Local Government Energy Audit Report

Green Hall

May 6, 2021

Prepared for:

The College of New Jersey

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Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information about financial incentives that may be available. Most energy conservation measures have received preliminary analysis of feasibility that identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to establish a basis for further discussion and to help prioritize energy measures.

TRC reviewed the energy conservation measures and estimates of energy savings for technical accuracy. Actual, achieved energy savings depend on behavioral factors and other uncontrollable variables and, therefore, estimates of final energy savings are not guaranteed. TRC and the New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy savings vary.

TRC bases estimated material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on selected products and installers. TRC and NJBPU do not guarantee cost estimates and shall in no event be held liable should actual installed costs vary from these material and labor 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. Please review all available program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

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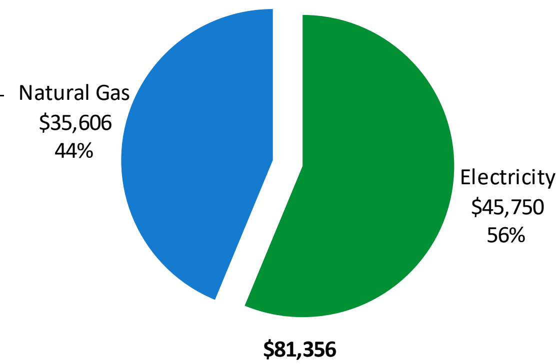
1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Green Hall. This report provides you with information about your facility's energy use, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help make changes in your facility. TRC conducted this study as part of a comprehensive effort to assist New Jersey school districts and local governments in controlling their energy costs and to help protect our environment by reducing statewide energy consumption.

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $81,356 Electricity: 1,605,913 kWh Natural Gas: 84,155 Therms	
ENERGY STAR® Benchmarking Score	N/A *(1-100 scale)*	A standard energy use benchmark is not available for this facility type. This report contains suggestions about how to improve building performance and reduce energy costs.

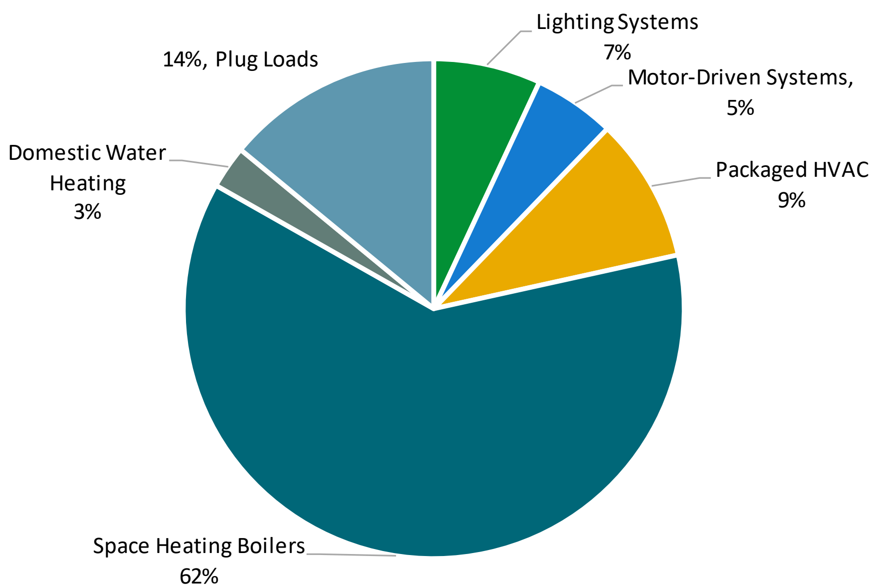


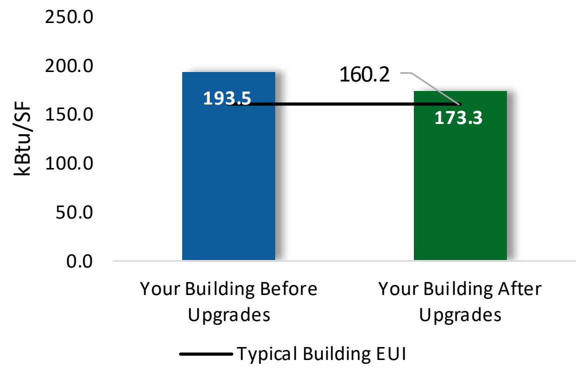
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

This energy audit considered a range of potential energy improvements in your building. Costs and savings will vary between improvements. Presented below are two potential scopes of work for your consideration.

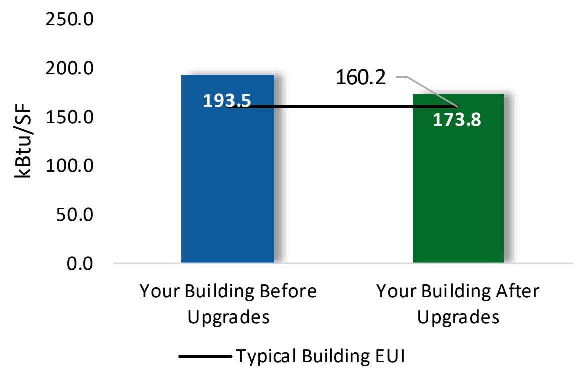
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$189,187
Potential Rebates & Incentives[1]	$20,261
Annual Cost Savings	$54,134
Annual Energy Savings	Electricity: 361,843 kWh Natural Gas: 2,126 Therms
Greenhouse Gas Emission Savings	195 Tons
Simple Payback	3.1 Years
Site Energy Savings (all utilities)	10%



Scenario 2: Cost Effective Package[2]

Installation Cost	$161,380
Potential Rebates & Incentives	$18,683
Annual Cost Savings	$52,607
Annual Energy Savings	Electricity: 351,467 kWh Natural Gas: 2,126 Therms
Greenhouse Gas Emission Savings	189 Tons
Simple Payback	2.7 Years
Site Energy Savings (all utilities)	10%



On-site Generation Potential

Photovoltaic	None
Combined Heat and Power	None

[1] Incentives are based on current SmartStart Prescriptive incentives. Other program incentives may apply.

[2] A cost-effective measure is defined as one where the simple payback does not exceed two-thirds of the expected proposed equipment useful life. Simple payback is based on the net measure cost after potential incentives.

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**151,357**	**16.7**	**-32**	**$22,134**	**$27,237**	**$7,091**	**$20,146**	**0.9**	**148,713**
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	189	0.1	0	$28	$118	$20	$98	3.6	186
ECM 2	Retrofit Fixtures with LED Lamps	Yes	151,168	16.6	-32	$22,106	$27,119	$7,071	$20,048	0.9	148,527
Lighting Control Measures			**37,136**	**4.2**	**-8**	**$5,430**	**$24,707**	**$5,285**	**$19,422**	**3.6**	**36,486**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	33,388	3.8	-7	$4,882	$22,232	$3,155	$19,077	3.9	32,804
ECM 4	Install High/Low Lighting Controls	Yes	3,748	0.4	-1	$548	$2,475	$2,130	$345	0.6	3,682
Variable Frequency Drive (VFD) Measures			**28,589**	**3.0**	**0**	**$4,206**	**$25,930**	**$2,450**	**$23,480**	**5.6**	**28,789**
ECM 5	Install VFDs on Constant Volume (CV) Fans	Yes	8,331	1.3	0	$1,226	$10,189	$250	$9,939	8.1	8,390
ECM 6	Install VFDs on Heating Water Pumps	Yes	6,092	0.7	0	$896	$7,768	$400	$7,368	8.2	6,134
ECM 7	Install VFDs on Water Supply Pump	Yes	14,165	1.0	0	$2,084	$7,974	$1,800	$6,174	3.0	14,264
Unitary HVAC Measures			**35,244**	**10.5**	**0**	**$5,185**	**$78,047**	**$5,253**	**$72,794**	**14.0**	**35,490**
ECM 8	Install High Efficiency Air Conditioning Units	Yes	24,868	7.4	0	$3,659	$50,239	$3,675	$46,564	12.7	25,042
ECM 9	Install High Efficiency Heat Pumps	No	10,376	3.1	0	$1,526	$27,808	$1,578	$26,230	17.2	10,448
HVAC System Improvements			**3,311**	**0.0**	**0**	**$487**	**$231**	**$80**	**$151**	**0.3**	**3,334**
ECM 10	Install Pipe Insulation	Yes	3,311	0.0	0	$487	$231	$80	$151	0.3	3,334
Domestic Water Heating Upgrade			**3,614**	**0.0**	**0**	**$532**	**$93**	**$52**	**$41**	**0.1**	**3,640**
ECM 11	Install Low-Flow DHW Devices	Yes	3,614	0.0	0	$532	$93	$52	$41	0.1	3,640
Food Service & Refrigeration Measures			**1,209**	**0.1**	**0**	**$178**	**$230**	**$50**	**$180**	**1.0**	**1,217**
ECM 12	Vending Machine Control	Yes	1,209	0.1	0	$178	$230	$50	$180	1.0	1,217
Custom Measures			**101,383**	**0.0**	**252**	**$15,982**	**$32,712**	**$0**	**$32,712**	**2.0**	**131,601**
ECM 13	Retro-Commissioning Study	Yes	11,664	0.0	168	$2,427	$21,542	$0	$21,542	8.9	31,418
ECM 14	Sub Metering	Yes	16,059	0.0	84	$2,718	$9,100	$0	$9,100	3.3	26,008
ECM 15	Install Heat Pump Water Heater	Yes	73,660	0.0	0	$10,837	$2,070	$0	$2,070	0.2	74,175
TOTALS (COST EFFECTIVE MEASURES)			**351,467**	**31.3**	**213**	**$52,607**	**$161,380**	**$18,683**	**$142,697**	**2.7**	**378,821**
TOTALS (ALL MEASURES)			**361,843**	**34.4**	**213**	**$54,134**	**$189,187**	**$20,261**	**$168,927**	**3.1**	**389,270**

* - All incentives presented in this table are based on NJ SmartStart 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).

Figure 2 – Evaluated Energy Improvements

For more detail on each evaluated energy improvement and a break out of cost-effective improvements, see **Section 4: Energy Conservation Measures**.

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decisions to make, such as:

- How will the project be funded and/or financed?
- Is it best to pursue individual ECMs, groups of ECMs, or use a comprehensive approach where all ECMs are installed together?
- Are there other facility improvements that should happen at the same time?

Pick Your Installation Approach

New Jersey's Clean Energy Programs give you the flexibility to do a little or a lot. Rebates, incentives, and financing are available to help reduce both your installation costs and your energy bills. If you are planning to take advantage of these programs, make sure to review incentive program guidelines before proceeding. This is important because in most cases you will need to submit applications for the incentives before purchasing materials or starting installation.

The potential ECMs identified for this building likely qualify for multiple incentive and funding programs. Based on current program rules and requirements, your measures are likely to qualify for the following programs:

Energy Conservation Measure		SmartStart	Direct Install	Pay For Performance
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	X		X
ECM 2	Retrofit Fixtures with LED Lamps	X		X
ECM 3	Install Occupancy Sensor Lighting Controls	X		X
ECM 4	Install High/Low Lighting Controls	X		X
ECM 5	Install VFDs on Constant Volume (CV) Fans	X		X
ECM 6	Install VFDs on Heating Water Pumps	X		X
ECM 7	Install VFDs on Water Supply Pump	X		X
ECM 8	Install High Efficiency Air Conditioning Units	X		X
ECM 9	Install High Efficiency Heat Pumps	X		X
ECM 10	Install Pipe Insulation	X		X
ECM 11	Install Low-Flow DHW Devices	X		X
ECM 12	Vending Machine Control	X		X
ECM 13	Retro-Commissioning Study			
ECM 14	Sub Metering			
ECM 15	Install Heat Pump Water Heater			X

Figure 3 – Funding Options

New Jersey's Clean Energy Programs At-A-Glance

	SmartStart Flexibility to install at your own pace	**Direct Install** Turnkey installation	**Pay for Performance** Whole building upgrades
Who should use it?	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together. Average peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. Peak demand should be over 200 kW.
How does it work?	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
What are the Incentives?	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to $125,000 per project. You pay the remaining 30% directly to the contractor.	Incentives are paid out in three installments. The first installment is meant to help offset the costs of the initial engineering study. The subsequent incentives are paid based on the level of energy savings up to 50% of the total project cost. See Section 7.3 for all incentive details.
How do I participate?	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified Partner to develop your Energy Reduction Plan and set your energy savings targets.

Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor.

Individual Measures with SmartStart

For facilities wishing 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, you can use internal resources or an outside firm or contractor to perform the final design of the ECM(s) and install the equipment. Program pre-approval is required for some SmartStart incentives, so only after receiving pre-approval should you proceed with ECM installation.

Turnkey Installation with Direct Install

The Direct Install program provides turnkey installation of multiple measures through an authorized network of participating contractors. This program can provide substantially higher incentives than SmartStart, up to 70 percent of the cost of selected measures. Direct Install contractors will assess and verify individual measure eligibility and, in most cases, they perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

Whole Building Approach with Pay for Performance

Pay for Performance can be a good option for medium to large sized facilities to achieve deep energy savings. Pay for Performance allows you to install as many measures as possible under a single project as well as address measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program (ESIP) loan also use this program. Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures resulting in at least 15 percent energy savings, where lighting cannot make up the majority of the savings.

More Options from Around the State

Financing and Planning Support with the Energy Savings Improvement Program (ESIP)

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the 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. You have already taken the first step as an LGEA customer, because this report is required to participate in ESIP.

Resiliency with Return on Investment through Combined Heat & Power (CHP)

The CHP program provides incentives for combined heat and power (aka cogeneration) and waste heat to power projects. Combined heat and power systems generate power on-site and recover heat from the generation system to meet on-site thermal loads. Waste heat to power systems use waste heat to generate power. You will work with a qualified developer who will design a system that meets your building's heating and cooling needs.

Ongoing Electric Savings with Demand Response

The Demand Response Energy Aggregator program reduces 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. By enabling commercial facilities to reduce electric demand 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 demand response (DR) programs. Program participation is voluntary, and facilities receive payments regardless of whether they are called upon to curtail their load during times of peak demand.

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Green Hall. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs. This report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing ECMs.

TRC conducted this study as part of a comprehensive effort to assist New Jersey educational and local government facilities in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

2.1 Site Overview

On November 6, 2020, TRC performed an energy audit at The College of New Jersey's (TCNJ) Green Hall located in Ewing, New Jersey. TRC met with Joe O'Brien to review the facility operations and help focus our investigation on specific energy-using systems.

Green Hall is a three-story, 71,808 square foot building built in 1931. It was the first TCNJ academic building and, as of today, it is the center of TCNJ's administrative operations. Spaces include offices, conference rooms, corridors, stairwells, restrooms, break rooms, and attic floor mechanical spaces. Additionally, the building houses the TCNJ main data center and the Media and Technology Support Services.

Lighting is provided by a combination of LED fixtures and linear fluorescent T8 lamps. The facility uses steam from the Power House/Cogen building or Central Utilities Plant. Cooling is provided by split system and window air conditioners.

Recent improvements include sections of the second-floor offices were renovated, including replacing the lighting system with LED fixtures.

2.2 Building Occupancy

Green Hall is the college administrative center and operates on a 12-month schedule. Weekend and summer occupancies vary, and most sections of facility (except the data center) are shut down at approximately 10:00 PM weekdays. During a typical day, the facility is occupied by approximately 280 staff. It should be noted that the energy and economic analysis for this building is based on the use of the building during the utility billing period, and results will vary based on changes to building use patterns.

Building Name	Weekday/Weekend	Operating Schedule
Green Hall	Weekday	6:00 AM - 10:00 PM
	Weekend	Varies
	Summer	Varies

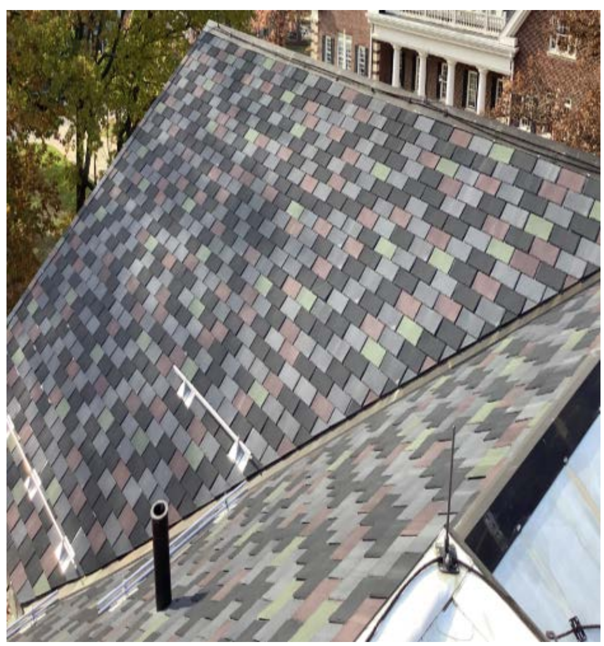
Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are made of concrete block over structural steel with brick veneer façade. The main center flat roof is supported with steel trusses and a wood deck, and it is finished with a thermoplastic white membrane. The center flat roof is surrounded with perimeter clay tile pitched roofing. The roofing systems are in good condition.

The windows are double glazed and have aluminum frames. The glass-to-frame seals are in good condition. The weather seals for the fixed windows are in good condition, showing little signs of outside air infiltration. The entrance doors have aluminum frames with incorporated glass. The exit doors are made of wood frames and are in poor condition with damaged door seals. Degraded door seals increase drafts and outside air infiltration. Overall, the building envelope appears in an age appropriate condition.


Building Walls

Roofs

Windows

Exterior Doors

Damage Door Seal

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several LED linear tubes and LED fixtures. Fixture types include 2- 3- or 4-lamp, 2- or 4-foot long troffer, recessed, surface mounted, pendant fixtures and 2-foot fixtures with U-bend linear tube lamps.

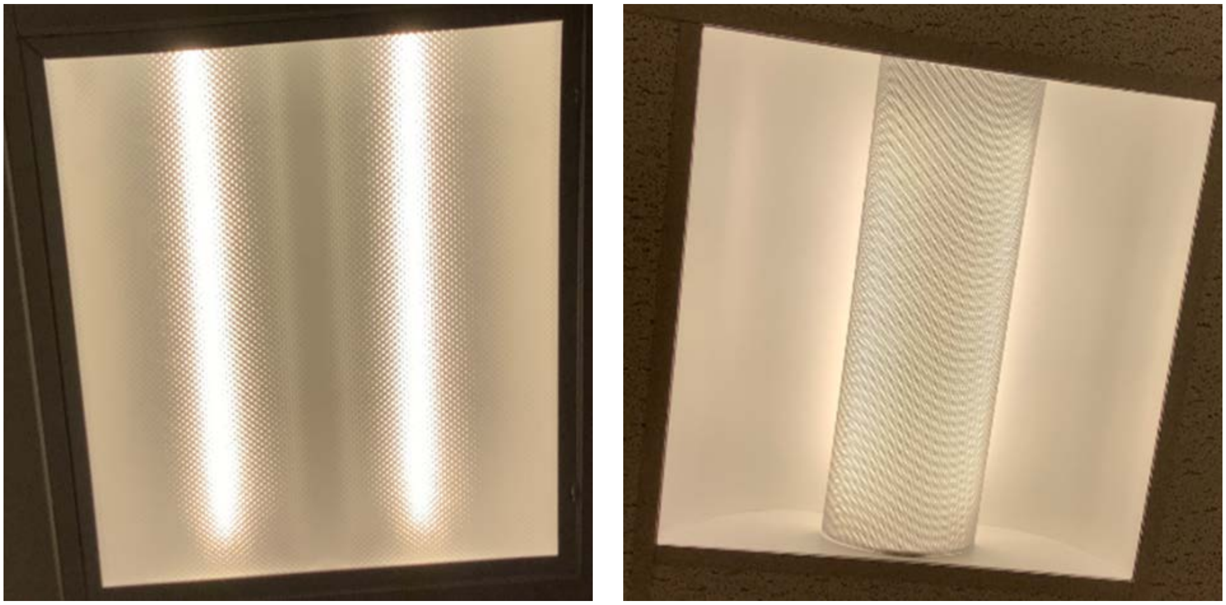
LED linear tubes are located in spaces including the second-floor corridor and first and second floor men's restrooms. Building areas such as room 210B, 205 are lit with LED recessed fixtures. Additionally, the middle stairs and the second-floor corridor have chandelier fixtures with 15 7-Watt and 5 7-Watt decorative LED lamps, respectively. Remaining spaces are illuminated with fluorescent T8 lamps including some U-bend linear tubes.

The fixtures are in fair to good condition. All exit signs are LED units. Interior lighting levels were generally sufficient except in the attic floor, which was has a limited number of light fixtures and appears to be under lit.

Lighting fixtures in most spaces are controlled by wall switches except the first and second-floor men's restrooms and the first-floor women's restroom, where fixtures are controlled by occupancy sensors.

Exterior fixtures include 8 100-Watt landscape and spot luminaire LED fixtures, 5 LED recessed and 25 30-Watt pole mounted walkway fixtures. There also three wall mounted fixtures with compact fluorescent lamps. The pole mounted fixtures are controlled by a timeclock, while the other exterior fixtures are controlled by photocells.

Linear Fluorescent T8 Fixtures



2-Foot Long LED Linear Tubes & LED Fixture

4-Foot Long LED Tubes

U-Bend Tubes & LED Lamps

Pendant LED Fixtures & LED Exit Signs

LED Landscape Spot Luminaire & CFL Fixture


LED Fixtures

2.5 Air Handling Systems

Unitary Electric Heating, Ventilation, and Air Conditioning (HVAC) Equipment

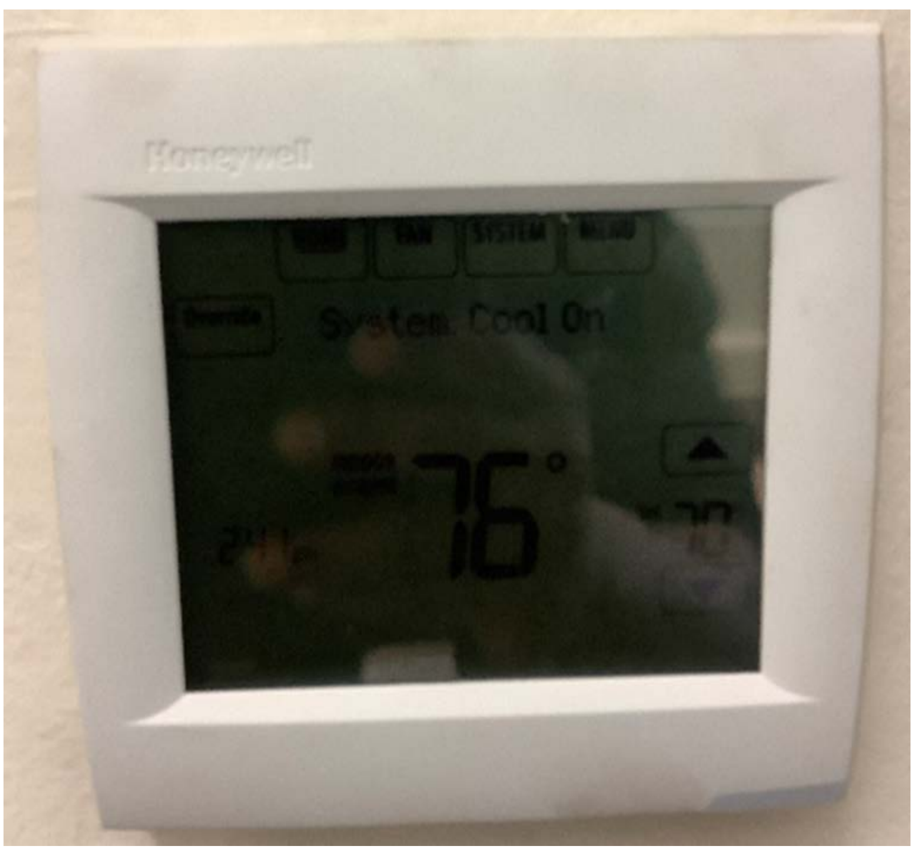
Various building areas, including offices and conference rooms, are cooled with window and split system air conditioning units. There are 45 window units with cooling capacities that vary from 0.67 to 1.5 tons. Four units are in poor condition and have been evaluated for replacement. There are two 2-ton and three 1 ton split system air conditioners (AC) that serve offices.

Additionally, there are nine condensing units that serve the cooling coils of the air handling units (AHUs) located in the attic floor. They vary in cooling capacity from 2.5 to 7.5 tons. Seven condensing units have passed their useful life and have been evaluated for replacement. There are four split system air source heat pumps. They vary from 3 to 7.5 tons in cooling capacity and 19.65 MBh to 48 MBh in heating capacity. The split system ACs are controlled via programmable thermostats.

The data center, including the UPS and the computer room, are served by one 5 ton and two 20 ton Liebert liquid cooled direct expansion systems. They use dry coolers that reject heat from a glycol loop before it flows into the unit. The glycol is then used in the computer room condenser to condense the refrigerant. The units are equipped with an onboard digital control panel and are also controllable via the energy management system (EMS).

Split System AC

Window ACs



Programmable Thermostats

Condensing Units

Old Condensing Unit

Liebert Outdoor Condensing Units & Digital Control Panel

Evaporator Units

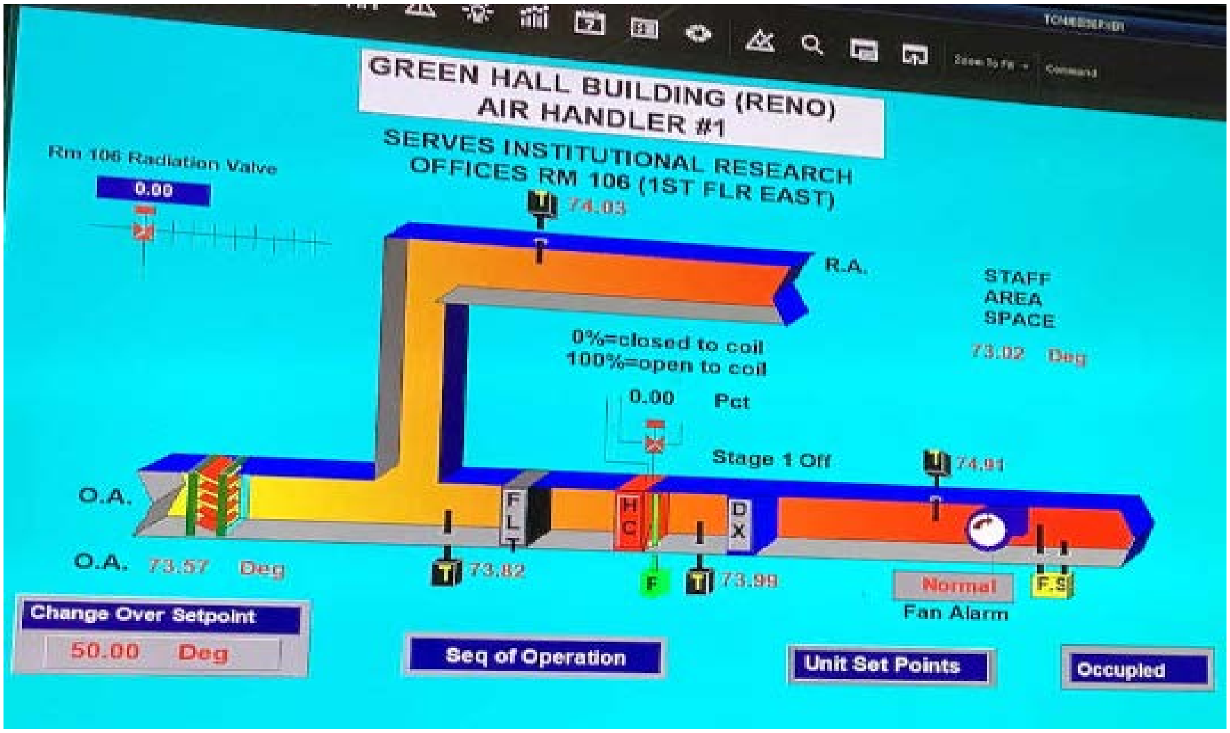
AHUs

The large offices are conditioned by nine air handling units physically located in the attic floor. The AHUs operate at constant volume and are equipped with a supply fan motor. AHU-1, 2 and 3 are equipped with hot water heating coils and a refrigerant coil for cooling. They serve the renovated areas. The remaining AHUs are equipped with steam heating coils and a refrigerant coil for cooling.

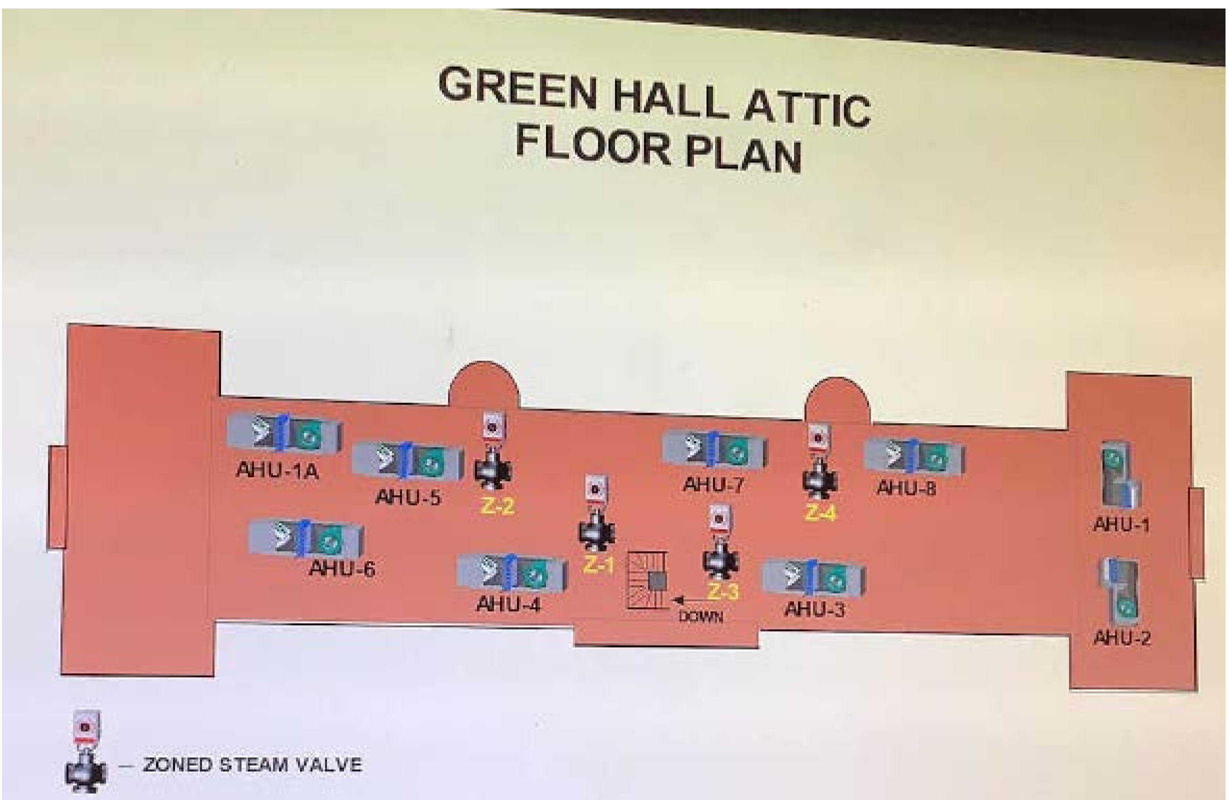
The cooling is provided by outdoors condensing units located either on the roof or the ground floor and the heating source is provided from the Power House/Cogen.

The AHUs are in fair condition and are controlled by the building EMS. They are enabled/disabled based upon a time of day schedule or a manual command at EMS. The occupied hours are established by a seven-day adjustable time schedule, currently set from 7:00 AM to 5:00 PM, excluding holidays and weekends.

AHU



AHU-1 EMS Diagram View



Attic Floor AHUs EMS Diagram View

2.6 Steam System

Steam is supplied by boilers and the cogeneration heat recovery system located in the Power House/Cogen Building. Steam is used directly to heat some sections of this building.

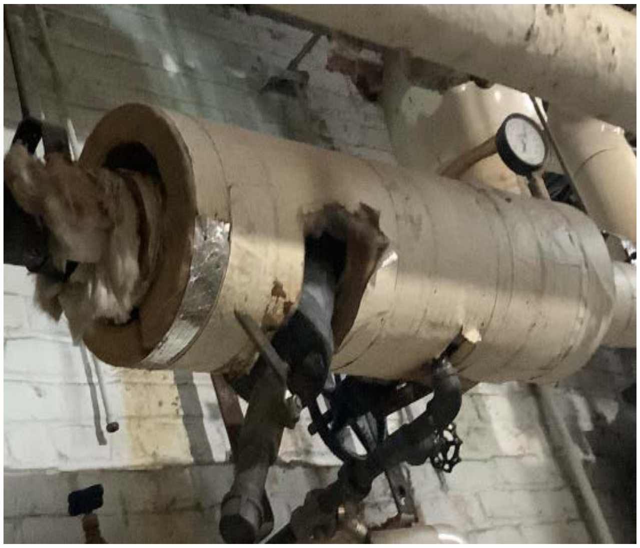
Steam is used to produce space heating water through a steam heat exchanger for heating the renovated area. Space heating water is circulated to AHU-1, 2, and 3 and hydronic baseboard heaters using two 3 hp constant flow hot water pumps. The pumps appear in fair condition although one was leaking during the audit. The hot water distribution system is two-pipe heating only. The hot water system is designed such that one dedicated hot water pump will operate at a time during hot water system operation. Pumps operate in a lead lag arrangement.

The hot water supply temperature is controlled to maintain 120°F when the outside temperature is below 60°F and this setpoint is reset to 180°F when the outside temperature is below 20°F. A flow transmitter and BTU meter are used to measure the hot water energy usage of the building.

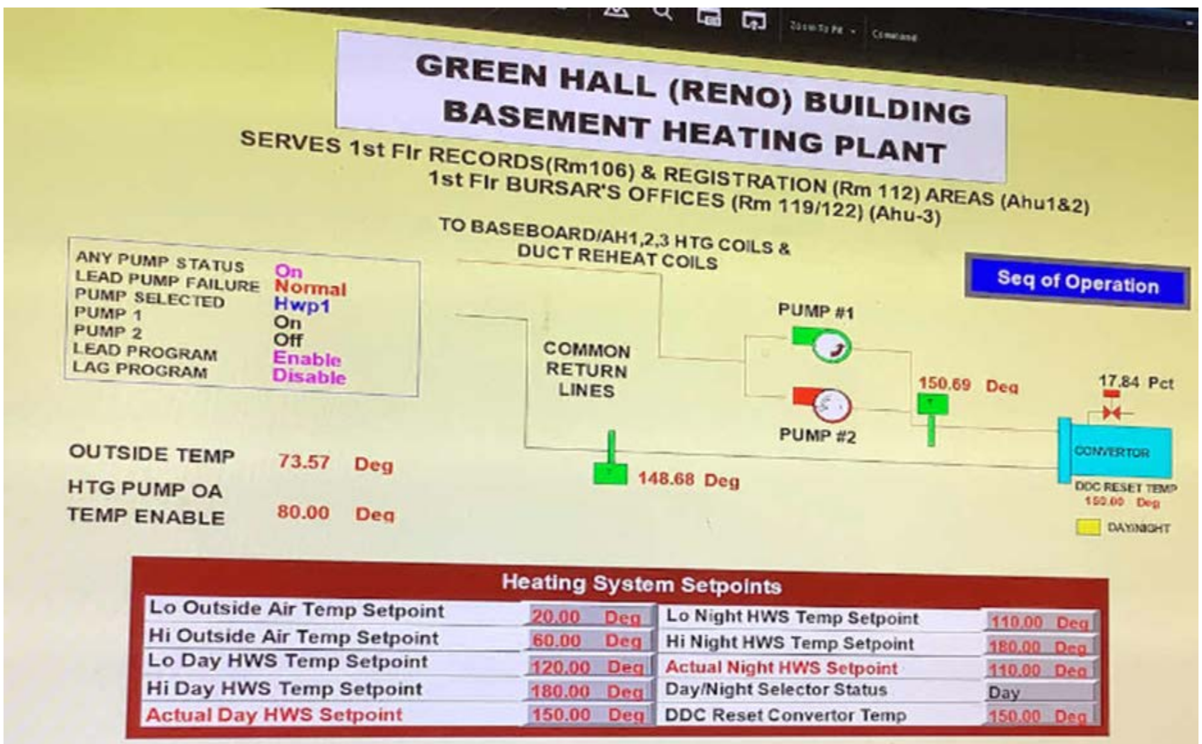
Energy use associated with producing steam was allocated to individual buildings served by the cogeneration system and boilers. Please see the Power House/Cogen building report for details regarding the steam system.

There are five 0.3 hp condensate pumps and four zone steam valves that control the building steam system. According to the maintenance personnel, the control valves are inefficient and in need of replacement.

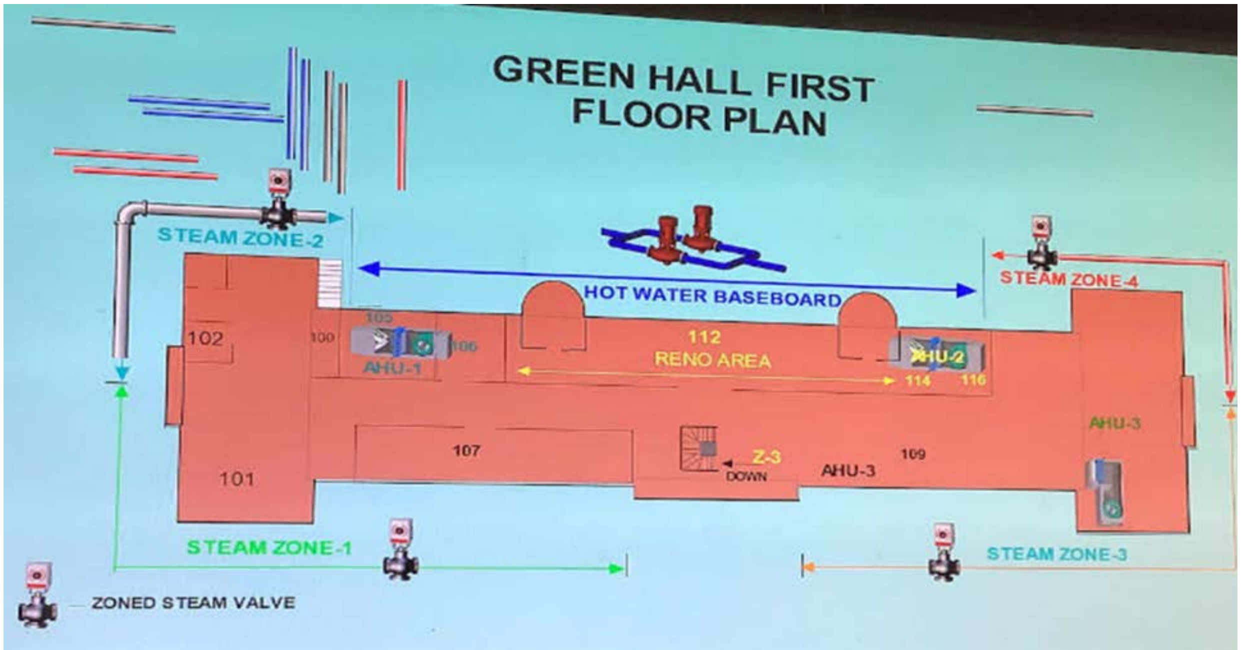
Hot Water Pumps



Heat Exchanger & Condensate Pumps



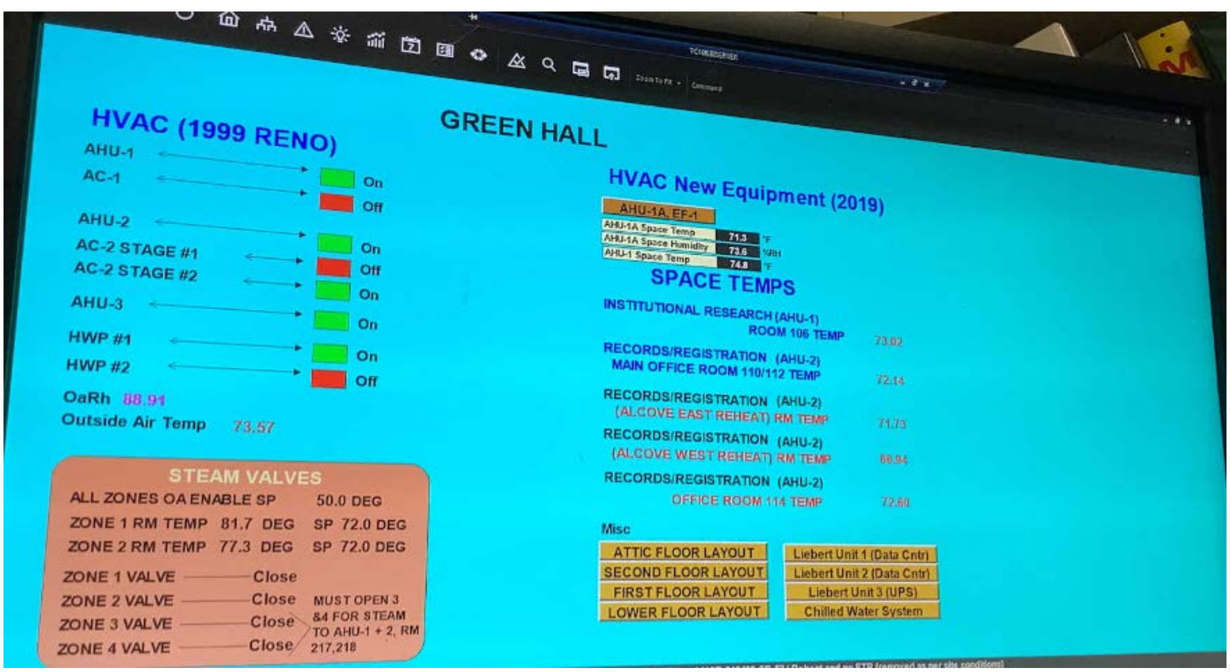
Hot Water System EMS Diagram View



Zone Steam Valves EMS Diagram View

2.7 Building EMS

A Honeywell EMS controls the HVAC equipment, boilers, chillers, and air handlers. The EMS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, steam, and heating water loop temperatures.

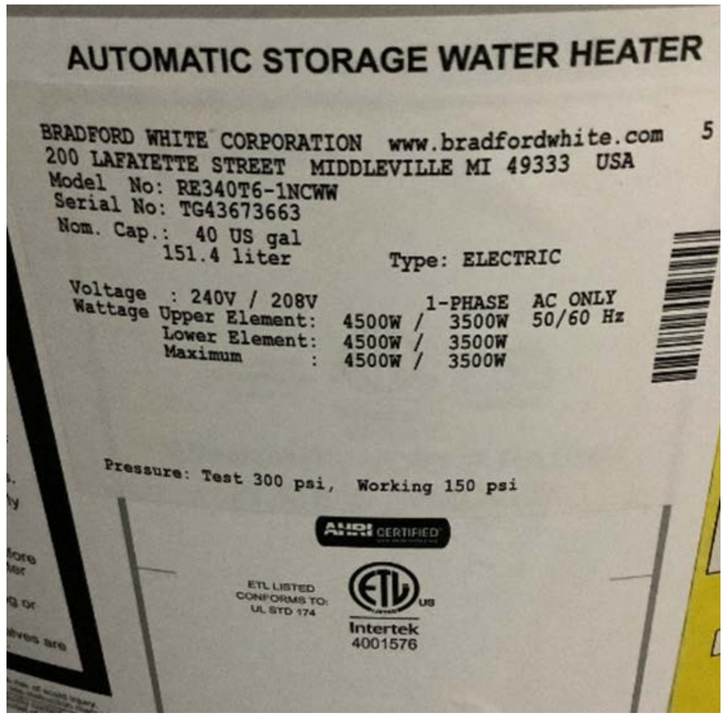


Green Hall EMS Main Page

2.8 Domestic Hot Water

Hot water is produced by a 40-gallon 4.5 kW electric storage water heater physically located in the mechanical room 015. The domestic hot water pipes are not insulated.

Two 5 hp constant flow booster pumps are used to supply domestic cold water to the building.



Electric Storage Tank Water Heater

5 hp Booster Pumps

2.9 Plug Load & Vending Machines

There are approximately 259 computer workstations throughout the facility. Plug loads throughout the building include general café and office equipment. There are also typical office loads such as copiers, small printers, projectors, televisions, microwaves, water coolers, and mini fridges. There are seven residential style refrigerators throughout the building

There are one refrigerated beverage and one non-refrigerated vending machines located in the ground floor corridor. Vending machines are not equipped with occupancy-based control.

The estimated plug load for this building is relatively high due to the substantial load associated with the data center.


Copier & Residential Style Refrigerator

Vending Machines

2.10 Water-Using Systems

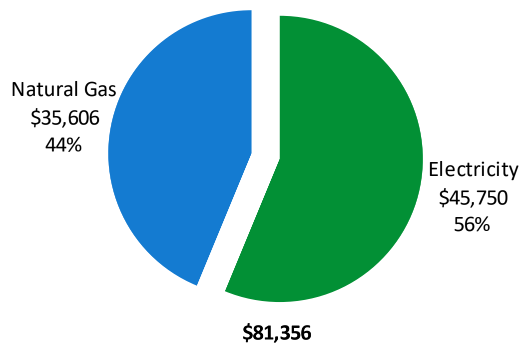
There are several restrooms with toilets, urinals, and sinks. Most faucet flow rates are at 2.2 gallons per minute (gpm) or higher. Toilets are rated at 2.5 gallons per flush (gpf) and urinals are rated at 2.5 gpf.

Typical Restroom Sinks

3 Energy Use and Costs

Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	1,605,913 kWh	$45,750
Natural Gas	84,155 Therms	$35,606
Total		**$81,356**



An energy balance identifies and quantifies energy use in your various building systems. This can highlight areas with the most potential for improvement. This energy balance was developed using calculated energy use for each of the end uses noted in the figure.

The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated energy use is then compared to the historical energy use and the initial inputs are revised, as necessary, to balance the calculated energy use to the historical energy use.

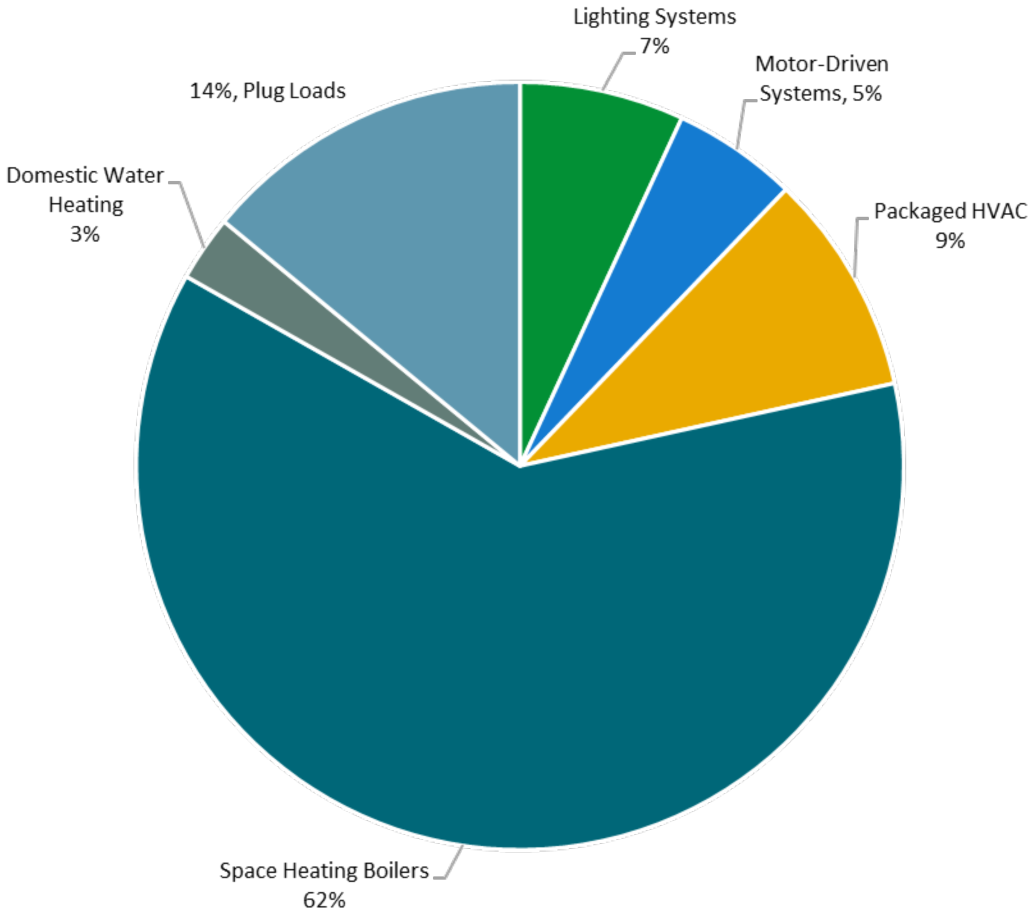
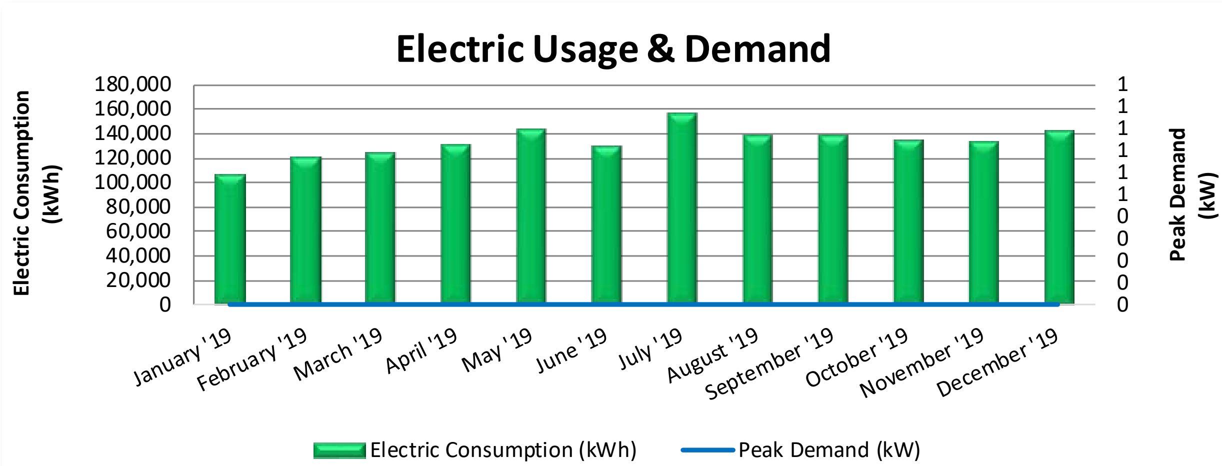


Figure 5 - Energy Balance

3.1 Electricity

PSE&G delivers electricity under rate class High Tension Service (HTS). Electricity for the building is supplemented by the cogeneration plant.



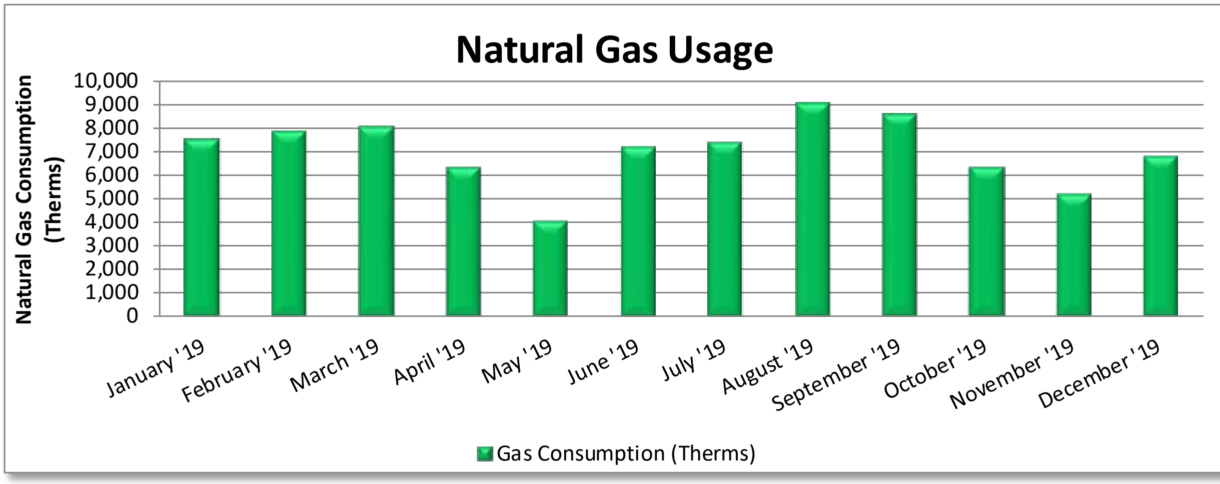
Electric Billing Data						
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost	TRC Estimated Usage?
1/28/19	31	106,958	0	$0	$2,334	Yes
2/28/19	31	120,719	0	$0	$2,970	Yes
3/28/19	28	124,881	0	$0	$2,715	Yes
4/28/19	31	131,207	0	$0	$2,953	Yes
5/29/19	31	144,099	0	$0	$5,313	Yes
6/27/19	29	130,205	0	$0	$4,138	Yes
7/29/19	32	157,207	0	$0	$5,667	Yes
8/27/19	29	139,635	0	$0	$3,964	Yes
9/26/19	30	139,559	0	$0	$4,341	Yes
10/25/19	29	134,863	0	$0	$3,743	Yes
11/25/19	31	133,583	0	$0	$3,228	Yes
12/11/19	33	142,997	0	$0	$4,385	Yes
Totals	**365**	**1,605,913**	**0**	**$0**	**$45,750**	
Annual	**365**	**1,605,913**	**0**	**$0**	**$45,750**	

Notes:

- Electric data has been estimated based on a campus wide approach and utilization of sub metered data. Please refer to the Power House/Cogen Building report for details regarding utility baseline and campus building utility desegregation.
- The peak demand for this facility was unavailable because the building is served with electricity from the master meter.
- The average purchased electric cost over the past 12 months was $0.147/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.
- Effectively all of the electricity generated on-site is used on-site.

3.2 Natural Gas

PSE&G delivers natural gas for the main boiler meter under rate class TSGNF.



Gas Billing Data				
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost	TRC Estimated Usage?
1/28/19	31	7,523	$2,822	Yes
2/28/19	31	7,822	$3,722	Yes
3/28/19	28	8,014	$3,597	Yes
4/28/19	31	6,329	$2,650	Yes
5/29/19	31	4,072	$1,761	Yes
6/27/19	29	7,151	$3,084	Yes
7/29/19	32	7,365	$2,977	Yes
8/27/19	29	9,060	$3,548	Yes
9/26/19	30	8,594	$3,440	Yes
10/25/19	29	6,280	$2,682	Yes
11/25/19	31	5,141	$2,263	Yes
12/11/19	33	6,804	$3,060	Yes
Totals	**365**	**84,155**	**$35,606**	
Annual	**365**	**84,155**	**$35,606**	

Notes:

- Natural gas data has been estimated based on a campus wide approach. Please refer to the Power House/Cogen Building report for details regarding the utility baseline and campus building utility desegregation analysis.
- The average gas cost for the past 12 months is $0.423/therm, which is the blended rate used throughout the analysis.

3.3 Benchmarking

Your building was benchmarked using the United States Environmental Protection Agency's (EPA) *Portfolio Manager®* software. Benchmarking compares your building's energy use to that of similar buildings across the country, while neutralizing variations due to location, occupancy, and operating hours. Some building types can be scored with a 1-100 ranking of a building's energy performance relative to the national building market. A score of 50 represents the national average and a score of 100 is best.

This ENERGY STAR® benchmarking score provides a comprehensive snapshot of your building's energy performance. It assesses the building's physical assets, operations, and occupant behavior, which is compiled into a quick and easy-to-understand score.

Benchmarking Score	N/A

Due to its unique characteristics, this building type is not able to receive a benchmarking score. This report contains suggestions about how to improve building performance and reduce energy costs.

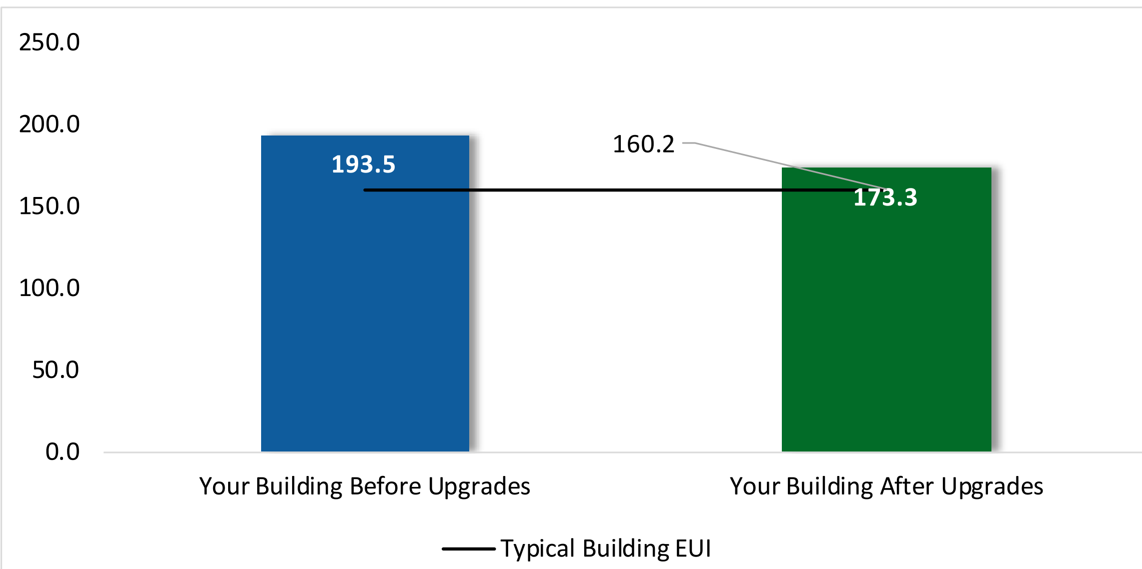


Figure 6 - Energy Use Intensity Comparison[3]

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. A number of factors can cause a building to vary from the "typical" energy usage. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and occupant behavior all contribute to a building's energy use and the benchmarking score.

Benchmarking is provided for The College of New Jersey's campus. Please refer to the Power House/Cogen report for additional details regarding the benchmarking approach within Portfolio Manager®.

[3] Based on all evaluated ECMs

Tracking Your Energy Performance

Keeping track of your energy use on a monthly basis is one of the best ways to keep energy costs in check. Update your utility information in Portfolio Manager® regularly, so that you can keep track of your building's performance.

We have created a Portfolio Manager® account for your facility and we have already entered the monthly utility data shown above for you. Account login information for your account will be sent via email.

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.

For more information on ENERGY STAR® and Portfolio Manager®, visit their website[4].

[4] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

4 ENERGY CONSERVATION MEASURES

The goal of this audit report is to identify and evaluate potential energy efficiency improvements, provide information about the cost effectiveness of those improvements, and recognize potential financial incentives from NJBPU. Most energy conservation measures have received preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is typically sufficient to demonstrate project cost-effectiveness and help prioritize energy measures.

Calculations of energy use and savings are based on the current version of the *New Jersey's Clean Energy Program Protocols to Measure Resource Savings*, which is approved by the NJBPU. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances.

Operation and maintenance costs for the proposed new equipment will generally be lower than the current costs for the existing equipment—especially if the existing equipment is at or past its normal useful life. We have conservatively assumed there to be no impact on overall maintenance costs over the life of the equipment.

Financial incentives are based on the current NJCEP prescriptive SmartStart program. A higher level of investigation may be necessary to support any SmartStart Custom, Pay for Performance, or Direct Install incentive applications. Some measures and proposed upgrades may be eligible for higher incentives than those shown below through other NJCEP programs described in a following section of this report.

For a detailed list of the locations and recommended energy conservation measures for all inventoried equipment, see **Appendix A: Equipment Inventory & Recommendations.**

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**151,357**	**16.7**	**-32**	**$22,134**	**$27,237**	**$7,091**	**$20,146**	**0.9**	**148,713**
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	189	0.1	0	$28	$118	$20	$98	3.6	186
ECM 2	Retrofit Fixtures with LED Lamps	Yes	151,168	16.6	-32	$22,106	$27,119	$7,071	$20,048	0.9	148,527
Lighting Control Measures			**37,136**	**4.2**	**-8**	**$5,430**	**$24,707**	**$5,285**	**$19,422**	**3.6**	**36,486**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	33,388	3.8	-7	$4,882	$22,232	$3,155	$19,077	3.9	32,804
ECM 4	Install High/Low Lighting Controls	Yes	3,748	0.4	-1	$548	$2,475	$2,130	$345	0.6	3,682
Variable Frequency Drive (VFD) Measures			**28,589**	**3.0**	**0**	**$4,206**	**$25,930**	**$2,450**	**$23,480**	**5.6**	**28,789**
ECM 5	Install VFDs on Constant Volume (CV) Fans	Yes	8,331	1.3	0	$1,226	$10,189	$250	$9,939	8.1	8,390
ECM 6	Install VFDs on Heating Water Pumps	Yes	6,092	0.7	0	$896	$7,768	$400	$7,368	8.2	6,134
ECM 7	Install VFDs on Water Supply Pump	Yes	14,165	1.0	0	$2,084	$7,974	$1,800	$6,174	3.0	14,264
Unitary HVAC Measures			**35,244**	**10.5**	**0**	**$5,185**	**$78,047**	**$5,253**	**$72,794**	**14.0**	**35,490**
ECM 8	Install High Efficiency Air Conditioning Units	Yes	24,868	7.4	0	$3,659	$50,239	$3,675	$46,564	12.7	25,042
ECM 9	Install High Efficiency Heat Pumps	No	10,376	3.1	0	$1,526	$27,808	$1,578	$26,230	17.2	10,448
HVAC System Improvements			**3,311**	**0.0**	**0**	**$487**	**$231**	**$80**	**$151**	**0.3**	**3,334**
ECM 10	Install Pipe Insulation	Yes	3,311	0.0	0	$487	$231	$80	$151	0.3	3,334
Domestic Water Heating Upgrade			**3,614**	**0.0**	**0**	**$532**	**$93**	**$52**	**$41**	**0.1**	**3,640**
ECM 11	Install Low-Flow DHW Devices	Yes	3,614	0.0	0	$532	$93	$52	$41	0.1	3,640
Food Service & Refrigeration Measures			**1,209**	**0.1**	**0**	**$178**	**$230**	**$50**	**$180**	**1.0**	**1,217**
ECM 12	Vending Machine Control	Yes	1,209	0.1	0	$178	$230	$50	$180	1.0	1,217
Custom Measures			**101,383**	**0.0**	**252**	**$15,982**	**$32,712**	**$0**	**$32,712**	**2.0**	**131,601**
ECM 13	Retro-Commissioning Study	Yes	11,664	0.0	168	$2,427	$21,542	$0	$21,542	8.9	31,418
ECM 14	Sub Metering	Yes	16,059	0.0	84	$2,718	$9,100	$0	$9,100	3.3	26,008
ECM 15	Install Heat Pump Water Heater	Yes	73,660	0.0	0	$10,837	$2,070	$0	$2,070	0.2	74,175
TOTALS			**361,843**	**34.4**	**213**	**$54,134**	**$189,187**	**$20,261**	**$168,927**	**3.1**	**389,270**

* - All incentives presented in this table are based on NJ SmartStart 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).

Figure 7 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**151,357**	**16.7**	**-32**	**$22,134**	**$27,237**	**$7,091**	**$20,146**	**0.9**	**148,713**
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	189	0.1	0	$28	$118	$20	$98	3.6	186
ECM 2	Retrofit Fixtures with LED Lamps	151,168	16.6	-32	$22,106	$27,119	$7,071	$20,048	0.9	148,527
Lighting Control Measures		**37,136**	**4.2**	**-8**	**$5,430**	**$24,707**	**$5,285**	**$19,422**	**3.6**	**36,486**
ECM 3	Install Occupancy Sensor Lighting Controls	33,388	3.8	-7	$4,882	$22,232	$3,155	$19,077	3.9	32,804
ECM 4	Install High/Low Lighting Controls	3,748	0.4	-1	$548	$2,475	$2,130	$345	0.6	3,682
Variable Frequency Drive (VFD) Measures		**28,589**	**3.0**	**0**	**$4,206**	**$25,930**	**$2,450**	**$23,480**	**5.6**	**28,789**
ECM 5	Install VFDs on Constant Volume (CV) Fans	8,331	1.3	0	$1,226	$10,189	$250	$9,939	8.1	8,390
ECM 6	Install VFDs on Heating Water Pumps	6,092	0.7	0	$896	$7,768	$400	$7,368	8.2	6,134
ECM 7	Install VFDs on Water Supply Pump	14,165	1.0	0	$2,084	$7,974	$1,800	$6,174	3.0	14,264
Unitary HVAC Measures		**24,868**	**7.4**	**0**	**$3,659**	**$50,239**	**$3,675**	**$46,564**	**12.7**	**25,042**
ECM 8	Install High Efficiency Air Conditioning Units	24,868	7.4	0	$3,659	$50,239	$3,675	$46,564	12.7	25,042
HVAC System Improvements		**3,311**	**0.0**	**0**	**$487**	**$231**	**$80**	**$151**	**0.3**	**3,334**
ECM 10	Install Pipe Insulation	3,311	0.0	0	$487	$231	$80	$151	0.3	3,334
Domestic Water Heating Upgrade		**3,614**	**0.0**	**0**	**$532**	**$93**	**$52**	**$41**	**0.1**	**3,640**
ECM 11	Install Low-Flow DHW Devices	3,614	0.0	0	$532	$93	$52	$41	0.1	3,640
Food Service & Refrigeration Measures		**1,209**	**0.1**	**0**	**$178**	**$230**	**$50**	**$180**	**1.0**	**1,217**
ECM 12	Vending Machine Control	1,209	0.1	0	$178	$230	$50	$180	1.0	1,217
Custom Measures		**101,383**	**0.0**	**252**	**$15,982**	**$32,712**	**$0**	**$32,712**	**2.0**	**131,601**
ECM 13	Retro-Commissioning Study	11,664	0.0	168	$2,427	$21,542	$0	$21,542	8.9	31,418
ECM 14	Sub Metering	16,059	0.0	84	$2,718	$9,100	$0	$9,100	3.3	26,008
ECM 15	Install Heat Pump Water Heater	73,660	0.0	0	$10,837	$2,070	$0	$2,070	0.2	74,175
TOTALS		**351,467**	**31.3**	**213**	**$52,607**	**$161,380**	**$18,683**	**$142,697**	**2.7**	**378,821**

* - All incentives presented in this table are based on NJ SmartStart 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).

Figure 8 – Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**151,357**	**16.7**	**-32**	**$22,134**	**$27,237**	**$7,091**	**$20,146**	**0.9**	**148,713**
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	189	0.1	0	$28	$118	$20	$98	3.6	186
ECM 2	Retrofit Fixtures with LED Lamps	151,168	16.6	-32	$22,106	$27,119	$7,071	$20,048	0.9	148,527

When considering lighting upgrades, we suggest using a comprehensive design approach that simultaneously upgrades lighting fixtures and controls to maximize energy savings and improve occupant lighting. Comprehensive design will also consider appropriate lighting levels for different space types to make sure that the right amount of light is delivered where needed. If conversion to LED light sources are proposed, we suggest converting all of a specific lighting type (e.g. linear fluorescent) to LED lamps to minimize the number of lamp types in use at the facility, which should help reduce future maintenance costs.

ECM 1: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Retrofit fluorescent fixtures by removing the fluorescent tubes and ballasts and replacing them with LED tubes and LED drivers (if necessary), which are designed to be used in retrofitted fluorescent fixtures.

The measure uses the existing fixture housing but replaces the electric components with more efficient lighting technology which use less power than other lighting technologies but provides equivalent lighting output. Maintenance savings may also be achieved since LED tubes last longer than fluorescent tubes and therefore do not need to be replaced as often.

Affected building areas: closet.

ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent T8, CFL and incandescent lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies.

This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space. Maintenance savings may also be available, as longer-lasting LEDs lamps will not need to be replaced as often as the existing lamps.

Affected building areas: all areas with fluorescent fixtures with T8 tubes, CFL, and incandescent lamps.

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**37,136**	**4.2**	**-8**	**$5,430**	**$24,707**	**$5,285**	**$19,422**	**3.6**	**36,486**
ECM 3	Install Occupancy Sensor Lighting Controls	33,388	3.8	-7	$4,882	$22,232	$3,155	$19,077	3.9	32,804
ECM 4	Install High/Low Lighting Controls	3,748	0.4	-1	$548	$2,475	$2,130	$345	0.6	3,682

Lighting controls reduce energy use by turning off or lowering lighting fixture power levels when not in use. A comprehensive approach to lighting design should upgrade the lighting fixtures and the controls together for maximum energy savings and improved lighting for occupants.

ECM 3: Install Occupancy Sensor Lighting Controls

Install occupancy sensors to control lighting fixtures in areas that are frequently unoccupied, even for short periods. For most spaces, we recommend that lighting controls use dual technology sensors, which reduce the possibility of lights turning off unexpectedly.

Occupancy sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Most occupancy sensor lighting controls allow users to manually turn fixtures on/off, as needed. Some controls can also provide dimming options.

A vacancy sensor turns the lights off when the space is not occupied but differs slightly from an occupancy sensor in that it does not automatically turn the lights on when the space is reoccupied. It requires a manual button press by the occupant to engage the lighting systems. Vacancy sensing maximizes the energy savings from the sensor because it's not always necessary to turn lights on when you walk into a room. Vacancy sensors should be used in cases where occupants are less likely to turn the lights on when temporarily entering a space, when adequate day light is available, or when lighting from adjacent spaces or emergency systems is adequate for the task at hand. Application examples for vacancy sensors may include dorm residential spaces and common areas such as conference rooms.

Occupancy sensors can be mounted on the wall at existing switch locations, mounted on the ceiling, or in remote locations. In general, wall switch replacement sensors are best suited to single occupant offices and other small rooms. Ceiling-mounted or remote mounted sensors are used in large spaces, locations without local switching, and where wall switches are not in the line-of-sight of the main work area.

This measure provides energy savings by reducing the lighting operating hours.

Affected building areas: offices, conference rooms, restrooms, and storage rooms.

ECM 4: Install High/Low Lighting Controls

Install occupancy sensors to provide dual level lighting control for lighting fixtures in spaces that are infrequently occupied but may require some level of continuous lighting for safety or security reasons.

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety code requirements for egress. Sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Fixtures automatically switch back to low level after a predefined period of vacancy. In parking lots and parking garages with significant ambient lighting, this control can sometimes be combined with photocell controls to turn the lights off when there is sufficient daylight.

The controller lowers the light level by dimming the fixture output. Therefore, the controlled fixtures need to have a dimmable ballast or driver. This will need to be considered when selecting retrofit lamps and bulbs for the areas proposed for high/low control.

This measure provides energy savings by reducing the light fixture power draw when reduced light output is appropriate.

Affected building areas: corridors and stairwells.

For this type of measure the occupancy sensors will generally be ceiling or fixture mounted. Sufficient sensor coverage must be provided to ensure that lights turn on in each area as an occupant approaches.

4.3 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**28,589**	**3.0**	**0**	**$4,206**	**$25,930**	**$2,450**	**$23,480**	**5.6**	**28,789**
ECM 5	Install VFDs on Constant Volume (CV) Fans	8,331	1.3	0	$1,226	$10,189	$250	$9,939	8.1	8,390
ECM 6	Install VFDs on Heating Water Pumps	6,092	0.7	0	$896	$7,768	$400	$7,368	8.2	6,134
ECM 7	Install VFDs on Water Supply Pump	14,165	1.0	0	$2,084	$7,974	$1,800	$6,174	3.0	14,264

Variable frequency drives control motors for fans, pumps, and process equipment based on the actual output required of the driven equipment. Energy savings result from more efficient control of motor energy usage when equipment operates at partial load. The magnitude of energy savings depends on the estimated amount of time that the motor would operate at partial load. For equipment with proposed VFDs, we have included replacing the controlled motor with a new inverter duty rated motor to conservatively account for the cost of an inverter duty rated motor.

ECM 5: Install VFDs on Constant Volume (CV) Fans

Install VFDs to control constant volume fan motor speeds. This converts a constant-volume, single-zone air handling system into a variable-air-volume (VAV) system. A separate VFD is usually required to control the return fan motor or dedicated exhaust fan motor, if the air handler has one.

Zone thermostats signal the VFD to adjust fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature.

For air handlers with direct expansion (DX) cooling systems, the minimum air flow across the cooling coil required to prevent the coil from freezing must be determined during the final project design. The control system programming should maintain the minimum air flow whenever the compressor is operating. Prior to implementation, verify minimum fan speed in cooling mode with the manufacturer. Note that savings will vary depending on the operating characteristics of each AHU.

Energy savings result from reducing the fan speed (and power) when conditions allow for reduced air flow.

Affected Units: all AHUs.

ECM 6: Install VFDs on Heating Water Pumps

Install variable frequency drives (VFD) to control heating water pumps. Two-way valves must serve the hot water coils and the hot water loop must have a differential pressure sensor installed. If three-way valves or a bypass leg are used in the hot water distribution they will need to be modified when this measure is implemented. As the hot water valves close, the differential pressure increases and the VFD modulates the pump speed to maintain a differential pressure setpoint.

Energy savings result from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

Affected pumps: two 3 hp hot water pumps.

ECM 7: Install VFDs on Water Supply Pump

Install VFDs to control water supply pump(s). Since water supply systems become an open system whenever and end-use valve or fixture is opened the VFD will need to be controlled to maintain sufficient pressure in the distribution system to deliver water to the furthest point in the system.

Energy savings result from reducing the pump speed during low demand periods. Ensure that your control system includes the sensors and inputs required to optimize water flow in your water supply.

4.4 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**35,244**	**10.5**	**0**	**$5,185**	**$78,047**	**$5,253**	**$72,794**	**14.0**	**35,490**
ECM 8	Install High Efficiency Air Conditioning Units	24,868	7.4	0	$3,659	$50,239	$3,675	$46,564	12.7	25,042
ECM 9	Install High Efficiency Heat Pumps	10,376	3.1	0	$1,526	$27,808	$1,578	$26,230	17.2	10,448

Replacing the unitary HVAC units has a long payback period and may not be justifiable based simply on energy considerations. However, most of the units have reached the end of their normal useful life. Typically, the marginal cost of purchasing a high efficiency unit can be justified by the marginal savings from the improved efficiency. When the unitary HVAC units eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 8: Install High Efficiency Air Conditioning Units

Replace standard efficiency window and split system air conditioning units with high efficiency window and split system air conditioning units. 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.

Affected units: four window and six split system ACs.

ECM 9: Install High Efficiency Heat Pumps

We have evaluated replacing standard efficiency heat pumps with high efficiency heat pumps. A higher EER or SEER rating indicates a more efficient cooling system and a higher HSPF rating indicates more efficient heating mode. 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 heating and cooling loads, and the estimated annual operating hours.

Affected units: four heat pumps

4.5 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**3,311**	**0.0**	**0**	**$487**	**$231**	**$80**	**$151**	**0.3**	**3,334**
ECM 10	Install Pipe Insulation	3,311	0.0	0	$487	$231	$80	$151	0.3	3,334

ECM 10: Install Pipe Insulation

Install insulation on domestic hot water system piping. Distribution system losses are dependent on system fluid temperature, the size of the distribution system, and the level of insulation of the piping. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is exposed to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Affected Systems: domestic hot water piping.

4.6 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**3,614**	**0.0**	**0**	**$532**	**$93**	**$52**	**$41**	**0.1**	**3,640**
ECM 11	Install Low-Flow DHW Devices	3,614	0.0	0	$532	$93	$52	$41	0.1	3,640

ECM 11: Install Low-Flow DHW Devices

Install low-flow devices to reduce overall hot water demand. The following low flow devices are recommended to reduce hot water usage:

Device	Flow Rate
Faucet aerators (lavatory)	0.5 gpm

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing. Additional cost savings may result from reduced water usage.

4.7 Food Service & Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**1,209**	**0.1**	**0**	**$178**	**$230**	**$50**	**$180**	**1.0**	**1,217**
ECM 12	Vending Machine Control	1,209	0.1	0	$178	$230	$50	$180	1.0	1,217

ECM 12: Vending Machine Control

Vending machines operate continuously, even during unoccupied hours. Install occupancy sensor controls to reduce energy use. These controls power down vending machines when the vending machine area has been vacant for some time, and they power up the machines at necessary regular intervals or when the surrounding area is occupied. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines.

4.8 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**101,383**	**0.0**	**252**	**$15,982**	**$32,712**	**$0**	**$32,712**	**2.0**	**131,601**
ECM 13	Retro-Commissioning Study	11,664	0.0	168	$2,427	$21,542	$0	$21,542	8.9	31,418
ECM 14	Sub Metering	16,059	0.0	84	$2,718	$9,100	$0	$9,100	3.3	26,008
ECM 15	Install Heat Pump Water Heater	73,660	0.0	0	$10,837	$2,070	$0	$2,070	0.2	74,175

ECM 13: Retro-Commissioning Study

Due to the complexity of today's HVAC systems and controls a thorough analysis and rebalance of heating, ventilation, and cooling systems should periodically be conducted. There are indications that systems may be not be operating correctly or as efficiently as they could be. One important tool available to building operators to ensure proper system operation is retro-commissioning.

Retro-commissioning is a common practice recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to be implemented every few years. We recommend that you contact a reputable engineering firm that specializes in energy control systems and retro-commissioning. Ask them to propose a scope of work and an outline of the procedures and processes to be implemented, including a schedule and the roles of all responsible parties.

Once goals and responsibilities are established, the objective of the investigation process is to understand how the building is currently operating, identify the issues, and determine the most cost-effective way to improve performance. The retro-commissioning agent will review building documentation, interview building occupants, and inspect and test the equipment. Information is then compiled into a report and shared with facility staff, who will select which recommendations to implement after reviewing the findings.

The implementation phase puts the selected processes into place. Typical measures may include sensor calibration, equipment schedule changes, damper linkage repair and similar relatively low-cost adjustments -- although more expensive sophisticated programming and building control system upgrades may be warranted. Approved measures may be implemented by the agent, the building staff, or by subcontractors. Typically, a combination of these individuals makes up the retro-commissioning team.

After the approved measures are implemented, the team will verify that the changes are working as expected. Baseline and post-case measurements will allow building staff to monitor equipment and ensure that the benefits are maintained.

A high-level evaluation of potential savings and costs is provided for demonstration purposes only. It is a screening evaluation for the potential in HVAC Control Improvements. Based on industry standards and previous project experience, the potential energy savings may be up to 15% of existing HVAC energy use. The average cost of retro-commissioning studies and control improvements is $0.30 per square foot. Actual savings and costs will need to be outlined by the specific contractor engaged to perform the study. For the purposes of this report, we have conservatively estimated savings to be 2% of the total HVAC energy consumption baseline.

ECM 14: Sub Metering

Facility staff expressed interest in utility sub metering key buildings which are currently served by a master meter and the central plant. Utility submeters alone do not save energy, but they are a useful tool under the right circumstances. Utility sub-meters can provide facility staff with real-time energy use data for specific buildings, information that enhances the potential for greater energy management activities. Revenue grade submeters are a tool that allow owners to bill tenants or departments for the energy consumed in the spaces they occupy. Better resolution on building system performance can lead to occupant behavioral changes which often result in reduced energy use.

A high-level evaluation of potential savings and costs is provided for demonstration purposes only. Based on industry standards and case studies, the potential energy savings may be up to 5% of existing energy usage. For the purposes of this report, a conservative assumed savings of 1% was applied to building allocated electrical and natural gas consumption of the sub metered buildings based on the premise of occupant behavioral changes. For this building the following submeters are proposed: smart electric meter and steam flow meter. Meter costs for the evaluation are based on average building use across the campus: smart electric meter $2,400, steam flow meter $6,700, chilled water flow meter $9,700. The actual scope of work and implementation costs must be provided by a contractor in the future. This measure is recommended for implementation based on the initial energy and economic results but primarily for enhancing the potential for greater energy management activities.

ECM 15: Install Heat Pump Water Heater

A typical electric water heater uses electric resistance coils to heat water at a coefficient of performance (COP) of 1. Heat pump water heaters (HPWH) use a refrigeration cycle to transfer heat from the air to the domestic water. The typical average COP for a HPWH is about 2.5 so they require significantly less electricity to produce the same amount of hot water as a traditional electric water heater. HPWH also reject cold air. As such, they need to be in an unconditioned space with good ventilation. Ideal locations are garages or large enclosed, unconditioned storage areas.

Most HPHW operate effectively down to an air temperature of 40 °F. Below that temperature, an electric resistance booster heater is typically required to achieve full heating capacity. It is critical that the HPWH controls are set up so that the electric resistance heat only engages when the air temperature is too cold for the HPWH to extract heat from it.

HPWH operate most effectively when the temperature difference between the incoming and outgoing water is high. Generally, this means that cold make-up water should be piped to the bottom of the tank and return water should be piped to the top of the tank in order to maintain stratification within the storage tank. Water should be drawn from the bottom of the tank to be heated. If there is a DHW recirculation pump, it should only be operated during high hot water demand periods.

5 Energy Efficient Best Practices

A whole building maintenance plan will extend equipment life; improve occupant comfort, health, and safety; and reduce energy and maintenance costs.

Operation and maintenance (O&M) plans enhance the operational efficiency of HVAC and other energy intensive systems and could save between 5 to 20 percent of the energy usage in your building without substantial capital investment. A successful plan includes your records of energy usage trends and costs, building equipment lists, current maintenance practices, planned capital upgrades, and incorporates your ideas for improved building operation. Your plan will address goals for energy-efficient operation, provide detail on how to reach the goals, and will outline procedures for measuring and reporting whether goals have been achieved.

You may already be doing some of these things— see our list below for potential additions to your maintenance plan. Be sure to consult with qualified equipment specialists for details on proper maintenance and system operation.

Energy Tracking with ENERGY STAR® Portfolio Manager®

You've heard it before - you can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[5] . Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Weatherization

Caulk or weather strip leaky doors and windows to reduce drafts and loss of heated or cooled air. Sealing cracks and openings can reduce heating and cooling costs, improve building durability, and create a healthier indoor environment. Materials used may include caulk, polyurethane foam, and other weather-stripping materials. There is an energy savings opportunity by reducing the uncontrolled air exchange between the outside and inside of the building. Blower door assisted comprehensive building air sealing will reduce the amount of air exchange which will in turn reduce the load on the buildings heating and cooling equipment and thus providing energy savings and increased occupant comfort.

Doors and Windows

Close exterior doors and windows in heated and cooled areas. Leaving doors and windows open leads to a loss of heat during the winter and chilled air during the summer. Reducing air changes per hour (ACH) can lead to increased occupant comfort as well as heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

[5] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager.

Lighting Maintenance

Clean lamps, reflectors and lenses of dirt, dust, oil, and smoke buildup every six to twelve months. Light levels decrease over time due to lamp aging, lamp and ballast failure, and buildup of dirt and dust. Together, this can reduce total light output by up to 60% while still drawing full power.

In addition to routine cleaning, developing a maintenance schedule can ensure that maintenance is performed regularly, and it can reduce the overall cost of fixture re-lamping and re-ballasting. Group re-lamping and re-ballasting maintains lighting levels and minimizes the number of site visits by a lighting technician or contractor, decreasing the overall cost of maintenance.

Lighting Controls

As part of a lighting maintenance schedule, test lighting controls to ensure proper functioning. For occupancy sensors, this requires triggering the sensor and verifying that the sensor's timer settings are correct. For daylight and photocell sensors, maintenance involves cleaning sensor lenses and confirming that setpoints and sensitivity are configured properly. Adjust exterior lighting time clock controls seasonally as needed to match your lighting requirements.

Motor Maintenance

Motors have many moving parts. As these parts degrade over time, the efficiency of the motor is reduced. Routine maintenance prevents damage to motor components. Routine maintenance should include 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.

Thermostat Schedules and Temperature Resets

Use thermostat setback temperatures and schedules to reduce heating and cooling energy use during periods of low or no occupancy. 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 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.

Economizer Maintenance

Economizers can significantly reduce cooling system load. A malfunctioning economizer can increase the amount of heating and mechanical cooling required by introducing excess amounts of cold or hot outside air. Common economizer malfunctions include broken outdoor thermostat or enthalpy control, or dampers that are stuck or improperly adjusted.

Periodic inspection and maintenance will keep economizers working in sync with the heating and cooling system. This maintenance should be part of annual system maintenance, and it should include proper setting of the outdoor thermostat/enthalpy control, inspection of control and damper operation, lubrication of damper connections, and adjustment of minimum damper position.

AC System Evaporator/Condenser Coil Cleaning

Dirty evaporator and condenser coils restrict air flow and restrict heat transfer. This increases the loads on the evaporator and condenser fan and decreases overall cooling system performance. Keeping the coils clean allows the fans and cooling system to operate more efficiently.

HVAC Filter Cleaning and Replacement

Air filters should be checked regularly (often monthly) and cleaned or replaced when appropriate. Air filters reduce indoor air pollution, increase occupant comfort, and help keep equipment operating efficiently. If the building has a building management system, consider installing a differential pressure switch across filters to send an alarm about premature fouling or overdue filter replacement. Over time, filters become less and less effective as particulate buildup increases. Dirty filters also restrict air flow through the air conditioning or heat pump system, which increases the load on the distribution fans.

Ductwork Maintenance

Duct maintenance has two primary goals: keep the ducts clean to avoid air quality problems and seal leaks to save energy. Check for cleanliness, obstructions that block airflow, water damage, and leaks. Ducts should be inspected at least every two years.

The biggest symptoms of clogged air ducts are differing temperatures throughout the building and areas with limited airflow from supply registers. If a particular air duct is clogged, then air flow will only be cut off to some rooms in the building - not all of them. The reduced airflow will make it more difficult for those areas to reach the temperature setpoint which will cause the HVAC system to run longer to cool or heat that area properly. If you suspect clogged air ducts, ensure that all areas in front of supply registers are clear of items that may block or restrict air flow, and check for fire dampers or balancing dampers that have failed closed.

Duct leakage in commercial buildings can account for 5% to 25% of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building wasting conditioned air. Check ductwork for leakage. Eliminating duct leaks can improve ventilation system performance and reduce heating and cooling system operation.

Distribution system losses are dependent on air system temperature, the size of the distribution system, and the level of insulation of the ductwork. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is missing or worn, the system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Steam Trap Repair and Replacement

Steam traps are a crucial part of delivering heat from the boiler to the space heating units. Steam traps are automatic valves that remove condensate from the system. If the traps fail closed, condensate can build up in the steam supply side of the trap which reduces the flow in the steam lines and thermal capacity of the radiators. Or they may fail open, allowing steam into the condensate return lines resulting in wasted energy, water and hammering. Losses can be significantly reduced by testing and replacing equipment as they start to fail. Repair or replace traps that are blocked or allowing steam to pass. Inspect steam traps as part of a regular steam system maintenance plan.

Water Heater Maintenance

The lower the supply water temperature that is used for hand washing sinks, the less energy is needed to heat the water. Reducing the temperature results in energy savings and the change is often unnoticeable to users. Be sure to review the domestic water temperature requirements for sterilizers and dishwashers as you investigate reducing the supply water temperature.

Also, preventative maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. At least once a year, follow manufacturer instructions to 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. Annual checks should include checks for:

- Leaks or heavy corrosion on the pipes and valves.
- 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 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 more than three years old, have a technician inspect the sacrificial anode annually.

Compressed Air System Maintenance

Compressed air systems require periodic maintenance to operate at peak efficiency. A maintenance plan for compressed air systems should include:

- Inspection, cleaning, and replacement of inlet filter cartridges
- Cleaning of drain traps
- Daily inspection of lubricant levels to reduce unwanted friction
- Inspection of belt condition and tension
- Check for leaks and adjust loose connections
- Overall system cleaning

Contact a qualified technician for help with setting up periodic maintenance schedule.

Water Conservation

Installing dual flush or low-flow toilets and low-flow/waterless urinals are ways to reduce water use. The EPA WaterSense® ratings for urinals is 0.5 gallons per flush (gpf) and for flush valve toilets is 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

For more information regarding water conservation go to the EPA's WaterSense® website[6] or download a copy of EPA's "WaterSense® at Work: Best Management Practices for Commercial and Institutional Facilities"[7] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Water conservation devices that do not reduce hot water consumption will not provide energy savings at the site level, but they may significantly affect your water and sewer usage costs. Any reduction in water use does however ultimately reduce grid-level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users.

If the facility has detached buildings with a master water meter for the entire campus, check for unnatural wet areas in the lawn or water seeping in the foundation at water pipe penetrations through the foundation. Periodically check overnight meter readings when the facility is unoccupied, and there is no other scheduled water usage.

Manage irrigation systems to use water more effectively outside the building. Adjust spray patterns so that water lands on intended lawns and plantings and not on pavement and walls. Consider installing an evapotranspiration irrigation controller that will prevent over-watering.

Procurement Strategies

Purchasing efficient products reduces energy costs without compromising quality. Consider modifying your procurement policies and language to require ENERGY STAR® or WaterSense® products where available.

[6] https://www.epa.gov/watersense.

[7] https://www.epa.gov/watersense/watersense-work-0.

6 On-site Generation

You don't have to look far in New Jersey to see one of the thousands of solar electric systems providing clean power to homes, businesses, schools, and government buildings. On-site generation includes both renewable (e.g., solar, wind) and non-renewable (e.g., fuel cells) technologies that generate power to meet all or a portion of the facility's electric energy needs. Also referred to as distributed generation, these systems contribute to greenhouse gas (GHG) emission reductions, demand reductions and reduced customer electricity purchases, which results in improved electric grid reliability through better use of transmission and distribution systems.

Preliminary screenings were performed to determine if an on-site generation measure could be a cost-effective solution for your facility. Before deciding to install an on-site generation system, we recommend conducting a feasibility study to analyze 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 Solar Photovoltaic

Photovoltaic (PV) panels convert sunlight into electricity. Individual panels are combined into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is then connected to the building's electrical distribution system.

A preliminary screening based on the facility's electric demand, size and location of free area, and shading elements shows that the facility has no potential for installing a PV array.

This facility does not appear to meet the minimum criteria for a cost-effective solar PV installation. To be cost-effective, a solar PV array needs certain minimum criteria, such as sufficient and sustained electric demand and sufficient flat or south-facing rooftop or other unshaded space on which to place the PV panels.

The graphic below displays the results of the PV potential screening conducted as a part of this audit. The position of each slider indicates the potential (potential increases to the right) that each factor contributes to the overall site potential.

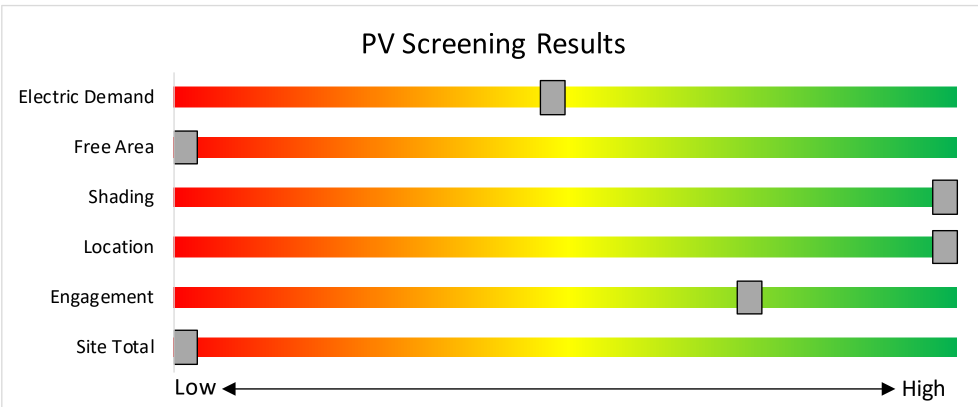


Figure 9 - Photovoltaic Screening

Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program 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 prior to the start of construction to establish the project's eligibility to earn TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installation.

Get more information about solar power in New Jersey or find a qualified solar installer who can help you decide if solar is right for your building:

- **Transition Incentive (TI) Program:** https://www.njcleanenergy.com/renewable-energy/programs/transition-incentive-program
- **Basic Info on Solar PV in New Jersey**: www.njcleanenergy.com/whysolar.
- **New Jersey Solar Market FAQs**: www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs.
- **Approved Solar Installers in the New Jersey Market**: 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) generates electricity at the facility and puts waste heat energy to good use. Common types of CHP systems are reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines.

CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for space cooling.

The key criteria used for screening is the amount of time that the CHP system would operate at full load and the facility's ability to use the recovered heat. Facilities with a continuous need 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 no potential for installing a cost-effective CHP system.

Based on a preliminary analysis, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation. The Low or infrequent thermal load, and lack of space for siting the equipment are the most significant factors contributing to the lack of CHP potential.

The graphic below displays the results of the CHP potential screening conducted as a part of this audit. The position of each slider indicates the potential (potential increases to the right) that each factor contributes to the overall site potential.

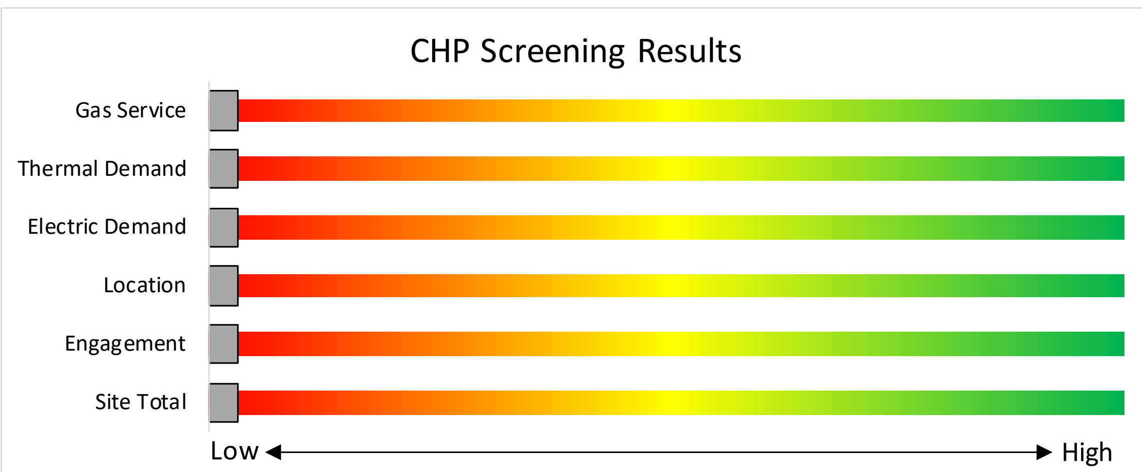


Figure 10 - Combined Heat and Power Screening

Find a qualified firm that specializes in commercial CHP cost assessment and installation: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/

7 PROJECT FUNDING AND INCENTIVES

Ready to improve your building's performance? New Jersey's Clean Energy Programs can help. Pick the program that works best for you. Incentive programs that may apply to this facility are identified in the Executive Summary. This section provides an overview of currently available New Jersey's Clean Energy Programs.

	SmartStart *Flexibility to install at your own pace*	**Direct Install** *Turnkey installation*	**Pay for Performance** *Whole building upgrades*
Who should use it?	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together. Average peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. Peak demand should be over 200 kW.
How does it work?	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
What are the Incentives?	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to $125,000 per project. You pay the remaining 30% directly to the contractor.	Incentives are paid out in three installments. The first installment is meant to help offset the costs of the initial engineering study. The subsequent incentives are paid based on the level of energy savings up to 50% of the total project cost. See Section 7.3 for all incentive details.
How do I participate?	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified Partner to develop your Energy Reduction Plan and set your energy savings targets.
Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor.			

7.1 SmartStart

SmartStart offers incentives for installing prescriptive and custom energy efficiency measures at your facility. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades. This program serves most common equipment types and sizes.

SmartStart routinely adds, removes, or modifies incentives from year-to-year for various energy efficient 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

Incentives

The SmartStart Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type.

SmartStart Custom provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives. Custom incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings. Incentives are 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

Submit an application for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. You can work with your preferred contractor or use internal staff to install measures.

Visit www.njcleanenergy.com/SSB for a detailed program description, instructions for applying, and applications.

7.2 Direct Install

Direct Install is a turnkey program available to existing small to medium-sized facilities with an average peak electric demand that does not exceed 200 kW over the recent 12-month period. You 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.

Based on the site building and utility data provided, the facility does not meet the requirements of the current Direct Install program.

Incentives

The program pays up to 70 percent of the total installed cost of eligible measures, up to $125,000 per project. Each entity is limited to incentives up to $250,000 per fiscal year.

How to Participate

To participate in Direct Install, you will need to contact the participating contractor assigned to 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 percent of eligible costs are covered by the program, subject to program caps and eligibility, while the remaining 30 percent of the cost is paid to the contractor by the customer.

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

7.3 Pay for Performance - Existing Buildings

Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures that results in at least 15 percent source energy savings, and lighting cannot make up the majority of the savings.

P4P is a generally a good option for medium-to-large sized facilities looking to implement as many measures as possible under a single project to achieve deep energy savings. This program has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program.

For master metered campuses, such as The College of New Jersey, P4P eligibility is evaluated at the campus level. For the purposes of reporting P4P eligibility is being presented at all of the buildings. Final eligibility will be assessed once all of the reports are completed and will be addressed at the Exit Meeting. If the campus does not meet the 15% savings threshold based on measures identified during the LGEA Program process it is possible that additional measures could be identified at a later point in time, for example through further evaluation or the Energy Savings Improvement Program process.

Incentives

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

How to Participate

Contact one of the pre-approved consultants and contractors (“Partners”). Under direct contract to you, they will help further evaluate the measures identified in this report through development of the energy reduction plan), assist you in implementing selected measures, and verify actual savings one year after the installation. Your Partner will also help you apply for incentives.

Approval of the final scope of work is required by the program prior to installation. Installation can be done by the contractor of your choice (some P4P Partners are also contractors) or by internal staff, but the Partner remains involved throughout construction to ensure compliance with the program requirements.

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

7.4 Combined Heat and Power

The Combined Heat & Power (CHP) program provides incentives for eligible CHP or waste heat to power (WHP) projects. Eligible CHP or WHP projects must achieve an annual system efficiency of at least 65% (lower heating value, or LHV), based on total energy input and total utilized energy output. Mechanical energy may be included in the efficiency evaluation.

Incentives

Eligible Technologies	Size (Installed Rated Capacity)[1]	Incentive ($/kW)	% of Total Cost Cap per Project[3]	$ Cap per Project[3]
Powered by non-renewable or renewable fuel source[4]	≤500 kW	$2,000	30-40%[2]	$2 million
Gas Internal Combustion Engine	>500 kW - 1 MW	$1,000		
Gas Combustion Turbine	> 1 MW - 3 MW	$550	30%	$3 million
Microturbine Fuel Cells with Heat Recovery	>3 MW	$350		
Waste Heat to Power*	<1 MW	$1,000	30%	$2 million
	> 1MW	$500		$3 million

*Waste Heat to Power: Powered by non-renewable fuel source, heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine).

Check the NJCEP website for details on program availability, current incentive levels, and requirements.

How to Participate

You work with a qualified developer or consulting firm to complete the CHP application. Once the application is approved the project can be installed. Information about the CHP program can be found at www.njcleanenergy.com/CHP.

7.5 Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) serves New Jersey's government agencies by financing energy projects. 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. Annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive for the life of the contract.

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 described above can also be used to help further reduce the total project cost of eligible measures.

How to Participate

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 used 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. Carefully consider all alternatives to develop an approach that best meets your needs. A detailed program descriptions and application can be found at www.njcleanenergy.com/ESIP.

ESIP is a program delivered directly by the NJBPU and is not an NJCEP incentive program. As mentioned above, you can use NJCEP incentive programs to help further reduce costs when developing the energy savings plan. Refer to the ESIP guidelines at the link above for further information and guidance on next steps.

7.6 Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program 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 prior to the start of construction to establish the project's eligibility to earn TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installations. NJBPU calculates the value of a Transition Renewable Energy Certificate (TREC) by multiplying the base compensation rate ($152/MWh) by the project's assigned factor (i.e. $152 x 0.85 = $129.20/MWh). The TREC factors are defined based on the chart below:

Project Type	Factor
Subsection (t): landfill, brownfield, areas of historic fill	1.00
Grid supply (Subsection (r)) rooftop	1.00
Net metered non-residential rooftop and carport	1.00
Community solar	0.85
Grid supply (Subsection (r)) ground mount	0.60
Net metered residential ground mount	0.60
Net metered residential rooftop and carport	0.60
Net metered non-residential ground mount	0.60

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 TRECs.

Eligible projects may generate TRECs for 15 years following the commencement of commercial operations (also referred to as the "Transition Incentive Qualification Life"). After 15 years, projects may be eligible for a New Jersey Class I REC.

TRECs will be used by the identified compliance entities to satisfy a compliance obligation tied to a new Transition Incentive Renewable Portfolio Standard ("Tl-RPS"), which will exist in parallel with, and completely separate from, the existing Solar RPS for Legacy SRECs. The Tl-RPS is a carve-out of the current Class I RPS requirement. The creation of TRECs is based upon metered generation supplied to PJM-EIS General Attribute Tracking System ("GATS") by the owners of eligible facilities or their agents. GATS would create one TREC for each MWh of energy produced from a qualified facility.

TRECs will be purchased monthly by a TREC Administrator who will allocate the TRECs to the Load Serving Entities (BGS Providers and Third-Party Suppliers) annually based on their market share of retail electricity sold during the relevant Energy Year.

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan. The Transition Incentive Program online portal is now open to new applications effective May 1, 2020. There are instructions on "How and When to Transfer my SRP Registration to the Transition Incentive Program". If you are considering installing solar photovoltaics on your building, visit the following link for more information:

https://www.njcleanenergy.com/renewable-energy/programs/transition-incentive-program

8 PROJECT DEVELOPMENT

Energy conservation measures (ECMs) have been identified for your site and their energy and economic analyses are provided within this LGEA report. The next steps with project development are to set goals and create a comprehensive project plan. The graphic below provides an overview of the process flow for a typical energy efficiency or renewable energy project. We recommend implementing as many ECMs as possible prior to undertaking a feasibility study for a renewable project. The cyclical nature of this process flow demonstrates the ongoing work required to continually improve building energy efficiency over time. If your building(s) scope of work is relatively simple to implement or small in scope, the measurement and verification (M&V) step may not be required. It should be noted through a typical project cycle, there will be changes in costs based on specific scopes of work, contractor selections, design considerations, construction, etc. The estimated costs provided throughout this LGEA report demonstrate the unburdened turn-key material and labor cost only. There will be contingencies and additional costs at the time of implementation. We recommend comprehensive project planning includes the review of multiple bids for project work, incorporate potential operational & maintenance (O&M) cost savings and maximize your incentive potential.

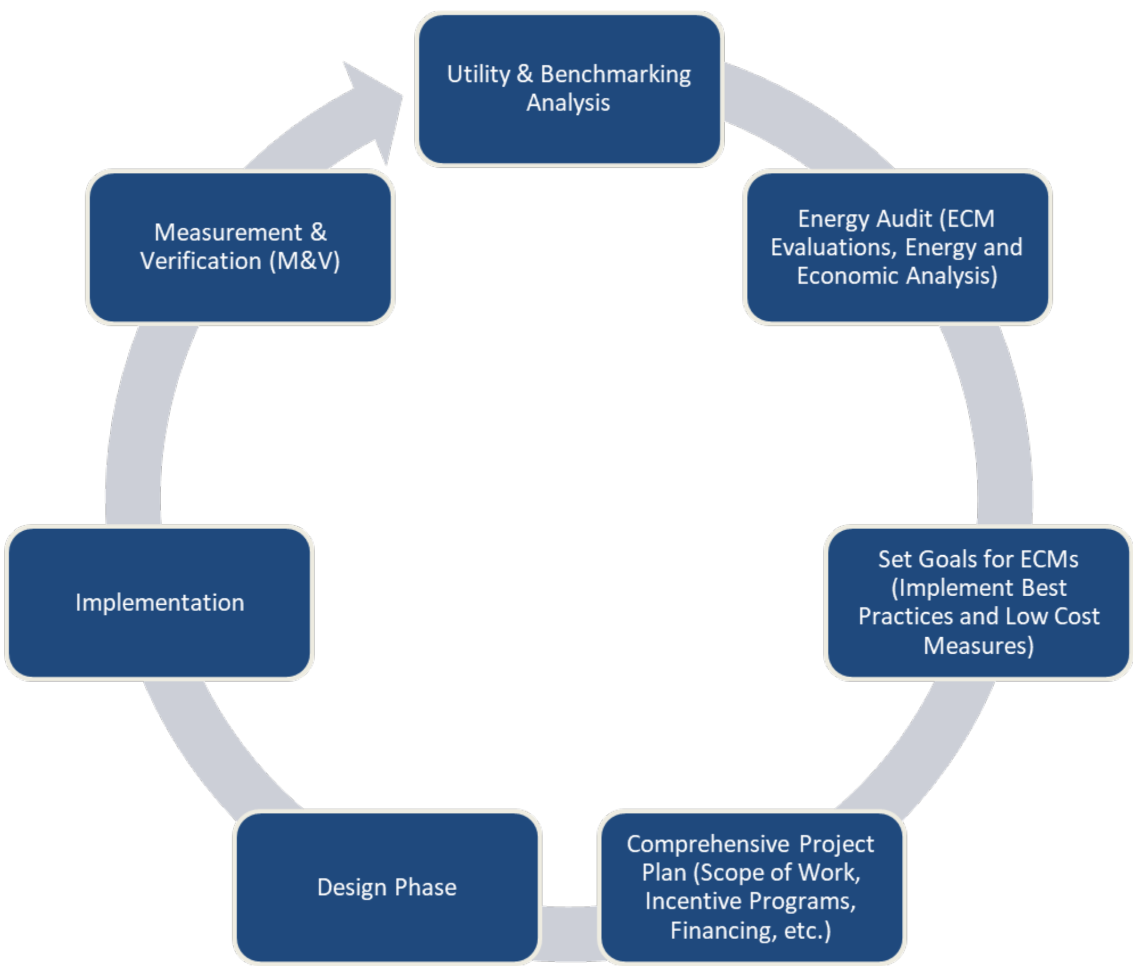


Figure 11 – Project Development Cycle

9 Energy Purchasing and Procurement Strategies

9.1 Retail Electric Supply Options

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 already buys electricity from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party electric suppliers is available at the NJBPU website[8].

9.2 Retail Natural Gas Supply Options

The natural gas market in New Jersey is also deregulated. Most customers that remain with the utility for natural gas service pay rates that are market-based and that fluctuate monthly. 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 typically depends on whether a customer prefers 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 does not already purchase natural gas from a third-party supplier, consider shopping for a reduced rate from third-party natural gas suppliers. If your facility already purchases natural gas from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party natural gas suppliers is available at the NJBPU website[9].

[8] www.state.nj.us/bpu/commercial/shopping.html.

[9] 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	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Room119A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Room 119F	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Room 119G	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Attic Floor	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Attic Floor	20	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	8,760	2	Relamp	No	20	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	8,760	0.8	10,792	-2	$1,578	$1,461	$400	0.7
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,456	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,456	0.0	53	0	$8	$37	$10	3.4
Closet	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	1,456	1	Relamp & Reballast	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,456	0.1	189	0	$28	$118	$20	3.6
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,456	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,456	0.0	53	0	$8	$37	$10	3.4
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,456	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,456	0.0	53	0	$8	$37	$10	3.4
Common Rm 019-020	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	4,019	0.1	503	0	$74	$261	$40	3.0
Conference 204	9	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	5,824	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	4,019	0.1	1,226	0	$179	$563	$89	2.6
Conference 204	1	LED - Fixtures: 4-Foot Linear Strip	Wall Switch	S	40	5,824		None	No	1	LED - Fixtures: 4-Foot Linear Strip	Wall Switch	40	5,824	0.0	0	0	$0	$0	$0	0.0
Conference Rm 116	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.1	807	0	$118	$226	$50	1.5
Copy Rm	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Corridor - Rm 6	1	LED - Fixtures: 2-Foot Linear Strip	Wall Switch	S	21	5,824		None	No	1	LED - Fixtures: 2-Foot Linear Strip	Wall Switch	21	5,824	0.0	0	0	$0	$0	$0	0.0
Corridor 1st Floor	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 1st Floor	1	Incandescent: (12) 40W Screw-in Lamps	Wall Switch	S	480	8,760	2	Relamp	No	1	LED Lamps: 7W LED Lamp	Wall Switch	72	8,760	0.3	3,931	-1	$575	$291	$12	0.5
Corridor 1st Floor	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 4	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,019	0.4	3,228	-1	$472	$888	$540	0.7
Corridor 2nd Floor	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 2nd Floor	1	LED Lamps: (5) 7W Lamp - Decorative Pendant	Wall Switch	S	35	8,760		None	No	1	LED Lamps: (5) 7W Lamp - Decorative Pendant	Wall Switch	35	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 2nd Floor	11	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	S	34	5,824	4	None	Yes	11	LED - Linear Tubes: (4) 2' Lamps	High/Low Control	34	4,019	0.1	743	0	$109	$450	$385	0.6
Corridor Ground Floor	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor Ground Floor	1	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	S	34	5,824	4	None	Yes	1	LED - Linear Tubes: (4) 2' Lamps	High/Low Control	34	4,019	0.0	68	0	$10	$0	$0	0.0
Corridor Ground Floor	25	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 4	Relamp	Yes	25	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,019	0.8	6,725	-1	$983	$2,038	$1,125	0.9
Data Center operation	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.2	1,422	0	$208	$489	$95	1.9

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Elevator Rm	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,456	2	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,456	0.1	179	0	$26	$146	$40	4.0
Entrance Exit 3	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Exterior Front Recessed	5	LED - Fixtures: Downlight Recessed	Photocell		21	4,380		None	No	5	LED - Fixtures: Downlight Recessed	Photocell	21	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Ground Floor	8	LED - Fixtures: Landscape/Accent Flood and Spot Luminaires	Photocell		100	4,380		None	No	8	LED - Fixtures: Landscape/Accent Flood and Spot Luminaires	Photocell	100	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Recessed	1	LED - Fixtures: Downlight Recessed	Photocell		13	4,380		None	No	1	LED - Fixtures: Downlight Recessed	Photocell	13	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Wall Pack	1	Compact Fluorescent: (1) 23W A19 Screw-In Lamp	Photocell		23	4,380	2	Relamp	No	1	LED Lamps: A19 Lamps	Photocell	16	4,380	0.0	30	0	$4	$17	$1	3.6
Exterior Wall Pack	2	Compact Fluorescent: (1) 26W Plug-In Lamp	Photocell		26	4,380	2	Relamp	No	2	LED Lamps: G25 Lamps	Photocell	18	4,380	0.0	68	0	$10	$50	$4	4.6
Exterior Wall Pack	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell		30	4,380		None	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	30	4,380	0.0	0	0	$0	$0	$0	0.0
Floor 112R	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.3	2,421	-1	$354	$599	$125	1.3
Green Hall 001	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Green Hall 001	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	5,824	0.0	186	0	$27	$72	$10	2.3
Green Hall 002	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Green Hall 002	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.3	2,421	-1	$354	$599	$125	1.3
Green Hall 002B	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7
Green Hall 002D	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 002E	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 003	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Green Hall 003	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.3	2,421	-1	$354	$599	$125	1.3
Green Hall 003	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	4,019	0.1	503	0	$74	$261	$40	3.0
Green Hall 003A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 003B	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 010B	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7
Green Hall 010C	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7
Green Hall 010D	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7
Green Hall 010K	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Green Hall 016A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 016B	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 016C	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 018	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	1,076	0	$157	$416	$75	2.2
Green Hall 019	16	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	5,824	2, 3	Relamp	Yes	16	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,019	0.3	2,255	0	$330	$832	$150	2.1
Green Hall 020	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	1,076	0	$157	$416	$75	2.2
Green Hall 020	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	4,019	0.1	503	0	$74	$261	$40	3.0
Green Hall 020A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 020B	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 020C	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 022	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Green Hall 022	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	4,019	0.1	503	0	$74	$261	$40	3.0
IT Conference Rm	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Janitorial	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	1,456		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,456	0.0	0	0	$0	$0	$0	0.0
Janitorial	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,456	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,456	0.0	53	0	$8	$37	$10	3.4
Lab Staff	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Mechanical Rm 15 Ground Floor	1	Compact Fluorescent: (1) 23W A19 Screw-In Lamp	Wall Switch	S	23	5,824	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	16	5,824	0.0	44	0	$6	$17	$1	2.5
Mechanical Rm 15 Ground Floor	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	5,824		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	5,824	0.0	0	0	$0	$0	$0	0.0
Mechanical Rm B Ground Floor	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	5,824	0.0	359	0	$52	$73	$20	1.0
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.1	807	0	$118	$226	$50	1.5
Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7
Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.2	1,614	0	$236	$489	$95	1.7
Office - Amina	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.1	807	0	$118	$226	$50	1.5
Office - Christopher	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	5,824	0.0	359	0	$52	$73	$20	1.0
Office - Maura	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.1	807	0	$118	$226	$50	1.5

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Office - Nina	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	5,824	0.0	359	0	$52	$73	$20	1.0
Office - Robby	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	1,076	0	$157	$416	$75	2.2
Pump Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,456	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,456	0.0	53	0	$8	$37	$10	3.4
Restroom	2	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	5,824		None	No	2	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	5,824	0.0	0	0	$0	$0	$0	0.0
Restroom	1	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	5,824		None	No	1	LED - Fixtures: Downlight Recessed	Wall Switch	13	5,824	0.0	0	0	$0	$0	$0	0.0
Restroom - All Gender	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Restroom - All Gender	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	4,019	0.1	503	0	$74	$261	$55	2.8
Restroom - Men's 1st Floor	2	LED - Linear Tubes: (4) 2' Lamps	Occupancy Sensor	S	34	4,019		None	No	2	LED - Linear Tubes: (4) 2' Lamps	Occupancy Sensor	34	4,019	0.0	0	0	$0	$0	$0	0.0
Restroom - Men's 2nd Floor	2	LED - Linear Tubes: (4) 2' Lamps	Occupancy Sensor	S	34	4,019		None	No	2	LED - Linear Tubes: (4) 2' Lamps	Occupancy Sensor	34	4,019	0.0	0	0	$0	$0	$0	0.0
Restroom - Women's 1st Floor	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	4,019	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.0	292	0	$43	$73	$20	1.2
Rm 010	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 010	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 010	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	4,019	0.1	503	0	$74	$261	$40	3.0
Rm 016	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 016	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	1,076	0	$157	$416	$75	2.2
Rm 016	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	5,824	0.0	186	0	$27	$72	$10	2.3
Rm 101	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7
Rm 101B	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7
Rm 101C	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 101D	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 101G	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 101H	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 101J	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 101K	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 101K	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Rm 101L	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	1,076	0	$157	$416	$75	2.2
Rm 101N	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 105	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.2	1,614	0	$236	$489	$95	1.7
Rm 106	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 106	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.4	3,228	-1	$472	$708	$155	1.2
Rm 107	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.6	5,649	-1	$826	$1,307	$280	1.2
Rm 109	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.4	3,792	-1	$554	$854	$195	1.2
Rm 111	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	5,824	0.0	359	0	$52	$73	$20	1.0
Rm 111 A	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.1	948	0	$139	$262	$60	1.5
Rm 111B	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.1	948	0	$139	$262	$60	1.5
Rm 111C	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	5,824	0.0	359	0	$52	$73	$20	1.0
Rm 111D	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.1	948	0	$139	$262	$60	1.5
Rm 111E	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.1	948	0	$139	$262	$60	1.5
Rm 112	4	Compact Fluorescent: (3) 31W Double Biaxial Plug-In Lamps	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	4	LED Lamps: PL-L (Biax) Lamps	Occupancy Sensor	65	4,019	0.1	1,232	0	$180	$432	$47	2.1
Rm 112	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 112	31	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	31	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	1.4	12,509	-3	$1,829	$2,508	$570	1.1
Rm 112M	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.1	807	0	$118	$226	$50	1.5
Rm 118	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.2	1,614	0	$236	$489	$95	1.7
Rm 118 - Office	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.2	1,614	0	$236	$489	$95	1.7
Rm 119 Student Affairs	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 119 Student Affairs	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.2	1,345	0	$197	$453	$85	1.9
Rm 119 Student Affairs	13	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	13	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.4	3,497	-1	$511	$745	$165	1.1
Rm 13	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.2	1,614	0	$236	$489	$95	1.7
Rm 14	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.3	2,690	-1	$393	$635	$135	1.3
Rm 14	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	5,824	0.0	186	0	$27	$72	$10	2.3

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Rm 17	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 17	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.2	1,883	0	$275	$526	$105	1.5
Rm 17	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	5,824	0.0	186	0	$27	$72	$10	2.3
Rm 17A	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 17A	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.2	1,614	0	$236	$489	$95	1.7
Rm 17B	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.3	2,690	-1	$393	$635	$135	1.3
Rm 202	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	5,824	0.0	186	0	$27	$72	$10	2.3
Rm 202	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.1	807	0	$118	$226	$50	1.5
Rm 202A	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.4	3,228	-1	$472	$708	$155	1.2
Rm 202B	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.5	4,439	-1	$649	$872	$200	1.0
Rm 202D	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 203	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.1	1,211	0	$177	$434	$80	2.0
Rm 205	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 205	2	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	5,824		None	No	2	LED - Fixtures: Downlight Recessed	Wall Switch	13	5,824	0.0	0	0	$0	$0	$0	0.0
Rm 205	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.1	948	0	$139	$262	$60	1.5
Rm 205A	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.1	1,211	0	$177	$434	$80	2.0
Rm 207	5	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	5	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.3	2,370	0	$347	$635	$135	1.4
Rm 207C	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	5,824	0.0	359	0	$52	$73	$20	1.0
Rm 207D	1	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	S	63	5,824	2	Relamp	No	1	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	5,824	0.0	186	0	$27	$65	$12	2.0
Rm 207F	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.1	948	0	$139	$262	$60	1.5
Rm 207I	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	5,824	0.0	359	0	$52	$73	$20	1.0
Rm 207L	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.1	948	0	$139	$262	$60	1.5
Rm 209	1	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	5,824		None	No	1	LED - Fixtures: Downlight Recessed	Wall Switch	13	5,824	0.0	0	0	$0	$0	$0	0.0
Rm 209	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7
Rm 210	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Rm 210	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,019	0.1	1,211	0	$177	$434	$80	2.0
Rm 210	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,019	0.1	948	0	$139	$262	$60	1.5
Rm 210A	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	4,019	0.1	1,005	0	$147	$560	$75	3.3
Rm 210B	4	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	5,824		None	No	4	LED - Fixtures: Downlight Recessed	Wall Switch	13	5,824	0.0	0	0	$0	$0	$0	0.0
Rm 210E	3	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	5,824	3	None	Yes	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	4,019	0.0	101	0	$15	$116	$20	6.5
Rm 211	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.2	2,152	0	$315	$562	$115	1.4
Rm 211A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 211B	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 211C	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 212	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	1,076	0	$157	$416	$75	2.2
Rm 212A	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	807	0	$118	$380	$65	2.7
Rm 212B	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 212C	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 212D	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 212E	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	5,824	0.0	211	0	$31	$37	$10	0.9
Rm 212H	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.2	1,614	0	$236	$489	$95	1.7
Rm 214	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.4	3,228	-1	$472	$708	$155	1.2
Rm 214B	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 214F	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	1,076	0	$157	$416	$75	2.2
Rm 215	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.3	2,421	-1	$354	$599	$125	1.3
Rm 215A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 215B	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 215C	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 218	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 218	26	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	26	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.8	6,994	-1	$1,023	$1,489	$330	1.1

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Rm 218B	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 218H	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 218K	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 218P	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Rm 6	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.3	2,690	-1	$393	$635	$135	1.3
Rm 9 Data Center	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Rm 9 Data Center	35	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	35	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	1.1	9,415	-2	$1,377	$2,088	$455	1.2
Rm5	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Room 06A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,019	0.1	538	0	$79	$189	$40	1.9
Stairs 1	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs 1	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 4	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,019	0.2	1,883	0	$275	$481	$295	0.7
Stairs 2	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs 2	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,824	2, 4	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,019	0.2	1,883	0	$275	$481	$295	0.7
Stairs Middle	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs Middle	1	LED Lamps: (15) 7W Lamp - Decorative Pendant	Wall Switch	S	105	5,824		None	No	1	LED Lamps: (15) 7W Lamp - Decorative Pendant	Wall Switch	105	5,824	0.0	0	0	$0	$0	$0	0.0
Stairs Middle	1	LED Lamps: (7) 7W Lamp - Decorative Pendant	Wall Switch	S	49	5,824		None	No	1	LED Lamps: (7) 7W Lamp - Decorative Pendant	Wall Switch	49	5,824	0.0	0	0	$0	$0	$0	0.0
Exterior Walkway Poles	25	LED - Fixtures: Outdoor Post-Mount	Timeclock		30	4,380		None	No	25	LED - Fixtures: Outdoor Post-Mount	Timeclock	30	4,380	0.0	0	0	$0	$0	$0	0.0

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?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Elevator Room	Elevator Room	1	Other	40.0	84.0%	No			W	1,627		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Elevator Room	Condensate Pump	2	Condensate Pump	0.3	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Rm 15	Condensate Pump	1	Condensate Pump	0.3	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room	Condensate Pump	2	Condensate Pump	0.3	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Rm 15	Mechanical Rm 15	1	Exhaust Fan	0.3	65.0%	No			W	6,039		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-1,3	2	Exhaust Fan	0.3	65.0%	No			W	6,039		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Attic Floor	2	Exhaust Fan	1.0	82.0%	No			W	6,039	5	No	85.5%	Yes	2	0.6	3,880	0	$571	$6,566	$150	11.2
Mechanical Rm 15	AHU-1,2,3 & Baseboards	2	Heating Hot Water Pump	3.0	84.0%	No			B	2,745	6	No	89.5%	Yes	2	0.7	6,092	0	$896	$7,768	$400	8.2
Room 13	Process Pump	1	Process Pump	0.3	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Floor	Heat Pump #1,2	1	Supply Fan	0.5	70.0%	No			W	6,039		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Floor	AHU-003	1	Supply Fan	0.5	70.0%	No			W	6,039		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Floor	AHU-001 - Room 106	1	Supply Fan	0.8	81.1%	No			W	6,039		No	81.1%	No		0.0	0	0	$0	$0	$0	0.0
Attic Floor	AHU-004	1	Supply Fan	0.3	65.0%	No			W	6,039		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Floor	Heat Pump #4	1	Supply Fan	2.0	82.0%	No			W	6,039	5	No	86.5%	Yes	1	0.6	4,452	0	$655	$3,623	$100	5.4
Attic Floor	AHU-002	1	Supply Fan	0.8	70.0%	No			W	6,039		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Pump Room	Cold Water Supply Pumps	2	Water Supply Pump	5.0	86.5%	No			W	4,380	7	No	86.5%	Yes	2	1.0	14,165	0	$2,084	$7,974	$1,800	3.0
Room 13	Data Center	1	Supply Fan	0.5	70.0%	No			W	8,760		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Room 9	Data Center	2	Supply Fan	4.0	89.5%	No			W	8,760		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Room 9	Data Center	3	Ventilation Fan	0.8	70.0%	No			W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Various	Various Split Systems	9	Supply Fan	1.0	82.0%	No			W	6,039		No	82.0%	No		0.0	0	0	$0	$0	$0	0.0

Packaged 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 (MBh)	Cooling Mode Efficiency (SEER/IEER/ EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/ EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Exterior Ground Floor	Green Hall	1	Split-System	3.50		11.50		ICP	PAJ442000K	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Ground Floor	Green Hall	1	Split-System	5.00		10.39		Trane		B	8	Yes	1	Split-System	5.00		16.00		1.0	3,443	0	$507	$6,521	$525	11.8
Exterior Ground Floor	Green Hall	1	Split-System	15.00		10.11		Trane	TTA180B300CC	B	8	Yes	1	Split-System	15.00		14.00		2.5	8,408	0	$1,237	$16,000	$1,335	11.9
Underground	Data Center UPS	1	Split-System	5.00		12.00		Liebert	BU067	W		No							0.0	0	0	$0	$0	$0	0.0
Underground	Data Center CRAC	2	Split-System	20.00		12.00		Liebert	DS077	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Heat Pump #4	1	Split-System Air-Source HP	7.50	40.94	10.48	2.5 COP			B	9	Yes	1	Split-System Air-Source HP	7.50	40.94	12.80	3.5 COP	0.8	4,277	0	$629	$10,899	$578	16.4
Roof	Heat Pump #1,2	2	Split-System Air-Source HP	3.00	19.65	10.67	8.5 HSPF	Trane	TWR036C	B	9	Yes	2	Split-System Air-Source HP	3.00	19.65	15.50	8.5 HSPF	1.1	3,578	0	$526	$10,145	$600	18.1
Roof	Green Hall	1	Split-System	2.50		12.00		York	YFE30B21	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Green Hall	1	Split-System	7.50		12.00		Trane		W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Green Hall	1	Split-System Air-Source HP	4.00	48.00	10.48	8.5 HSPF	Trane	2TWA3048A	B	9	Yes	1	Split-System Air-Source HP	4.00	48.00	15.50	8.5 HSPF	1.3	2,521	0	$371	$6,764	$400	17.2
Roof	Green Hall	1	Split-System	7.50		10.48		Trane	RAUC-B626-A	B	8	Yes	1	Split-System	7.50		14.00		1.1	3,669	0	$540	$5,887	$593	9.8
Roof	Green Hall	1	Split-System	7.50		10.48		Trane	RAUF-B506-A	B	8	Yes	1	Split-System	7.50		14.00		1.1	3,669	0	$540	$5,887	$593	9.8
Exterior Ground Floor	Green Hall	1	Split-System	4.00		10.48		Trane	TTA048D300	B	8	Yes	1	Split-System	4.00		16.00		0.8	2,685	0	$395	$6,486	$420	15.4
Exterior Ground Floor	Green Hall	1	Split-System	3.00		12.00		Panasonic	U-36PS1U6	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Ground Floor	Green Hall	1	Split-System	3.00		12.00		Sanyo	C3672R	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Ground Floor	Green Hall 002E	1	Split-System	2.00		10.67		Sanyo	CM2472	B	8	Yes	1	Split-System	2.00		16.00		0.4	1,275	0	$188	$5,922	$210	30.5
Exterior Ground Floor	Green Hall 002B	2	Split-System	2.00		12.00		Sanyo	C2672R	W		No							0.0	0	0	$0	$0	$0	0.0
Room 205A	Room 205A	1	Through-The-Wall AC	1.50		12.00				W		No							0.0	0	0	$0	$0	$0	0.0
Offices	Various Offices	28	Window AC	1.50		10.70		Multi Manufacturer	Multi Model	W		No							0.0	0	0	$0	$0	$0	0.0
Offices	Various Offices	4	Window AC	1.50		10.08		Multi Manufacturer	Multi Model	B	8	Yes	4	Window AC	1.50		12.00		0.6	1,719	0	$253	$3,537	$0	14.0

		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 (MBh)	Cooling Mode Efficiency (SEER/IEER/ EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	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	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Offices	Various Offices	10	Window AC	0.85		10.70		Multi Manufacturer	Multi Model	W		No							0.0	0	0	$0	$0	$0	0.0
Offices	Various Offices	3	Window AC	0.67		11.30		Multi Manufacturer	Multi Model	W		No							0.0	0	0	$0	$0	$0	0.0

Space Heating Boiler 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)	Manufacturer	Model	Remaining Useful Life	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Central Plant	Building Space Heating	1	Forced Draft Steam Boiler	3,789	Central Plant	Proxy Boiler	W		No						0.0	0	0	$0	$0	$0	0.0

Pipe Insulation Recommendations

		Recommendation Inputs			Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Rm 015	Domestic Hot Water Pipes	10	40	0.75	0.0	3,311	0	$487	$231	$80	0.3

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Rm 015	Domestic Hot Water System	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White	RE340T6-1NCWW	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	11	13	Faucet Aerator (Lavatory)	2.20	0.50	0.0	3,614	0	$532	$93	$52	0.1

Plug Load Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Green Hall	2	Humidifier	55	Yes		
Green Hall	12	Coffee Machine	400	No		
Green Hall	259	Desktop Computer	120	Yes		
Green Hall	29	Microwave	1,000	No		
Green Hall	9	Paper Shredder	200	No		
Green Hall	40	Printer (Medium/Small)	500	Yes		
Green Hall	19	Printer/Copier (Large)	8,000	Yes		
Green Hall	1	Projector	240	Yes		
Green Hall	30	Refrigerator (Mini)	800	Yes		
Green Hall	7	Refrigerator (Residential)	1,300	Yes		
Green Hall	11	Television	220	Yes		
Green Hall	12	Toaster	400	No		
Green Hall	13	Water Cooler	192	Yes		
Data Center	1	UPS (L1-N/L2)	9,000	Yes		
Data Center	1	UPS (L2-N/L3)	11,500	Yes		
Data Center	1	UPS (L3-N/L1)	7,000	Yes		
Data Center	8	Server Clusters	1,000	Yes		

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Corridor Ground Floor	1	Glass Fronted Refrigerated	12	Yes	0.1	1,209	0	$178	$230	$50	1.0
Corridor Ground Floor	1	Non-Refrigerated	N/A	No	0.0	0	0	$0	$0	$0	0.0

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

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.

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ENERGY STAR® Statement of Energy Performance

N/A

ENERGY STAR® Score[1]

The College of New Jersey

Primary Property Type: College/University
Gross Floor Area (ft²): 2,830,421
Built: 1855

For Year Ending: January 31, 2020
Date Generated: December 13, 2020

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
The College of New Jersey 2000 Pennington Road Ewing, New Jersey 08628	The College of New Jersey 2000 Pennington Rd Ewing, NJ 08628 609-771-2874	David Matlack 2000 Pennington Road Ewing, NJ 08628 609-771-2874 sstewart@trccompanies.com

Property ID: 5984875

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
229 kBtu/ft²

Annual Energy by Fuel

Fuel	
Natural Gas (kBtu)	619,522,872 (96%)
Electric - Grid (kBtu)	28,774,949 (4%)

Source EUI
258.3 kBtu/ft²

National Median Comparison

National Median Site EUI (kBtu/ft²)	160.2
National Median Source EUI (kBtu/ft²)	180.6
% Diff from National Median Source EUI	43%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	35,660

Signature & Stamp of Verifying Professional

I _______________ (Name) verify that the above information is true and correct to the best of my knowledge.

LP Signature: ____________________ Date: __________

Licensed Professional

___ ______

(___)___-_____

____

Professional Engineer or Registered Architect Stamp (if applicable)

Appendix C: Glossary

TERM	DEFINITION
Blended Rate	Used to calculate fiscal savings associated with measures. The blended rate is calculated by dividing the amount of your bill by the total energy use. For example, if your bill is $22,217.22, and you used 266,400 kilowatt-hours, your blended rate is 8.3 cents per kilowatt-hour.
Btu	*British thermal unit*: a unit of energy equal to the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
CHP	*Combined heat and power*. Also referred to as cogeneration.
COP	*Coefficient of performance*: a measure of efficiency in terms of useful energy delivered divided by total energy input.
Demand Response	Demand response reduces or shifts electricity usage at or among participating buildings/sites during peak energy use periods in response to time-based rates or other forms of financial incentives.
DCV	*Demand control ventilation*: a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need.
US DOE	*United States Department of Energy*
EC Motor	*Electronically commutated motor*
ECM	*Energy conservation measure*
EER	*Energy efficiency ratio*: a measure of efficiency in terms of cooling energy provided divided by electric input.
EUI	*Energy Use Intensity:* measures energy consumption per square foot and is a standard metric for comparing buildings' energy performance.
Energy Efficiency	Reducing the amount of energy necessary to provide comfort and service to a building/area. Achieved through the installation of new equipment and/or optimizing the operation of energy use systems. Unlike conservation, which involves some reduction of service, energy efficiency provides energy reductions without sacrifice of service.
ENERGY STAR®	ENERGY STAR® is the government-backed symbol for energy efficiency. The ENERGY STAR® program is managed by the EPA.
EPA	*United States Environmental Protection Agency*
Generation	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
GHG	*Greenhouse gas* gases that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface.
gpf	*Gallons per flush*

gpm	*Gallon per minute*
HID	*High intensity discharge:* high-output lighting lamps such as high-pressure sodium, metal halide, and mercury vapor.
hp	*Horsepower*
HPS	*High-pressure sodium*: a type of HID lamp
HSPF	*Heating seasonal performance factor:* a measure of efficiency typically applied to heat pumps. Heating energy provided divided by seasonal energy input.
HVAC	*Heating, ventilating, and air conditioning*
IHP 2014	US DOE Integral Horsepower rule. The current ruling regarding required electric motor efficiency.
IPLV	*Integrated part load value:* a measure of the part load efficiency usually applied to chillers.
kBtu	One thousand British thermal units
kW	*Kilowatt*: equal to 1,000 Watts.
kWh	*Kilowatt-hour*: 1,000 Watts of power expended over one hour.
LED	*Light emitting diode*: a high-efficiency source of light with a long lamp life.
LGEA	*Local Government Energy Audit*
Load	The total power a building or system is using at any given time.
Measure	A single activity, or installation of a single type of equipment, that is implemented in a building system to reduce total energy consumption.
MH	*Metal halide*: a type of HID lamp
MBh	*Thousand Btu per hour*
MBtu	*One thousand British thermal units*
MMBtu	*One million British thermal units*
MV	*Mercury Vapor:* a type of HID lamp
NJBPU	*New Jersey Board of Public Utilities*
NJCEP	*New Jersey's Clean Energy Program:* NJCEP is a statewide program that offers financial incentives, programs and services for New Jersey residents, business owners and local governments to help them save energy, money and the environment.
psig	Pounds per square inch gauge
Plug Load	Refers to the amount of power used in a space by products that are powered by means of an ordinary AC plug.
PV	*Photovoltaic:* refers to an electronic device capable of converting incident light directly into electricity (direct current).

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR® Portfolio Manager®.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC	*Solar renewable energy credit*: a credit you can earn from the state for energy produced from a photovoltaic array.
TREC	*Transition Incentive Renewable Energy Certificate:* a factorized renewable energy certificate you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of 1/8th of an inch.
Temperature Setpoint	The temperature at which a temperature regulating device (thermostat, for example) has been set.
therm	100,000 Btu. Typically used as a measure of natural gas consumption.
tons	A unit of cooling capacity equal to 12,000 Btu/hr.
Turnkey	Provision of a complete product or service that is ready for immediate use
VAV	*Variable air volume*
VFD	*Variable frequency drive*: a controller used to vary the speed of an electric motor.
WaterSense®	The symbol for water efficiency. The WaterSense® program is managed by the EPA.
Watt (W)	Unit of power commonly used to measure electricity use.