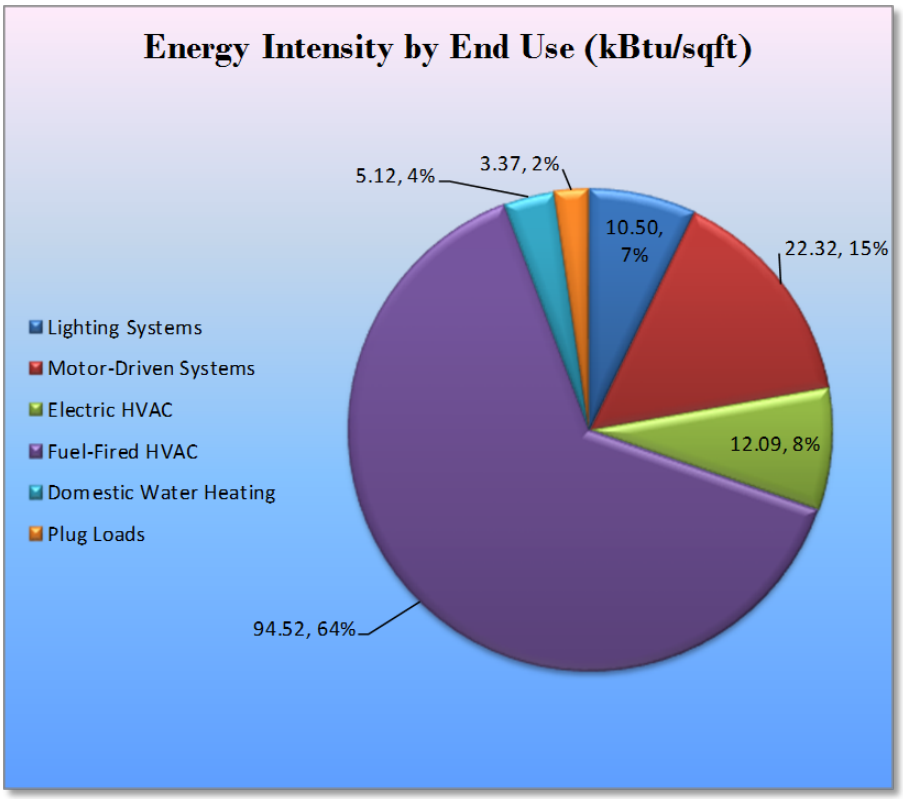
3.5 Energy End-Use Breakdown

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

This breakdown of energy usage is based on both our estimates of the Library's shares of the total electric and gas loads as well as number and sizes of energy-using equipment on site. The relative share of gas usage appears to be a bit high in the pie chart below, but that result is uncertain. The relatively higher share for gas usage might be partly due to assumptions that we made when dividing up energy usage by building for the mater electric and gas accounts.

TRC recommends to installing electric submeters for all buildings and also metering the hot and chilled water flow to each building to better sharpen the view of relative energy demand between one campus building and another.

Figure 18 - Energy Balance (kBtu/ft² & %)



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 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 recommended measures.

4.1 Recommended ECMs

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

Figure 19 – Summary of Recommended ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		111,280	18.8	0.0	$18,224.61	$88,711.73	$5,965.00	$82,746.73	4.5	112,058
ECM 1	Install LED Fixtures	25,747	3.6	0.0	$4,216.57	$16,541.13	$100.00	$16,441.13	3.9	25,927
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and	81,582	14.7	0.0	$13,360.83	$70,653.85	$5,850.00	$64,803.85	4.9	82,152
ECM 3	Retrofit Fixtures with LED Lamps	3,952	0.5	0.0	$647.22	$1,516.75	$15.00	$1,501.75	2.3	3,980
Lighting Control Measures		1,868	0.2	0.0	$305.89	$1,412.00	$585.00	$827.00	2.7	1,881
ECM 4	Install Occupancy Sensor Lighting Controls	1,868	0.2	0.0	$305.89	$1,412.00	$585.00	$827.00	2.7	1,881
Motor Upgrades		8,538	1.6	0.0	$1,398.36	$14,350.26	$0.00	$14,350.26	10.3	8,598
ECM 5	Premium Efficiency Motors	8,538	1.6	0.0	$1,398.36	$14,350.26	$0.00	$14,350.26	10.3	8,598
Variable Frequency Drive (VFD) Measures		74,070	4.9	0.0	$12,130.58	$16,940.60	$0.00	$16,940.60	1.4	74,588
ECM 6	Install VFDs on Chilled Water Pumps	64,117	3.6	0.0	$10,500.58	$10,388.90	$0.00	$10,388.90	1.0	64,565
ECM 7	Install VFDs on Hot Water Pumps	9,953	1.3	0.0	$1,630.00	$6,551.70	$0.00	$6,551.70	4.0	10,022
Plug Load Equipment Control - Vending Machine		5,521	0.0	0.0	$904.11	$1,150.00	$0.00	$1,150.00	1.3	5,559
ECM 8	Vending Machine Control	5,521	0.0	0.0	$904.11	$1,150.00	$0.00	$1,150.00	1.3	5,559
TOTALS		201,277	25.5	0.0	$32,963.56	$122,564.59	$6,550.00	$116,014.59	3.5	202,684

* - 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).

4.2 Lighting Upgrades

Our recommendations for upgrades to existing lighting fixtures are summarized in Figure 20 below.

Figure 20 – 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		111,280	18.8	0.0	$18,224.61	$88,711.73	$5,965.00	$82,746.73	4.5	112,058
ECM 1	Install LED Fixtures	25,747	3.6	0.0	$4,216.57	$16,541.13	$100.00	$16,441.13	3.9	25,927
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	81,582	14.7	0.0	$13,360.83	$70,653.85	$5,850.00	$64,803.85	4.9	82,152
ECM 3	Retrofit Fixtures with LED Lamps	3,952	0.5	0.0	$647.22	$1,516.75	$15.00	$1,501.75	2.3	3,980

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

ECM 1: Install LED Fixtures

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	7,327	1.1	0.0	$1,199.98	$9,487.18	$0.00	$9,487.18	7.9	7,378
Exterior	18,419	2.4	0.0	$3,016.58	$7,053.95	$100.00	$6,953.95	2.3	18,548

Measure Description

We recommend replacing existing interior and exterior fixtures HID, compact fluorescent, or incandescent lamps with new high-performance LED light fixtures.

This measure includes LED fixture replacements for most exterior lighting fixtures, as well as installation of LED retrofit kits for recessed can lighting in some areas (like the ones already installed in the Tower Reading Room).

This measure saves energy by installing LEDs, which use less power than other technologies with a comparable light output.

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

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	81,582	14.7	0.0	$13,360.83	$70,653.85	$5,850.00	$64,803.85	4.9	82,152
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

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

Since most of the interior fixtures are liner fluorescent, this is the largest category of recommended lighting measures. We recommend replacing fluorescent ballasts with new LED drivers as well. Though this is not required for all types of LED "tubes" on the market. Upgrading the ballasts at the same time will eliminate will reduce lighting maintenance costs, as it eliminates the possibility that a retrofitted LED tubes might fail prematurely due to an old fluorescent ballast.

This measure saves energy by installing LEDs, which use less power than other lighting technologies yet provide equivalent lighting output for the space.

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

ECM 3: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	1,149	0.2	0.0	$188.17	$912.53	$5.00	$907.53	4.8	1,157
Exterior	2,803	0.4	0.0	$459.05	$604.22	$10.00	$594.22	1.3	2,823

Measure Description

For some types of fixtures, we recommend simply replacing the lamps with compatible LED lamps that will fit that fixture rather than installing a new LED fixture, as this in many cases is less expensive.

This measure saves energy by installing LEDs, which use less power than other lighting technologies yet provide equivalent lighting output for the space.

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

4.3 Lighting Control Measures

Our recommendations for upgrades to lighting control measures are summarized in Figure 20 below.

Figure 21-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		1,868	0.2	0.0	$305.89	$1,412.00	$585.00	$827.00	2.7	1,881
ECM 4	Install Occupancy Sensor Lighting Controls	1,868	0.2	0.0	$305.89	$1,412.00	$585.00	$827.00	2.7	1,881

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

ECM 4: Install Occupancy Sensor Lighting Controls

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
1,868	0.2	0.0	$305.89	$1,412.00	$585.00	$827.00	2.7	1,881

Measure Description

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in all restrooms, storage rooms, classrooms, offices, and other areas where occupancy often varies throughout the day. Most areas of the Library already have lights that are controlled by occupancy sensors. However, we found a few remaining areas with no sensors which could be cost effectively upgraded.

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

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

4.4 Motor Upgrades

Our recommendations for motor upgrades are summarized in Figure 21 below.

Figure 22- Summary of Motor 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)
Motor Upgrades		8,538	1.6	0.0	$1,398.36	$14,350.26	$0.00	$14,350.26	10.3	8,598
ECM 5	Premium Efficiency Motors	8,538	1.6	0.0	$1,398.36	$14,350.26	$0.00	$14,350.26	10.3	8,598

ECM 5: Premium Efficiency Motors

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
8,538	1.6	0.0	$1,398.36	$14,350.26	$0.00	$14,350.26	10.3	8,598

Measure Description

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

We recommend replacing the two (2) 5-HP heating hot water pump motors (located on the Lower Level) with new NEMA Premium motors as part of the VFD measure (ECM-6) below. Unless motors have been recently replaced, it is generally advisable to replace existing motors with new high-efficiency models whenever adding variable frequency drive controls.

4.5 Variable Frequency Drive Measures

Our recommendations for variable frequency drive (VFD) measures are summarized Figure 22 below.

Figure 23-Summary of Variable Frequency Drive 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)
Variable Frequency Drive (VFD) Measures		74,070	4.9	0.0	$12,130.58	$16,940.60	$0.00	$16,940.60	1.4	74,588
ECM 6	Install VFDs on Chilled Water Pumps	64,117	3.6	0.0	$10,500.58	$10,388.90	$0.00	$10,388.90	1.0	64,565
ECM 7	Install VFDs on Hot Water Pumps	9,953	1.3	0.0	$1,630.00	$6,551.70	$0.00	$6,551.70	4.0	10,022

Summary of Measure Economics

ECM 6: Install VFDs on Chilled Water (Condenser) Pumps

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)
64,117	3.6	0.0	$10,500.58	$10,388.90	$0.00	$10,388.90	1.0	64,565

Measure Description

We recommend installing a variable frequency drives (VFD) to control condenser water pumps. The VFD modulates pump speed to maintain a differential pressure setpoint. Energy savings results from reducing pump motor speed (and power) as chilled water valves close. The magnitude of energy savings is based on the estimated amount of time that the system operates at reduced loads.

ECM 7: 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)
9,953	1.3	0.0	$1,630.00	$6,551.70	$0.00	$6,551.70	4.0	10,022

Measure Description

We recommend installing a variable frequency drives (VFD) to control the building's hot water pumps. This measure requires that existing hot water coils be served by 2-way valves (or that 2-way valves be added as part of the upgrade) and that a differential pressure sensor is installed in the hot water loop. As the hot water valves close, the differential pressure increases. The VFD modulates pump speed to maintain a differential pressure setpoint. Energy savings results from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

4.6 Plug Load Equipment Control - Vending Machines

Our recommendations for plug load equipment controls are summarized in Figure 23 below.

Figure 24-Plug Load Equipment Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending Machine		5,521	0.0	0.0	$904.11	$1,150.00	$0.00	$1,150.00	1.3	5,559
ECM 8	Vending Machine Control	5,521	0.0	0.0	$904.11	$1,150.00	$0.00	$1,150.00	1.3	5,559

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)
5,521	0.0	0.0	$904.11	$1,150.00	$0.00	$1,150.00	1.3	5,559

Measure Description

Vending machines operate continuously, even during non-business hours. We recommend to installation of occupancy sensor-controlled devices on these machine to reduce their energy consumption. Vending Machine Controls power down vending machines when the vending machine area near the machine has been unoccupied for an extended period of time, then powers them up again at regular intervals, as needed, to turn machine lights on or keep the product cool. Energy savings are a dependent on vending machine and activity level in the area surrounding the machines.

5 Energy Efficient Practices

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

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.

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.

Perform Routine Motor Maintenance

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

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.

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.

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 deciding to implement any on-site generation measures, a feasibility study should be conducted to take a closer look at existing energy profiles, siting and interconnection issues, and the costs associated with the project including interconnection costs, departing load charges, roof upgrades, or other facility-specific 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.

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

A preliminary screening based on the facility's electric demand, size and location of free area, and shading elements shows that the campus has a **High Potential** for cost-effective installation of rooftop PV arrays.

TRC analyzed the potentially available rooftop areas for each of the central campus buildings, in order to determine the potential cost and energy savings for installing a campus-wide solar PV array at Ocean County College. Based on our analysis, we estimate that Ocean County College has about 106,687 square feet of available unshaded roof space for all buildings combined. We estimate that the Library has approximately 7,072 square feet of unshaded roof space available, representing about 6.6% of the total array. See rooftop image below.

We estimate that the available rooftop space could support up to **1,487 kW** of solar generating capacity (~4,956 PV panels @300-W_{DC} each).[1] The combined PV array could generate nearly 2 million kWh on an annual basis. This could potentially offset $326,719 of annual electric purchases from the grid. In addition, Ocean County College could receive during the first 15 years of the solar project's lifetime, up to $795,309 per year in Solar Renewable Energy Certificate (SREC) income (@ $235/MWh). We estimate that the installed cost of such an array would be about $5.2 million. Based on these numbers, we estimate that such an investment would have a simple payback period of about 6.5 years.

Figure 25-Potentially Available Rooftop Spaces for Solar PV Development at the Library

[1] Our estimate was based on the National Renewable Energy Lab's *PVWatts*® Online Calculator (http://pvwatts.nrel.gov/), plus TRC's analysis of current market conditions for commercial solar power development in New Jersey.

Figure 26-Summary of Solar PV Array Analysis for All OCC Campus Buildings

Total Installed Cost	**$5,203,450**	**$**
Value of Electric Generation per Year	**$326,719**	**$**
Annual Income from SRECS	**$468,590**	**$**
Total Economic Value per Year	**$795,309**	**$**
Simple Payback Period	**6.54**	**years**

Solar projects must register their projects in the SREC 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 developed new solar projects and insight into future SREC pricing. See Section 8.3 below for additional information.

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 for 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

7 DEMAND RESPONSE

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

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

Typically, electric customers need to be able to reduce their electric demand, within a few minutes, by at least 100 kW or more, in order to participate in DR programs. 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 with DR programs often find it to be a valuable source of revenue for their facility because the payments can significantly offset annual electric costs.

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

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

The first step toward participation in a DR program is to contact a Curtailment Service Provider. A list of these providers is available on PJM's website and it includes contact information for each company, as well as the states where they have active business (http://www.pjm.com/markets-and-operations/demand-response/csps.aspx). PJM also posts training materials that are developed for program members interested in specific rules and requirements regarding DR activity (http://www.pjm.com/training/training%20material.aspx), along with a variety of other DR program information.

Curtailment Service Providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding program rules and requirements for metering and controls, assess a facility's ability to temporarily reduce electric load, and provide details on payments to be expected for participation in the program. Providers usually offer multiple options for DR to larger facilities and may also install controls or remote monitoring equipment of their own to help ensure compliance with all terms and conditions of a DR contract.

8 PROJECT FUNDING / INCENTIVES

The NJCEP can 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. All customers of a state-regulated electric or gas utilities contribute to the SBC fund, which makes them eligible to participate in the NJCEP programs receive incentive payments for qualifying energy efficiency measures at their facilities. Figure 27 shows which incentive programs each recommended ECM might qualify for. There are also some alternative financing programs available to ratepayers described later in this section.

Figure 27 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive
ECM 1	Install LED Fixtures	X
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	X
ECM 3	Retrofit Fixtures with LED Lamps	X
ECM 4	Install Occupancy Sensor Lighting Controls	X
ECM 5	Premium Efficiency Motors	
ECM 6	Install VFDs on Chilled Water Pumps	X
ECM 7	Install VFDs on Hot Water Pumps	
ECM 8	Vending Machine Control	

SmartStart is generally well-suited for implementation of individual measures or small group of measures. It provides flexibility to install measures at your own pace using in-house staff or a preferred contractor. Direct Install caters to small to mid-size facilities that can bundle multiple ECMs together. This can greatly simplify participation and may lead to higher incentive amounts but requires the use of pre-approved contractors. The Pay for Performance (P4P) program is a "whole-building" energy improvement program designed for larger facilities. It requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants.

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

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

8.1 SmartStart

Overview

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

Equipment with Prescriptive Incentives Currently Available:

Electric Chillers
Electric Unitary HVAC
Gas Cooling
Gas Heating
Gas Water Heating
Ground Source Heat Pumps
Lighting
Lighting Controls
Refrigeration Doors
Refrigeration Controls
Refrigerator/Freezer Motors
Food Service Equipment
Variable Frequency Drives

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

Incentives

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

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

How to Participate

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

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

8.2 Pay for Performance - Existing Buildings

Overview

The Pay for Performance – Existing Buildings (P4P EB) program is designed for larger customers with a peak demand over 200 kW in any of the preceding 12 months. Under this program the minimum installed scope of work must include at least two unique measures resulting in at least 15% energy savings, where lighting cannot make up the majority of the savings. P4P is a generally a good option for medium to large sized facilities looking to implement as many measures as possible under a single project in order to achieve deep energy savings. This program has an added benefit of evaluating a broad spectrum of measures that may not otherwise qualify under other programs. Many facilities pursuing an Energy Savings Improvement Program (ESIP) loan also utilize the P4P program.

Incentives

Incentives are calculated based on estimated and achieved energy savings ranging from $0.18-$0.22/kWh and $1.80-$2.50/therm, capped at the lesser of 50% total project cost, or $1 million per electric account and $1 million per natural gas account, per fiscal year, not to exceed $2 million per project. An incentive of $0.15/square foot is also available to offset the cost of developing the Energy Reduction Plan (see below) contingent on the project moving forward with measure installation.

How to Participate

To participate in the P4B EB program you will need to contact one of the pre-approved consultants and contractors ("Partners"). Under direct contract to you, the Partner will help further evaluate the measures identified in this report through development of the Energy Reduction Plan (ERP), assist you in implementing selected measures, and verify actual savings one year after the installation. At each of these three milestones your Partner will also facilitate securing program incentives.

Approval of the final scope of work is required by the program prior to installation completion. Although installation can be accomplished by a contractor of your choice (some P4P Partners are also contractors) or by internal personnel, the Partner must remain involved to ensure compliance with the program guidelines and requirements.

Detailed program descriptions, instructions for applying, applications and list of Partners can be found at: www.njcleanenergy.com/P4P.

8.3 SREC Registration Program

The SREC (Solar Renewable Energy Certificate) Registration Program (SRP) is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the 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.

After the registration is accepted, construction is complete, and final paperwork has been submitted and is deemed complete, the project is issued a New Jersey certification number which enables it to generate New Jersey SRECs. SREC's are generated once the solar project has been authorized to be energized by the Electric Distribution Company (EDC).

Each time a solar installation generates 1,000 kilowatt-hours (kWh) of electricity, an SREC is earned. Solar project owners report the energy production to the SREC Tracking System. This reporting allows SREC's to be placed in the customer's electronic account. SRECs can then be sold on the SREC Tracking System, providing revenue for the first 15 years of the project's life.

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar RPS. One way they can meet the RPS requirements is by purchasing SRECs. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period can and will fluctuate depending on supply and demand.

Information about the SRP can be found at: www.njcleanenergy.com/srec.

8.4 Energy Savings Improvement Program

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

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

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

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

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

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

8.5 Demand Response Energy Aggregator

The first step toward participation in a Demand Response (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 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. See Section 7 for additional information.

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 of deregulation, utilities were allowed to charge Cost of Service rates and customers were given the ability to choose to purchase energy as a commodity from 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 fluctuate on a month to month. The utility provides basic gas supply service (BGSS) to customers who choose not to buy natural gas from a third-party supplier.

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 few 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
Lower Level Main Hallway	31	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	31	LED - Fixtures: Downlight Recessed	None	17	4,836	0.21	1,552	0.0	$254.11	$1,782.81	$0.00	7.02
LL Side Hallway	5	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	5	LED - Fixtures: Downlight Recessed	None	17	4,836	0.03	250	0.0	$40.99	$287.55	$0.00	7.02
LL Main Hallway	13	Compact Fluorescent: Hemispherical Sconce	None	19	4,836	LED Retrofit	No	13	LED Screw-In Lamps: Wall Sconces	None	13	4,836	0.06	434	0.0	$71.04	$303.03	$0.00	4.27
Office: L024	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Office: L025	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp & Reballast	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.18	1,391	0.0	$227.88	$726.00	$200.00	2.31
Switchboard Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp & Reballast	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	4,836	0.04	275	0.0	$45.08	$131.50	$15.00	2.58
Continuing Education	10	Linear Fluorescent - T8: 4' T8 (32W) - 3L	None	93	4,836	Relamp & Reballast	No	10	LED - Linear Tubes: (3) 4' Lamps	None	44	4,836	0.36	2,753	0.0	$450.85	$1,315.00	$150.00	2.58
Continuing Education	3	U-Bend Fluorescent - T8: U T8 (32W) - 3L	None	92	4,836	Relamp & Reballast	No	3	LED - Linear Tubes: (3) U-Lamp	None	50	4,836	0.09	709	0.0	$116.13	$394.50	$0.00	3.40
End of Hallway	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	None	93	4,836	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	None	44	4,836	0.07	551	0.0	$90.17	$263.00	$30.00	2.58
End Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp & Reballast	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.18	1,391	0.0	$227.88	$642.00	$80.00	2.47
Conf Rm: 004	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.33	1,734	0.0	$284.03	$1,183.50	$135.00	3.69
Office: 002B	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Office: 002C	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp & Reballast	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.05	348	0.0	$56.97	$247.50	$35.00	3.73
Dean's Office: 002D	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp & Reballast	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.09	696	0.0	$113.94	$379.00	$50.00	2.89
Office: 002E	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp & Reballast	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.09	696	0.0	$113.94	$379.00	$50.00	2.89
Office: 002G	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp & Reballast	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.09	696	0.0	$113.94	$379.00	$50.00	2.89
Office: 002F	2	U-Bend Fluorescent - T8: U T8 (32W) - 3L	Wall Switch	92	4,836	Relamp & Reballast	Yes	2	LED - Linear Tubes: (3) U-Lamp	Occupancy Sensor	50	3,385	0.08	638	0.0	$104.47	$379.00	$20.00	3.44
LL Exits	5	Exit Signs: LED - 2 W Lamp	None	6	8,760	None	No	5	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Class: 016	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.22	1,156	0.0	$189.36	$789.00	$90.00	3.69
Class: 017	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp & Reballast	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.28	2,087	0.0	$341.82	$989.00	$300.00	2.02
Mech Rm	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	None	93	4,836	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	None	44	4,836	0.07	551	0.0	$90.17	$263.00	$30.00	2.58
LL 2nd Sm Hallway	6	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	6	LED - Fixtures: Downlight Recessed	None	17	4,836	0.04	300	0.0	$49.18	$345.06	$0.00	7.02
Room: 023	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	None	93	4,836	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	None	44	4,836	0.07	551	0.0	$90.17	$263.00	$30.00	2.58
Office: 018	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	None	93	4,836	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	None	44	4,836	0.07	551	0.0	$90.17	$263.00	$30.00	2.58
Men's Rm	5	Compact Fluorescent: Recessed Cans	Occupancy Sensor	26	3,385	LED Retrofit	No	5	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.03	175	0.0	$28.69	$287.55	$0.00	10.02

	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
Men's Rm	3	Compact Fluorescent: Hemispherical Sconce	Occupancy Sensor	19	3,385	LED Retrofit	No	3	LED Screw-In Lamps: Wall Sconces	Occupancy Sensor	13	3,385	0.01	70	0.0	$11.48	$69.93	$0.00	6.09
Women's Rm	4	Compact Fluorescent: Recessed Cans	Wall Switch	26	4,836	LED Retrofit	Yes	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.04	314	0.0	$51.37	$346.04	$20.00	6.35
Women's Rm	3	Compact Fluorescent: Hemispherical Sconce	Wall Switch	19	4,836	LED Retrofit	Yes	3	LED Screw-In Lamps: Wall Sconces	Occupancy Sensor	13	3,385	0.02	165	0.0	$27.05	$269.93	$105.00	6.10
Class: 006	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.44	2,312	0.0	$378.71	$1,578.00	$180.00	3.69
Class: 006	5	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	5	LED - Fixtures: Downlight Recessed	None	19	4,836	0.03	195	0.0	$31.88	$287.55	$0.00	9.02
Elevator Room: 008	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	300	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	300	0.02	11	0.0	$1.86	$117.00	$10.00	57.39
Testing Rm: 015	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
LL 3rd Sm Hallway	2	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	2	LED - Linear Tubes: Downlight Recessed	None	17	4,836	0.01	100	0.0	$16.39	$115.02	$0.00	7.02
Rear Entrance	10	Compact Fluorescent: Hemispherical Sconce	None	19	4,836	LED Retrofit	No	10	LED Screw-In Lamps: Wall Sconces	None	13	4,836	0.04	334	0.0	$54.65	$233.10	$0.00	4.27
Front Entrance	1	Metal Halide: (1) 250W Lamp	None	295	4,836	LED Retrofit	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	46	4,836	0.18	1,385	0.0	$226.79	$416.54	$100.00	1.40
E-Learning Ctr: L010	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.15	771	0.0	$126.24	$526.00	$60.00	3.69
E-Leaning Hallway	11	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	11	LED - Fixtures: Downlight Recessed	None	17	4,836	0.07	551	0.0	$90.17	$632.61	$0.00	7.02
Office: L011A	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.11	578	0.0	$94.68	$394.50	$45.00	3.69
Office: L011B	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.11	578	0.0	$94.68	$394.50	$45.00	3.69
Sm. Kitchen: L011C	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	None	93	4,836	Relamp & Reballast	No	1	LED - Linear Tubes: (3) 4' Lamps	None	44	4,836	0.04	275	0.0	$45.08	$131.50	$15.00	2.58
Office: L010A	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Office: L010E	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.11	578	0.0	$94.68	$394.50	$45.00	3.69
Office: L010D	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Office: L010D	4	Compact Fluorescent: Recessed Cans	Occupancy Sensor	26	3,385	LED Retrofit	No	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.03	140	0.0	$22.95	$230.04	$0.00	10.02
Office: L010C	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Office: L010C	4	Compact Fluorescent: Recessed Cans	Occupancy Sensor	26	3,385	LED Retrofit	No	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.03	140	0.0	$22.95	$90.56	$0.00	3.95
Office: L010B	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
LL Back Sm. Hallway	6	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	6	LED - Fixtures: Downlight Recessed	None	17	4,836	0.04	300	0.0	$49.18	$345.06	$0.00	7.02
Class: 013	2	U-Bend Fluorescent - T8: U T8 (32W) - 3L	Occupancy Sensor	92	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) U-Lamp	Occupancy Sensor	50	3,385	0.06	331	0.0	$54.19	$263.00	$0.00	4.85
Class: 013	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.44	2,312	0.0	$378.71	$1,578.00	$180.00	3.69

	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
Server Rm.	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	62	4,836	Relamp & Reballast	No	3	LED - Linear Tubes: (2) 4' Lamps	None	29	4,836	0.07	551	0.0	$90.17	$351.00	$30.00	3.56
Sm Office: 014A	8	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	8	LED - Fixtures: Downlight Recessed	None	17	4,836	0.05	400	0.0	$65.58	$460.08	$0.00	7.02
Lg Office	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	None	93	4,836	Relamp & Reballast	No	8	LED - Linear Tubes: (3) 4' Lamps	None	44	4,836	0.29	2,202	0.0	$360.68	$1,052.00	$120.00	2.58
Lg Office	1	Compact Fluorescent: Table Lamp	None	23	4,836	LED Retrofit	No	1	LED Screw-In Lamps: 15W LED Screw-in	None	15	4,836	0.01	44	0.0	$7.29	$26.75	$5.00	2.99
Office: 014D	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Break Rm	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.04	193	0.0	$31.56	$131.50	$15.00	3.69
Office: 014B	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.33	1,734	0.0	$284.03	$1,183.50	$135.00	3.69
Office: 014B	3	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	3	LED - Fixtures: Downlight Recessed	None	17	4,836	0.02	150	0.0	$24.59	$172.53	$0.00	7.02
Mech Rm	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	62	300	Relamp & Reballast	No	8	LED - Linear Tubes: (2) 4' Lamps	None	29	300	0.19	91	0.0	$14.92	$936.00	$80.00	57.39
1st Floor Entrance	9	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	9	LED - Fixtures: Downlight Recessed	None	17	4,836	0.06	450	0.0	$73.78	$517.59	$0.00	7.02
1st Floor Entrance	10	Compact Fluorescent: Hemispherical Sconce	None	17	4,836	LED Retrofit	No	10	LED Screw-In Lamps: Wall Sconces	None	13	4,836	0.03	222	0.0	$36.43	$233.10	$0.00	6.40
Elevator Alcove	1	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	1	LED - Fixtures: Downlight Recessed	None	17	4,836	0.01	50	0.0	$8.20	$57.51	$0.00	7.02
Elevator Alcove	2	Compact Fluorescent: Hemispherical Sconce	None	17	4,836	LED Retrofit	No	2	LED Screw-In Lamps: Wall Sconces	None	13	4,836	0.01	44	0.0	$7.29	$46.62	$0.00	6.40
Vending Machine Rm	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	62	4,836	Relamp & Reballast	No	2	LED - Linear Tubes: (2) 4' Lamps	None	29	4,836	0.05	367	0.0	$60.11	$234.00	$20.00	3.56
Hall (on left)	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	62	4,836	Relamp & Reballast	No	2	LED - Linear Tubes: (2) 4' Lamps	None	29	4,836	0.05	367	0.0	$60.11	$234.00	$20.00	3.56
Left Main Office: L124	6	Compact Fluorescent: Recessed Cans	None	26	4,836	LED Retrofit	No	6	LED - Fixtures: Downlight Recessed	None	17	4,836	0.04	300	0.0	$49.18	$345.06	$0.00	7.02
Left Main Office: L125	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Sm Office: L124A	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.04	193	0.0	$31.56	$131.50	$15.00	3.69
Sm Office: L124B	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.04	193	0.0	$31.56	$131.50	$15.00	3.69
Sm Office: L124C	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.04	193	0.0	$31.56	$131.50	$15.00	3.69
Sm Office: L124D	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Sm Office: L124E	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Right Main Office: 101	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp & Reballast	No	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,385	0.06	339	0.0	$55.47	$351.00	$0.00	6.33
Right Main Office: 101	1	Compact Fluorescent: Recessed Cans	Occupancy Sensor	26	3,385	LED Retrofit	No	1	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.01	35	0.0	$5.74	$57.51	$0.00	10.02
Conf Rm: 101A	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.29	1,542	0.0	$252.47	$1,052.00	$120.00	3.69

	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
Sm Office: 101B	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.15	771	0.0	$126.24	$526.00	$60.00	3.69
Sm Office: 101C	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Sm Office: 101D	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.15	771	0.0	$126.24	$526.00	$60.00	3.69
Main Library	7	Linear Fluorescent - T8: 4' T8 (32W) - 6L	Occupancy Sensor	176	3,385	Relamp & Reballast	No	7	LED - Linear Tubes: (6) 4' Lamps	Occupancy Sensor	87	3,385	0.46	2,425	0.0	$397.20	$1,538.83	$210.00	3.35
Main Library	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	114	3,385	Relamp & Reballast	No	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	3,385	0.12	654	0.0	$107.11	$485.50	$60.00	3.97
Main Library	24	Compact Fluorescent: Recessed Cans	Occupancy Sensor	26	3,385	LED Retrofit	No	24	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.16	841	0.0	$137.71	$1,380.24	$0.00	10.02
Main Library	32	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp & Reballast	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.78	4,111	0.0	$673.27	$3,744.00	$320.00	5.09
Main Library	7	Compact Fluorescent: Recessed Cans	Occupancy Sensor	26	3,385	LED Retrofit	No	7	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.05	245	0.0	$40.17	$402.57	$0.00	10.02
Main Library	32	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp & Reballast	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.78	4,111	0.0	$673.27	$3,744.00	$320.00	5.09
Main Library	4	Compact Fluorescent: Recessed Cans	Occupancy Sensor	26	3,385	LED Retrofit	No	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.03	140	0.0	$22.95	$80.00	$0.00	3.49
Main Library	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp & Reballast	No	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.49	2,569	0.0	$420.79	$2,340.00	$200.00	5.09
Main Library	64	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp & Reballast	No	64	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	1.55	8,222	0.0	$1,346.53	$7,488.00	$640.00	5.09
Main Library	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp & Reballast	No	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.58	3,083	0.0	$504.95	$2,808.00	$240.00	5.09
Main Library	6	Compact Fluorescent: Recessed Cans	Occupancy Sensor	26	3,385	LED Retrofit	No	6	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.04	210	0.0	$34.43	$345.06	$0.00	10.02
Main Library	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp & Reballast	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.29	1,542	0.0	$252.47	$1,404.00	$120.00	5.09
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
OPAC-A	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.07	385	0.0	$63.12	$263.00	$30.00	3.69
Tower Reading Rm	16	LED - Fixtures: Downlight Recessed	Occupancy Sensor	14	3,385	None	No	16	LED - Fixtures: Downlight Recessed	Occupancy Sensor	14	3,385	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Tower Reading Rm	8	LED - Fixtures: Downlight Recessed	Occupancy Sensor	14	3,385	None	No	8	LED - Fixtures: Downlight Recessed	Occupancy Sensor	14	3,385	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Tower (3rd floor)	9	LED - Fixtures: Downlight Recessed	Occupancy Sensor	14	3,385	None	No	9	LED - Fixtures: Downlight Recessed	Occupancy Sensor	14	3,385	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Viewing Rm: 114	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Occupancy Sensor	32	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	3,385	0.03	136	0.0	$22.31	$196.00	$10.00	8.34
Viewing Rm: 115	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Occupancy Sensor	32	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	3,385	0.03	136	0.0	$22.31	$196.00	$10.00	8.34
Viewing Rm: 111	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Occupancy Sensor	32	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	3,385	0.03	136	0.0	$22.31	$196.00	$10.00	8.34
Viewing Rm: 111	2	U-Bend Fluorescent - T8: U T8 (32W) - 3L	Occupancy Sensor	92	3,385	Relamp & Reballast	No	2	LED - Linear Tubes: (3) U-Lamp	Occupancy Sensor	50	3,385	0.06	331	0.0	$54.19	$263.00	$0.00	4.85
3rd Floor	20	Compact Fluorescent: Recessed Cans	Occupancy Sensor	26	3,385	LED Retrofit	No	20	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	3,385	0.13	701	0.0	$114.76	$1,150.20	$0.00	10.02

	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
3rd Floor	64	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Occupancy Sensor	32	3,385	Relamp & Reballast	No	64	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	3,385	0.82	4,360	0.0	$714.07	$6,272.00	$320.00	8.34
3rd Floor	140	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Occupancy Sensor	32	3,385	Relamp & Reballast	No	140	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	3,385	1.80	9,538	0.0	$1,562.03	$13,720.00	$700.00	8.34
3rd Floor	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp & Reballast	No	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.39	2,055	0.0	$336.63	$1,872.00	$160.00	5.09
Copy Rm	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp & Reballast	No	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,385	0.06	339	0.0	$55.47	$351.00	$0.00	6.33
Stairwell	7	Compact Fluorescent: Hemispherical Sconce	None	19	4,836	LED Retrofit	No	7	LED Screw-In Lamps: Wall Sconces	None	13	4,836	0.03	234	0.0	$38.25	$163.17	$0.00	4.27
Walkway walls & HC Ramp	10	Compact Fluorescent: CFL Globe Wall Pack	None	18	4,836	LED Retrofit	No	10	LED - Fixtures: (2) 3.5W LED Bulbs	None	7	4,836	0.08	612	0.0	$100.19	$411.50	$0.00	4.11
Steps Btw Door A & D	2	Compact Fluorescent: CFL Wall Pack	None	26	4,836	Fixture Replacement	No	2	LED - Fixtures: Wall Sconces (SLED5 or Equiv.)	None	5	4,836	0.03	234	0.0	$38.25	$659.00	$0.00	17.23
Above Door A	3	High-Pressure Sodium: (1) 150W Lamp	None	188	4,836	Fixture Replacement	No	3	LED - Fixtures: Wall Sconces (SLIM57 or Equiv.)	None	57	4,836	0.29	2,186	0.0	$357.95	$1,182.18	$0.00	3.30
Outside Door D	3	Metal Halide: (1) 100W Lamp	None	128	4,836	LED Retrofit	No	3	LED Screw-In Lamps: 30W LED Replacement for MH Bulbs	None	30	4,836	0.22	1,635	0.0	$267.78	$318.69	$0.00	1.19
Penthouse Roof Access Door	1	High-Pressure Sodium: (1) 50W Lamp	None	66	4,836	Fixture Replacement	No	1	LED - Fixtures: Wall Sconces (ENTRA12 or Equiv.)	None	12	4,836	0.04	300	0.0	$49.18	$334.41	$0.00	6.80
Rooftop Sidewall	1	Halogen Incandescent: (2) Bulb PAR 38 Flood Lights	None	180	4,836	Fixture Replacement	No	1	LED Screw-In Lamps: PAR39 LED (Med Base Screw-in) Bulbs	None	30	4,836	0.11	834	0.0	$136.62	$52.43	$10.00	0.31
Clock Tower	8	Metal Halide: (1) 400W Lamp	None	458	4,836	Fixture Replacement	No	8	LED - Fixtures: 150W LED Flood Light Fixture (FXLED15-T or Equiv.)	None	150	4,836	1.81	13,703	0.0	$2,244.22	$4,050.32	$0.00	1.80

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
1st Flr Mechanical Room	Library	3	Exhaust Fan	0.3	82.5%	No	2,745	No	82.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
1st Flr Mechanical Room	Library	2	Chilled Water Pump	15.0	91.0%	No	3,391	Yes	92.4%	Yes	2	3.84	36,581	0.0	$5,990.90	$14,171.74	$0.00	2.37
3rd Flr Mechanical Room	Library	3	Supply Fan	10.0	87.5%	Yes	3,391	No	87.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
3rd Flr Mechanical Room	Library	2	Return Fan	10.0	87.5%	Yes	3,391	No	87.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
3rd Flr Mechanical Room	Library	2	Chilled Water Pump	15.0	90.2%	No	6,125	Yes	93.0%	Yes	2	4.00	67,205	0.0	$11,006.38	$14,082.34	$0.00	1.28
Cooling Tower	Library	2	Cooling Tower Fan	20.0	88.5%	No	3,391	Yes	93.0%	Yes	2	0.81	51,064	0.0	$8,362.87	$17,700.46	$2,400.00	1.83
1st Floor	Library	2	Heating Hot Water Pump	5.0	87.5%	No	2,745	Yes	89.5%	Yes	2	1.35	10,306	0.0	$1,687.81	$8,393.82	$0.00	4.97
3rd Floor	Library	2	Water Supply Pump	0.8	82.5%	No	2,745	No	82.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Ground Floor	Library	2	Heating Hot Water Pump	0.1	82.5%	No	2,745	No	82.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Elevator Room	Library	1	Other	20.0	87.5%	No	450	No	87.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

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
Mechanical Room	Whole Building	1	Water-Cooled Screw Chiller	180.00	No							0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Central Plant	Library	4	Condensing Hot Water Boiler	5,580.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
2nd Floor	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?
Switchboard Rm	1	Sm. Refrigerator (~2 cu ft)	34.2	No
Offices & Classrooms	98	Computers	109.0	Yes
Offices & Classrooms	98	LCD Computer Monitors	41.0	Yes
Conf Room	1	TV	150.0	Yes
Library	4	Large Copiers	240.0	Yes
Library	6	Med. Printers	80.0	Yes
Server Rm	1	Server	400.0	No

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Vending Machine Rm (1st Flr)	3	Refrigerated	Yes	0.00	4,836	0.0	$791.92	$690.00	$0.00	0.87
Vending Machine Rm (1st Flr)	2	Non-Refrigerated	Yes	0.00	685	0.0	$112.19	$460.00	$0.00	4.10

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]

Ocean County College

Primary Property Type: College/University
Gross Floor Area (ft²): 526,034
Built: 1966

For Year Ending: June 30, 2015
Date Generated: April 21, 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
Ocean County College 1 College Drive Toms River, New Jersey 08754	_____ , (___)___-_____	___ _____ , (___)___-_____ _____

Property ID: 5093695

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
164.7 kBtu/ft²

Source EUI
315.4 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	50,787,318 (59%)
Electric - Grid (kBtu)	35,847,151 (41%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	137.1
National Median Source EUI (kBtu/ft²)	262.6
% Diff from National Median Source EUI	20%

Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	6,808

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)