Local Government Energy Audit:
Energy Audit Report

Wall Higher Education Center

Brookdale Community College
800 Monmouth Boulevard
Wall, NJ 07719

March 27, 2018

Final Report by:
TRC Energy Services

Disclaimer

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

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

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

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

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1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Wall Higher Education Center.

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, as part of a comprehensive effort to help public facilities in New Jersey reduce their control their energy costs and help protect our environment by reducing energy demand statewide.

1.1 Facility Summary

Wall Higher Education Center (WHEC) is a single story 22,500 square-foot higher educational facility. The facility is located at 800 Monmouth Ave in Wall Township., New Jersey. It is a satellite campus of Brookdale Community College (BCC).

The original building was built in the 1970s. The building was originally owned by the U.S. military as part of Camp Evans which closed in 1997. In 2002, the building was acquired by BCC and an extension to the building was added. Construction is currently on-going on a new larger building next door to further expand BCC's Wall Township campus.

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

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC recommends eight energy conservation measures for the facility which together represent an opportunity for Wall Higher Education Center to reduce its annual energy costs by $13,972 and annual greenhouse gas emissions by 108,391 lbs CO_2e. We estimate that if all measures were implemented as recommended, the project would pay for itself in energy savings in 7.7 years. 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 Wall Higher Education Center's annual energy use by 27%.

Figure 1 – Previous 12 Month Utility Costs

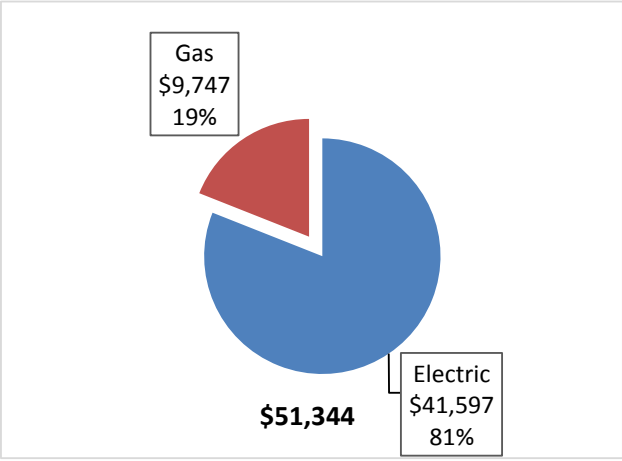
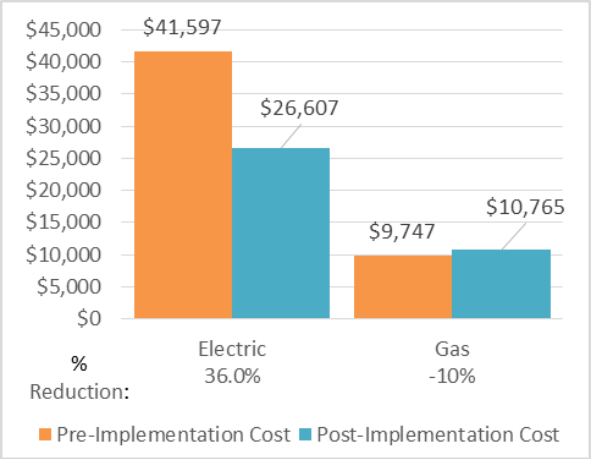


Figure 2 – Potential Post-Implementation Costs



A detailed description of Wall Higher Education Center'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_2e Emissions Reduction (lbs)
Lighting Upgrades			**54,823**	**10.3**	**0.0**	**$7,024.89**	**$42,075.56**	**$3,895.00**	**$38,180.56**	**5.4**	**55,206**
ECM 1	Install LED Fixtures	Yes	28,055	3.7	0.0	$3,594.89	$10,353.76	$1,200.00	$9,153.76	2.5	28,251
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	26,720	6.5	0.0	$3,423.82	$31,650.00	$2,685.00	$28,965.00	8.5	26,907
ECM 3	Retrofit Fixtures with LED Lamps	Yes	48	0.0	0.0	$6.19	$71.80	$10.00	$61.80	10.0	49
Lighting Control Measures			**7,024**	**1.7**	**0.0**	**$900.04**	**$8,838.00**	**$1,235.00**	**$7,603.00**	**8.4**	**7,073**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	7,024	1.7	0.0	$900.04	$8,838.00	$1,235.00	$7,603.00	8.4	7,073
Electric Unitary HVAC Measures			**16,654**	**9.9**	**0.0**	**$2,133.95**	**$10,957.97**	**$0.00**	**$10,957.97**	**5.1**	**16,770**
ECM 5	Install High Efficiency Electric AC	Yes	16,654	9.9	0.0	$2,133.95	$10,957.97	$0.00	$10,957.97	5.1	16,770
Electric Chiller Replacement			**29,182**	**14.4**	**0.0**	**$3,739.26**	**$55,941.68**	**$4,950.00**	**$50,991.68**	**13.6**	**29,386**
ECM 6	Install High Efficiency Chillers	Yes	29,182	14.4	0.0	$3,739.26	$55,941.68	$4,950.00	$50,991.68	13.6	29,386
Domestic Water Heating Upgrade			**5,742**	**0.9**	**-80.4**	**$633.87**	**$6,934.80**	**$240.00**	**$6,694.80**	**10.6**	**-3,635**
ECM 7	Install High Efficiency Gas Water Heater	Yes	5,742	0.9	-80.4	$633.87	$6,934.80	$240.00	$6,694.80	10.6	-3,635
Plug Load Equipment Control - Vending Machine			**3,566**	**0.0**	**0.0**	**$456.96**	**$690.00**	**$0.00**	**$690.00**	**1.5**	**3,591**
ECM 8	Vending Machine Control	Yes	3,566	0.0	0.0	$456.96	$690.00	$0.00	$690.00	1.5	3,591
TOTALS			**116,990**	**37.1**	**-80.4**	**$14,888.98**	**$125,438.01**	**$10,320.00**	**$115,118.01**	**7.7**	**108,391**

* - All incentives presented in this table are based on NJ Smart Start Building equipment incentives and assume proposed equipment meets minimum performance criteria for that program.
** - Simple Payback Period is based on net measure costs (i.e. after incentives).

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

Lighting Controls measures generally involve the installation of automated controls to turn off lights or reduce light output when 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.

Electric Unitary HVAC measures generally involve replacing older inefficient air conditioning systems with modern energy efficient systems. New air conditioning systems can provide equivalent cooling to older

air condition systems at a reduced energy cost. These measures save energy by reducing the power used by the air conditioning systems, due to improved electrical efficiency.

Electric Chiller measures generally involve replacing older inefficient hydronic chillers with modern energy efficient systems. New chillers can provide equivalent cooling compared to older chillers at a reduced energy cost. These measures save energy by reducing chiller energy usage, due to improved electrical and heat transfer efficiency.

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.

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

Energy Efficient Practices

TRC also identified 9 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 Wall Higher Education Center include:

- Close Doors and Windows
- Perform Routine Motor Maintenance
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Perform Proper Furnace Maintenance
- Perform Proper Water Heater Maintenance
- Install Plug Load Controls
- Replace Computer Monitors

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

On-Site Generation Measures

TRC evaluated the potential for installing on-site generation for Wall Higher Education Center. Based on the configuration of the site and its electric load there appears to be a high potential for installing a cost-effective photovoltaic (PV) array.

We estimate that the building's roof has about 8,864 ft^2 of potentially usable unshaded roof space available. According to PV-Watts® (an online solar calculator developed by the U.S. DOE), a rooftop space of that size might accommodate as many as 412 solar panels (300 watts each), which could produce up to 169,184 kWh per year which is about 52% of the facility's annual electric usage. The estimated cost and benefits of such an array are shown below in Figure 4.

Figure 4 – Photovoltaic Potential

Total Installed Cost	$432,250	$
Value of Electric Generation per Year	$20,635.64	$
Annual Income from SRECS	$37,835.00	$
Total Economic Value per Year	$58,470.64	$
Simple Payback Period	7.39	years

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

1.3 Implementation Planning

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

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

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

- SmartStart
- Direct Install
- 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.

This facility may also qualify for the Direct Install program which can provide turnkey installation of multiple measures, through an authorized network of participating contractors. This program can provide substantially higher incentives that SmartStart, up to 70% of the cost of selected measures, although measure eligibility will have to be assessed and be verified by the designated Direct Install contractor and, in most cases, they will perform the installation work.

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

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

Additional information on relevant incentive programs is located in Section 8 or: www.njcleanenergy.com/ci.

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 5 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Tim Drury	Director of Facilities Management & Construction	tdrury@brookdalecc.edu	732-224-2217
Scott Dyson	Facility Manager - WHEC		
TRC Energy Services			
Tom Page	Auditor	tpage@TRCsolutions.com	(732) 855-0033

2.2 General Site Information

On December 13, 2016, TRC performed an energy audit at Wall Higher Education Center located in Wall Township, New Jersey. TRC's team met with Scott Dyson to review the facility operations and help focus our investigation on specific energy-using systems.

Wall Higher Education Center (WHEC) is a single story 22,500 square foot higher educational facility. The facility is located at 800 Monmouth Ave in Wall Township, New Jersey. It is a satellite campus of Brookdale Community College (BCC). The building was originally owned by the U.S. military as part of the Camp Evans which closed in 1997. In 2002, the building was acquired by BCC and an extension to the building was added. The original building was built in the 1970s. Construction is currently on-going on a new larger building next door, to further expand BCC's Wall Township campus.

2.3 Building Occupancy

The building is a comprised classroom and office spaces. It is open year-round and is typically occupied by about 200 people per day (on weekdays from 7:30 AM-10:00 PM and on Saturdays from 8:30AM to 4:00 PM).

Figure 6 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Wall Higher Education Center (WHEC)	Weekday	7:30 AM - 10:00 PM
Wall Higher Education Center (WHEC)	Weekend	8:30 am - 4:00 pm (every other Sat.)

2.4 Building Envelope

The building is a slab on grade construction. All rooms are connected by a single main corridor that runs the length of the building. The building appears to be well insulated. It has vinyl siding and rolled asphalt sloped roof.

The front door and windows are all double-pane with aluminum frames. No excessive air infiltration was observed.

Image 1: Building Exterior, Widows, and Doors

2.5 On-Site Generation

Wall Higher Education Center does not have any on-site electric generation capacity.

2.6 Energy-Using Systems

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

Lighting System

Lighting at Wall Higher Education Center consists of primarily of linear fluorescent T8 fixtures with 32-Watt, 4-ft tubes and electronic ballasts. There are also a few recessed can ceiling fixtures with 26Watt compact fluorescents (CFLs). All interior lights are controlled by manual switches. All exit signs use LEDs.

The perimeter of the building, the parking area, and road from Monmouth Boulevard to the main parking area is lit primarily by metal halide (MH) fixtures (250Watt and 400Watt). All exterior lights are believed to be on sunset-to-sunrise timers.

Image 2: Interior Lighting Fixtures

Image 3: Exterior Lighting Fixtures

Heating, Ventilation and Air Conditioning (HVAC)

The main section of the building is cooled by an old 55-ton McQuay/Snyder-General air-cooled condensing unit, located near the main entrance. According to the serial number, the Snyder General / McQuay air cooled condensing unit was manufactured in 1990. It is beyond its rated useful lifetime and shows considerable signs of wear and rust.

Chilled water is supplied to a McQuay air handling unit (AHU) located in the mechanical room. Conditioned air is distributed via ductwork above the drop ceiling. It is divided into four zones. Four gas-fired 160-MBH Reznor duct heaters provide heating to all areas of the original section of the building.

For the most part, temperature setpoints and schedules are all controlled remotely by facility staff at the main BCC campus. However, occupants can adjust the settings if needed. Controls for each are located in Rooms 104, 111, 112, and 119.

In the newer section of the building, heating and cooling is provided by eight 4-ton Bard® through-the-wall heat pumps. These have their own controls, but are also monitored and controlled remotely by facility staff at the main campus.

The building also has also four ductless mini-split systems (multiple brands, 0.75 to 2.0 tons each), three window air conditioning units (multiple brands, 0.75 to 2.0 tons each), and three window AC heat pumps (Carrier brand, 2 tons each) to provide supplementary heating and cooling in classrooms and offices. We were told that some additional window AC units are added in the summer to cool classrooms, but they are removed from windows during the heating season to prevent air leakage.

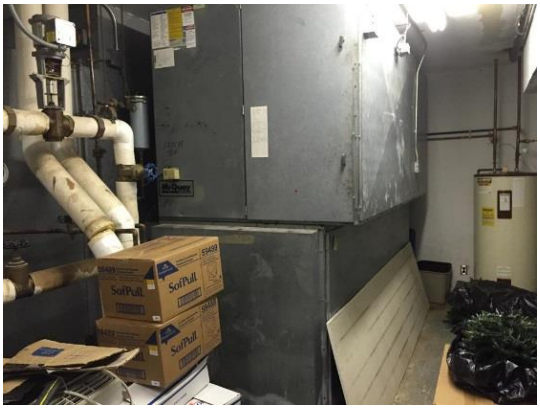


Image 4: McQuay® AHU

Image 5: McQuay® Air-Cooled Condenser System

Image 6: Ductless Mini-Split and Window AC Heat Pumps

Image 7: Bard® Through-the-Wall Heat Pumps

Building Energy Management System (BEMS)

The building used to have its own on-site control system, manufactured by Automated Building Controls®. However, about three years ago, the building's control system was retrofitted with Carrier iVu® control boxes, so that the building's HVAC system could be remotely monitored and controlled from the main BCC campus in Lincroft. The McQuay AHU and air-cooled condensing unit were added to the iVu® system, along with the (8) Bard™ heat pumps in the newer section of the building. All temperature setpoints and schedules for major HVAC equipment at WHEC are now remotely controlled by BCC staff at the Lincroft campus.

Image 8: HVAC Control System

Domestic Hot Water Heating System

Domestic hot water is supplied by a single 80-gallon A.O. Smith® Energy Saver hot water heater. It is an electric unit, about eight years old. No problems were reported with it and it appears to be in fair condition. However, since the building has gas service, it would likely be more cost effective to replace with a similarly-sized, yet higher efficient, gas-fired unit.

Image 9: Domestic Hot Water Heater

Building Plug Load

The building was found to have approximately 126 desktop computers and monitors and in classrooms and office spaces. There were also computer servers, many types of office equipment and appliances typical for such a facility such as printers, copier, refrigerators, microwaves, and vending machines.

Image 10: Computers and Printers

Image 11: Refrigerators and Vending Machines

Image 12: Large Old CRT TVs

Several classrooms, were found to still be using older CRT video monitors. There are six large CRT televisions in use with 40-inch screens or larger. We recommend retiring these old TVs and replacing them with ENERGY STAR®-rated flat panel LED TVs, which often use less than half as much energy as older CRT models. See Section 5 for more details on this proposed upgrade and other energy saving O&M recommendations.

2.7 Water-Using Systems

The building's restrooms were found to have sinks, toilets, and urinals with flow restrictors and/or sensors to reduce water usage in compliance with current low-flow federal water conservation standards.

3 SITE ENERGY USE AND COSTS

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

3.1 Total Cost of Energy

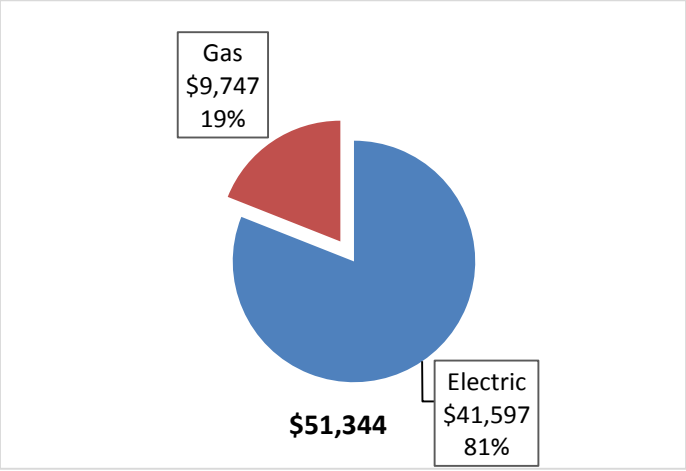
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 7 - Utility Summary

Utility Summary for Wall Higher Education Center		
Fuel	**Usage**	**Cost**
Electricity	324,631 kWh	$41,597
Natural Gas	7,696 Therms	$9,747
Total		**$51,344**

The current annual energy cost for this facility is $51,344 as shown in the chart below.

Figure 8 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by JCP&L. The average electric cost over the past 12 months was $0.128/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 9 -Electric Usage & Demand

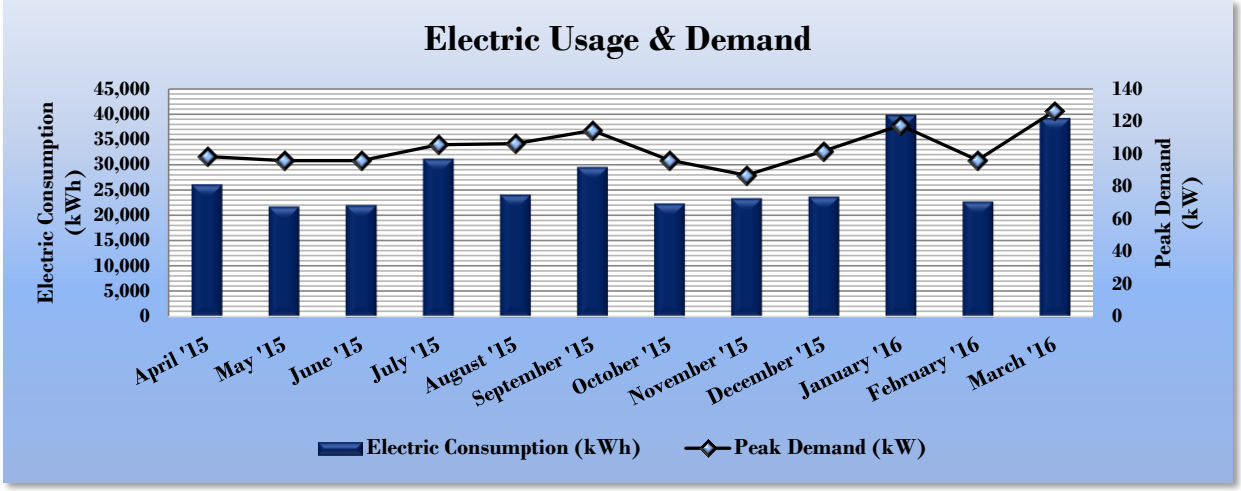


Figure 10 -Electric Usage & Demand

Electric Billing Data for Wall Higher Education Center					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost	TRC Estimated Usage?
4/16/15	30	26,080	98	$3,390	No
5/18/15	32	21,760	96	$2,889	No
6/17/15	30	22,000	96	$2,954	No
7/17/15	30	31,120	106	$3,999	No
8/18/15	32	24,080	106	$3,242	No
9/17/15	30	29,520	114	$3,748	No
10/17/15	30	22,320	96	$2,857	No
11/16/15	30	23,360	87	$2,915	No
12/16/15	30	23,680	102	$3,032	No
1/19/16	34	39,760	118	$4,736	No
2/17/16	29	22,720	96	$2,966	No
3/17/16	29	39,120	126	$4,983	Yes
Totals	**366**	**325,520**	**126.4**	**$41,711**	1
Annual	**365**	**324,631**	**126.4**	**$41,597**	

3.3 Natural Gas Usage

Natural gas is provided by New Jersey Natural Gas. The average gas cost for the past 12 months is $1.266/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

Figure 11 -Natural Gas Usage

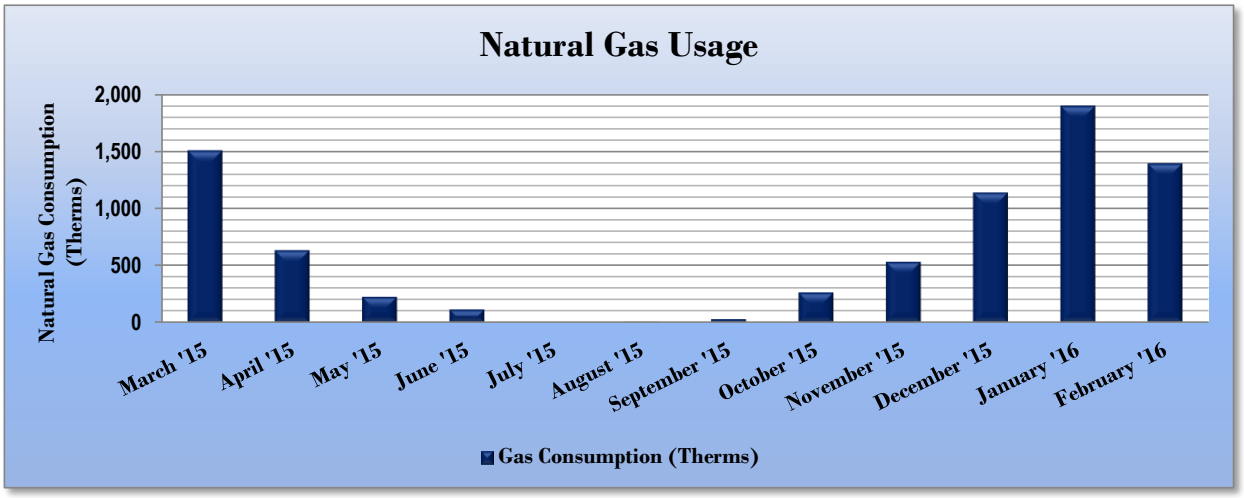


Figure 12 Natural Gas Usage

Gas Billing Data for Wall Higher Education Center			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
4/1/15	31	1,505	$1,714
5/1/15	30	630	$819
6/1/15	31	224	$404
7/1/15	30	112	$285
8/1/15	31	1	$175
9/1/15	31	4	$179
10/1/15	30	29	$203
11/1/15	31	261	$431
12/1/15	30	530	$695
1/1/16	31	1,136	$1,291
2/1/16	31	1,895	$2,036
3/1/16	29	1,390	$1,541
Totals	**366**	**7,718**	**$9,773**
Annual	**365**	**7,696**	**$9,747**

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 13 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Wall Higher Education Center	National Median Building Type: Higher Education - Public
Source Energy Use Intensity (kBtu/ft^2)	190.5	262.6
Site Energy Use Intensity (kBtu/ft^2)	83.4	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 14 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Wall Higher Education Center	National Median Building Type: Higher Education - Public
Source Energy Use Intensity (kBtu/ft^2)	138.5	262.6
Site Energy Use Intensity (kBtu/ft^2)	69.3	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.

Community College buildings are not one of the building types that are eligible to receive an ENERGY STAR® score. However, a comparison between the estimated EUI for this building and the National Median score from EPA ENERGY STAR® shows that this building is more energy efficient than most other buildings of typical size, type, and vintage.

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

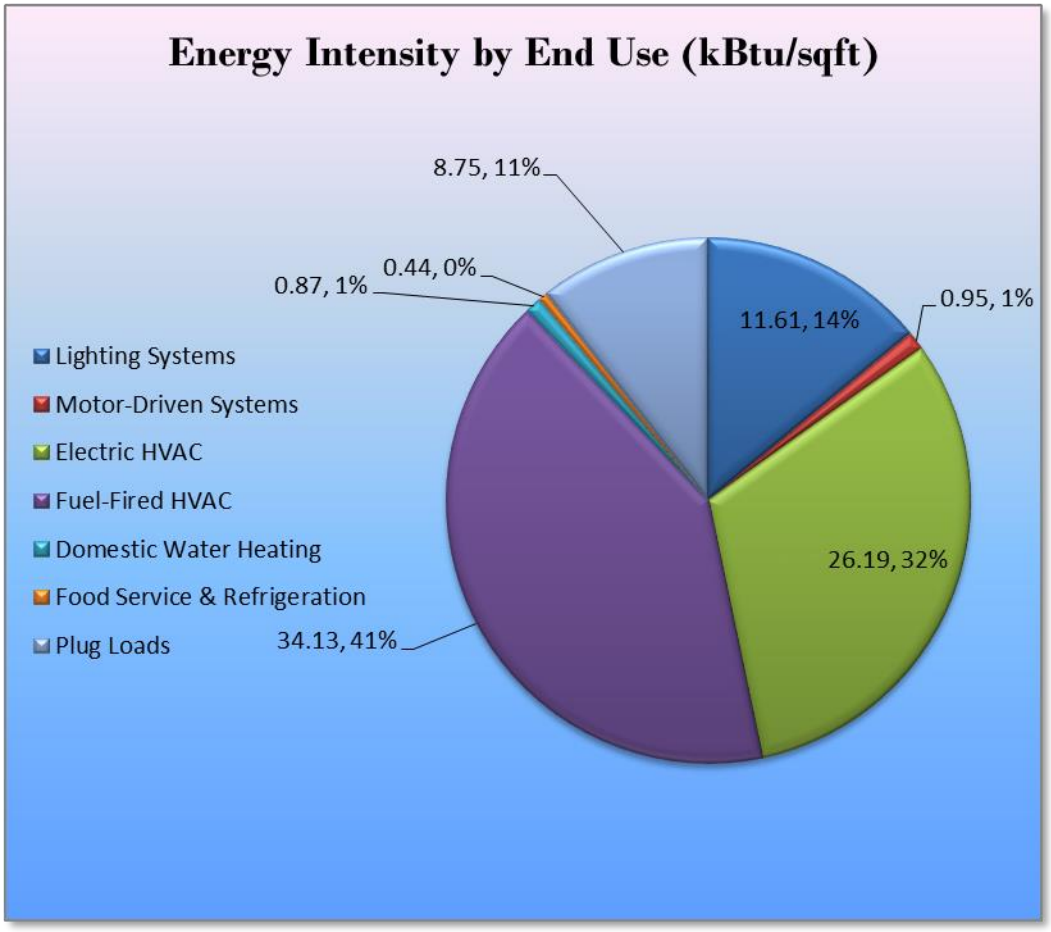
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

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.

3.4 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.

Figure 15 - Energy Balance (kBtu/SF,%)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the Wall Higher Education Center 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 16 – Summary of Recommended ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**54,823**	**10.3**	**0.0**	**$7,024.89**	**$42,075.56**	**$3,895.00**	**$38,180.56**	**5.4**	**55,206**
ECM 1	Install LED Fixtures	28,055	3.7	0.0	$3,594.89	$10,353.76	$1,200.00	$9,153.76	2.5	28,251
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	26,720	6.5	0.0	$3,423.82	$31,650.00	$2,685.00	$28,965.00	8.5	26,907
ECM 3	Retrofit Fixtures with LED Lamps	48	0.0	0.0	$6.19	$71.80	$10.00	$61.80	10.0	49
Lighting Control Measures		**7,024**	**1.7**	**0.0**	**$900.04**	**$8,838.00**	**$1,235.00**	**$7,603.00**	**8.4**	**7,073**
ECM 4	Install Occupancy Sensor Lighting Controls	7,024	1.7	0.0	$900.04	$8,838.00	$1,235.00	$7,603.00	8.4	7,073
Electric Unitary HVAC Measures		**16,654**	**9.9**	**0.0**	**$2,133.95**	**$10,957.97**	**$0.00**	**$10,957.97**	**5.1**	**16,770**
ECM 5	Install High Efficiency Electric AC	16,654	9.9	0.0	$2,133.95	$10,957.97	$0.00	$10,957.97	5.1	16,770
Electric Chiller Replacement		**29,182**	**14.4**	**0.0**	**$3,739.26**	**$55,941.68**	**$4,950.00**	**$50,991.68**	**13.6**	**29,386**
ECM 6	Install High Efficiency Chillers	29,182	14.4	0.0	$3,739.26	$55,941.68	$4,950.00	$50,991.68	13.6	29,386
Domestic Water Heating Upgrade		**5,742**	**0.9**	**-80.4**	**$633.87**	**$6,934.80**	**$240.00**	**$6,694.80**	**10.6**	**-3,635**
ECM 7	Install High Efficiency Gas Water Heater	5,742	0.9	-80.4	$633.87	$6,934.80	$240.00	$6,694.80	10.6	-3,635
Plug Load Equipment Control - Vending Machine		**3,566**	**0.0**	**0.0**	**$456.96**	**$690.00**	**$0.00**	**$690.00**	**1.5**	**3,591**
ECM 8	Vending Machine Control	3,566	0.0	0.0	$456.96	$690.00	$0.00	$690.00	1.5	3,591
TOTALS		**116,990**	**37.1**	**-80.4**	**$14,888.98**	**$125,438.01**	**$10,320.00**	**$115,118.01**	**7.7**	**108,391**

* - All incentives presented in this table are based on NJ Smart Start Building equipment incentives and assume proposed equipment meets minimum performance criteria for that program.
** - Simple Payback Period is based on net measure costs (i.e. after incentives).

4.1.1 Lighting Upgrades

Recommended upgrades to existing lighting fixtures are summarized in Figure 17 below.

Figure 17 – Summary of Lighting Upgrade Measures

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		**54,823**	**10.3**	**0.0**	**$7,024.89**	**$42,075.56**	**$3,895.00**	**$38,180.56**	**5.4**	**55,206**
ECM 1	Install LED Fixtures	28,055	3.7	0.0	$3,594.89	$10,353.76	$1,200.00	$9,153.76	2.5	28,251
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	26,720	6.5	0.0	$3,423.82	$31,650.00	$2,685.00	$28,965.00	8.5	26,907
ECM 3	Retrofit Fixtures with LED Lamps	48	0.0	0.0	$6.19	$71.80	$10.00	$61.80	10.0	49

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	205	0.1	0.0	$26.26	$460.08	$0.00	$460.08	17.5	206
Exterior	27,850	3.7	0.0	$3,568.63	$9,893.68	$1,200.00	$8,693.68	2.4	28,045

Measure Description

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

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

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	26,720	6.5	0.0	$3,423.82	$31,650.00	$2,685.00	$28,965.00	8.5	26,907
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. This measure proposes to use existing fixture housing but replaces the rest of the components with more efficient lighting technology. We have assumed this type of upgrade for most interior light fixtures. TRC recommends replacing the fluorescent ballasts along with upgrading tubes with LED strips. For some types of LED retrofit lamps, it is not necessary to replace the existing ballasts. However, we recommend installing new LED drivers, where cost effective, because most LED lamps have a longer rated lifetime than the fluorescent ballasts do.

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

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

ECM 3: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	48	0.0	0.0	$6.19	$71.80	$10.00	$61.80	10.0	49
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

We recommend retrofitting existing incandescent, halogen, HID or other lighting technologies with LED lamps. Many LED lamps are direct replacements for existing compact fluorescent, HID, or incandescent lamps and require no corresponding ballast upgrades. LED bulbs can be used in existing fixtures as a direct replacement for many lighting technologies.

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

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

4.1.2 Lighting Control Measures

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

Figure 18 – Summary of Lighting Control Measures

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		**7,024**	**1.7**	**0.0**	**$900.04**	**$8,838.00**	**$1,235.00**	**$7,603.00**	**8.4**	**7,073**
ECM 4	Install Occupancy Sensor Lighting Controls	7,024	1.7	0.0	$900.04	$8,838.00	$1,235.00	$7,603.00	8.4	7,073

Measure Description

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

4.1.3 Electric HVAC Measures

Our recommendations for unitary HVAC measures are summarized in Figure 19 below.

Figure 19 - Summary of Electric HVAC Measures

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)
ECM 5	Install High Efficiency Electric AC	16,654	9.9	0.0	$2,133.95	$10,957.97	$0.00	$10,957.97	5.1	16,770

ECM 5: Install High Efficiency Mini-Split Air Conditioning Units

Measure Description

We recommend replacing standard efficiency ductless mini-split air conditioning units with high efficiency packaged air conditioning units. There have been significant improvements in both compressor and fan motor efficiencies over the past several years. Therefore, electricity savings can be achieved by replacing older units with new high efficiency units. There were four ductless mini-split units found, one DAIKIN unit, one MITSUBISHI unit, and two PEAKE units. The MITSUBISHI units are high efficiency units. Hwoever, the PEAKE units are not. We recommend replacing them with similarly-sized high efficiency units.

A higher EER or SEER rating indicates a more efficient cooling system. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average cooling load, and the estimated annual operating hours.

4.1.4 Electric Chiller Replacement

ECM 6: Install High Efficiency Chillers

Summary of Measure Economics

Figure 20 - Summary of Electric Chiller Measures

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)
Electric Chiller Replacement		**29,182**	**14.4**	**0.0**	**$3,739.26**	**$55,941.68**	**$4,950.00**	**$50,991.68**	**13.6**	**29,386**
ECM 6	Install High Efficiency Chillers	29,182	14.4	0.0	$3,739.26	$55,941.68	$4,950.00	$50,991.68	13.6	29,386

Measure Description

We recommend replacing older inefficient electric chillers with new high efficiency chillers. According to the serial number, the Snyder General / McQuay® air-cooled condensing unit (in front of the building) was manufactured in 1990. It is beyond its rated useful lifetime and show considerable signs of wear and rust.

The type of chiller to be installed depends on the magnitude of the cooling load and variability of the cooling load profile. Constant speed chillers should be used to meet cooling loads with little or no variation while variable speed chillers are more efficient for variable cooling load profiles. Water-cooled chillers are more efficient than air-cooled chillers but require cooling towers and additional pumps to circulate the cooling water. In any given size range, variable speed chillers tend to have better partial load efficiency, but worse full load efficiency, than constant speed chillers. For the purpose of this analysis, we assumed that existing equipment would be replaced with a variable speed air-cooled reciprocating chiller.

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

4.1.5 Domestic Hot Water Heating System Upgrades

Our recommendations for domestic water heating system improvements are summarized in Figure 21 below.

Figure 21 - Summary of Domestic Hot Water Heating Measures

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		**5,742**	**0.9**	**-80.4**	**$633.87**	**$6,934.80**	**$240.00**	**$6,694.80**	**10.6**	**-3,635**
ECM 7	Install High Efficiency Gas Water	5,742	0.9	-80.4	$633.87	$6,934.80	$240.00	$6,694.80	10.6	-3,635

ECM 7: Install High Efficiency Gas-Fired Water Heater

Measure Description

We recommend replacing the existing tank water heater with a high efficiency tank water heater. Improvements in combustion efficiency and reductions in heat losses have improved the overall efficiency of storage water heaters. Energy savings results from using less gas to heat water, due to higher unit efficiency, and fewer run hours to maintain the tank water temperature.

4.1.6 Plug Load Equipment Control - Vending Machines

ECM 8: Vending Machine Controls

Figure 22 - Summary of Plug Load & Vending Machine Control Measures

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending		**3,566**	**0.0**	**0.0**	**$456.96**	**$690.00**	**$0.00**	**$690.00**	**1.5**	**3,591**
ECM 8	Vending Machine Control	3,566	0.0	0.0	$456.96	$690.00	$0.00	$690.00	1.5	3,591

Measure Description

Vending machines operate continuously, even during non-business hours. It is recommended to install occupancy sensor controls to reduce the energy use. These controls power down vending machines when the vending machine area has been vacant for some time, then power up at regular intervals, as needed, to turn machine lights on or keep the product cool. Energy savings are a dependent on vending machine and activity level in the area surrounding the machines.

5 ENERGY EFFICIENT PRACTICES

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

Close Doors and Windows

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

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.

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 Furnace Maintenance

Preventative furnace maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. Following the manufacturer's instructions, a yearly tune-up should include tasks such as checking for gas / carbon monoxide leaks; changing the air and fuel filters; checking components for cracks, corrosion, dirt, or debris build-up; ensuring the ignition system is working properly; testing and adjusting operation and safety controls; inspecting the electrical connections; and ensuring proper lubrication for motors and bearings.

Perform Proper Water Heater Maintenance

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

Plug Load Controls

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

Replace Computer Monitors

Replacing old computer monitors or video displays with efficient LED monitors will reduce energy use. ENERGY STAR® rated monitors have specific requirements for on mode power consumption as well as idle and sleep mode power. According to the ENERGY STAR® website monitors that have earned the ENERGY STAR® label are 25% more efficient than standard monitors and LED TVs often use less than half as much energy as old cathode ray tube (CRT) models of a similar size.

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 facility's electric demand, size and location of free area, and shading elements shows that the facility has High potential for installing a PV array.

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the high potential for PV at the site. A PV array located on the roof may be feasible. If Brookdale County College is interested in pursuing the installation of a PV array, we recommended a full feasibility study be conducted.

Figure 23 - Photovoltaic Screening

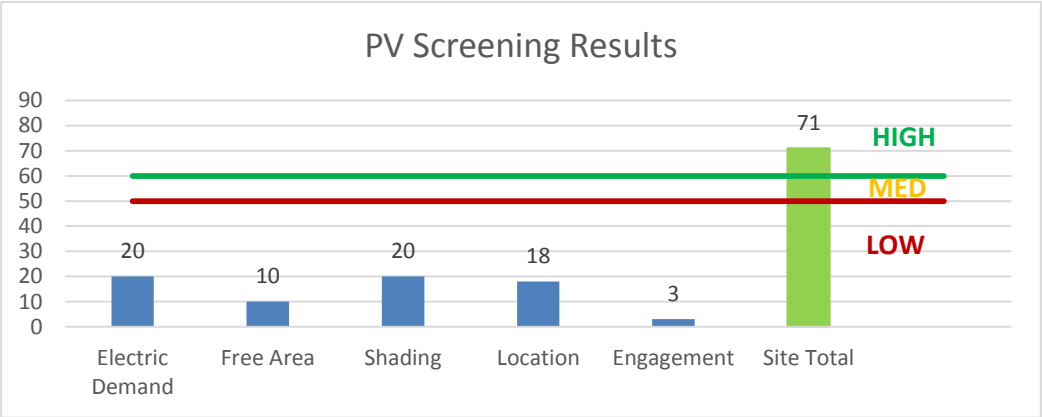


Figure 24 Estimated Maximum Size, Cost, and Savings for a Rooftop PV System at WHEC

Total Installed Cost	**$432,250**	**$**
Value of Electric Generation per Year	**$20,635.64**	**$**
Annual Income from SRECS	**$37,835.00**	**$**
Total Economic Value per Year	**$58,470.64**	**$**
Simple Payback Period	**7.39**	**years**

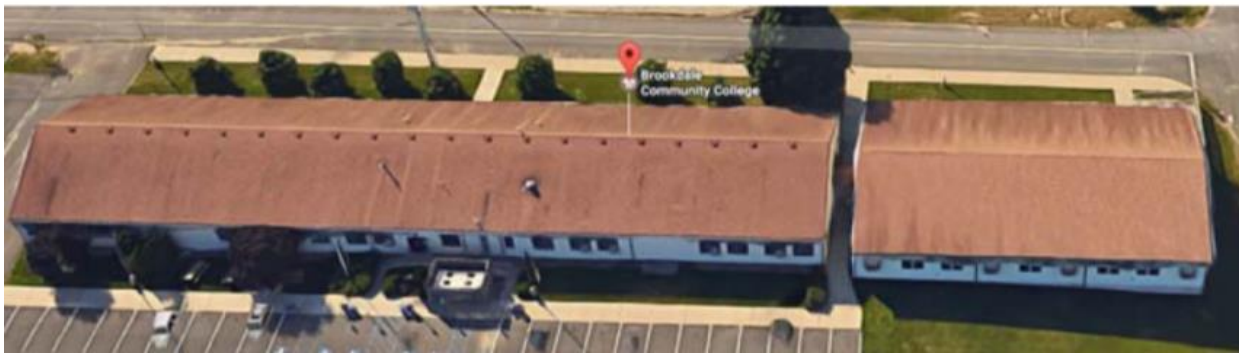


Image 13: WHEC Rooftop

Based on our preliminary calculations, we estimate that the building's roof has about 8,864 ft^2 of potentially usable unshaded roof space available. According to PV-Watts® (an online solar calculator developed by the U.S. Department of Energy) a rooftop space of that size might accommodate as many as 412 solar panels (300 watts each), which could produce up to 169,184 kWh per year on that site which is about 52% of the facility's annual electric usage.

In addition to providing reduced cost electric power, a rooftop PV array on this site could potentially provide additional revenue to the college of up $37,835 in annual income through the SREC program. Based on current costs for commercial solar installation and current values for SRECs in New Jersey, we estimate that such a system would likely pay for itself in about 7.4 years. See Figure 24 above.

Customers wishing to develop solar projects at their facilities must register with the SREC Program prior to the start of construction in order to establish the project's eligibility to earn renewable energy credits. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about developed new solar projects and insight into future SREC pricing. For more information on the SREC program, see Section 8.3.

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 web 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 is the amount of time the system operates at full load and the facility's ability to use the recovered heat. Facilities with continuous use for large quantities of waste heat are the best candidates for CHP.

A preliminary screening based on heating and electrical demand, siting, and interconnection shows that the facility has a low potential for installing a cost-effective CHP system, due to insufficient year-round thermal load.

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

7 DEMAND RESPONSE

Demand Response (DR) is a program designed to reduce 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 25 for a list of the eligible programs identified for each recommended ECM.

Figure 25 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings
ECM 1	Install LED Fixtures	X		X	
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	X		X	
ECM 3	Retrofit Fixtures with LED Lamps	X		X	
ECM 4	Install Occupancy Sensor Lighting Controls	X		X	
ECM 5	Install High Efficiency Electric AC		X	X	
ECM 6	Install High Efficiency Chillers		X	X	
ECM 7	Install High Efficiency Gas Water Heater		X	X	
ECM 8	Vending Machine Control			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.

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 Direct Install

Overview

Direct Install is a turnkey program available to existing small to medium-sized facilities with a peak electric demand that does not exceed 200 kW for any recent 12-month period. You will work directly with a pre-approved contractor who will perform a free energy assessment at your facility, identify specific eligible measures, and provide a clear scope of work for installation of selected measures. Energy efficiency measures may include lighting and lighting controls, refrigeration, HVAC, motors, variable speed drives and controls.

Incentives

The program pays up to 70% of the total installed cost of eligible measures, up to $125,000 per project. Direct Install participants will also be held to a fiscal year cap of $250,000 per entity.

How to Participate

To participate in the Direct Install program, you will need to contact the participating contractor who the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the Direct Install website linked below. The contractor will be paid the measure incentives directly by the program which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

Since Direct Install offers a free assessment of eligible measures, Direct Install is also available to small businesses and other commercial facilities too that may not be eligible for the more detailed facility audits provided by LGEA.

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

8.3 SREC Registration Program

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

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

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

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

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

8.4 Energy Savings Improvement Program

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

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

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

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

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

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

9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

9.1 Retail Electric Supply Options

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

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

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

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

9.2 Retail Natural Gas Supply Options

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

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

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

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

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp & Reballast	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.15	228	0.0	$29.18	$702.00	$60.00	22.00
Main Corridor	32	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,965	Relamp & Reballast	Yes	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,776	0.98	6,085	0.0	$779.66	$5,364.00	$530.00	6.20
Main Corridor	7	Exit Signs: LED - 2 W Lamp	None	2	8,760	None	No	7	Exit Signs: LED - 2 W Lamp	None	2	8,760	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rm 101	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.25	950	0.0	$121.67	$1,206.00	$115.00	8.97
Rm 102	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.25	950	0.0	$121.67	$1,206.00	$115.00	8.97
Rm 103	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.25	950	0.0	$121.67	$1,206.00	$115.00	8.97
Rm 104	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.28	1,068	0.0	$136.88	$1,323.00	$125.00	8.75
Rm 105	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.28	1,068	0.0	$136.88	$1,323.00	$125.00	8.75
Rm 107	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.18	712	0.0	$91.25	$972.00	$95.00	9.61
Rm 107	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,475	Relamp & Reballast	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,733	0.03	124	0.0	$15.94	$196.00	$10.00	11.67
Rm 107A	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.12	475	0.0	$60.83	$584.00	$60.00	8.61
Rm 107A	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	None	32	1,200	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	None	15	1,200	0.01	24	0.0	$3.09	$35.90	$5.00	9.99
Rm 107A	1	Exit Signs: LED - 2 W Lamp	None	2	2,475	None	No	1	Exit Signs: LED - 2 W Lamp	None	2	2,475	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rm 107B	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.06	237	0.0	$30.42	$350.00	$40.00	10.19
Rm 107B	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	None	32	1,200	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	None	15	1,200	0.01	24	0.0	$3.09	$35.90	$5.00	9.99
Break Rm 107C	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.06	237	0.0	$30.42	$350.00	$40.00	10.19
Rm 108	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.15	593	0.0	$76.04	$701.00	$70.00	8.30
Student Lounge Rm 109	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.18	712	0.0	$91.25	$818.00	$80.00	8.09
Rm 110	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.37	1,424	0.0	$182.50	$1,674.00	$155.00	8.32
Rm 111	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.37	1,424	0.0	$182.50	$1,674.00	$155.00	8.32
Rm 112	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.28	1,068	0.0	$136.88	$1,323.00	$125.00	8.75
Rm 112	4	Compact Fluorescent: 26W CFL Recessed Cans	Wall Switch	26	2,475	LED Retrofit	Yes	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	1,733	0.04	161	0.0	$20.57	$346.04	$20.00	15.85
Rm 112B	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.09	356	0.0	$45.63	$467.00	$50.00	9.14
ITV Rm 113	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.28	1,068	0.0	$136.88	$1,323.00	$125.00	8.75
ITV Rm 113	4	Compact Fluorescent: 26W CFL Recessed Cans	Wall Switch	26	2,475	LED Retrofit	Yes	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	17	1,733	0.04	161	0.0	$20.57	$346.04	$20.00	15.85

	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
Rm 114	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.46	1,780	0.0	$228.13	$2,295.00	$220.00	9.10
Rm 114	2	Exit Signs: LED - 2 W Lamp	None	2	2,475	None	No	2	Exit Signs: LED - 2 W Lamp	None	2	2,475	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Testing Rm 115	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,920	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,344	0.06	184	0.0	$23.60	$350.00	$40.00	13.14
Counseling Rm 116	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,920	Relamp & Reballast	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,344	0.02	48	0.0	$6.18	$214.00	$25.00	30.57
Main Entrance	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,965	Relamp & Reballast	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,965	0.05	301	0.0	$38.56	$234.00	$20.00	5.55
Main Entrance	1	Exit Signs: LED - 2 W Lamp	None	2	8,760	None	No	1	Exit Signs: LED - 2 W Lamp	None	2	8,760	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Men's Rm	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.12	475	0.0	$60.83	$738.00	$75.00	10.90
Women's Rm	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.12	475	0.0	$60.83	$738.00	$75.00	10.90
Computer Rm 119	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.37	1,424	0.0	$182.50	$1,674.00	$155.00	8.32
Class Rm 120	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.25	950	0.0	$121.67	$1,206.00	$115.00	8.97
Class Rm 121	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.25	950	0.0	$121.67	$1,206.00	$115.00	8.97
Class Rm 122	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.28	1,068	0.0	$136.88	$1,323.00	$125.00	8.75
Class Rm 123	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.18	712	0.0	$91.25	$818.00	$80.00	8.09
Class Rm 124	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.18	712	0.0	$91.25	$818.00	$80.00	8.09
Office Rm 125	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,920	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,344	0.06	184	0.0	$23.60	$350.00	$40.00	13.14
Office Rm 125	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,920	Relamp & Reballast	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,344	0.03	86	0.0	$11.01	$117.00	$0.00	10.63
Class Rm 126A	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.18	712	0.0	$91.25	$818.00	$80.00	8.09
Class Rm 126B	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.18	712	0.0	$91.25	$818.00	$80.00	8.09
Class Rm 127	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.37	1,424	0.0	$182.50	$1,674.00	$155.00	8.32
Office Rm 128	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,920	Relamp & Reballast	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,344	0.09	276	0.0	$35.39	$467.00	$50.00	11.78
Class Rm 129	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.18	712	0.0	$91.25	$818.00	$80.00	8.09
Class Rm 130	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,475	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,733	0.18	712	0.0	$91.25	$818.00	$80.00	8.09
End Door	1	Compact Fluorescent: 26W CFL Recessed Cans	None	26	4,860	LED Retrofit	No	1	LED - Fixtures: Downlight Recessed	None	17	4,860	0.01	50	0.0	$6.45	$57.51	$0.00	8.92
Central Door	1	LED - Fixtures: Architectural Flood/Spot Luminaire	None	39	4,860	None	No	1	LED - Fixtures: Architectural Flood/Spot Luminaire	None	39	4,860	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Central Door	1	LED - Fixtures: Architectural Flood/Spot Luminaire	None	13	4,860	None	No	1	LED - Fixtures: Architectural Flood/Spot Luminaire	None	13	4,860	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

	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
Right Door	2	Metal Halide: (1) 150W Lamp	None	190	4,860	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	40	4,860	0.22	1,677	0.0	$214.85	$667.58	$200.00	2.18
Parking Lot	10	Metal Halide: (1) 250W Lamp	None	295	4,860	Fixture Replacement	No	10	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	None	46	4,860	1.83	13,917	0.0	$1,783.24	$5,261.40	$1,000.00	2.39
Roadway	7	Metal Halide: (1) 400W Lamp	None	458	4,860	Fixture Replacement	No	7	LED - Fixtures: Large Pole/Arm-Mounted Area/Roadway Fixture	None	146	4,860	1.61	12,206	0.0	$1,564.10	$3,907.19	$0.00	2.50

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
McQuay Condnser Unit (in front of bldg)	Whole Building	4	Cooling Tower Fan	1.0	80.0%	No	2,745	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
McQuay AHU (Mech Rm)	Whole Building	1	Supply Fan	0.3	80.0%	No	2,745	No	80.0%	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
WHEC	Expansion	8	Through-The-Wall HP	4.00	38.40	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
WHEC	Rm 112B	1	Ductless Mini-Split AC	1.83		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
WHEC	Rm 119	1	Ductless Mini-Split AC	0.75		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
WHEC	Rm 107A&B, 112B	3	Window AC	1.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
WHEC	Rm 109, 110, 111	3	Through-The-Wall HP	2.00	24.00	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
WHEC	ITV Rm 113	2	Through-The-Wall AC	2.00		Yes	2	Ductless Mini-Split AC	2.00		18.00		No	9.87	16,654	0.0	$2,133.95	$10,957.97	$0.00	5.14
WHEC	Rm 123	1	Window AC	0.60		No							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
Front of Building	Whole Building	1	Air-Cooled Reciprocating Chiller	55.00	Yes	1	Air-Cooled Reciprocating Chiller	Variable	55.00	1.24	0.74	14.38	29,182	0.0	$3,739.26	$55,941.68	$4,950.00	13.64

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
Attic	Whole Building (4 Zones)	4	Furnace	160.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mech Rm	Whole Building	1	Storage Tank Water Heater (> 50 Gal)	Yes	1	Storage Tank Water Heater (> 50 Gal)	Natural Gas	95.00%	Et	0.90	5,742	-80.4	$633.87	$6,934.80	$240.00	10.56

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Condi	Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	Install ENERGY STAR Equipment?	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
Break Rm	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	Yes	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rm 112	1	Stand-Up Refrigerator, Solid Door (≤15 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rm 128	1	Stand-Up Refrigerator, Solid Door (≤15 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Classroom & Offices	126	Computers	109.0	Yes
Classroom & Offices	126	Computer Monitors	28.0	Yes
Various	3	Microwaves	1,000.0	No
Various	11	Sm. Printers	192.0	Yes
Office Rm 107 & 128	2	Lg. Copiers	494.0	No
Break Rm	1	Toaster Oven	900.0	No
Server Rm	2	Servers	183.0	No
Classrooms	10	Video Projectors	300.0	Yes
Classrooms	5	Large CRT-TV	245.0	No
Classrooms	2	Large LED TV	50.0	Yes

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Student Lounge	2	Refrigerated	Yes	0.00	3,224	0.0	$413.07	$460.00	$0.00	1.11
Student Lounge	1	Non-Refrigerated	Yes	0.00	343	0.0	$43.89	$230.00	$0.00	5.24

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]

Brookdale Community College - Wall

Primary Property Type: College/University
Gross Floor Area (ft²): 22,500
Built: 2002

For Year Ending: February 29, 2016
Date Generated: May 16, 2017

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Brookdale Community College - Wall 800 Monmouth Boulevard Wall, New Jersey 07719	Brookdale Community College 765 Newman Springs Road Lincroft, NJ 07738 (732) 224-2217	Timothy Drury 765 Newman Springs Road Lincroft, NJ 07738 (732) 224-2217 tdrury@brookdalecc.edu

Property ID: 5811153

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
83.9 kBtu/ft²

Source EUI
191.2 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	1,110,674 (59%)
Natural Gas (kBtu)	776,164 (41%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	115.2
National Median Source EUI (kBtu/ft²)	262.6
% Diff from National Median Source EUI	-27%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	169

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)