Local Government Energy Audit:
Energy Audit Report

Conference Center (#10)

Ocean County College

1 College Drive
Toms River, NJ 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 saving 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 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 Conference Center (#10).

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

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

1.1 Facility Summary

The Conference Center (#10) is a 11,075 square foot facility comprised of spaces such as bookstore, conference rooms, offices, and hallways. The building functions all year from 7:00 AM to 10:00 PM during the weekdays and from 9:00 AM to 6:00 PM during the weekends. Space heating in the building is provided by two gas fired non-condensing hot water boilers and three gas fired warm air unit heaters. Space cooling is provided using an 80-ton water-cooled reciprocating chiller coupled with air handlers. The Conference Center (#10) mostly consists of aging and inefficient T8 linear tube lighting. Most of the HVAC equipment has passed its useful life and also in need of replacement.

This energy audit report reflects the conditions and opportunities that were observed during the time of the audit. Since the audit, plans have been made for the heating and cooling for this facility to come from the central CHP Plant.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

Although opportunities exist for reducing energy usage from upgrading the current equipment, no ECMs are recommended in this report per the site contact, James Calamia. This building is scheduled for a gut rehab and a full-scale renovation. The report inventories all equipment and conditions that were observed by the auditor during the energy audit.

TRC recommends that Ocean County College opt for energy efficient equipment such as LED lighting and high efficiency HVAC as a part of the renovation project to incorporate energy savings by design.

Figure 1 – Previous 12 Month Utility Costs

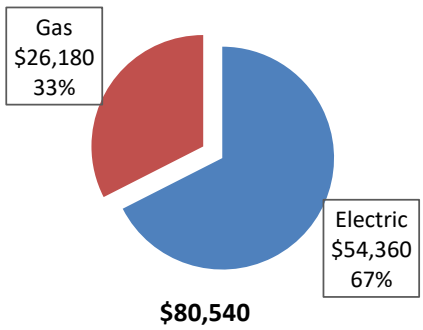


Figure 2 Potential Post-Implementation Costs

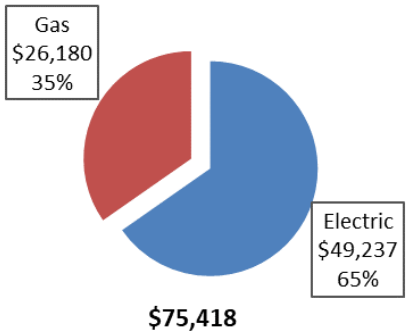


Figure 3 ECM Summary Table

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			**31,072**	**4.4**	**0.0**	**$5,061.03**	**$13,079.41**	**$2,250.00**	**$10,829.41**	**2.14**	**31,289**
ECM 1	Install LED Fixtures	Yes	670	0.1	0.0	$109.17	$1,172.03	$300.00	$872.03	7.99	675
ECM 2	Retrofit Fixtures with LED Lamps	Yes	30,402	4.3	0.0	$4,951.86	$11,907.38	$1,950.00	$9,957.38	2.01	30,614
Lighting Control Measures			**379**	**0.1**	**0.0**	**$61.68**	**$386.00**	**$55.00**	**$331.00**	**5.37**	**381**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	379	0.1	0.0	$61.68	$386.00	$55.00	$331.00	5.37	381
TOTALS			**31,450**	**4.4**	**0.0**	**$5,122.71**	**$13,465.41**	**$2,305.00**	**$11,160.41**	**2.18**	**31,670**

* - 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 detailed description of Conference Center (#10)'s existing energy use can be found in Section 3.

Energy Efficient Practices

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

- Reduce Air Leakage
- Close Doors and Windows
- Perform Lighting Maintenance
- Clean and/or Replace HVAC Filters
- Perform Boiler Maintenance
- Perform Water Heater Maintenance
- Replace Computer Monitors
- Water Conservation

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

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
Designated Representative			
Eugene Caulfield	Supervisor of Maintenance	ecaulfield@ocean.edu	732-255-0400 x 2829
TRC Energy Services			
Smruti Srinivasan	Auditor	smruti.srini@gmail.com	(732) 855-0033

2.2 General Site Information

On June 14, 2016, TRC performed an energy audit at the Conference Center (#10) located in Toms River, New Jersey. TRC's team met with Eugene Caulfield to review the facility operations and focus the investigation on specific energy-using systems.

The Conference Center (#10) is a 11,075 square foot facility comprised of spaces such as bookstore, conference rooms, offices, and hallways. The building functions all year from 7:00 AM to 10:00 PM during the weekdays and from 9:00 AM to 6:00 PM during the weekends. Space heating in the building is provided by two gas fired non-condensing hot water boilers and three gas fired warm air unit heaters.

The building was constructed in 1966. Space cooling is provided using an 80-ton water-cooled reciprocating chiller coupled with air handlers. Bookstore & College Center mostly consists of aging and inefficient T8 linear tube lighting. Most of the HVAC equipment has passed its useful life and also in need of replacement.

2.3 Building Occupancy

The typical schedule is presented in the table below.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Conference Center (#10)	Weekday	7AM - 10PM
Conference Center (#10)	Weekend	9AM - 6PM

2.4 Building Envelope

The building is constructed of concrete block, and structural steel with a brick facade. The cylindrical part of the building also has an aluminum framed glass façade. The buildings have flat roofs covered with an asphalt membrane that is in decent condition. The buildings have double pane windows. The exterior doors are single pane aluminum framed glass that are in fair condition.

2.5 On-Site Generation

The Conference Center (#10) does not have any on-site electric generation systems currently installed.

2.6 Energy-Using Systems

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

Lighting System

Lighting is provided predominately by 32-Watt linear fluorescent T8 lamps with electronic ballasts as well as compact fluorescent lamps (CFL). Most of the building spaces use 2-lamp or 3-lamp, 4-foot long and 2-foot U-bent troffers with diffusers. Areas like bookstore, conference room and rear entrance vestibule and book store entrance are lit using 9-Watt and 42-Watt CFL fixtures.

Lighting control in the spaces are provided using manual wall switches and occupancy sensors. The occupancy sensors are either wall mounted depending on the space layout. Stairwells, elevator lobbies and main lobby areas do not contain any occupancy sensors. The exterior lights in the building contain wall packs containing high pressure sodium lamps controlled using photo cells.

Chilled Water and Condenser Water System

The space cooling in the building is provided by an 80-ton water-cooled reciprocating chiller. The chilled water is circulated using two constant speed chilled water pumps of 7.5 hp capacity to the air handling units. The air handling units have 15 hp supply fans (constant speed) distribute conditioned air to the respective parts of the building. A 5 hp constant speed condenser water pump circulates condenser water to a single cell induced draft cooling tower located on the ground. The cooling tower fan is rated at 25 hp and has a constant speed motor.

Hot Water / Steam System

The hot water system in the building consists of two Weil McLain gas-fired non condensing hot water boilers with an output capacity of 948 MBh and a thermal efficiency of 81%. The hot water from the boiler is circulated to the air handling units, unit heaters and the unit vents in the building through two constant speed hot water pumps of 1.5hp capacity each. These terminal units have constant speed supply fans that distribute heated air to the respective spaces.

Domestic Hot Water

The domestic hot water system for the facility consists of one electric water heater from A.O. Smith. This unit has an input capacity of 6kW. The gallon capacity of this equipment is 30 gallons.

3 SITE ENERGY USE AND COSTS

Utility data for electricity and natural gas was analyzed to identify opportunities for savings. In addition, data for electricity and natural gas was evaluated to determine the annual energy performance metrics for the building in energy cost/ft^2 and energy use/ft^2. These energy use indices are indicative of the relative energy effectiveness of this building. There are a number of factors that could cause the energy use of this building to vary from the "typical" energy use for other facilities identified as: Education - Community College. Specific local climate conditions, daily occupancy hours of the facility, seasonal fluctuations in occupancy, daily operating hours of energy use systems, and the behavior of the occupants with regard to operating systems that impact energy use such as turning off appliances and leaving windows open. Please refer to the Benchmarking section within Section 3.4 for additional information.

3.1 Total Cost of Energy

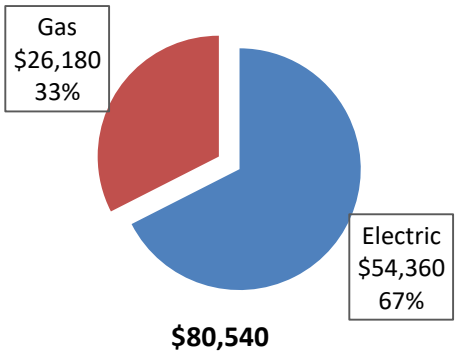
The following energy consumption and cost data is based on the last 12 month period of utility usage data that was provided for each utility. The annual consumption and cost was developed from this information.

Figure 6 - Utility Summary

Utility Summary for Bookstore & College Centre		
Fuel	**Usage**	**Cost**
Electricity	333,739 kWh	$54,360
Natural Gas	22,211 Therms	$26,180
Total		**$80,540**

The current utility cost for this site is $80,540 as shown in the chart below.

Figure 7 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by JCP&L. The average electric cost (combined for commodity, transmission and distribution) for the past 12 months is $0.163/kWh, which is the blended rate used throughout the analyses in this report. The monthly electricity consumption and peak demand is represented graphically in the chart below.

Figure 8 - Electric Usage & Demand

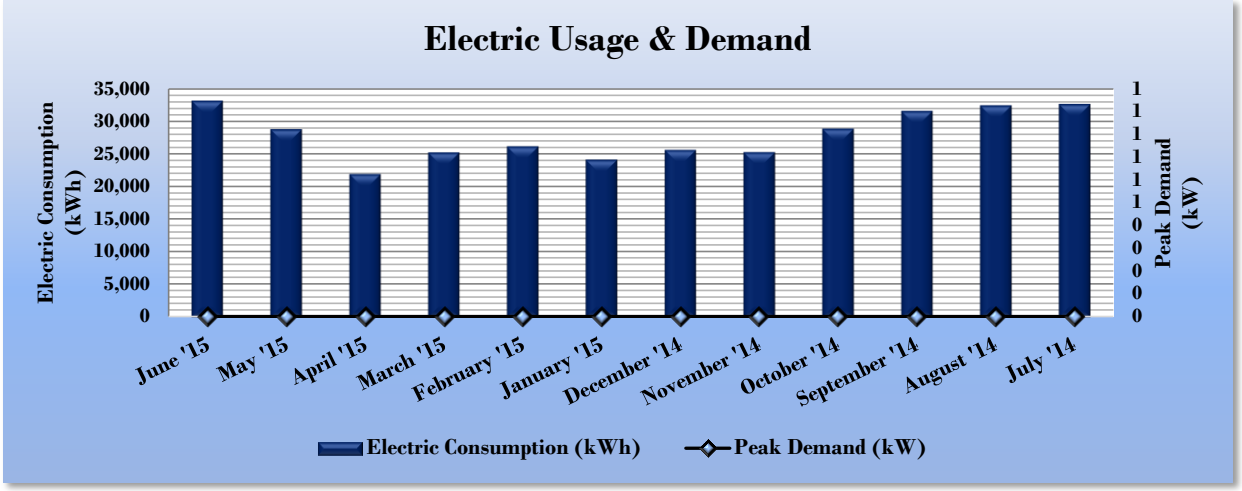


Figure 9 - Electric Usage & Demand

Electric Billing Data for Bookstore & College Centre						
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost	TRC Estimated Usage?
7/8/15	30	33,030			$4,572	Yes
6/8/15	32	28,704			$4,606	Yes
5/7/15	30	21,857			$3,623	Yes
4/7/15	32	25,165			$3,948	Yes
3/6/15	29	26,052			$6,065	Yes
2/5/15	30	24,053			$4,401	Yes
1/6/15	32	25,531			$4,238	Yes
12/5/14	31	25,169			$4,426	Yes
11/4/14	32	28,776			$4,900	Yes
10/3/14	29	31,461			$5,080	Yes
9/5/14	29	32,312			$4,954	Yes
8/6/14	30	32,544			$3,695	Yes
Totals	**366**	**334,654**	**0**	**$0**	**$54,509**	12
Annual	**365**	**333,739**	**0**	**$0**	**$54,360**	

3.3 Natural Gas Usage

Natural gas is provided by NJ Natural Gas. The average gas cost for the past 12 months is $1.179/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is represented graphically in the chart below.

Figure 10 - Natural Gas Usage

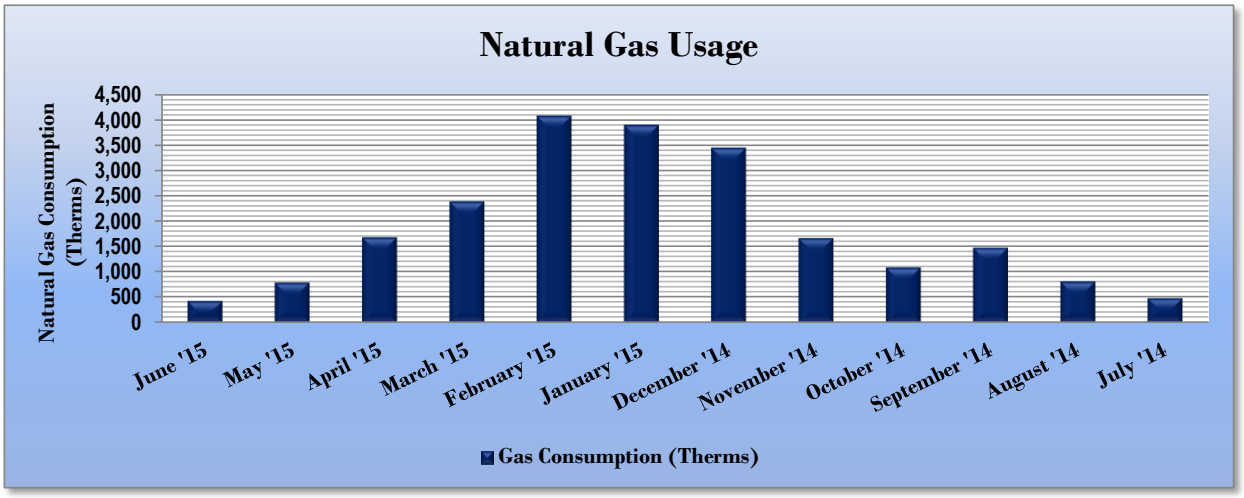


Figure 11 - Natural Gas Usage

Gas Billing Data for Bookstore & College Centre				
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost	TRC Estimated Usage?
6/24/15	29	419	$746	Yes
5/26/15	34	783	$1,129	Yes
4/22/15	30	1,675	$2,042	Yes
3/23/15	25	2,383	$2,766	Yes
2/26/15	31	4,068	$4,491	Yes
1/26/15	34	3,889	$4,307	Yes
12/23/14	35	3,437	$3,910	Yes
11/18/14	26	1,658	$1,700	Yes
10/23/14	31	1,084	$1,309	Yes
9/22/14	33	1,469	$1,929	Yes
8/20/14	28	809	$1,216	Yes
7/23/14	28	477	$563	Yes
Totals	**364**	**22,150**	**$26,108**	12
Annual	**365**	**22,211**	**$26,180**	

3.4 Benchmarking

This facility was benchmarked through Portfolio Manager®, an online tool created and managed by the United States Environmental Protection Agency (EPA) through the ENERGY STAR® program. Portfolio Manager® analyzes your building's consumption data, cost information, and operational use details and compares its performance against a yearly baseline, national medians, or similar buildings in your portfolio. Metrics used in this comparison are the energy use intensity (EUI) and ENERGY STAR® score.

The EUI is a measure of a facility's energy consumption per square foot, and it is the standard metric for comparing buildings' energy performance. Comparing the EUI of a building with the national median EUI for that building type illustrates whether that building uses more energy than similar buildings on a square foot basis or if that building performs better than the median. EUI is presented in both site energy and source energy. Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy is the raw fuel consumed to generate the energy consumed at the site, factoring in energy production and distribution losses.

Figure 12 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Bookstore & College Centre	National Median Building Type: Higher Education - Public
Source Energy Use Intensity (kBtu/ft^2)	533.4	262.6
Site Energy Use Intensity (kBtu/ft^2)	303.4	130.7

Many buildings can also receive a 1 – 100 ENERGY STAR® score. This score compares your building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75 percent of all similar buildings nationwide — and may be eligible for ENERGY STAR® certification. The campus is on a master meter and hence the energy usage of each building was calculated based on the building type. Due to this reason this building does not qualify for an ENERGY STAR® score. However, the Portfolio Manager®, Statement of Energy Performance on a campus level can be found in Appendix B: ENERGY STAR® Statement of Energy Performance.

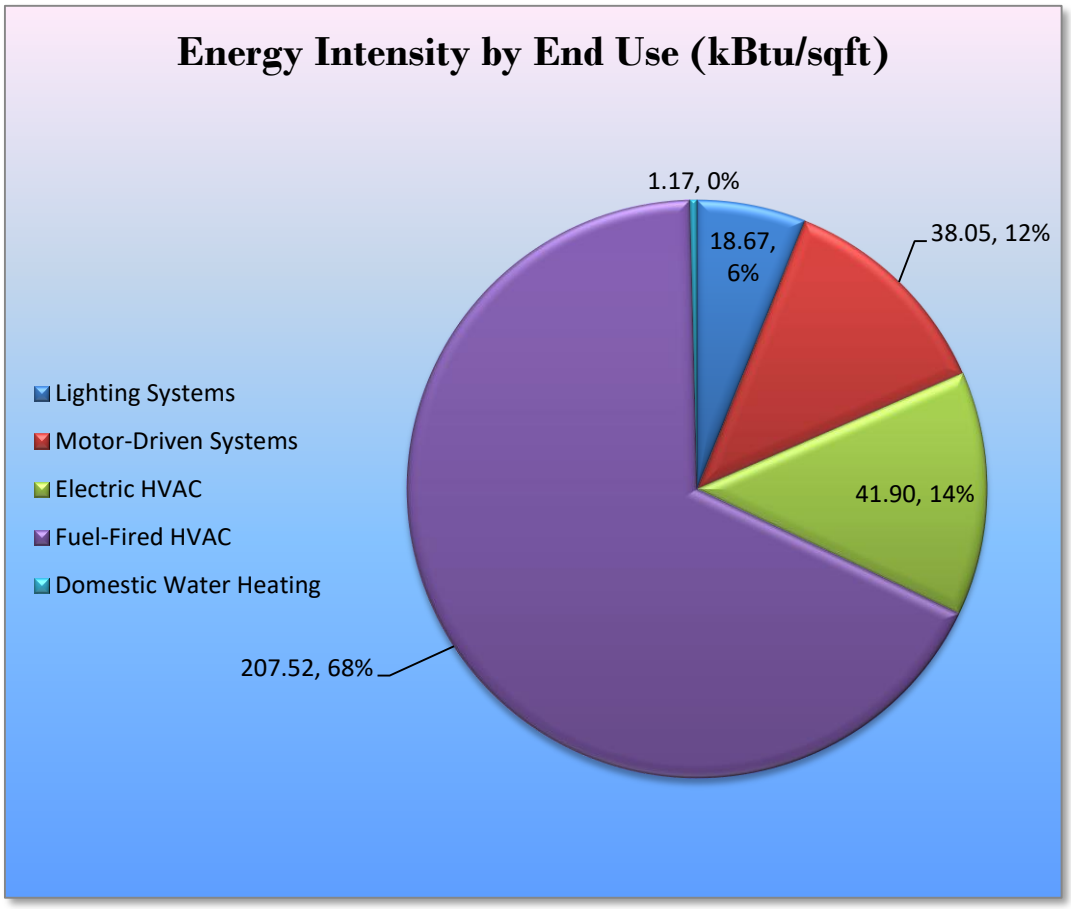
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

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

3.5 Energy End-Use Breakdown

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

Figure 13 - Energy Balance (% and kBtu/SF)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the Conference Center (#10) regarding financial incentives for which they may qualify to implement the recommended measures. For this audit report, most measures have received only a preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to demonstrate project cost-effectiveness and help prioritize energy measures. Savings are based on the New Jersey Clean Energy Program Protocols to Measure Resource Savings dated June 29, 2016, approved by the New Jersey Board of Public Utilities. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances. A higher level of investigation may be necessary to support any custom SmartStart or Pay for Performance, or Direct Install incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJCEP prescriptive SmartStart program. Some measures and proposed upgrade projects may be eligible for higher incentives than those shown below through other NJCEP programs as described in Section 8.

The following sections describe the evaluated measures.

4.1 Recommended ECMs

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

Figure 14 – Summary of Recommended ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**31,072**	**4.4**	**0.0**	**$5,061.03**	**$13,079.41**	**$2,250.00**	**$10,829.41**	**2.14**	**31,289**
ECM 1	Install LED Fixtures	Yes	670	0.1	0.0	$109.17	$1,172.03	$300.00	$872.03	7.99	675
ECM 2	Retrofit Fixtures with LED Lamps	Yes	30,402	4.3	0.0	$4,951.86	$11,907.38	$1,950.00	$9,957.38	2.01	30,614
Lighting Control Measures			**379**	**0.1**	**0.0**	**$61.68**	**$386.00**	**$55.00**	**$331.00**	**5.37**	**381**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	379	0.1	0.0	$61.68	$386.00	$55.00	$331.00	5.37	381
TOTALS			**31,450**	**4.4**	**0.0**	**$5,122.71**	**$13,465.41**	**$2,305.00**	**$11,160.41**	**2.18**	**31,670**

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

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

4.1.1 Lighting Upgrades

Our recommendations for upgrades to existing lighting fixtures are summarized in Figure 15 below.

Figure 15 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**31,072**	**4.4**	**0.0**	**$5,061.03**	**$13,079.41**	**$2,250.00**	**$10,829.41**	**2.14**	**31,289**
ECM 1	Install LED Fixtures	Yes	670	0.1	0.0	$109.17	$1,172.03	$300.00	$872.03	7.99	675
ECM 2	Retrofit Fixtures with LED Lamps	Yes	30,402	4.3	0.0	$4,951.86	$11,907.38	$1,950.00	$9,957.38	2.01	30,614

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

ECM 1: Install LED Fixtures

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.00	0
Exterior	670	0.1	0.0	$109.17	$1,172.03	$300.00	$872.03	7.99	675

Measure Description

We recommend replacing existing exterior fixtures containing HID lamps with new high-performance LED light fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output.

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

ECM 2: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	30,402	4.3	0.0	$4,951.86	$11,907.38	$1,950.00	$9,957.38	2.01	30,614
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.00	0

Measure Description

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

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

4.1.2 Lighting Control Measures

Our recommendations for lighting control measures are summarized in Figure 16 below.

Figure 16 – Summary of Lighting Control ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures			**379**	**0.1**	**0.0**	**$61.68**	**$386.00**	**$55.00**	**$331.00**	**5.37**	**381**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	379	0.1	0.0	$61.68	$386.00	$55.00	$331.00	5.37	381

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 3: Install Occupancy Sensor Lighting Controls

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
379	0.1	0.0	$61.68	$386.00	$55.00	$331.00	5.37	381

Measure Description

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in restrooms, storage rooms, offices areas etc. 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.

5 ENERGY EFFICIENT PRACTICES

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

Reduce Air Leakage

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

Close Doors and Windows

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

Perform Lighting Maintenance

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

Clean and/or Replace HVAC Filters

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

Perform Boiler Maintenance

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

Perform Water Heater Maintenance

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

Water Conservation

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

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

6 DEMAND RESPONSE

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

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

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

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

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

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

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

7 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

7.1 Retail Electric Supply Options

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

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

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

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

7.2 Retail Natural Gas Supply Options

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

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

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

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

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Book Store	28	CFL Screw-In Lamps: Double twin tube (G24q/GX24q socket)	None	26	4,836	Relamp	No	28	LED Screw-In Lamps: Double twin tube	None	18	4,836	0.16	1,215	0.0	$197.84	$1,233.43	$0.00	6.23
Book Store	62	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp	No	62	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	4,836	2.26	17,068	0.0	$2,780.06	$4,662.40	$930.00	1.34
Book Store Storage	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	14	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.34	2,569	0.0	$418.50	$819.00	$140.00	1.62
Small Storage	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.07	551	0.0	$89.68	$175.50	$30.00	1.62
Small Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.07	551	0.0	$89.68	$175.50	$30.00	1.62
Large Office	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.21	1,623	0.0	$264.42	$679.50	$105.00	2.17
Rear Entrance	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.05	367	0.0	$59.79	$117.00	$20.00	1.62
Conference Room	30	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp	No	30	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.73	3,854	0.0	$627.75	$1,755.00	$300.00	2.32
Conference Room	10	LED - Fixtures: Downlight Recessed	Occupancy Sensor	9	3,385	None	No	10	LED - Fixtures: Downlight Recessed	Occupancy Sensor	9	3,385	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Mechanical Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.05	367	0.0	$59.79	$117.00	$20.00	1.62
Fire Alarm/Electric Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.02	184	0.0	$29.89	$58.50	$10.00	1.62
Hallway	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.27	2,019	0.0	$328.82	$643.50	$110.00	1.62
Rear Entrance Vestibule	2	CFL Screw-In Lamps: Double twin tube (G24q/GX24q socket)	Wall Switch	26	4,836	Relamp	No	2	LED Screw-In Lamps: Double twin tube	Wall Switch	18	4,836	0.01	87	0.0	$14.13	$88.10	$0.00	6.23
Housekeeping Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.02	184	0.0	$29.89	$58.50	$10.00	1.62
Media Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.06	464	0.0	$75.55	$233.00	$40.00	2.55
CD Storage Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.02	184	0.0	$29.89	$58.50	$10.00	1.62
Student Club Rm 118	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,836	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,836	0.05	367	0.0	$59.79	$117.00	$20.00	1.62
Book Store Entrance	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	4,836	Relamp	No	8	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	4,836	0.29	2,202	0.0	$358.72	$601.60	$120.00	1.34
Book Store Entrance	3	CFL Screw-In Lamps: Double twin tube (G24q/GX24q socket)	Wall Switch	26	4,836	Relamp	No	3	LED Screw-In Lamps: Double twin tube	Wall Switch	18	4,836	0.02	130	0.0	$21.20	$132.15	$0.00	6.23
Women's Restroom	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp	No	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.11	578	0.0	$94.16	$225.60	$45.00	1.92
Women's Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.02	128	0.0	$20.93	$58.50	$10.00	2.32
Men's Restroom	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	3,385	Relamp	No	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	3,385	0.11	578	0.0	$94.16	$225.60	$45.00	1.92
Men's Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	3,385	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,385	0.02	128	0.0	$20.93	$58.50	$10.00	2.32
Outside	3	High-Pressure Sodium: (1) 50W Lamp	None	66	4,836	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	20	4,836	0.10	771	0.0	$125.55	$1,172.03	$300.00	6.95
Exit lights	8	Exit Signs: LED - 2 W Lamp	None	6	8,760	None	No	8	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

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
Air handling Unit	Building	2	Supply Fan	2.0	80.0%	No	2,745	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Building	1	Heating Hot Water Pump	1.5	84.0%	No	2,745	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Building	1	Heating Hot Water Pump	1.5	84.4%	No	2,745	No	84.4%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Women's Restroom	1	Exhaust Fan	0.3	64.0%	No	2,745	No	64.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Men's Restroom	1	Exhaust Fan	0.3	64.0%	No	2,745	No	64.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Vestibule	Exhaust	1	Exhaust Fan	0.3	64.0%	No	2,745	No	64.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Storage room and vestibule	AHU 001, AHU201	2	Supply Fan	2.0	88.5%	No	2,745	No	88.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Vestibule 1, Vestibule 1 ceiling, Main hallway, ladies room ceiling, Men's room ceiling, Radio Station, Club room	FCU 101, 102, 103, 104, 105, 106	6	Supply Fan	0.3	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Cooling Tower	Mechanical Room	1	Cooling Tower Fan	25.0	93.6%	No	4,067	No	93.6%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Mechanical Room	Building	1	Chilled Water Pump	5.0	87.5%	No	2,745	No	87.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Mechanical Room	Building	2	Chilled Water Pump	5.0	86.5%	No	2,745	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Mechanical Room	Building	1	Condenser Water Pump	5.0	89.5%	No	2,745	No	89.5%	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	Book Store and College Centre	1	Water-Cooled Reciprocating Chiller	80.00	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
Boiler Room	Entire Building	2	Non-Condensing Hot Water Boiler	950.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Entrance 1 & 2	Entrance 1 & 2	2	Warm Air Unit Heater	15.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Entrance 2	Entrance 2	1	Warm Air Unit Heater	15.00	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
Storage Closet	Male & Female Restrooms	1	Storage Tank Water Heater (≤ 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

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: June 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	Ocean County College 1 College Drive Toms River, NJ 08754 732-255-0533	James Calamia 1 College Drive Toms River, NJ 08754 732-255-0533 jcalamia@ocean.edu

Property ID: 5093695

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
173.3 kBtu/ft²

Source EUI
324 kBtu/ft²

Annual Energy by Fuel

Other: (kBtu)	4,536,360 (5%)
Natural Gas (kBtu)	50,787,318 (56%)
Electric - Grid (kBtu)	35,847,151 (39%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	140.5
National Median Source EUI (kBtu/ft²)	262.6
% Diff from National Median Source EUI	23%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	N/A

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)