Local Government Energy Audit:
Energy Audit Report

District Energy Plant

1 Normal Ave

Montclair, New Jersey 07043

Montclair State University

July 16, 2018

Final Report by:

TRC Energy Services

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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 in order to implement some of the measures recommended in this report.

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

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

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

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1 Executive Summary

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

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

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

1.1 Facility Summary

The District Energy Plant is a 23,352-square foot facility constructed in 2013. The building is a single story central plant facility having several spaces including chiller room, turbine room, electrical room, open office areas, and private offices.

The District Energy Plant prime mover is a 5.4 MW gas turbine. The waste heat from power generation is converted to steam and used by campus for space heating and in a 2,300-ton steam turbine driven chiller. There are also two 49 MMBtu/hr Cleaver-Brook steam boilers which are kept in standby. A 2,000-ton electric centrifugal chiller supplements the steam driven chiller.

Lighting at the District Energy Plant consists of a combination of 17-Watt T8 fluorescent fixtures, 28-Watt T5 fluorescent fixtures, and 15-Watt compact fluorescent fixtures; all of which are inefficient in performance when compared to the latest lighting technology available in the market. Exterior lighting is provided by 150-Watt High-Pressure Sodium fixtures. All the exit lamps are fluorescent lamps. Lighting control is provided by manual switches for both interior and exterior fixtures.

The minimal cooling and heating required by the DEP is provided by split a system heat pump, however, the DEP consists of cooling and heating equipment that serves the entire campus. This is further elaborated in Section 3 of the report.

A thorough description of the facility and our observations are located in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated and recommended five (5) measures for implementation which together represent an opportunity for the District Energy Plant to reduce annual energy costs by $5,569 and annual greenhouse gas emissions by 33,379 lbs CO_2e. We estimate that if all high priority measures are implemented as recommended, the project will pay for itself in 1.5 years. TRC has defined high priority measures as the evaluated measures that have a simple payback less than the typical equipment life of the proposed equipment. The breakdown of existing and potential utility costs after project implementation are illustrated in Figure 1 and Figure 2, respectively. Together these measures represent an opportunity to reduce District Energy Plant's annual energy use by 37%.

Figure 1 – Previous 12 Month Utility Costs

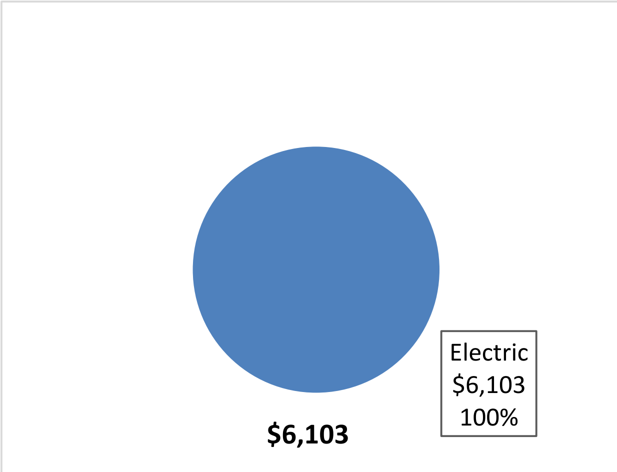
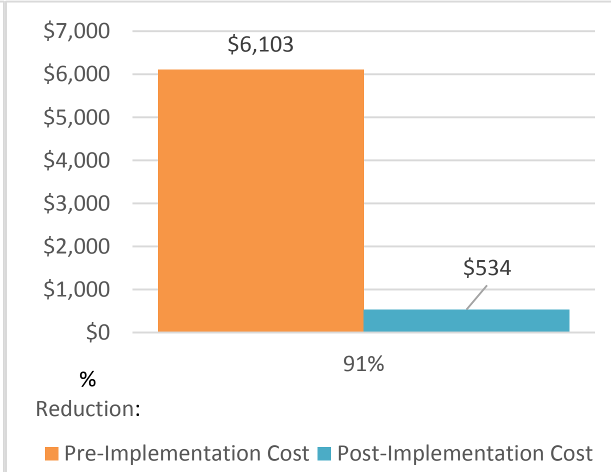


Figure 2 – Potential Post-Implementation Costs



A detailed description of the District Energy Plant's building systems existing energy use can be found in Section 3.

Estimates of the total cost, energy savings, and financial incentives for the evaluated 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		High Priority?	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			**32,092**	**2.6**	**0.0**	**$5,391.43**	**$9,393.45**	**$1,650.00**	**$7,743.45**	**1.4**	**32,316**
ECM 1	Install LED Fixtures	Yes	2,306	0.3	0.0	$387.35	$1,562.71	$400.00	$1,162.71	3.0	2,322
ECM 2	Retrofit Fixtures with LED Lamps	Yes	28,744	2.2	0.0	$4,828.95	$7,077.85	$1,250.00	$5,827.85	1.2	28,945
ECM 3	Install LED Exit Signs	Yes	1,042	0.1	0.0	$175.13	$752.89	$0.00	$752.89	4.3	1,050
Lighting Control Measures			**625**	**0.1**	**0.0**	**$105.08**	**$810.00**	**$105.00**	**$705.00**	**6.7**	**630**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	625	0.1	0.0	$105.08	$810.00	$105.00	$705.00	6.7	630
Domestic Water Heating Upgrade			**430**	**0.0**	**0.0**	**$72.27**	**$96.47**	**$0.00**	**$96.47**	**1.3**	**433**
ECM 5	Install Low-Flow Domestic Hot Water Devices	Yes	430	0.0	0.0	$72.27	$96.47	$0.00	$96.47	1.3	433
TOTALS FOR HIGH PRIORITY MEASURES			**33,147**	**2.7**	**0.0**	**$5,568.77**	**$10,299.92**	**$1,755.00**	**$8,544.92**	**1.5**	**33,379**
TOTALS FOR ALL EVALUATED MEASURES			**33,147**	**2.7**	**0.0**	**$5,568.77**	**$10,299.92**	**$1,755.00**	**$8,544.92**	**1.5**	**33,379**

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

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

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

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

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

Energy Efficient Practices

TRC also identified seven (7) low-cost or no-cost energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral or operational adjustments and by performing better routine maintenance on building systems. These practices can extend equipment lifetime, improve occupant comfort, provide better health and safety, as well as reduce annual energy and O&M costs. Potential opportunities identified at District Energy Plant include:

- Close Doors and Windows
- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Perform Routine Motor Maintenance
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Install Plug Load Controls

For details on these Energy Efficient Practices, please refer to Section 5.

On-Site Generation Measures

TRC evaluated the potential for expanding on-site generation at the District Energy Plant. Based on the configuration of the site and its loads there is a low potential for installing any PV or additional combined heat and power self-generation measures.

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

1.3 Implementation Planning

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

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

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

- SmartStart
- Pay for Performance - Existing Building (P4P)
- Energy Savings Improvement Program (ESIP)

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

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

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the Energy Savings Improvement Program (ESIP). Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. An LGEA report (or other approved energy audit) is required for participation in ESIP. Please refer to Section 8.3 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			
Ana Pinto	Director of Energy Management	pintoa@mail.montclair.edu	973-655-3244
TRC Energy Services			
Vish Nimbalkar	Auditor	VNaikNimbalkar@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On October 25, 2017, TRC performed an energy audit at the District Energy Plant located in Montclair, New Jersey. TRC met with Ana Pinto to review the facility operations and help focus our investigation on specific energy-using systems.

The District Energy Plant is a 23,352-square foot facility constructed 2013. The building is a single story central plant facility having several spaces including chiller room, turbine room, electrical room, open office areas, and private offices.

The District Energy Plant's prime mover is a 5.4 MW gas turbine. The waste heat from power generation is converted to steam and used by campus for space heating and in a 2,300-ton steam turbine driven chiller. There are also two 49 MMBtu/hr Cleaver-Brook steam boilers, which are kept in standby. A 2,000-ton electric centrifugal chiller supplements the steam driven chiller.

Lighting at the District Energy Plant consists of a combination of 17-Watt T8 fluorescent fixtures, 28-Watt T5 fluorescent fixtures, and 15-Watt compact fluorescent fixtures, all of which are inefficient in performance when compared to the latest lighting technology available in the market. Exterior lighting is provided by 150-Watt high-pressure sodium fixtures. All the exit lamps are fluorescent lamps. Lighting control is provided by manual switches for both interior and exterior fixtures.

The minimal cooling and heating required by the DEP is provided by split a system heat pump; however, the DEP consists of cooling and heating equipment that serves the entire campus. This further is elaborated in Section 3 of the report.

2.3 Building Occupancy

The building is continually occupied.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
District Energy Plant	Weekday	12:00 AM - 12:00 AM
District Energy Plant	Weekend	12:00 AM - 12:00 AM

2.4 Building Envelope

The District Energy Plant is a one-story building. The construction is of concrete masonry block with finished painted exterior. The flat roof is constructed of built-up roofing material.

Figure 6 – Building Façade

2.5 On-Site Generation

The District Energy plant generates electricity with a 5.4 MW natural gas fired turbine manufactured by Solar Turbines. Waste heat from the turbines is used to produce steam. The steam is delivered to some of the buildings on campus and used to produce chilled water which is also delivered to some of the buildings on campus.

2.6 Energy-Using Systems

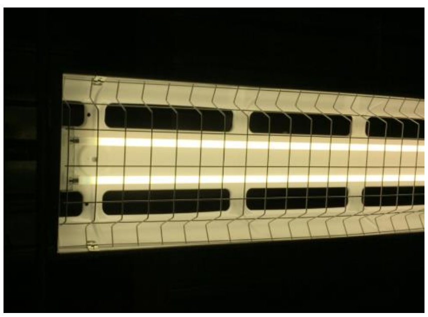
Please see Appendix A: Equipment Inventory & Recommendations for an inventory of the facility's equipment.

Lighting System

Lighting at the District Energy Plant consists of a combination of 17-Watt T8 fluorescent fixtures and 28-Watt T5 fluorescent fixtures, which are inefficient in performance when compared to the latest lighting technology available in the market. Most of the linear fluorescent fixtures are 2-foot or 4-foot long troffers with diffusers having 2-lamp configurations. In addition to the fluorescent fixtures, the facility is also served by 15-Watt compact fluorescent lamps. All the exit signs have 23-Watt compact fluorescent lamps.

Interior lighting control in the building is provided by manual switches.

Figure 7 - Building Lighting Systems

Typical 4-foot T5 Fluorescent Fixture	*Typical 2-foot T8 Fluorescent Fixture*
	

The building's exterior lighting consists primarily of 150-Watt high pressure sodium fixtures. The exterior lamps that are also controlled by manual switches.

Central Plant Equipment

The District Energy Plant is powered by a single 5.4 MW gas turbine that runs at 100% capacity. The heat recovery steam generator (HSRG) converts waste heat from power generation to steam which is used by the campus for space heating, in a steam turbine driven chiller, and by the deaerator which removes O_2 from the feedwater. Any excess steam goes to a dump condenser, which cools the steam into condensate. The cycle is completed as the steam condensate is returned to the condensate storage tank.

It should be noted, that a dump condenser should be used as last resort as it can dramatically lower system efficiency.

There is a supplementary natural gas duct burner before the HRSG which can increase its capacity from 28,000 to 53,000 lbs/hr as needed.

In addition, there are two (2) 49 MMBtu/hr Cleaver-Brook steam boilers, which are kept in standby mode and can be used for both heating and to generate chilled water with the steam driven chiller.

Figure 8 – Central Plant Equipment

Hot Water Boilers	*Solar Turbine*
	

Chilled water is provided by one (1) 2,300-ton steam turbine driven chiller and one (1) 2,000-ton electric centrifugal chiller. The steam chiller is used most of the year and the electric chiller is hardly used (2 weeks/yr).

In addition, there is a water-side economizer (WSE) rated at 800 tons that provides free cooling whenever possible based on OA conditions. The WSE is engaged (manually) when OAT enthalpy is in the right range and OAT is <=55F DB.

Figure 9 - Central Plant Equipment

Chiller

Cooling Towers

Three (3) chilled water (CHW) pumps rated at 250-hp each provide CHW to the campus. They all have VFDs and are rated at 2,000 gallons per minute (gpm) each. The CHW is supplied at 42°F, but is reset as high as 56°F.

Three (3) condenser water (CW) pumps also rated at 250-hp each circulate CW from the cooling tower. The pumps are rated at 6,750 gpm each and are constant speed. The CW is used for both chillers, the turbine oil cooler, steam dump condenser, and steam sampling station application. There are three (3) induced draft cooling towers with 2-cell each are used for heat transfer. The towers are rated at 5,400 gpm each (2,700 gpm per cell). Each cell has a 50-hp fan motor controlled via a VFD.

Rockwell controls are used to control all CHP equipment. The control system identifies the best pump to run based on specific pump curves, OAT, and demand.

Direct Expansion Air Conditioning System (DX)

A 2-ton Mitsubishi split system heat pump is used to condition the control room. The fan and evaporator are located in inside the building. The compressor and condensing unit are located on the ground outside. The unit provides constant air volume. The unit utilizes a scroll compressor and a direct-expansion (DX) coil.

Figure 10 – DX Split System

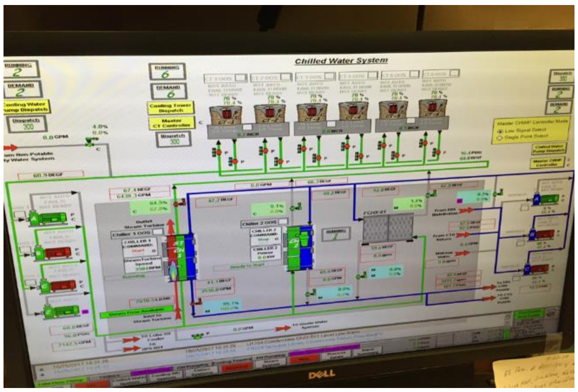
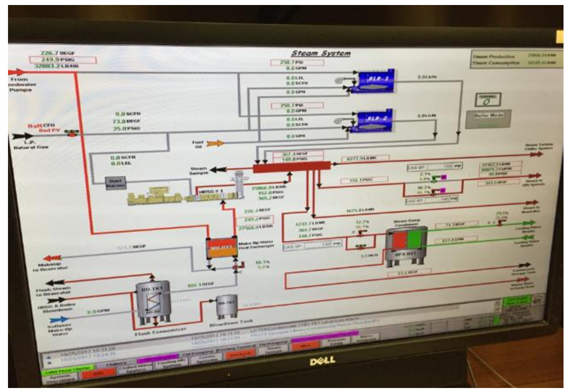
Indoor Evaporator Unit

Split System Nameplate

Building Energy Management System (BEMS)

The chiller plant has Trane Tracer EMS. The entire central plant is DDC. The Tracer EMS is capable of providing trends for individual DDC points for up to one-year of historical data. The boiler plant is manually controlled by the facility engineers.

Figure 11 – Building Energy Management System (BEMS)

Chiller EMS Screen	*Steam System EMS*
	

Building Plug Load

There are roughly six (6) computer work stations throughout the facility. All the computers are desktop units with LCD monitors. There is no centralized PC power management software installed.

The facility contains other systems which contribute to plug load including printers, microwaves, refrigerators, etc. at the facility.

3 SITE ENERGY USE AND COSTS

This building receives electricity through master meters. It also receives electricity from the cogeneration equipment located in the building. Electricity was prorated for individual buildings based on building size and function.

Prorated and direct purchase utility data were evaluated to determine the annual energy performance metrics for the building in energy cost per square foot and energy usage per square foot. These metrics are an estimate of the relative energy efficiency of this building. There are a number of factors that could cause the energy use of this building to vary from the "typical" energy usage profile for facilities with similar characteristics. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and energy efficient behavior of occupants all contribute to benchmarking scores. Please refer to the Benchmarking section within Section 3.3 for additional information.

3.1 Total Cost of Energy

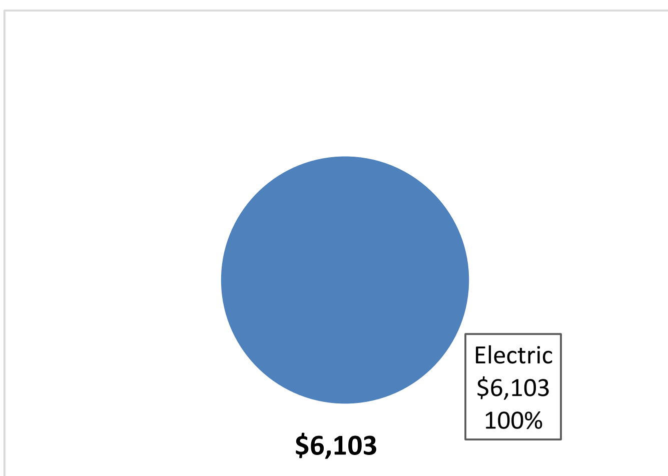
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 12 - Utility Summary

Utility Summary for District Energy Plant		
Fuel	**Usage**	**Cost**
Electricity	89,185 kWh	$6,103
Total		**$6,103**

The current annual energy cost for this facility is $6,103 as shown in the chart below.

Figure 13 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was $0.168/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 14 - Electric Usage & Demand

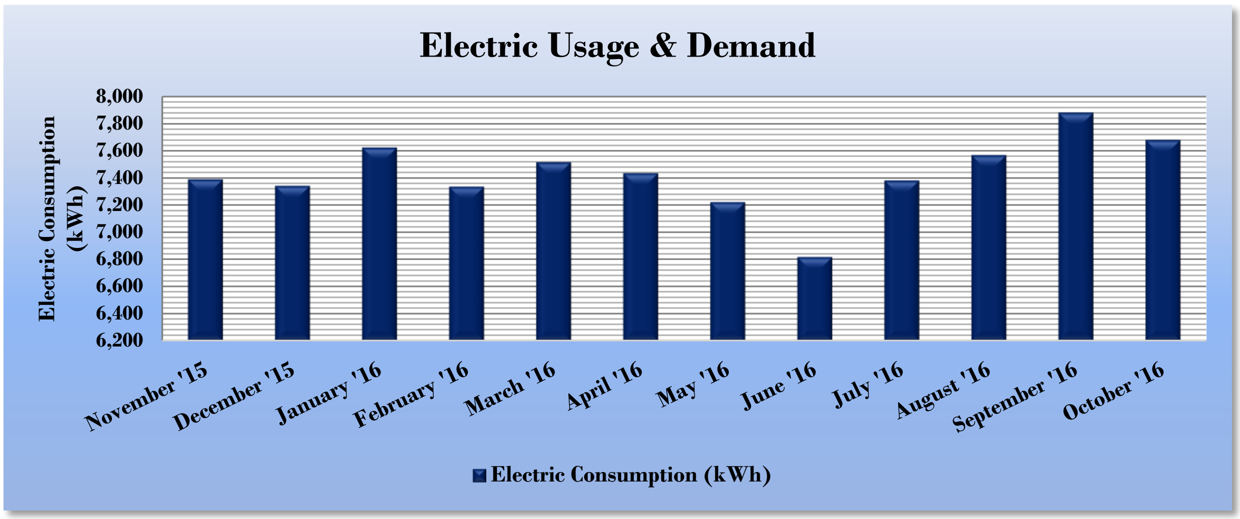


Figure 15 - Electric Usage & Demand

Electric Billing Data for District Energy Plant				
Period Ending	Days in Period	Electric Usage (kWh)	Total Electric Cost	TRC Estimated Usage?
11/30/15	30	7,388	$436	Yes
12/31/15	31	7,342	$552	Yes
1/31/16	31	7,623	$454	Yes
2/28/16	28	7,335	$1,053	Yes
3/31/16	31	7,515	$422	Yes
4/30/16	30	7,435	$421	Yes
5/31/16	31	7,220	$412	Yes
6/30/16	30	6,818	$444	Yes
7/31/16	31	7,380	$469	Yes
8/31/16	31	7,568	$498	Yes
9/30/16	30	7,880	$486	Yes
10/31/16	31	7,680	$457	Yes
Totals	**365**	**89,185**	**$6,103**	12
Annual	**365**	**89,185**	**$6,103**	

3.3 Natural Gas Usage

Natural gas is provided to the building for use in the combustion gas turbine and boilers, but no gas is used to condition the building.

3.4 Benchmarking

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

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

Figure 16 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	District Energy Plant	National Median Building Type: Higher Education - Public
Source Energy Use Intensity (kBtu/ft^2)	40.9	262.6
Site Energy Use Intensity (kBtu/ft^2)	13.0	130.7

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

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

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	District Energy Plant	National Median Building Type: Higher Education - Public
Source Energy Use Intensity (kBtu/ft^2)	25.7	262.6
Site Energy Use Intensity (kBtu/ft^2)	8.2	130.7

Many types of commercial buildings are also eligible to receive an ENERGY STAR® score. This score is a percentile ranking from 1 to 100. It compares your building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75 percent of all similar buildings nationwide and may be eligible for ENERGY STAR® certification.

As the electric and gas accounts were shared between various buildings, it was not possible to benchmark these buildings and provide a score individually. A campus wide Portfolio Manager Statement of Energy Performance (SEP) was generated.

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

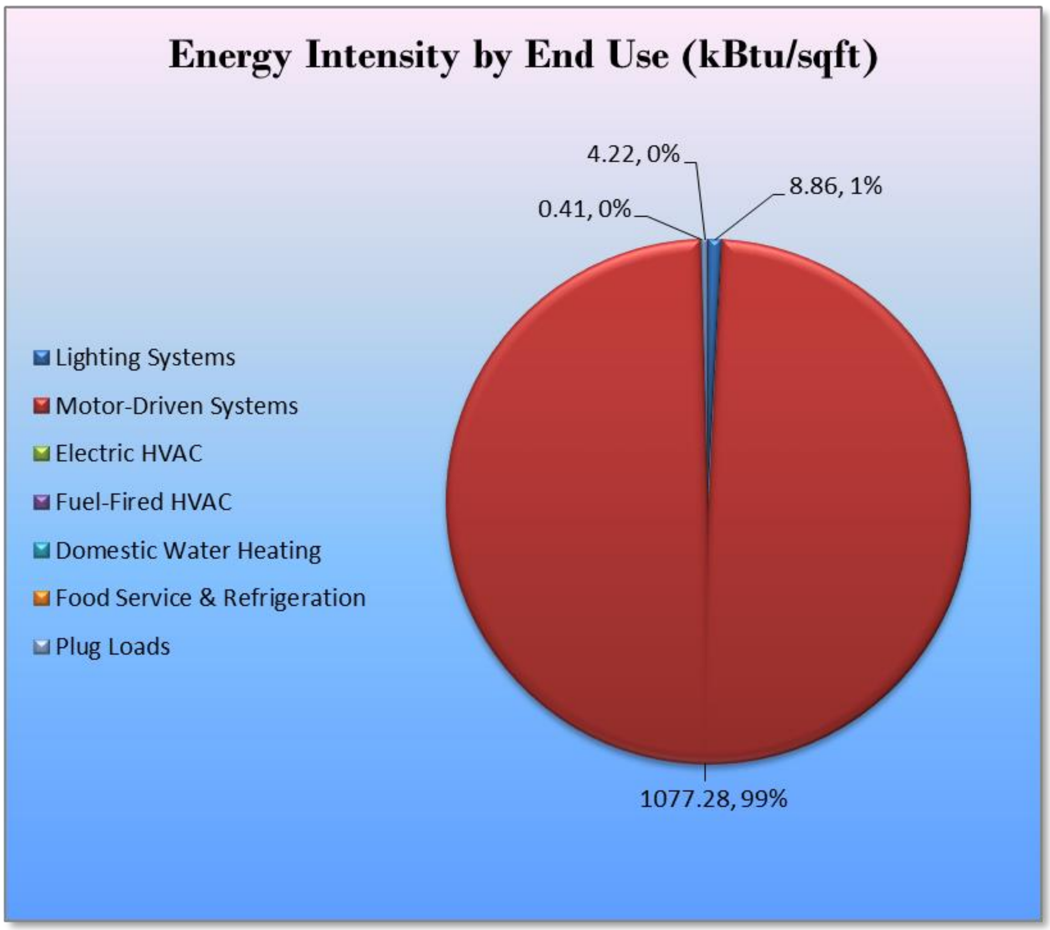
A Portfolio Manager account has been created online for your facility and you will be provided with the login information for the account. We encourage you to update your utility information in Portfolio Manager regularly, so that you can keep track of your building's performance. Free online training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

3.5 Energy End-Use Breakdown

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

It should be noted that the energy associated with the gas turbine, chillers, and boilers were prorated across all of the buildings using those utilities and accounted for at the building level. The campus distribution pumps, however, are accounted for at the DEP.

Figure 18 - Energy Balance (% and kBtu/SF)



4 Energy Conservation Measures

The goal of this audit report is to identify potential building system energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the District Energy 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 High Priority ECMs

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

Figure 19 – Summary of High Priority ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**32,092**	**2.6**	**0.0**	**$5,391.43**	**$9,393.45**	**$1,650.00**	**$7,743.45**	**1.4**	**32,316**
ECM 1	Install LED Fixtures	2,306	0.3	0.0	$387.35	$1,562.71	$400.00	$1,162.71	3.0	2,322
ECM 2	Retrofit Fixtures with LED Lamps	28,744	2.2	0.0	$4,828.95	$7,077.85	$1,250.00	$5,827.85	1.2	28,945
ECM 3	Install LED Exit Signs	1,042	0.1	0.0	$175.13	$752.89	$0.00	$752.89	4.3	1,050
Lighting Control Measures		**625**	**0.1**	**0.0**	**$105.08**	**$810.00**	**$105.00**	**$705.00**	**6.7**	**630**
ECM 4	Install Occupancy Sensor Lighting Controls	625	0.1	0.0	$105.08	$810.00	$105.00	$705.00	6.7	630
Domestic Water Heating Upgrade		**430**	**0.0**	**0.0**	**$72.27**	**$96.47**	**$0.00**	**$96.47**	**1.3**	**433**
ECM 5	Install Low-Flow Domestic Hot Water Devices	430	0.0	0.0	$72.27	$96.47	$0.00	$96.47	1.3	433
TOTALS		**33,147**	**2.7**	**0.0**	**$5,568.77**	**$10,299.92**	**$1,755.00**	**$8,544.92**	**1.5**	**33,379**

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

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

4.2 Lighting Upgrades

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

Figure 20 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**32,092**	**2.6**	**0.0**	**$5,391.43**	**$9,393.45**	**$1,650.00**	**$7,743.45**	**1.4**	**32,316**
ECM 1	Install LED Fixtures	2,306	0.3	0.0	$387.35	$1,562.71	$400.00	$1,162.71	3.0	2,322
ECM 2	Retrofit Fixtures with LED Lamps	28,744	2.2	0.0	$4,828.95	$7,077.85	$1,250.00	$5,827.85	1.2	28,945
ECM 3	Install LED Exit Signs	1,042	0.1	0.0	$175.13	$752.89	$0.00	$752.89	4.3	1,050

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	0.0	0
Exterior	2,306	0.3	0.0	$387.35	$1,562.71	$400.00	$1,162.71	3.0	2,322

Measure Description

We recommend replacing existing 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 HID 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	28,744	2.2	0.0	$4,828.95	$7,077.85	$1,250.00	$5,827.85	1.2	28,945
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

We recommend retrofitting existing T5 and T8 linear fluorescent 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.

Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice that of fluorescent tubes.

ECM 3: Install LED Exit Signs

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	1,042	0.1	0.0	$175.13	$752.89	$0.00	$752.89	4.3	1,050
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

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

4.3 Lighting Control Measures

Our recommendations for lighting control measures are summarized in Figure 21 below.

Figure 21 – Summary of Lighting Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**625**	**0.1**	**0.0**	**$105.08**	**$810.00**	**$105.00**	**$705.00**	**6.7**	**630**
ECM 4	Install Occupancy Sensor Lighting Controls	625	0.1	0.0	$105.08	$810.00	$105.00	$705.00	6.7	630

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

ECM 4: Install Occupancy Sensor Lighting Controls

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
625	0.1	0.0	$105.08	$810.00	$105.00	$705.00	6.7	630

Measure Description

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

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

4.4 Domestic Hot Water Heating System Upgrades

Our recommendations for domestic water heating system improvements are summarized in Figure 22 below.

Figure 22 - Summary of Domestic Water Heating ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**430**	**0.0**	**0.0**	**$72.27**	**$96.47**	**$0.00**	**$96.47**	**1.3**	**433**
ECM 5	Install Low-Flow Domestic Hot Water Devices	430	0.0	0.0	$72.27	$96.47	$0.00	$96.47	1.3	433

ECM 5: Install Low-Flow DHW Devices

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
430	0.0	0.0	$72.27	$96.47	$0.00	$96.47	1.3	433

Measure Description

We recommend installing low-flow domestic hot water devices to reduce overall hot water demand. Energy demand from domestic hot water heating systems can be reduced by reducing water usage in general. Faucet aerators and low-flow showerheads can reduce hot water usage, relative to standard showerheads and aerators, which saves energy.

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing. This reduces the amount of water used per day resulting in energy and water savings.

5 Energy Efficient Practices

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

Close Doors and Windows

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

Perform Proper 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.

Develop a Lighting Maintenance Schedule

In addition to routine fixture cleaning, development of a maintenance schedule can both ensure maintenance is performed regularly and can reduce the overall cost of fixture re-lamping and re-ballasting. By re-lamping and re-ballasting fixtures in groups, lighting levels are better maintained and the number of site visits by a lighting technician or contractor can be minimized, decreasing the overall cost of maintenance.

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.

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.

Plug Load Controls

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

6 On-Site Generation Measures

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

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

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

6.1 Photovoltaic

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

A preliminary screening based on the campus' electric demand and the size and location of free areas on campus was performed and is addressed in the campus level summary report.

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

Combined heat and power (CHP) is the on-site generation of electricity along with the recovery of heat energy, which is put to beneficial use. Common technologies for CHP include reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines. Electric generation from a CHP system is typically interconnected to local power distribution systems. Heat is recovered from exhaust and ancillary cooling systems and interconnected to the existing hot water (or steam) distribution systems.

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

The facility has a CHP system with waste heat to chiller plant.

Please see Section 2.6 for additional information.

7 Demand Response

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

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

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

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

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

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

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

In our opinion this building is not is a good candidate for DR.

8 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and other benefits to ratepayers, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey's Electricity Restructuring Law (1999), which requires all customers of investor-owned electric and gas utilities to pay a surcharge on their monthly energy bills. As a customer of a state-regulated electric or gas utility and therefore a contributor to the fund your organization is eligible to participate in the LGEA program and also eligible to receive incentive payment for qualifying energy efficiency measures. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 23 for a list of the eligible programs identified for each recommended ECM.

Figure 23 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings	Large Energy Users Program	Combined Heat & Power and Fuel Cell
ECM 1	Install LED Fixtures	X			X		
ECM 2	Retrofit Fixtures with LED Lamps	X			X		
ECM 3	Install LED Exit Signs	X			X		
ECM 4	Install Occupancy Sensor Lighting Controls	X			X		
ECM 5	Install Low-Flow Domestic Hot Water Devices						

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. This facility does not meet all of the criteria for participating in the P4P program based on the measures identified in this study. However, since additional measures may be identified during the P4P evaluation and the facility is close to meeting the P4P program criteria it is worth considering the P4P program for this site. 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 Pay for Performance - Existing Buildings

Overview

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

Incentives

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

How to Participate

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

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

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

8.3 Energy Savings Improvement Program

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

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

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

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

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

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

9 Energy Purchasing and Procurement Strategies

9.1 Retail Electric Supply Options

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

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

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

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

9.2 Retail Natural Gas Supply Options

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

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

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Turbine Section	8	Linear Fluorescent - T5: 4' T5 (28W) - 2L	Wall Switch	60	8,760	Relamp	No	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.16	2,172	0.0	$364.98	$468.00	$80.00	1.06
Turbine Section	7	Linear Fluorescent - T5: 4' T5 (28W) - 2L	Wall Switch	60	8,760	Relamp	No	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.16	2,186	0.0	$367.26	$409.50	$70.00	0.92
Boiler Room	14	Linear Fluorescent - T5: 4' T5 (28W) - 2L	Wall Switch	60	8,760	Relamp	No	14	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.32	4,372	0.0	$734.52	$819.00	$140.00	0.92
CWP Area	10	Linear Fluorescent - T5: 4' T5 (28W) - 2L	Wall Switch	60	8,760	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.23	3,123	0.0	$524.65	$585.00	$100.00	0.92
UPS Area	16	Linear Fluorescent - T5: 4' T5 (28W) - 2L	Wall Switch	60	8,760	Relamp	No	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.37	4,997	0.0	$839.45	$936.00	$160.00	0.92
All	4	Exit Signs: Fluorescent	None	23	8,760	Fixture Replacement	No	4	LED Exit Signs: 2 W Lamp	None	6	8,760	0.05	685	0.0	$115.09	$430.22	$0.00	3.74
CH Room	27	Linear Fluorescent - T5: 4' T5 (28W) - 2L	Wall Switch	60	8,760	Relamp	No	27	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.62	8,432	0.0	$1,416.57	$1,579.50	$270.00	0.92
CH Room	1	Exit Signs: Fluorescent	None	23	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	171	0.0	$28.77	$107.56	$0.00	3.74
Electrical Room	15	Linear Fluorescent - T5: 4' T5 (28W) - 2L	Wall Switch	60	8,760	Relamp	No	15	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.34	4,684	0.0	$786.98	$877.50	$150.00	0.92
Electrical Room	2	Exit Signs: Fluorescent	None	23	8,760	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.03	343	0.0	$57.54	$215.11	$0.00	3.74
Andrew	6	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	8,760	Relamp	Yes	6	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	6,132	0.09	1,275	0.0	$214.26	$559.20	$95.00	2.17
Alan Bandel	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	4,380	Relamp	Yes	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,066	0.06	425	0.0	$71.42	$462.80	$75.00	5.43
Server Room	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	4,380	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	4,380	0.01	81	0.0	$13.54	$48.20	$10.00	2.82
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	4,380	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	4,380	0.01	81	0.0	$13.54	$48.20	$10.00	2.82
Open Office	12	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	4,380	Relamp	Yes	12	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,066	0.19	1,275	0.0	$214.26	$848.40	$155.00	3.24
Kitchen	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	4,380	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	4,380	0.02	161	0.0	$27.08	$96.40	$20.00	2.82
Locker Room	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	4,380	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	4,380	0.02	161	0.0	$27.08	$96.40	$20.00	2.82
Shower	1	Compact Fluorescent: CFL - 15W	Wall Switch	15	4,380	Relamp	No	1	LED Screw-In Lamps: LED - 11 W	Wall Switch	11	4,380	0.00	23	0.0	$3.81	$53.75	$0.00	14.12
Exterior	4	High-Pressure Sodium: (1) 150W Lamp	Wall Switch	188	4,380	Fixture Replacement	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	56	4,380	0.39	2,651	0.0	$445.45	$1,562.71	$400.00	2.61

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
District Energy Plant	MSU Campus	3	Chilled Water Pump	250.0	96.2%	Yes	8,760	No	96.2%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
District Energy Plant	MSU Campus	3	Condenser Water Pump	250.0	95.4%	Yes	8,760	No	95.4%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
District Energy Plant	MSU Campus	3	Cooling Tower Fan	100.0	96.2%	Yes	8,760	No	96.2%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
District Energy Plant	MSU Campus	2	Other	3.0	85.5%	No	2,745	No	85.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Electric HVAC Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
District Energy Plant	District Energy Plant	1	Split-System Air-Source HP	2.00	26.00	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Low-Flow Device Recommendations

	Recommendation Inputs				Energy Impact & Financial Analysis						
Location	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
District Energy Plant	1	Faucet Aerator (Kitchen)	3.00	2.20	0.00	337	0.0	$56.56	$7.17	$0.00	0.13
District Energy Plant	1	Showerhead	2.20	2.00	0.00	94	0.0	$15.71	$89.30	$0.00	5.68

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
District Energy Plant	6	Desktop Computer and LCD Monitor	191.0	Yes
District Energy Plant	10	LCD Monitor	150.0	Yes
District Energy Plant	5	Printer	515.0	Yes
District Energy Plant	1	Laptop	40.0	Yes
District Energy Plant	1	Microwave	1,000.0	Yes
District Energy Plant	1	Refrigerator	600.0	Yes
District Energy Plant	11	Coffee Maker	400.0	Yes
District Energy Plant	1	Oven Small	1,200.0	Yes

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]

Montclair State University Campus (Buildings 1-41)

Primary Property Type: College/University
Gross Floor Area (ft²): 2,925,896
Built: 1908

For Year Ending: October 31, 2016
Date Generated: October 10, 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
Montclair State University Campus (Buildings 1-41)
1 Normal Avenue
Montclair, New Jersey 07043

Property Owner
Montclair Statet University
1 Normal Avenue
Montclair, NJ 07043
973-655-3244

Primary Contact
Ana Pinto
1 Normal Avenue
Montclair, NJ 07043
973-655-3244
pintoa@montclair.edu

Property ID: 6069294

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
172.3 kBtu/ft²

Source EUI
306.4 kBtu/ft²

Annual Energy by Fuel

District Chilled Water - Other (kBtu)	81,507,530 (16%)
District Steam (kBtu)	223,798,259 (44%)
Electric - Grid (kBtu)	161,334,839 (32%)
Natural Gas (kBtu)	37,406,141 (7%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	147.6
National Median Source EUI (kBtu/ft²)	262.6
% Diff from National Median Source EUI	17%

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)