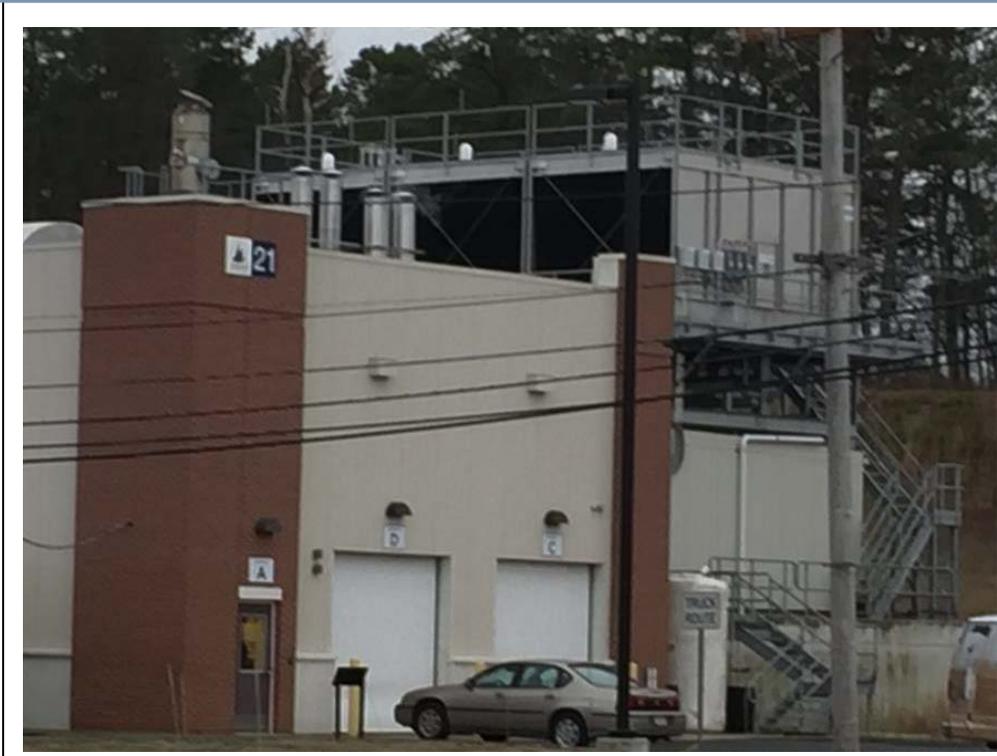




Local Government Energy Audit: Energy Audit Report



Copyright ©2018 TRC Energy Services. All rights reserved.

Reproduction or distribution of the whole, or any part of the contents of this document without written permission of TRC is prohibited. Neither TRC nor any of its employees makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any data, information, method, product or process disclosed in this document, or represents that its use will not infringe upon any privately-owned rights, including but not limited to, patents, trademarks or copyrights.

Combined Heat & Power Plant

(Includes: Campus Exterior Lighting)

Ocean County College

One 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.

Table of Contents

1	Executive Summary	6
1.1	Facility Summary	6
1.2	Your Cost Reduction Opportunities.....	7
	Energy Conservation Measures.....	7
	Energy Efficient Practices	8
	On-Site Generation Measures.....	8
1.3	Implementation Planning.....	9
2	Facility Information and Existing Conditions	10
2.1	Project Contacts	10
2.2	General Site Information.....	10
2.3	Building Occupancy	10
2.4	Building Envelope.....	11
2.5	On-Site Generation.....	11
2.6	Energy-Using Systems	11
	Lighting System	12
	Heating and Cooling Systems.....	12
	Building Energy Management System (BEMS).....	13
2.7	Water-Using Systems	13
3	Site Energy Use and Costs	14
3.1	Total Cost of Energy	14
3.2	Electricity Usage	15
3.3	Natural Gas Usage	16
4	Energy Conservation Measures	17
4.1	Recommended ECMs	17
4.1.1	Lighting Upgrades.....	18
	ECM 1: Install LED Fixtures	18
	ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers.....	19
	ECM 3: Retrofit Fixtures with LED Lamps.....	20
5	Energy Efficient Practices	21
	Turn Off Unneeded Motors.....	21
	Reduce Motor Short Cycling.....	21
	Perform Routine Motor Maintenance	21
	Practice Proper Use of Thermostat Schedules and Temperature Resets	21
	Assess Chillers & Request Tune-Ups	21
	Clean Evaporator/Condenser Coils on AC Systems	22
	Clean and/or Replace HVAC Filters	22
	Perform Proper Boiler Maintenance.....	22
	Perform Maintenance on Compressed Air Systems	22
6	On-Site Generation Measures	23
6.1	Photovoltaic.....	23

- 6.2 Combined Heat and Power 23
- 7 Demand Response24**
- 8 Project Funding / Incentives25**
- 8.1 SmartStart 26
- 8.2 Energy Savings Improvement Program 27
- 8.3 Demand Response Energy Aggregator 28
- 9 Energy Purchasing and Procurement Strategies29**
- 9.1 Retail Electric Supply Options..... 29
- 9.2 Retail Natural Gas Supply Options 29

Appendix A: Equipment Inventory & Recommendations

Table of Figures

Figure 1 – Previous 12 Month Utility Costs.....	7
Figure 2 – Potential Post-Implementation Costs	7
Figure 3 – Summary of Energy Reduction Opportunities	7
Figure 4 – Project Contacts	10
Figure 5 - Building Schedule.....	10
Figure 6 - Utility Summary	14
Figure 7 - Energy Cost Breakdown	14
Figure 8 - Electric Usage & Demand.....	15
Figure 9 - Electric Usage & Demand.....	15
Figure 10 - Natural Gas Usage.....	16
Figure 11 - Natural Gas Usage.....	16
Figure 12 – Summary of Recommended ECMs.....	17
Figure 13 - ECM Incentive Program Eligibility.....	25

I EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPUB) has sponsored this Local Government Energy Audit (LGEA) Report for the Combined Heat & Power (CHP) Plant.

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 help local governments and public institutions in New Jersey to control their energy costs and protect our environment by reducing energy usage statewide.

I.1 Facility Summary

The CHP Plant is a 3,257 square foot electric and thermal energy generating facility. The CHP supplies hot water for heating to 11 campus buildings, chilled water for cooling to 3 campus buildings and distributes electric power to 14 campus buildings. The CHP Plant was constructed in 2012 and consists of concrete masonry block around a steel frame. A new chiller plant was added adjacent to the main building in 2016.

End-use consumption of energy at the CHP Plant itself is negligible. The building is typically occupied by just one or two people from 7:00 AM to 11:00 PM. The CHP system converts and transmits energy delivered to the College through its primary natural gas and electric accounts to hot or chilled water and electric energy used by campus buildings.

Heating hot water is generated by four modular, gas-fired Aerco BMK 6000 condensing boilers (total input capacity of 24,000 MBH). The Aerco boilers are about 93% efficient and were installed in January 2016. The boilers supply heating hot water to a campus-wide district heating system. The boilers also supply hot water to a 1,100-kW Waukesha reciprocated engine CHP system and to a Broad 300-ton absorption chiller. A York YMC² magnetic bearing variable speed 1400-ton chiller plant was installed at the CHP Plant in May 2016.

The campus-wide hot and chilled water distribution system is powered by three 75-HP pumps which are controlled by variable frequency drives VFDs. The fans of the new cooling towers (recently installed for the new chiller plant) and all other large motors at the CHP Plant are also controlled by VFDs.

Interior lighting at the CHP Plant (and the new adjacent chiller plant) is provided by 4-ft T8 linear fluorescent fixtures. The exterior perimeter of the building is lit by a mixture of 400-Watt metal halide fixtures, 150-Watt high pressure sodium (HPS) lights, and a few compact fluorescents. We have included in this report an inventory of all campus exterior lighting that is not directly connected to any campus building – such as walkway lights, lamp posts, roadway, and parking lot lighting. Most exterior lighting on campus is provided by high wattage metal halide and HPS fixtures. The college has recently converted the lights in parking areas to high efficiency LED fixtures.

A thorough description of existing equipment at the CHP Plant, plus campus lighting that is supplied by the college's main electric account, is located in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC recommends three lighting measures which together represent an opportunity to reduce annual energy costs by roughly \$29,592 and annual greenhouse gas emissions by 181,951 lbs CO₂e. All major HVAC equipment at the CHP Plant was found to high efficiency, relatively new, and well-controlled. No significant HVAC equipment upgrade opportunities were found. However, we estimate that if all recommended lighting measures for the campus are implemented as recommended in this report, the project could potentially pay for itself in energy savings alone in less than 1 year. The breakdown of existing utility costs for the main campus electric and gas accounts is shown below in Figure 1. In Figure 2 we show the potential utility costs following implementation of the recommended measures. Together these measures represent an opportunity to reduce annual electric usage on the campus' main electric account by 8%.

Figure 1 – Previous 12 Month Utility Costs

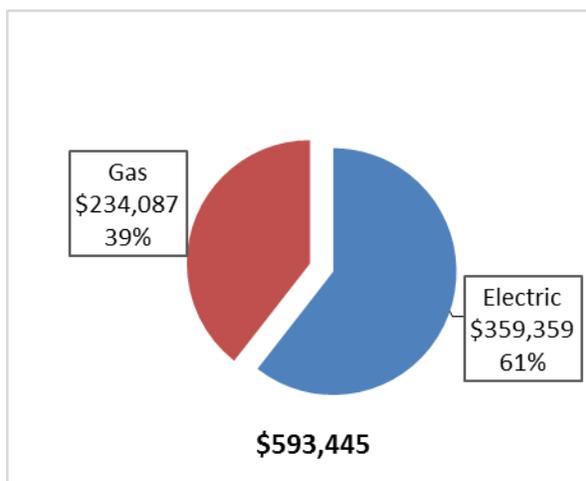
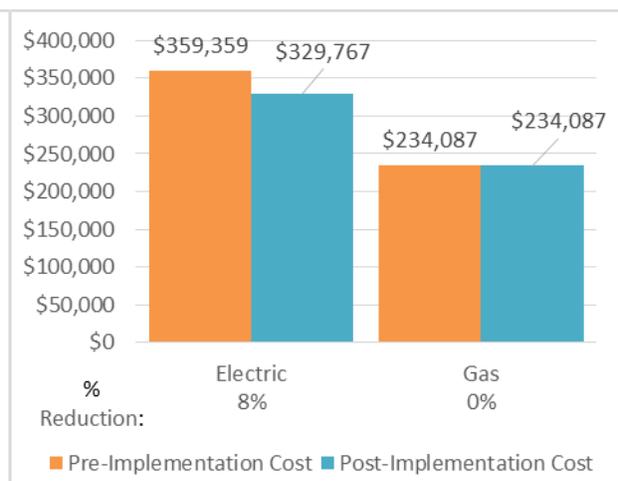


Figure 2 – Potential Post-Implementation Costs



A detailed description of the CHP Plant's existing energy use can be found in Section 3.

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

Figure 3 – Summary of Energy Reduction Opportunities

Energy Conservation Measure	Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades										
ECM 1 Install LED Fixtures	Yes	25,437	3.7	0.0	\$4,165.85	\$7,964.11	\$1,300.00	\$6,664.11	1.6	25,615
ECM 2 Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	17,932	1.3	0.0	\$2,936.72	\$4,343.83	\$525.00	\$3,818.83	1.3	18,057
ECM 3 Retrofit Fixtures with LED Lamps	Yes	137,319	20.1	0.0	\$22,489.01	\$15,497.60	\$0.00	\$15,497.60	0.7	138,279
TOTALS		180,687	25.1	0.0	\$29,591.59	\$27,805.55	\$1,825.00	\$25,980.55	0.9	181,951

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

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

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

Energy Efficient Practices

TRC also identified nine 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 recommended O&M are for all buildings and building equipment supplied by the CHP Plant. 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 O&M energy savings opportunities identified include:

- Turn Off Unneeded Motors
- Reduce Motor Short Cycling
- Perform Routine Motor Maintenance
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Assess Chillers & Request Tune-Ups
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Perform Proper Boiler Maintenance
- Perform Maintenance on Compressed Air Systems

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

On-Site Generation Measures

The CHP Plant has a 2-MW Waukesha combined heat and power system (aka cogeneration).

In other campus building reports, we have included estimates of photovoltaic (PV) solar electric generation potential. A summary of total solar PV generation potential for the campus will be included in a final summary report, which will include an estimate of the total impact of solar development on the campus' main electric account. With a relatively small rooftop, the CHP Plant is not a good candidate for solar PV development. The rooftops of other campus buildings would be more suitable for solar PV development. For details on our evaluation and on-site generation potential, please refer to section 6.

I.3 Implementation Planning

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

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

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

- SmartStart (SS)
- Energy Savings Improvement Program (ESIP)
- Demand Response Aggregator

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.

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 8.2 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 14, 2016, TRC performed an energy audit at CHP Plant located in Toms River, New Jersey. TRC's team met with James Calamia and Leonard Mannino to review the facility operations and help focus our investigation on specific energy-using systems.

The CHP Plant is a 3,257 square foot electric and thermal energy generating facility. The CHP Plant supplies heating hot water to 11 campus buildings, chilled water for cooling to three campus buildings and distributes electric power to 14 campus buildings. The CHP Plant was constructed in 2012.

A new chiller plant was added adjacent to the main building in 2016. End-use consumption of energy at the CHP Plant is minimal. The CHP Plant converts and transmits energy delivered to the College through its primary natural gas and electric accounts to hot or chilled water and electric energy used by campus buildings.

Overall, the major HVAC equipment at the CHP Plant was found to be high efficiency and relatively new with good control systems. No energy efficiency measures involving replacement of any existing HVAC equipment were found. Opportunities to further improve existing plant systems, through improved scheduling of the CHP and absorption chiller equipment or expanding capacity of the system, are addressed in a separate report.

2.3 Building Occupancy

The amount of end-use energy consumption at the CHP Plant is negligible. The building is typically occupied by just one or two people from 7:00 AM to 11:00 PM. The CHP Plant converts and transmits energy delivered to the college via its primary natural gas and electric accounts to thermal and electric energy used by campus buildings.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
CHP Plant	Weekday	7AM - 11PM
CHP Plant	Weekend	7AM - 11PM

2.4 Building Envelope

The building is constructed of concrete masonry block around a steel frame. The building has no windows. Building envelope measures are not relevant for this building, because most heat comes from equipment operation, not a separate building heating system and the building has minimal regular occupancy.

Image 1: CHP Plant - Building Exterior



2.5 On-Site Generation

The CHP Plant has a 1,100-kW Waukesha reciprocating engine CHP system which supplements power purchased from JCP&L through the campus' primary electric account, which is distributed from the CHP Plant to provide electric service to 14 campus buildings.

2.6 Energy-Using Systems

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

Lighting System

Interior lighting is provided by 4-ft T8 linear fluorescent fixtures.

The exterior perimeter of the building is lit by a mixture of 400-Watt metal halide fixtures, 150-Watt high pressure sodium lights, and a few compact fluorescents.

This report includes an inventory of all campus exterior lighting that is not directly connected to a campus building – such as walkway lights, lamp posts, roadway, and parking lot lighting. Most exterior lighting on campus is provided by high wattage metal halide and high pressure sodium fixtures. The college has recently converted the pole lighting in all of its parking lots to high efficiency LED fixtures.

Image 2: Interior Lighting



Image 3: Campus Walkway Lighting



Heating and Cooling Systems

Hot water for heating is generated by four modular, gas-fired Aerco BMK 6000 condensing boilers (total input capacity of 24,000 MBH). The Aerco boilers are about 93% efficient and were installed in January 2016. The boilers supply heating hot water to a campus-wide district heating system. The boilers also supply hot water to a 1.1 MW Waukesha reciprocated engine CHP system and to a Broad 300-ton absorption chiller.

The campus-wide hot and chilled water distribution system is powered by three 75-HP pumps, which are controlled by variable frequency drives (VFDs).

A York YMC² magnetic bearing variable speed 1400-ton chiller plant was installed at the CHP Plant in May 2016. It is a very high efficiency chiller system (0.582 kW/ton). The cooling towers installed for the new chiller plant have 5-HP motors which are controlled by VFDs.

All other large motors at the CHP Plant were also found to be controlled by VFDs. All major equipment at the CHP Plant and all HVAC equipment at campus buildings that are supplied by the CHP Plant is monitored and controlled from there via the building energy management system (BEMS).

Because all of the equipment at the CHP Plant was found to be high efficiency, well controlled, and of recent vintage no HVAC equipment replacements are recommended at this this. Options to increase the efficiency of the CHP and thermal distribution systems through operational changes or increases in capacity are provided in a separate CHP Plant Evaluation Report.

Image 4: York YMC2 High Efficiency Variable Speed Chillers

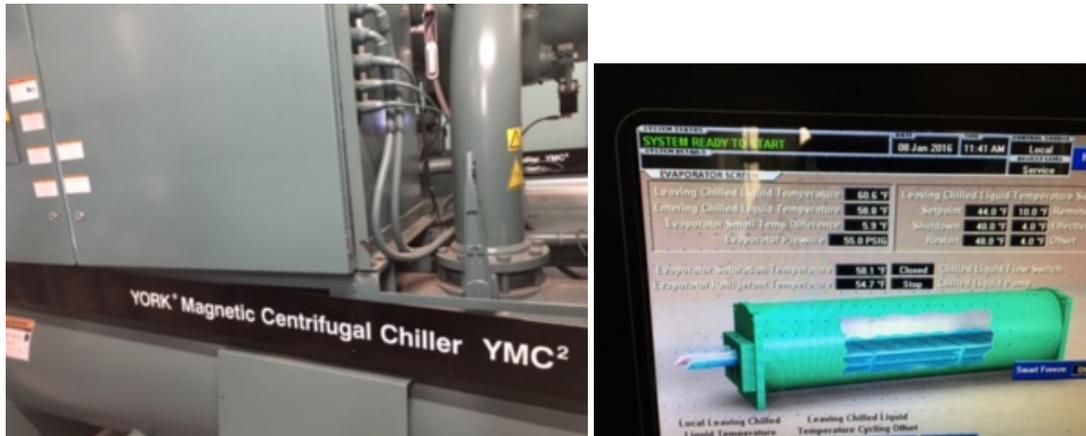


Image 5: VFDs control all pumps & fans system



Building Energy Management System (BEMS)

The CHP Plant uses a Tridium Building Energy Management System (BEMS) to monitor and control equipment onsite, its distribution system, and HVAC systems at all campus buildings. Other BEMS systems currently (or previously) used on campus include systems by: Siemens, Honeywell XL Plus, and Johnson Controls. However, they were all tied in via BACnet the new Tridium system to provide remote monitoring and control from the CHP Plant (or elsewhere) of virtually all building HVAC systems.

No BEMS upgrades are recommended at this time.

2.7 Water-Using Systems

The CHP Plant has one restroom. Restrooms faucets and toilets were found to meet current commercial “low-flow” standards for water usage efficiency.

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 **Error! Reference source not found.** for additional information.

3.1 Total Cost of Energy

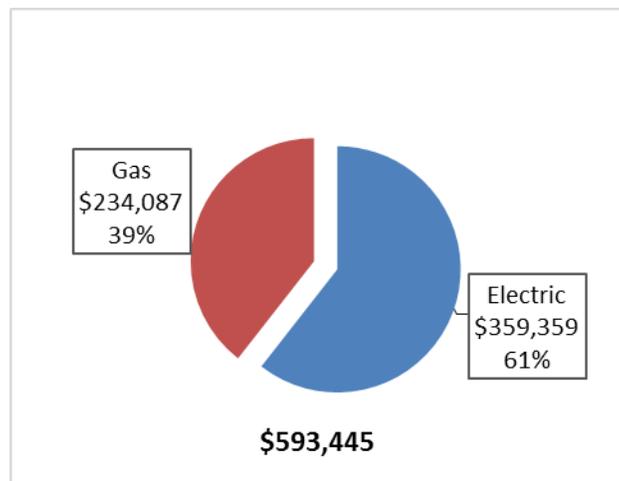
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 6 - Utility Summary

Utility Summary for Combined Heat & Power Building		
Fuel	Usage	Cost
Electricity	2,194,256 kWh	\$359,359
Natural Gas	265,267 Therms	\$234,087
Total		\$593,445

The current annual energy cost for this facility is \$593,445 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 over a recent 12-month billing period was \$0.164/kWh for the main campus electric account. This is a blended rate, which includes all delivery charges, all billing surcharges, and taxes paid. This rate used throughout the analyses in this report to assess energy costs and savings. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 8 - Electric Usage & Demand

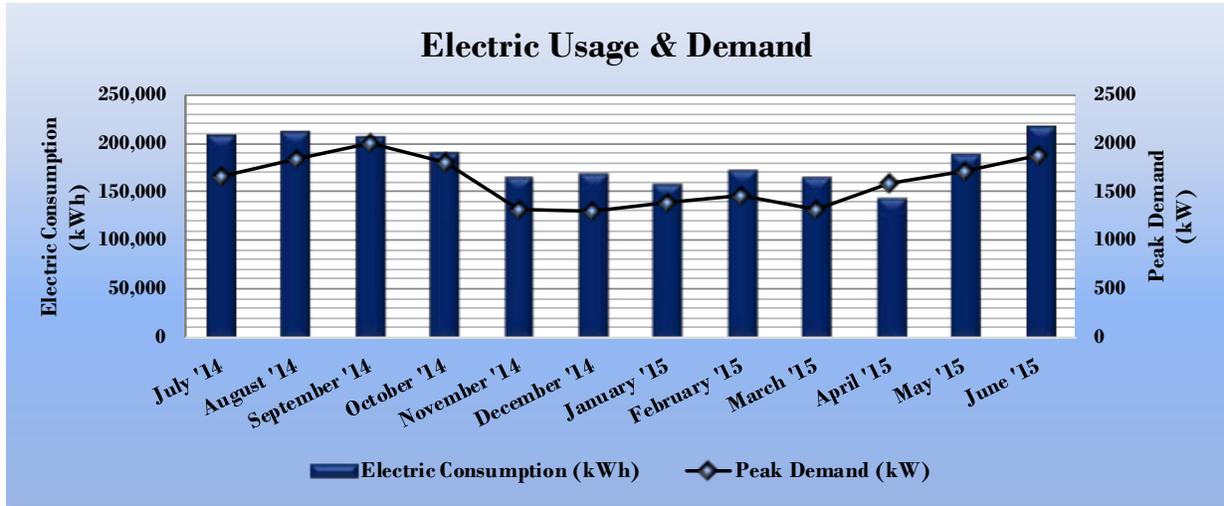


Figure 9 - Electric Usage & Demand

Electric Billing Data for Combined Heat & Power Plant					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost	TRC Estimated Usage?
8/6/14	31	208,353	1,665	\$24,087	No
9/5/14	29	213,118	1,839	\$32,894	No
10/3/14	29	208,160	1,996	\$33,739	No
11/4/14	32	191,033	1,800	\$32,627	No
12/5/14	31	166,747	1,320	\$29,285	No
1/6/15	32	169,129	1,306	\$28,013	No
2/5/15	30	159,372	1,385	\$29,245	No
3/6/15	29	172,684	1,468	\$40,306	No
4/7/15	32	165,334	1,314	\$26,140	No
5/7/15	30	144,261	1,582	\$24,022	No
6/8/15	32	190,166	1,712	\$30,595	No
7/8/15	30	217,922	1,879	\$30,373	No
Totals	367	2,206,279	1,996	\$361,328	0
Annual	365	2,194,256	1,996	\$359,359	

3.3 Natural Gas Usage

Natural gas is provided by NJ Natural Gas. The average gas cost over a recent 12-month billing period was \$0.882/therm for the main campus natural gas account. This is a blended rate, which includes all delivery charges, all billing surcharges, and taxes paid. This rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

Figure 10 - Natural Gas Usage

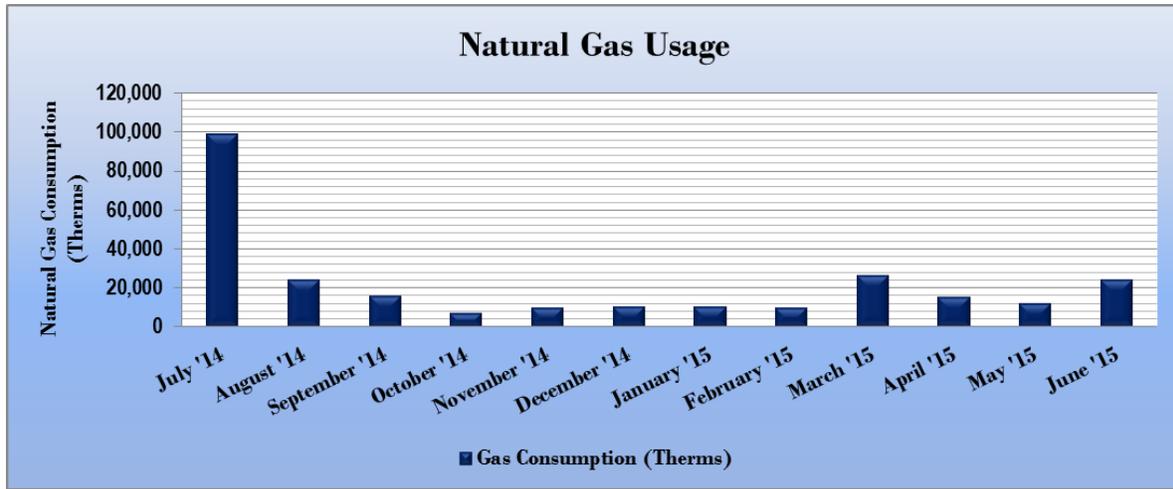


Figure 11 - Natural Gas Usage

Gas Billing Data for Combined Heat & Power Plant				
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost	TRC Estimated Usage?
8/1/14	31	98,837	\$86,388	No
9/1/14	31	24,487	\$20,728	No
10/1/14	30	16,123	\$14,279	No
11/1/14	31	7,249	\$5,620	No
12/1/14	30	10,003	\$9,526	Yes
1/1/15	31	10,336	\$9,844	Yes
2/1/15	31	10,336	\$9,844	Yes
3/1/15	28	9,724	\$9,315	No
4/1/15	31	26,671	\$23,614	No
5/1/15	30	15,409	\$14,112	No
6/1/15	31	11,828	\$10,727	No
7/1/15	30	24,265	\$20,089	No
Totals	365	265,267	\$234,087	3
Annual	365	265,267	\$234,087	

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 Combined Heat & Power Plant 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 12 – 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 ₂ e Emissions Reduction (lbs)
Lighting Upgrades		180,687	25.1	0.0	\$29,591.59	\$27,805.55	\$1,825.00	\$25,980.55	0.9	181,951
ECM 1	Install LED Fixtures	25,437	3.7	0.0	\$4,165.85	\$7,964.11	\$1,300.00	\$6,664.11	1.6	25,615
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	17,932	1.3	0.0	\$2,936.72	\$4,343.83	\$525.00	\$3,818.83	1.3	18,057
ECM 3	Retrofit Fixtures with LED Lamps	137,319	20.1	0.0	\$22,489.01	\$15,497.60	\$0.00	\$15,497.60	0.7	138,279
TOTALS		180,687	25.1	0.0	\$29,591.59	\$27,805.55	\$1,825.00	\$25,980.55	0.9	181,951

* - 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 below.

ECM 1: Install LED Fixtures

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO ₂ e Emissions Reduction (lbs)
Interior	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	0.0	0
Exterior	25,437	3.7	0.0	\$4,165.85	\$7,964.11	\$1,300.00	\$6,664.11	1.6	25,615

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, in order to maximize energy savings.

Measure Description

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

The fixtures included in this lighting measure are the exterior lighting fixtures at the CHP Plant. We recommend replacement of existing exterior lights at the CHP Plant with new LED exterior fixtures.

Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice that of a fluorescent tubes and more than 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 ₂ e Emissions Reduction (lbs)
Interior	17,932	1.3	0.0	\$2,936.72	\$4,343.83	\$525.00	\$3,818.83	1.3	18,057
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. This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space.

The fixtures included in this lighting measure are the interior lighting fixtures at the CHP Plant. We recommend retrofitting all of these fixtures with new LED lamps and ballasts. Replacing fluorescent ballasts with LED drivers, though not required for all LED tubes, is recommended when doing an LED upgrade to help ensure the long lifetime of the new LED tubes.

Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice that of a fluorescent tubes and more than 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 ₂ e Emissions Reduction (lbs)
Interior	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	0.0	0
Exterior	137,057	20.0	0.0	\$22,446.12	\$15,445.70	\$0.00	\$15,445.70	0.7	138,015

Measure Description

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

This lighting measure includes most of the exterior campus lighting, which is not directly associated with the CHP Plant, but is supplied by the campus' main electric account. Most of the walkway, roadway, and other non-building related campus lighting can be upgraded with LED retrofit kits designed to fit those fixtures, rather than replacing the entire fixture.

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

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.

Turn Off Unneeded Motors

Electric motors often run unnecessarily, and this is an overlooked opportunity to save energy. These motors should be identified and turned off when appropriate. For example, exhaust fans often run unnecessarily when ventilation requirements are already met. Reducing run hours for these motors can result in significant energy savings. Whenever possible, use automatic devices such as twist timers or occupancy sensors to ensure that motors are turned off when not needed.

Reduce Motor Short Cycling

Frequent stopping and starting of motors subjects rotors and other parts to substantial stress. This can result in component wear, reducing efficiency, and increasing maintenance costs. Adjust the load on the motor to limit the amount of unnecessary stopping and starting to improve motor performance.

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.

Clean Evaporator/Condenser Coils on AC Systems

Dirty evaporators and condensers coils cause a restriction to air flow and restrict heat transfer. This results in increased evaporator and condenser fan load and a decrease in cooling system performance. Keeping the coils clean allows the fans and cooling system to operate more efficiently.

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 and 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 Proper Boiler Maintenance

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

Perform Maintenance on Compressed Air Systems

Like all electro-mechanical equipment, compressed air systems require periodic maintenance to operate at peak efficiency. A maintenance plan should be developed for process related compressed air systems to include inspection, cleaning, and replacement of inlet filter cartridges, cleaning of drain traps, daily inspection of lubricant levels to reduce unwanted friction, inspection of belt condition and tension, checking for system leaks and adjustment of loose connections, and overall system cleaning. Contact a qualified technician for help with setting up periodic maintenance schedule.

6 ON-SITE GENERATION MEASURES

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

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

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

6.1 Photovoltaic

No solar PV measures are recommended for the CHP Plant. The rooftop is too small to make a solar array there cost effective. However, we recommend solar PV measures for multiple building that are supplied electricity via the main campus electric account, which is distributed from the CHP Plant. Those campus buildings with recommended solar measures, if implemented, would feed power into the campus-wide electric distribution system, which would reduce overall electric consumption.

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

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

6.2 Combined Heat and Power

The buildings has a 2-MW Waukesha cogeneration system, which according to our estimates, current generates about 13% of the total electric power provided from the CHP Plant to campus buildings. No upgrades to current CHP equipment or expansion of the current system is recommended at this time.

7 DEMAND RESPONSE

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

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

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

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

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

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

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

8 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and other benefits to ratepayers, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey’s Electricity Restructuring Law (1999), which requires all customers of investor-owned electric and gas utilities to pay a surcharge on their monthly energy bills. As a customer of a state-regulated electric or gas utility and therefore a contributor to the fund your organization is eligible to participate in the LGEA program and also eligible to receive incentive payment for qualifying energy efficiency measures. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 13 for a list of the eligible programs identified for each recommended ECM.

Figure 13 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings	Combined Heat & Power and Fuel Cell
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				

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

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

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

8.1 SmartStart

Overview

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

Equipment with Prescriptive Incentives Currently Available:

Electric Chillers

Electric Unitary HVAC

Gas Cooling

Gas Heating

Gas Water Heating

Ground Source Heat Pumps

Lighting

Lighting Controls

Refrigeration Doors

Refrigeration Controls

Refrigerator/Freezer Motors

Food Service Equipment

Variable Frequency Drives

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

Incentives

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

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

How to Participate

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

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

8.2 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.

8.3 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, utilities were allowed to charge Cost of Service and customers were given the ability to choose a third-party (i.e. non-utility) energy supplier.

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

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

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

9.2 Retail Natural Gas Supply Options

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

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

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

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

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

Location	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Main Boiler Room	10	Linear Fluorescent - T8: 4' T8 (32W) - 4L	None	114	8,760	Relamp & Reballast	No	10	LED - Linear Tubes: (4) 4' Lamps	None	58	8,760	0.41	5,641	0.0	\$923.91	\$1,618.33	\$200.00	1.54
Main Boiler Room	12	Linear Fluorescent - T8: 4' T8 (32W) - 5L	None	160	8,760	Relamp & Reballast	No	12	LED - Linear Tubes: (5) 4' Lamps	None	73	8,760	0.77	10,578	0.0	\$1,732.34	\$2,140.00	\$300.00	1.06
Control Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	None	93	8,760	Relamp & Reballast	No	1	LED - Linear Tubes: (1) 3' Lamp	None	11	8,760	0.06	831	0.0	\$136.11	\$95.50	\$0.00	0.70
Exterior	6	Metal Halide: (1) 400W Lamp	None	458	4,380	Fixture Replacement	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	90	4,380	1.63	11,122	0.0	\$1,821.43	\$2,344.06	\$600.00	0.96
Chiller Plant	5	Linear Fluorescent - T8: 4' T8 (32W) - 1L	None	32	8,760	Relamp & Reballast	No	5	LED - Linear Tubes: (1) 4' Lamp	None	15	8,760	0.06	881	0.0	\$144.36	\$490.00	\$25.00	3.22
Side Wall Over Door B	1	Compact Fluorescent: 2 x 13W CFLs	None	26	4,380	Relamp	No	1	LED Screw-In Lamps: 5W LED PL Lamps	None	10	4,380	0.01	81	0.0	\$13.20	\$43.00	\$0.00	3.26
Side Wall Over Door A	1	Compact Fluorescent: 2 x 13W CFLs	None	26	4,380	Relamp	No	1	LED Screw-In Lamps: 5W LED PL Lamps	None	10	4,380	0.01	81	0.0	\$13.20	\$43.00	\$0.00	3.26
Side Wall over Doors C & D	2	Metal Halide: (1) 100W Lamp	None	128	4,380	Fixture Replacement	No	2	LED - Fixtures: 18W LED Flood Light	None	18	4,380	0.16	1,108	0.0	\$181.48	\$454.28	\$0.00	2.50
Backside of Collong Tower	2	High-Pressure Sodium: (1) 150W Lamp	None	188	4,380	Fixture Replacement	No	2	LED - Fixtures: 18W LED Flood Light (w/ Battery Back-up)	None	18	4,380	0.25	1,713	0.0	\$280.47	\$1,564.46	\$0.00	5.58
Side wall next to Door B	1	High-Pressure Sodium: (1) 150W Lamp	None	188	4,380	Fixture Replacement	No	1	LED - Fixtures: 18W LED Flood Light (w/ Battery Back-up)	None	18	4,380	0.13	856	0.0	\$140.24	\$782.23	\$0.00	5.58
Campus Wide - Mall Lighting	14	High-Pressure Sodium: (1) 150W Lamp	None	188	4,380	Relamp	No	14	LED - Fixtures: Outdoor Post-Mount	None	45	4,380	1.47	10,084	0.0	\$1,651.49	\$1,356.60	\$0.00	0.82
Campus Wide - Mall Lighting	48	High-Pressure Sodium: (1) 250W Lamp	None	295	4,380	Relamp	No	48	LED - Fixtures: Outdoor Post-Mount	None	60	4,380	8.30	56,817	0.0	\$9,305.12	\$9,468.00	\$0.00	1.02
Lamp Posts - Tennis Court / Soccer Field	18	Quartz Halogen: 500W Flood Light	None	500	4,380	Relamp	No	18	LED - Fixtures: Outdoor Post-Mount	None	18	4,380	6.39	43,701	0.0	\$7,157.02	\$1,046.70	\$0.00	0.15
Gateway Mall Lights	36	Metal Halide: (1) 150W Lamp	None	190	4,380	Relamp	No	36	LED - Fixtures: Outdoor Post-Mount	None	45	4,380	3.84	26,293	0.0	\$4,306.09	\$3,488.40	\$0.00	0.81
Gateway Service Road - Pole Lights	4	Metal Halide: (1) 400W Lamp	None	458	4,380	LED Retrofit	No	4	LED - Fixtures: Large Pole/Arm-Mounted Area/Roadway Fixture	None	120	4,380	1.00	6,810	0.0	\$1,115.29	\$1,294.04	\$600.00	0.62
Lake Flag Pole Lights	2	Metal Halide: (1) 400W Lamp	None	458	4,380	Fixture Replacement	No	2	LED - Fixtures: Architectural Flood/Spot Luminaire	None	78	4,380	0.56	3,828	0.0	\$626.94	\$1,525.04	\$100.00	2.27
ACC Bus Stop	1	High-Pressure Sodium: (1) 50W Lamp	None	66	4,380	Relamp	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	14	4,380	0.04	262	0.0	\$42.90	\$51.90	\$0.00	1.21

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
PARKING LOT LIGHTS	273	LED - Fixtures: Large Pole/Arm-Mounted Area/Roadway Fixture	None	458	4,380	None	No	273	LED - Fixtures: Large Pole/Arm-Mounted Area/Roadway Fixture	None	458	4,380	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
Boiler area	Central Campus	3	Heating Hot Water Pump	75.0	94.1%	Yes	5,840	No	94.1%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Chiller plant	Serves 4 New Chillers	3	Cooling Tower Fan	5.0	89.5%	Yes	2,920	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
Chiller Plant	Central Campus	1	Water-Cooled Centrifugal Chiller	1,400.00	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
CHP Building	Serves (11) Campus Buildings	4	Condensing Hot Water Boiler	5,580.00	No						0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

