Local Government Energy Audit Report

Power House

March 28, 2025

Prepared for:
NJ DHS - Woodbine DC
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Woodbine, New Jersey 08270

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Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities and help prioritize specific measures for implementation. 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.

Incentive values provided in this report are estimated based on previously run state efficiency programs. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available utility 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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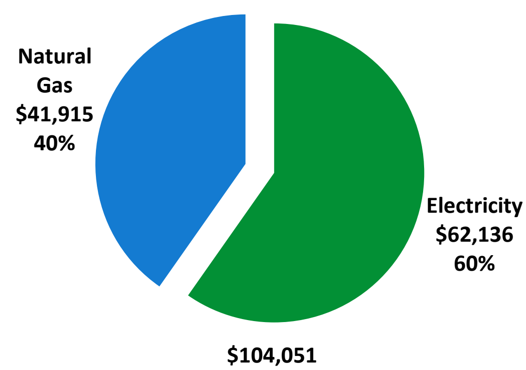
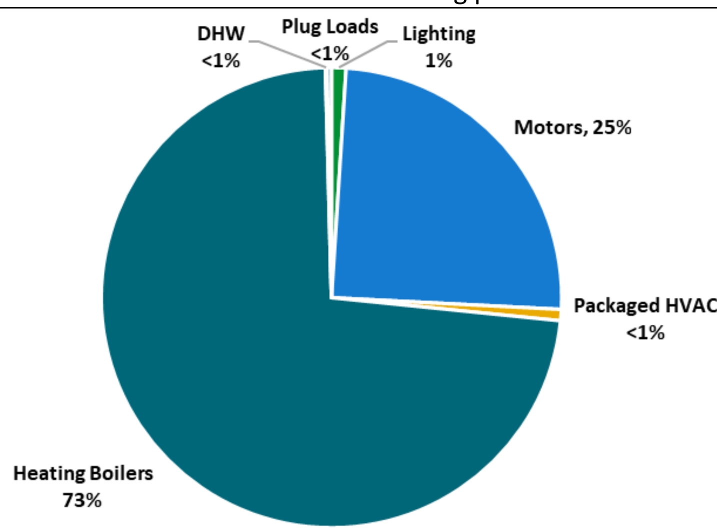
1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Power House and the associated restroom. 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 Energy Utilities	Costs: $104,051 Electricity: 412,230 kWh Natural Gas: 37,617 Therms Water: 22,389,500 Gallons	
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.



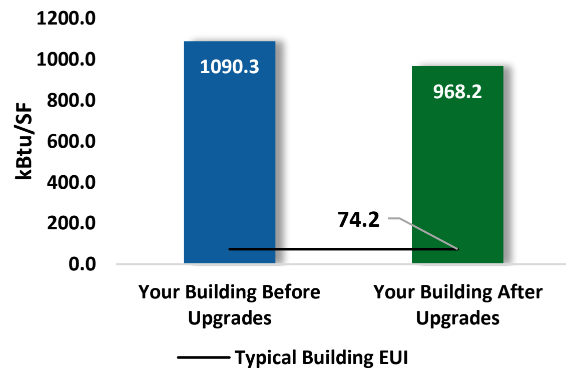
Energy Use by System

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.

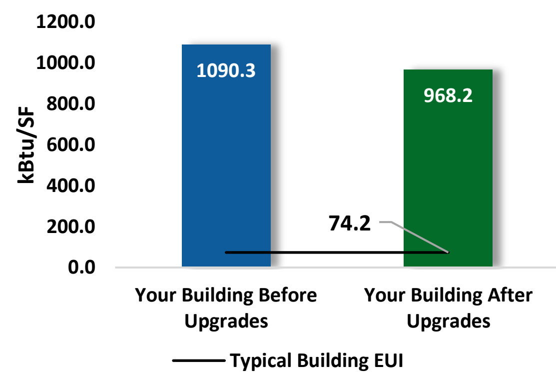
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$108,140
Potential Rebates & Incentives[1]	$12,130
Annual Cost Savings	$25,602
Annual Energy Savings	Electricity: 169,903 kWh Natural Gas: -7 Therms
Greenhouse Gas Emission Savings	86 Tons
Simple Payback	3.8 Years
Site Energy Savings (All Utilities)	11%



Scenario 2: Cost Effective Package[2]

Installation Cost	$108,140
Potential Rebates & Incentives	$12,130
Annual Cost Savings	$25,602
Annual Energy Savings	Electricity: 169,903 kWh Natural Gas: -7 Therms
Greenhouse Gas Emission Savings	86 Tons
Simple Payback	3.8 Years
Site Energy Savings (all utilities)	11%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	High

[1] Incentives are based on previously run state rebate programs. Contact your utility provider for current program incentives that 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			**6,229**	**0.5**	**-1**	**$933**	**$3,600**	**$460**	**$3,140**	**3.4**	**6,207**
ECM 1	Install LED Fixtures	Yes	3,767	0.0	0	$568	$2,650	$250	$2,400	4.2	3,793
ECM 2	Retrofit Fixtures with LED Lamps	Yes	2,462	0.5	-1	$365	$950	$210	$740	2.0	2,414
Lighting Control Measures			**780**	**0.2**	**0**	**$116**	**$810**	**$90**	**$720**	**6.2**	**765**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	780	0.2	0	$116	$810	$90	$720	6.2	765
Variable Frequency Drive (VFD) Measures			**162,402**	**63.6**	**0**	**$24,479**	**$103,200**	**$11,500**	**$91,700**	**3.7**	**163,538**
ECM 4	Install Boiler Draft Fan VFDs	Yes	70,071	26.8	0	$10,562	$54,600	$5,600	$49,000	4.6	70,561
ECM 5	Install VFDs on Boiler Feedwater Pumps	Yes	92,332	36.8	0	$13,917	$48,600	$5,900	$42,700	3.1	92,977
HVAC System Improvements			**340**	**0.0**	**0**	**$51**	**$410**	**$60**	**$350**	**6.8**	**342**
ECM 6	Install Pipe Insulation	Yes	340	0.0	0	$51	$410	$60	$350	6.8	342
Domestic Water Heating Upgrade			**152**	**0.0**	**0**	**$23**	**$120**	**$20**	**$100**	**4.4**	**153**
ECM 7	Install Low-Flow DHW Devices	Yes	152	0.0	0	$23	$120	$20	$100	4.4	153
TOTALS (COST EFFECTIVE MEASURES)			**169,903**	**64.3**	**-1**	**$25,602**	**$108,140**	**$12,130**	**$96,010**	**3.8**	**171,006**
TOTALS (ALL MEASURES)			**169,903**	**64.3**	**-1**	**$25,602**	**$108,140**	**$12,130**	**$96,010**	**3.8**	**171,006**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

All Evaluated Energy Improvements[3]

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

[3] 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.

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decision 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

Utility-run energy efficiency programs and 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.

Options from Your Utility Company

Prescriptive and Custom Rebates

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 Prescriptive and Custom Rebates 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 may be required for some incentives. Contact your utility company for more details prior to project installation.

Direct Install

The Direct Install program provides turnkey installation of multiple measures through an authorized contractor. This program can provide incentives up to 70% or 80% of the cost of selected measures. A Direct Install contractor will assess and verify individual measure eligibility and perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

Engineered Solutions

The Engineered Solutions program provides tailored energy-efficiency assistance and turnkey engineering services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. The program provides all professional services from audit, design, construction administration, to commissioning and measurement and verification for custom whole-building energy-efficiency projects. Engineered Solutions 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.

For more details on these programs please contact your utility provider.

Options from New Jersey's Clean Energy Program

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 and Power (CHP)

The CHP program provides incentives for combined heat and power (i.e., 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.

Successor Solar Incentive Program (SuSI)

New Jersey is committed to supporting solar energy. Solar projects help the state reach the renewable goals outlined in the state's Energy Master Plan. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available, but certified solar projects are able to earn one SREC II (Solar Renewable Energy Certificates II) for each megawatt-hour of solar electricity produced from a qualifying solar facility.

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.

Large Energy User Program (LEUP)

LEUP is designed to promote self-investment in energy efficiency for the largest energy consumers in the state. Customers in this category spend about $5 million a year on energy bills. This program incentivizes owners/users of buildings to upgrade or install energy conserving measures in existing buildings to help offset the capital costs associated with the project. The efficiency upgrades are customized to meet the requirements of the customers' existing facilities, while advancing the State's energy efficiency, conservation, and greenhouse gas reduction goals.

For more details on these programs please visit New Jersey's Clean Energy Program website.

2 EXISTING CONDITIONS

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Power House and the associated restroom. 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.

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 16, 2023, TRC performed an energy audit at Power House located in Woodbine, New Jersey. TRC met with Juan Perez to review the facility operations and help focus our investigation on specific energy-using systems.

The Power House is a single-story, 4,700 square foot building built in 1930. Spaces include a small office and mechanical space. The restroom is a nearby 40 square foot facility.

2.2 Building Occupancy

The facility run 24 hours, seven days a week. occupied Monday through Friday during regular business hours. Janitorial services are performed after hours.

Building Name	Weekday/Weekend	Operating Schedule
Power House	Weekday	24/7
	Weekend	
Power House - Bathroom/Showerhouse	Weekday	8:00 AM - 4:00 PM
	Weekend	Intermittent

Building Occupancy Schedule

2.3 Building Envelope

The walls are made of brick with a painted CMU interior finish. Wooden trusses support a pitched roof with asphalt shingles. Roof encloses an unconditioned space. The thermal barrier is at the roof.

Most of the windows are single glazed and have wood frames. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition, showing some evidence of excessive wear. Exterior doors have aluminum frames and are in fair condition with worn door seals. Degraded window and door seals increase drafts and outside air infiltration.

Building Windows

Side of Building

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent 4-lamp, 4-foot T8 fixtures. There are also ceiling mounted and wall mounted LED fixtures. The restroom has an LED lamp and several 2-lamp, 4-foot T8 fluorescent fixtures. Most fixtures are in good condition. Interior lighting levels were generally sufficient. Lighting fixtures in the power house are controlled by wall switches.

Linear Fluorescent T8 Fixture

LED High Bay

Exterior fixtures include wall packs and floodlights with a mix of high intensity discharge (HID) and LED lamps. Exterior fixtures are photocell controlled.

Metal Halide Wallpack

LED Wallpack

2.5 Air Handling Systems

Unitary Electric HVAC Equipment

The power house and restroom are cooled using window air conditioning (AC) units. These have a capacity of about 1 ton each. The units are in fair condition and have an efficiency of about 11.00 EER. They are not ENERGY STAR labeled.

Window AC Unit

Unitary Heating Equipment

Sections of the power house and restroom are heated by electric resistance heaters. The electric resistance heaters have a capacity of about 40 MBh or about 12 kW. The units are in fair condition. The main portion of power house is heated by suspended unit heaters which are supplied by the boilers described in the following section.

Electric Resistance Heater

2.6 Heating Stea`m Systems

Three steam boilers serve the building and campus heating load with capacities ranging between 16,000 MBh to 23,000 MBh at a nominal efficiency of 80 percent. The boilers are configured in a lead-lag control scheme. Multiple boilers are required under high load conditions. They are in good condition.

A one-pipe steam distribution system serves the building and campus heating terminals. There are several boiler feed pumps in the mechanical room with capacities ranging between 7.5 hp and 20 hp. There are combustion air fans, fuel pumps, air compressors, and condensate return pumps associated with the boilers, steam distribution, and controls. There are about 100 feet of 3-inch steam supply and condensate return pipe within the building with insulation, which is in good condition.

Steam Boiler

Steam Boiler

2.7 Domestic Hot Water

The power house has a 12 gallon, 1.5 kW electric storage water heater and the restroom has a 40 gallon, 4.5 kW unit. The domestic hot water pipes were not insulated.

Electric Storage Water Heater

2.8 Plug Load and Vending Machines

The location is doing a great job managing the electrical plug loads. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

There is one computer workstation and miscellaneous plug loads including general café and office equipment such as microwaves, televisions, and water coolers.

There is a residential-style refrigerator in the building. It is in good condition and standard efficiency.

Water Cooler

Residential-style Refrigerator

2.9 Water-Using Systems

Water is provided by the Borough of Woodbine Water Department.

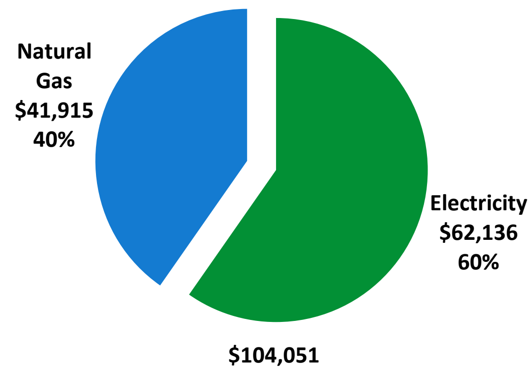
Water leaks were not observed/reported. There are two restrooms with toilets and sinks throughout these buildings. Faucet flow rates are at 2.2 gallons per minute (gpm) or higher. Toilets are rated at 2.0 gallons per flush (gpf). One restroom has a shower, and the showerhead is rated at 2.5 gpm.

Restroom Faucet

3 Energy and Water Use and Costs

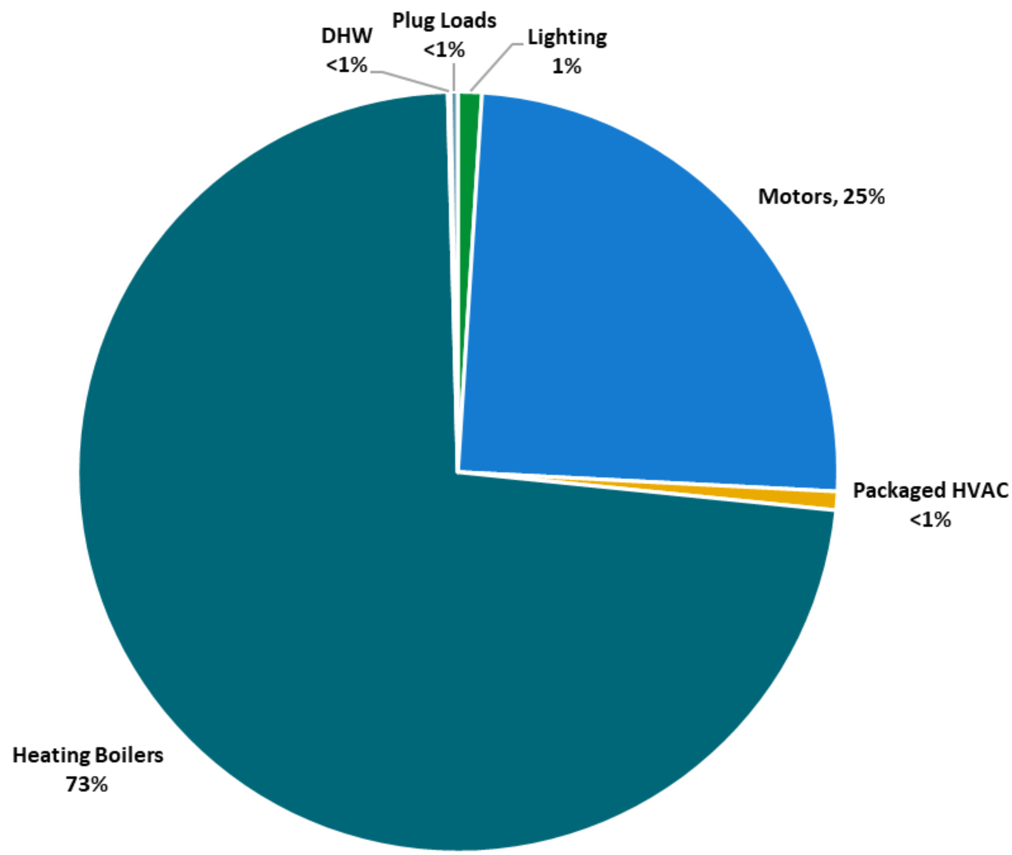
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	412,230 kWh	$62,136
Natural Gas	37,617 Therms	$41,915
Total		**$104,051**



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.

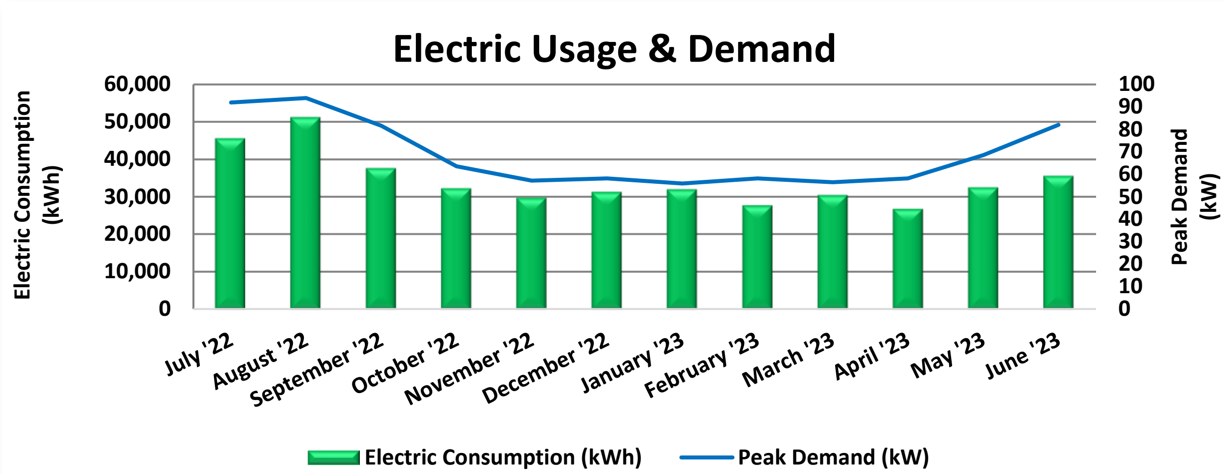
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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



Energy Balance by System

3.1 Electricity

Atlantic City Electric delivers electricity under rate class Annual General Service Primary, with electric production provided by Constellation, a third-party supplier.



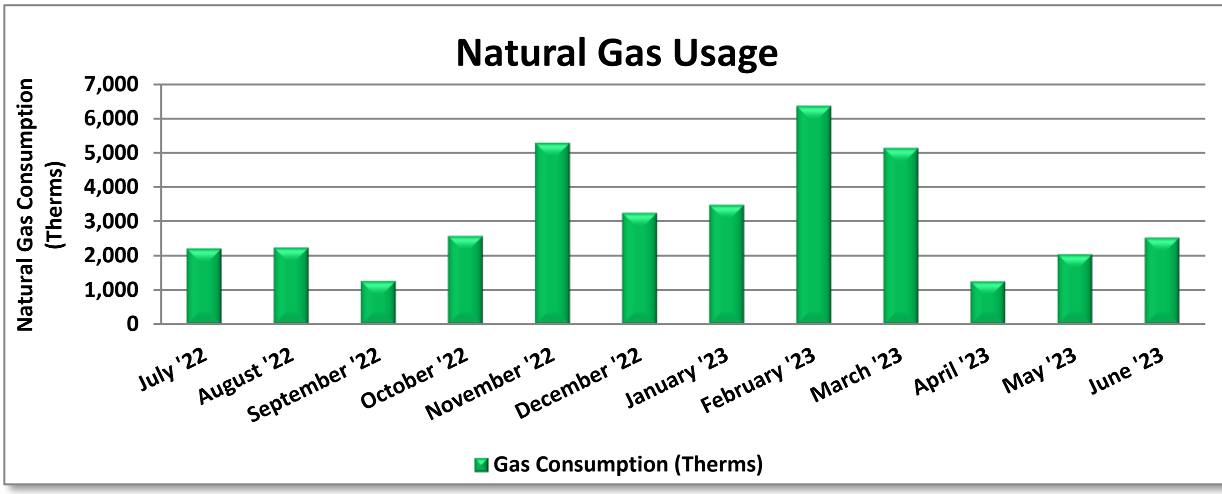
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
7/28/22	29	45,522	92		$6,504
8/30/22	33	51,167	94		$7,343
9/29/22	30	37,544	82		$5,538
10/30/22	31	32,243	64		$4,774
11/29/22	30	29,754	57		$4,443
12/29/22	30	31,235	58		$4,616
1/30/23	32	31,930	56		$4,960
2/27/23	28	27,675	58		$4,327
3/30/23	31	30,391	56		$4,741
4/27/23	28	26,745	58		$4,186
5/30/23	33	32,508	69		$5,078
6/29/23	30	35,516	82		$5,626
Totals	**365**	**412,230**	**94**	**$0**	**$62,136**
Annual	**365**	**412,230**	**94**	**$0**	**$62,136**

Notes:

- An estimated peak demand of 94 kW occurred in August '22.
- An estimated average demand over the past 12 months was 69 kW.
- Energy usage (kWh) and demand (kW) was apportioned among those buildings using a formula that accounts for building area (sf), usage, and the energy intensity of the equipment.
- The average electric cost over the past 12 months was $0.151/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.

3.2 Natural Gas

South Jersey Gas delivers natural gas under rate class LVFT(SJ-GSGLV), with natural gas supply provided by UGI Energy, a third-party supplier.



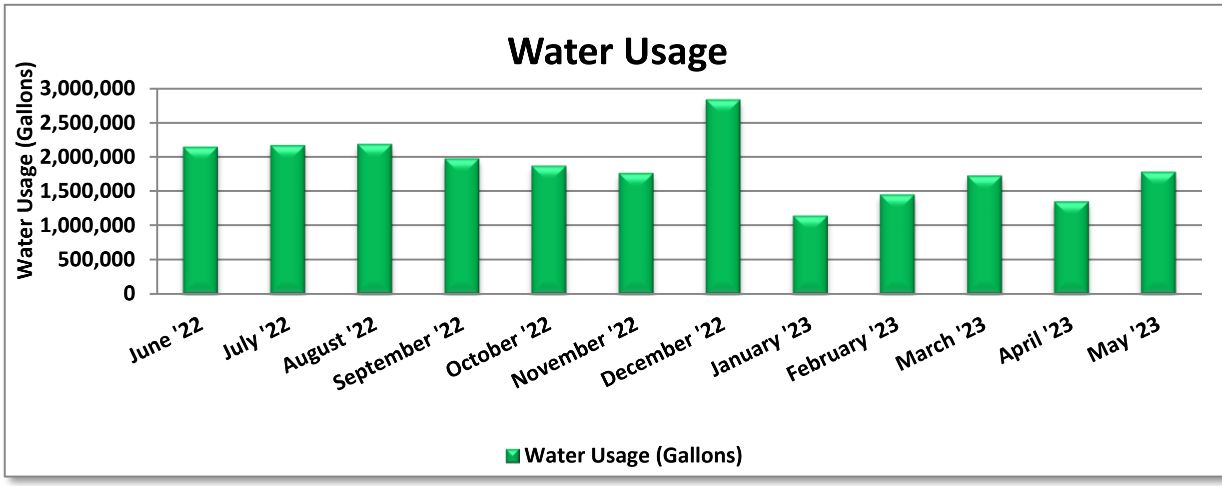
Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
8/15/22	32	2,208	$2,118
9/16/22	32	2,238	$2,492
10/13/22	27	1,272	$1,443
11/11/22	29	2,573	$3,150
12/12/22	31	5,277	$5,536
1/13/23	32	3,251	$4,200
2/11/23	29	3,480	$4,425
3/15/23	32	6,354	$7,707
4/14/23	30	5,131	$5,571
5/11/23	27	1,263	$1,855
6/12/23	32	2,046	$1,922
7/14/23	32	2,524	$1,496
Totals	**365**	**37,617**	**$41,915**
Annual	**365**	**37,617**	**$41,915**

Notes:

- The average gas cost for the past 12 months is $1.114/therm, which is the blended rate used throughout the analysis.
- Central plant natural gas use has been apportioned among the buildings served with steam using a formula that accounts for building area (sf), usage, and the energy intensity of the equipment. The apportionment of steam to this building also includes an estimate of system wide steam losses, which is why the building steam use is much higher than expected for a building of this size.

3.3 Water

The Borough of Woodbine Water Department delivers water to the project site.



Water Billing Data			
Period Ending	Days in Period	Water Usage (gallons)	Water Cost
7/15/22	30	2,146,000	$10,806
8/15/22	31	2,166,000	$10,907
9/15/22	31	2,186,000	$10,758
10/15/22	30	1,975,000	$9,945
11/16/22	32	1,869,500	$9,414
12/15/22	29	1,764,000	$8,882
1/15/23	31	2,835,000	$14,275
2/15/23	31	1,141,000	$5,745
3/15/23	28	1,450,000	$7,301
4/15/23	31	1,726,000	$9,336
5/15/23	30	1,348,000	$8,097
6/15/23	31	1,783,000	$10,710
Totals	**365**	**22,389,500**	**$116,176**
Annual	**365**	**22,389,500**	**$116,176**

Notes:

- Water use indicated is for the entire Woodbine campus/
- The average cost of water for the past 12 months is $0.0052/gal.

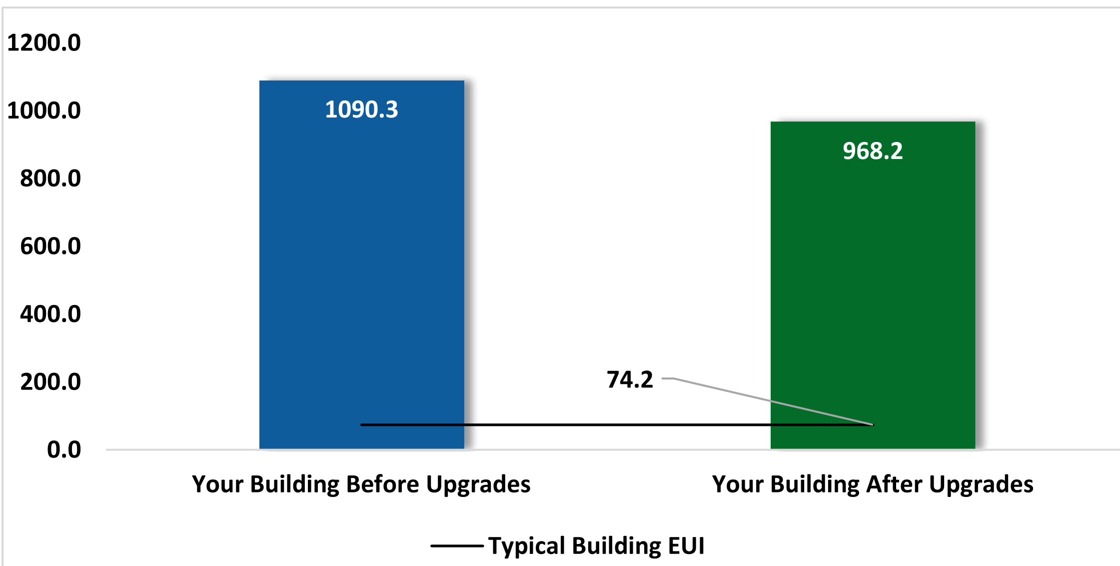
3.4 Benchmarking

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.

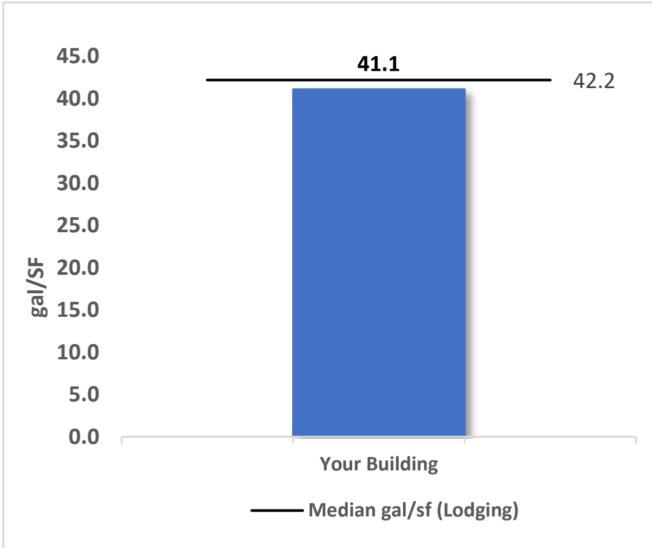


Energy Use Intensity Comparison[4]

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. Several factors can cause a building to vary from 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.

[4] Based on all evaluated ECMs

Water Benchmarking



A benchmark is provided for your building's water use based on the annual water use in gallons per square foot of building area (gal/sf-yr). Your building is compared to other similar buildings based on average water usage as available from the 2012 Commercial Buildings Energy Consumption Survey (CBECS) and from the EPA ENERGY STAR DataTrends Water Use Tracking database.

Water use varies considerably depending mainly on the extent of outdoor water use and whether process water is used, such as for vehicle washing and for laboratory sterilizers. Cooling towers and steam boilers are also significant water users. Kitchens and sanitary fixtures may use varying amounts of water.

Tracking your Energy Performance

Keeping track of your energy and water use on a monthly basis is one of the best ways to keep utility costs in check and keep your facility operating efficiently. 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 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.

3.5 Understanding Your Utility Bills

The State of New Jersey Department of the Public Advocate provides detailed information on how to read natural gas and electric bills. Your bills contain important information including account numbers, meter numbers, rate schedules, meter readings, and the supply and delivery charges. Gas and electric bills both provide comparisons of current energy consumption with prior usage.

Sample bills, with annotation, may be viewed at:
https://www.nj.gov/rpa/docs/Understanding_Electric_Bill.pdf
https://www.nj.gov/rpa/docs/Understanding_Gas_Bill.pdf

Why Utility Bills Vary

Utility bills vary from one month to another for many reasons. For this reason, assessing the effects of your energy savings efforts can be difficult.

Billing periods vary, typically ranging between 28 and 33 days. Electric bills provide the kilowatt-hours (kWh) used per month while gas bills provide therms (or hundreds of cubic feet - CCF) per month consumption information. Monthly consumption information can be helpful as a tool to assess your efforts to reduce energy, particularly when compared to monthly usage from a similar calendar period in a prior year.

Bills typically vary seasonally, often with more gas consumed in the winter for heating, and more electricity used in the summer when air conditioning is used. Facilities with electric heating may experience higher electricity use in the winter. Seasonal variance will be impacted by the type of heating and cooling systems used. Normal seasonal fluctuations are further impacted by the weather. Extremely cold or hot weathers causes HVAC equipment to run longer, increasing usage. Other monthly fluctuations in usage can be caused by changes in building occupancy. Utility bills provide a comparison of usage between the current period and comparable billing month period of the prior year. Year-to-year monthly use comparisons can point to trends with energy savings for measures/projects that were implemented within the timeframe, but these comparisons do not account for changing weather of occupancy patterns.

The price of fuel and purchased power used to produce and delivery electricity and gas fluctuates. Any increase or decrease in these costs will be reflected in your monthly bill. Additionally, billing rates occasionally change after justification and approval of the NJBPU. For this reason, it is more useful to review energy use rather than cost when assessing energy use trends or the impact of energy conservation measures implemented.

4 Energy Conservation Measures

The goal of this audit report is to identify and evaluate potential energy efficiency improvements and provide information about the cost effectiveness of those improvements. Most energy conservation measures have received preliminary analysis of feasibility, which identifies expected ranges of savings. 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 in this report are based on the previously run state rebate program SmartStart, which has been retired. Now, all investor-owned gas and electric utility companies are offering complementary energy efficiency programs directly to their customers. Some measures and proposed upgrades may be eligible for higher incentives than those shown below. The incentives in the summary tables should be used for high-level planning purposes. To verify incentives, reach out to your utility provider or visit the NJCEP website for more information.

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			**6,229**	**0.5**	**-1**	**$933**	**$3,600**	**$460**	**$3,140**	**3.4**	**6,207**
ECM 1	Install LED Fixtures	Yes	3,767	0.0	0	$568	$2,650	$250	$2,400	4.2	3,793
ECM 2	Retrofit Fixtures with LED Lamps	Yes	2,462	0.5	-1	$365	$950	$210	$740	2.0	2,414
Lighting Control Measures			**780**	**0.2**	**0**	**$116**	**$810**	**$90**	**$720**	**6.2**	**765**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	780	0.2	0	$116	$810	$90	$720	6.2	765
Variable Frequency Drive (VFD) Measures			**162,402**	**63.6**	**0**	**$24,479**	**$103,200**	**$11,500**	**$91,700**	**3.7**	**163,538**
ECM 4	Install Boiler Draft Fan VFDs	Yes	70,071	26.8	0	$10,562	$54,600	$5,600	$49,000	4.6	70,561
ECM 5	Install VFDs on Boiler Feedwater Pumps	Yes	92,332	36.8	0	$13,917	$48,600	$5,900	$42,700	3.1	92,977
HVAC System Improvements			**340**	**0.0**	**0**	**$51**	**$410**	**$60**	**$350**	**6.8**	**342**
ECM 6	Install Pipe Insulation	Yes	340	0.0	0	$51	$410	$60	$350	6.8	342
Domestic Water Heating Upgrade			**152**	**0.0**	**0**	**$23**	**$120**	**$20**	**$100**	**4.4**	**153**
ECM 7	Install Low-Flow DHW Devices	Yes	152	0.0	0	$23	$120	$20	$100	4.4	153
TOTALS			**169,903**	**64.3**	**-1**	**$25,602**	**$108,140**	**$12,130**	**$96,010**	**3.8**	**171,006**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

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		**6,229**	**0.5**	**-1**	**$933**	**$3,600**	**$460**	**$3,140**	**3.4**	**6,207**
ECM 1	Install LED Fixtures	3,767	0.0	0	$568	$2,650	$250	$2,400	4.2	3,793
ECM 2	Retrofit Fixtures with LED Lamps	2,462	0.5	-1	$365	$950	$210	$740	2.0	2,414
Lighting Control Measures		**780**	**0.2**	**0**	**$116**	**$810**	**$90**	**$720**	**6.2**	**765**
ECM 3	Install Occupancy Sensor Lighting Controls	780	0.2	0	$116	$810	$90	$720	6.2	765
Variable Frequency Drive (VFD) Measures		**162,402**	**63.6**	**0**	**$24,479**	**$103,200**	**$11,500**	**$91,700**	**3.7**	**163,538**
ECM 4	Install Boiler Draft Fan VFDs	70,071	26.8	0	$10,562	$54,600	$5,600	$49,000	4.6	70,561
ECM 5	Install VFDs on Boiler Feedwater Pumps	92,332	36.8	0	$13,917	$48,600	$5,900	$42,700	3.1	92,977
HVAC System Improvements		**340**	**0.0**	**0**	**$51**	**$410**	**$60**	**$350**	**6.8**	**342**
ECM 6	Install Pipe Insulation	340	0.0	0	$51	$410	$60	$350	6.8	342
Domestic Water Heating Upgrade		**152**	**0.0**	**0**	**$23**	**$120**	**$20**	**$100**	**4.4**	**153**
ECM 7	Install Low-Flow DHW Devices	152	0.0	0	$23	$120	$20	$100	4.4	153
TOTALS		**169,903**	**64.3**	**-1**	**$25,602**	**$108,140**	**$12,130**	**$96,010**	**3.8**	**171,006**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

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		**6,229**	**0.5**	**-1**	**$933**	**$3,600**	**$460**	**$3,140**	**3.4**	**6,207**
ECM 1	Install LED Fixtures	3,767	0.0	0	$568	$2,650	$250	$2,400	4.2	3,793
ECM 2	Retrofit Fixtures with LED Lamps	2,462	0.5	-1	$365	$950	$210	$740	2.0	2,414

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 is 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: Install LED Fixtures

Replace existing fixtures containing HID lamps with new LED light fixtures. This measure saves energy by installing LEDs, which use less power than other technologies with a comparable light output.

In some cases, HID fixtures can be retrofit with screw-based LED lamps. Replacing an existing HID fixture with a new LED fixture will generally provide better overall lighting optics; however, replacing the HID lamp with a LED screw-in lamp is typically a less expensive retrofit. We recommend you work with your lighting contractor to determine which retrofit solution is best suited to your needs and will be compatible with the existing fixture(s).

Maintenance savings may also be achieved since LED lamps last longer than other light sources and therefore do not need to be replaced as often.

Affected Building Areas: exterior fixtures

ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent 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. Be sure to specify replacement lamps that are compatible with existing dimming controls, where applicable. In some circumstances, you may need to upgrade your dimming system for optimum performance.

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

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		**780**	**0.2**	**0**	**$116**	**$810**	**$90**	**$720**	**6.2**	**765**
ECM 3	Install Occupancy Sensor Lighting Controls	780	0.2	0	$116	$810	$90	$720	6.2	765

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.

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: restrooms and mechanical spaces

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		**162,402**	**63.6**	**0**	**$24,479**	**$103,200**	**$11,500**	**$91,700**	**3.7**	**163,538**
ECM 4	Install Boiler Draft Fan VFDs	70,071	26.8	0	$10,562	$54,600	$5,600	$49,000	4.6	70,561
ECM 5	Install VFDs on Boiler Feedwater Pumps	92,332	36.8	0	$13,917	$48,600	$5,900	$42,700	3.1	92,977

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 4: Install Boiler Draft Fan VFDs

Replace existing volume control devices on boiler draft fans, such as inlet vanes or dampers, with VFDs. Inlet vanes or dampers are an inefficient means of controlling the air volume compared to VFDs. The existing volume control device will be removed or permanently disabled, and the control signal will be redirected to the VFD to determine proper fan motor speed.

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

Additional maintenance savings may result from this measure. VFDs are solid state electronic devices, which generally require less maintenance than mechanical air volume control devices.

ECM 5: Install VFDs on Boiler Feedwater Pumps

Install VFDs to control boiler feedwater pumps. The existing level control valve will need to be maintained fully open, and its control signal used by the VFD to modulate the feedwater speed.

Energy savings result from reducing the pump motor speed (and power) at reduced feedwater flow. The magnitude of energy savings is based on the estimated amount of time that the pumping system will operate at reduced load.

4.4 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		**340**	**0.0**	**0**	**$51**	**$410**	**$60**	**$350**	**6.8**	**342**
ECM 6	Install Pipe Insulation	340	0.0	0	$51	$410	$60	$350	6.8	342

ECM 6: Install Pipe Insulation

Install insulation on domestic hot water system piping. Distribution system thermal losses are dependent on system fluid temperature, the size of the distribution system, and the extent and condition of piping insulation. When the insulation has been damaged due to exposure to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated, system thermal efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Affected Systems: domestic hot water piping

4.5 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		**152**	**0.0**	**0**	**$23**	**$120**	**$20**	**$100**	**4.4**	**153**
ECM 7	Install Low-Flow DHW Devices	152	0.0	0	$23	$120	$20	$100	4.4	153

ECM 7: 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
Showerhead	2.0 gpm

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing.

4.6 Measures for Future Consideration

Installation of a Building Automation System

Most larger facilities have some type of building automation system (BAS), which provides for centralization, remote control, and monitoring of HVAC equipment and sometimes lighting or other building systems. A BAS utilizes a system of temperature and pressure sensors that obtain feedback about field conditions and provide signals to control systems that adjust HVAC system operation for optimal functioning. Thirty years ago, most control systems were pneumatic systems driven by compressed air, with pneumatic thermostats and air driven actuators for valves and dampers. Pneumatics controls have largely been replaced by direct digital control (DDC) systems, but many pneumatic systems remain. Contemporary DDC systems afford tighter controls and enhanced monitoring and trending capabilities as compared to the older systems.

Based on our survey, it appears that the installation of a BAS at your site could increase the efficiency of your campus.

A controls upgrade would enable automated equipment start and stop times, temperature setpoints, and lockouts and deadbands to be programmed remotely using a graphic interface. Controls can be configured to optimize ventilation and outside air intake by adjusting economizer position, damper function, and fan speed. Existing chilled and hot water distribution system controls are typically tied in, including associated pumps and valves. Coordinated control of HVAC systems is dependent on a network of sensors and status points. A comprehensive building control system provides monitoring and control for all HVAC systems, so operators can adjust system programming for optimal comfort and energy savings.

It is recommended that an HVAC engineer or contractor who specializes in BAS be contacted for a detailed evaluation and implementation costs. For the purposes of this report, the potential energy savings and measure costs were estimated based on industry standards and previous project experience. Further analysis should be conducted for the feasibility of this measure. This is not an investment grade analysis nor should be used as a basis for design and construction.

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 5% –20% 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, and planned capital upgrades, and it 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 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 cannot manage what you do not 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, 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 can lead to increased occupant comfort as well as heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

Window Treatments/Coverings

Use high-reflectivity films or cover windows with shades or shutters to reduce solar heat gain and reduce the load on cooling and heating systems. Older, single-pane windows and east- or west-facing windows are especially prone to solar heat gain. In addition, use shades or shutters at night during cold weather to reduce heat loss.

[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 Controls

Electric motors often run unnecessarily, and this is an overlooked opportunity to save energy. These motors should be identified and turned off when appropriate. For example, exhaust fans often run unnecessarily when ventilation requirements are already met. Whenever possible, use automatic devices such as twist timers or occupancy sensors to turn off motors when they are not needed.

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.

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.

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.

Boiler Maintenance

Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to keeping the heating system running efficiently and preventing expensive repairs. Annual tune-ups should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is operating safely and efficiently. Boilers should be cleaned according to the manufacturer's instructions to remove soot and scale from the boiler tubes to improve heat transfer.

Label HVAC Equipment

For improved coordination in maintenance practices, we recommend labeling or re-labeling the site HVAC equipment. Maintain continuity in labeling by following labeling conventions as indicated in the facility drawings or BAS building equipment list. Use weatherproof or heatproof labeling or stickers for permanence, but do not cover over original equipment nameplates, which should be kept clean and readable whenever possible. Besides equipment, label piping for service and direction of flow when possible. Ideally, maintain a log of HVAC equipment, including nameplate information, asset tag designation, areas served, installation year, service dates, and other pertinent information.

This investment in your equipment will enhance collaboration and communication between your staff and your contracted service providers and may help you with regulatory compliance.

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

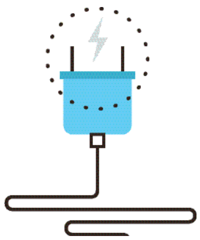
Compressed air systems require periodic maintenance to operate at peak efficiency. A maintenance plan for compressed air systems should include:

- 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.
- Reduce pressure setting to minimum needed for air operated equipment.
- Turn off compressor if not routinely needed.
- Use low pressure blower air rather than high pressure compressed air.

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

Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips[6]. Your local utility may offer incentives or rebates for this equipment.

Procurement Strategies

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

[6] For additional information refer to "Assessing and Reducing Plug and Process Loads in Office Buildings" http://www.nrel.gov/docs/fy13osti/54175.pdf, or "Plug Load Best Practices Guide" http://www.advancedbuildings.net/plug-load-best-practices-guide-offices.

6 Water Best Practices

Getting Started

The commercial and institutional sector is the second largest consumer of publicly supplied water in the United States, accounting for 17% of the withdrawals from public water supplies[7]. In New Jersey, excluding water used for power generation, approximately 80% of total water use was attributed to potable supply during the period of 2009 to 2018. Water withdrawals for potable supply have not changed noticeably during the period from 1990 to 2018[8].

Water management planning serves as the foundation for any successful water reduction effort. It is the first step a commercial or institutional facility owner or manager should take to achieve and sustain long-term water savings. Understanding how water is used within a facility is critical for the water management planning process. A water assessment provides a comprehensive account of all known water uses at the facility. It allows the water management team to establish a baseline from which progress and program success can be measured. It also enables the water management team to set achievable goals and identify and prioritize specific projects based on the relative savings opportunities and project cost-effectiveness.

Water conservation devices may significantly reduce your water and sewer usage costs. Any reduction in water use reduces grid-level electricity use since a significant amount of electricity is used to treat and deliver water from reservoirs to end users.

For more information regarding water conservation or additional details regarding the practices shown below go to the EPA's WaterSense website[9] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[10] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Water Metering and Submetering

Tracking a facility's total water use, as well as specific end uses, is a key component of a facility's water-efficiency efforts. Accurately measuring water use can help facility managers identify areas for targeted reductions and track progress from water-efficiency upgrades. If possible, install meters to measure all water conveyed to the facility, regardless of the source. Each source should be metered separately. Consider developing a metering plan and installing separate submeters to measure specific end uses. There are many types and sizes of meters intended for different uses. Installing the correct type and size of meter are critical to accurate water measurement. Sub-metering applications may include:

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[7] Estimated from analyzing data in: Solley, Wayne B,. et al, "Estimated Use of Water in the United States in 1995", U.S Geological Survey Circular 1200, (1998)

[8] https://dep.nj.gov/wp-content/uploads/dsr/trends-water-supply.pdf

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

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

- Individual tenant spaces
- Cooling tower make-up and blowdown water supply
- Water lines serving other HVAC systems including water circulating loops
- Make up water supply for steam boiler plants with a capacity of 500,000 Btu/hr. or greater
- Systems or equipment that use single pass cooling water
- Irrigation systems
- Roof spray systems (for irrigating vegetated roofs or thermal conditioning)
- Ornamental water features
- Indoor and outdoor pools and spas
- Industrial water using processes

Leak Detection and Repair

Identifying and repairing leaks and other water use anomalies within a facility's water distribution system or from processes or equipment can keep a facility from wasting significant quantities of water. Examples of common leaks include leaking toilets and faucets, drip irrigation malfunctions, stuck float valves, and broken distribution lines. Reading meters, installing failure abatement technologies, and conducting visual and auditory inspections are important best practices to detect leaks. Train building occupants, employees, and visitors to report any leaks that they detect. To reduce unnecessary water loss, detected leaks should be repaired quickly. Repairing leaks in water distribution that is pressurized by on-site pumps or in heated or chilled water piping will also reduce energy use.

Toilets and Urinals

Toilets and urinals are considered sanitary fixtures and are found in most facilities. High efficiency fixtures are at least 20% more efficient than available standard products. Leaking or damaged equipment is a substantial source of water waste. Train users to report continuously flushing, leaking, or otherwise improperly operating equipment to the appropriate personnel. Depending on the age of the equipment and the frequency of use, it may be cost effective to replace older inefficient fixtures with current generation WaterSense labeled equipment.

Commercial facilities typically use tank toilets or wall-mount flushometers. Educate and inform users with restroom signage and other means to avoid flushing inappropriate objects. For tank toilets, periodically check to ensure fill valves are working properly and that water level is set correctly. Annually test toilets to ensure the flappers are not worn or allowing water to seep from the tank into the bowl and down the sewer. Control stops and piston valves on flushometer toilets should be checked at least annually.

Most urinals use water to flush liquid. These standard single-user fixtures are present in most facilities. Non-water urinals use a specially designed trap that allows liquid waste to drain out of the fixture through a trap seal, and into the drainage system. Flushing urinals should be inspected at least annually for proper valve and sensor operation. For non-water urinals, follow maintenance practices as directed by the manufacturer to ensure products perform as expected. Non-water urinals can be considered during urinal replacement, however, review the condition and design of the existing plumbing system and the expected usage patterns to ensure that these products will provide the anticipated performance.

Faucets and Showerheads

Faucets and showerheads are sanitary fixtures that generally dispense heated water. Reducing water use by these fixtures translates into a reduction of site fuel or electric use depending on how water is heated. High efficiency fixtures are at least 20% more efficient than available standard products. Leaking or damaged equipment is a substantial source of water waste. Train users to report continuously dripping, leaking, or otherwise improperly operating equipment to the appropriate personnel. Depending on the age of the equipment and the frequency of use, it may be cost effective to replace older fixtures with current generation WaterSense labeled equipment.

Faucets are used for a variety of purposes, and standard flow rates are dictated by the intended use. Public use lavatory faucets and kitchen faucets are subject to maximum flow rates while service sinks are not. Periodically inspect faucet aerators for scale buildup to ensure flow is not being restricted. Clean or replace the aerator or other spout end device as needed. Check and adjust automatic sensors (where installed) to ensure they are operating properly to avoid faucets running longer than necessary. Post materials in restrooms and kitchens to ensure user awareness of the facility’s water-efficiency goals. Remind users to turn off the tap when they are done and to consider turning the tap off during sanitation activities when it is not being used. Consider installing lavatory and kitchen faucet fixtures with reduced flow. Federal standards limit kitchen and restroom faucet flows to 2.2 gpm. To qualify for a WaterSense label a faucet cannot exceed 1.5 gpm.

Effective in 1992, the maximum allowable flow rate for all showerheads sold in the United States is 2.5 gpm. Since this standard was enacted, many showerheads have been designed to use even less water. WaterSense labeled equipment is designed to use 2.0 gpm, or less. For optimum showerhead efficiency, the system pressure should be tested to make sure that it is between 20 and 80 pounds per square inch (psi). Verify that plumbing lines are routed through a shower valve to prevent water pressure fluctuations. Periodically inspect showerheads for scale buildup to ensure flow is not being restricted. In general, replace showerheads with 2.5 gpm flow rates or higher with WaterSense labeled models. Note: Use of poor performing replacement reduced flow showerheads may result in increased use if the duration of use is increased to compensate for reduced performance. WaterSense labeled showerheads are independently certified to meet or exceed minimum performance requirements for spray coverage and force.

Steam Boiler System

Typically, boilers that produce hot water are closed loop systems and do not have significant water losses as long as there are no leaks in the boiler or distribution piping. Therefore, this section focuses on boilers that produce steam. Steam is typically used for space heating, indirectly to heat domestic water and for process heating.

As steam is distributed, its heat is transferred to the process or the ambient environment and, as a result, the steam condenses to water. This condensate is then either discharged to the sewer or captured and returned to the boiler for reuse.

As water is converted to steam within the boiler, dissolved solids, such as calcium, magnesium, chloride, and silica, are left behind. With evaporation, the total dissolved solids (TDS) concentration increases. If the concentration gets too high, the TDS can cause scale to form within the system or can lead to corrosion. The concentration of TDS is controlled by removing (i.e., blowing down) a portion of the water that has a high concentration of TDS and replacing that water with make-up water, which has a lower concentration of TDS. Some boiler operators practice continuous blowdown by leaving the blowdown valve partially open, requiring a continuous feed of make-up water.

Proper control of boiler blowdown water is critical to ensure efficient boiler operation and minimize make-up water use. Insufficient blowdown can lead to scaling and corrosion, while excessive blowdown wastes water, energy, and chemicals. The optimum blowdown rate is influenced by several factors, including boiler type, operating pressure, water treatment, and quality of make-up water. Generally, blowdown rates range from 4% to 8% of the make-up water flow rate, although they can be as high as 10% if the make-up water is poor quality with high concentrations of solids.

Blowdown is typically assessed and controlled by measuring the conductivity of the boiler make-up water compared to that in the boiler blowdown water. Conductivity provides an indication of the overall TDS concentration in the boiler. The blowdown percentage can be calculated as indicated below. The boiler water quality is often expressed in terms of cycles of concentration, which is the inverse of the blowdown percentage. See figure below.

Blowdown Percentage = Make-up Water Conductivity / Blowdown Conductivity

Blowdown Percentage

Controlling the blowdown percentage and maximizing the cycles of concentration will reduce make-up water use; however, this can only be done within the constraints of the make-up and boiler water chemistry. As the TDS concentration in the blowdown water increases, scaling and corrosion problems can occur, unless carefully controlled.

For optimum steam boiler water efficiency, there are several operations, maintenance, and user education strategies to consider.

- Check steam, hot water, and condensate lines for leaks regularly and make repairs promptly.
- Regularly clean and inspect boiler water and fire tubes.
- Develop and implement an annual boiler tune-up program.
- Provide proper insulation on piping and the central storage tank to conserve heat.
- Implement a steam trap inspection program for boiler systems with condensate recovery. Repair leaking traps as soon as possible.
- Choose a water treatment vendor that will work with you to minimize water use, chemical use, and cost, while maintaining appropriate water chemistry for efficient scale and corrosion control.
- Have the water treatment vendor produce a report every time they evaluate the water chemistry in the boiler. Review the reports to ensure that characteristics, such as conductivity and cycles of concentration, are within the target range.
- To minimize blowdown, calculate and understand the boiler's cycles of concentration.
- Consider pre-treating boiler make-up water to remove impurities, which can increase the cycles of concentration the boiler can achieve.

There are also retrofits to consider if the steam system is not already equipped with these items.

- Install and maintain a condensate recovery system to return condensate to the boiler for reuse. If there already is a condensate recovery system inspect and maintain it regularly to maintain the maximum level of condensate return possible. Maximizing condensate return to the boiler is the most effective way to reduce water use. Recovering condensate:
  - Reduces the amount of make-up water required,
  - Reduces the frequency of blowdown,
  - Reduces boiler fuel use since the temperature of the condensate is considerably higher than the temperature of the make-up water.
- Where condensate cannot be returned to the boiler and must be discharged to the sanitary sewer, consider one of the following options:
  - Installing a heat exchanger to recover heat from the condensate to preheat the make-up water,
  - Install an expansion tank to temper hot condensate rather than adding water to cool it.

- Install an automatic blowdown control system, particularly on boilers that are more than 200 horsepower (6,700 kBtu/hr.), to control the amount and frequency of blowdown rather than relying on continuous blowdown. Control systems with a conductivity controller will initiate blowdown only when the TDS concentrations in the boiler have built up to a specified concentration.
- Install flow meters on the make-up water line and the condensate return line to monitor the amount of make-up water added to the boiler.
- Install automated chemical feed systems to monitor conductivity, control blowdown, and add chemicals based on make-up water flow. These systems minimize water and chemical use while protecting against scale buildup and corrosion.

7 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.

7.1 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.

An additional study for solar photovoltaic for the Woodbine Development Center is provided below.

Executive Summary

This section summarizes projected energy and cost impacts, as well as design considerations, for a proposed 4.8 MW-DC solar photovoltaic (PV) system and 500 kWh battery energy storage system (BESS) for Woodbine Developmental Center located at 1175 Dehirsch Ave, Woodbine, NJ 08270. Please note this is a feasibility stage study, and all cost/savings values are solely estimates and not for design level application.

Two pieces of equipment contribute to the system:

- 4.8 MW Solar PV System: Three solar configuration proposals have been developed and analyzed by TRC as part of this additional scope work.
    - Option 1: Railroad Field Ground Mount PV
    - Option 2: Tower Field Ground Mount PV
    - Option 3: Dispersed Rooftop, Carport, and Ground Mount

All three proposed configurations are expected to generate a total energy output of about 6,760,000 kWh, accounting for 100% of the site's total electricity consumption for the year 2022-2023. The PV systems are sized to achieve Net Zero Energy.

- 500 kWh BESS: The sizing of the battery has been optimized to ensure that the projected annual cost savings remain within a positive range for the battery installation project. Please take note that the site's highest electricity demand for month of August 2022 is approximately 2,013 kW. Opting for a larger battery to sustain the entire electric load of the facilities during a power outage is not a financially viable solution.

Among the three solar design options, the most suitable choice for the site, according to TRC's evaluation, is to install a 4.8 MW capacity Ground Mount Solar PV System at the Tower Field (i.e., Option 2) along with a 500 MW battery system.

PV System Location Options

Three PV array layouts have been developed for the campus. Each produces approximately the same amount of electricity annually. The project costs vary due to differences in the number of panels used and installation costs.

Option 1: Railroad Field Ground Mount PV

The Railroad Field option utilizes entirely ground mounted solar panels. This location is the closest to the main meter for the campus (red dot in image below), limiting trenching costs. However, it requires trenching under a public road (County Route 550), a private road (Dehirsch Ave), and the Woodbine Railroad Trail, which may lead to increase project complexity due permitting for work in an area containing underground public utilities.

Solar PV Layout Figure Option 1: Railroad Field – HelioScope Design

Option 2: Tower Field Ground Mount PV

Like the Railroad Field option, the Tower Field option is also entirely ground mount. It also uses the same number of panels as the Railroad Field. The Tower field is on the same side of country route 550 as the campus's main meter, so wires would not need to be run under a public road. However, the Tower field is more than twice as far from the main meter than the Railroad field, increasing trenching costs.

Solar PV Layout Figure Option 2: Tower Field – HelioScope Design

Option 3: Dispersed Rooftop, Carport, and Ground Mount PV

This option proposes utilizing roof top space on two of the campus's larger buildings along with installing carport solar structures over many of the campus's parking lots as well as some ground mount solar. Carport and rooftop solar can be cheaper to install and more energy efficient than ground mount solar. This will significantly contribute to project complexity and trenching costs.

Solar PV Layout Figure Option 3: Dispersed Rooftop, Carport, and Ground Mount – HelioScope Design

The red on the image is by the main meter. Please note that, specifically for option 3 where PV design options ground-mounted, carport, and roof-mounted solar panel arrays are anticipated to be spread across the facility. Following standard design protocols, these arrays should be connected to the nearest utility meter. The power generated by each solar array connected to a specific meter must not exceed the amount consumed or delivered to prevent surplus energy from being fed back into the grid. To achieve this, a thorough evaluation of individual meter locations and capacities is necessary. However, it's important to note that these specific details are not addressed in this study.

Below is a table summarizing the project costs of the different solar options with battery system.

Equipment	Estimated Max Demand Savings (kW)	Estimated Annual Energy Generation (kWh)	Estimated Annual GHG Reduction ($MT\text{-}CO_2e$)	Estimated Annual Cost Savings ($)	Estimated G12ross Project Cost ($)	Total Incentives ($)	Net Project Cost ($)	Simple Payback Period[11] (yr.)
Option1 Solar w/ Battery	-1,625	6,692,467	1,332	$691,866	$26,241,000	$14,432,550	$11,808,450	17.1
Option2 Solar w/ Battery	-1625	6,692,467	1,332	$685,363	$26,341,000	$14,487,550	$11,853,450	17.1
Option 3 Solar w/ Battery	-1625	6,681,790	1,330	$695,691	$25,568,000	$14,062,400	$11,505,600	16.5

Rebates and Incentives

Equipment	Estimated Gross Project Cost ($)	ITC Rebate (1)	MACRS Rebate (2)	Net Project Cost
500 kWh Battery	$598,206	$179,462	$149,552	$269,193
Option 1: Solar w/ Battery	$26,241,000	$7,872,300	$6,560,250	$11,808,450
Option 2: Solar w/ Battery	$26,341,000	$7,902,300	$6,585,250	$11,853,450
Option3: Solar w/ Battery	$25,568,000	$7,670,400	$6,392,000	$11,505,600

Incentive Summary Table

Multiple incentives are available to reduce the project cost.

1. Federal Income Tax Credit (ITC): As of the passage of the 2022 Inflation Reduction Act, the ITC refund can be claimed by non-taxable entities as a cash rebate. The ITC is equal to 30% of the system cost and is scheduled to persist until 2033.

2. Modified Accelerated Cost Recovery System (MACRS): As of the passage of the 2022 Inflation Reduction Act, the MACRS refund can be claimed by non-taxable entities as a cash rebate. This rebate allows 85% of the system cost to be claimed as equipment depreciation at Year 1, approximately equivalent to 25% of the system cost.

Ownership Models

This report explores two ownership models: Cash Purchase and Power Purchase Agreement (PPA).

- Cash Purchase: In this case, the entire system is purchased upfront by the customer.
- Standard Power Purchase Agreement: In this scenario, a third party installs and owns the system, and sells electricity to the customer at a reduced rate. Calculations assume the owner charges a 3% interest rate on the system. In the table below, the interest rate is factored in as an offset to the "Annual Savings ($)." Return on Investment (ROI) is null because there is no cost to the customer.

[11] Simple payback is computed as the "Net Project Cost" divided by the "Estimated Annual Cost Savings".

Ownership Plan	Upfront Gross Project Cost ($)	Year 1 Cost After Rebates ($)	Annual Savings ($)	Lifetime 30-Year Cost Savings ($)	30-Year ROI
Option 1: Railroad Field					
Cash Purchase	$26,241,000	$11,808,450	$691,866	$20,755,995	176%
PPA	$0	$0	$89,408	$2,682,244	-
Option 2: Tower Field					
Cash Purchase	$26,341,000	$11,853,450	$691,363	$20,740,875	175%
PPA	$0	$0	$86,608	$2,598,248	-
Option 3: Dispersed Rooftop, Carport, and Ground Mount					
Cash Purchase	$25,568,000	$11,505,600	$695,691	$20,870,726	181%
PPA	$0	$0	$108,684	$3,260,510	-

Ownership Model Table

Analysis clearly shows that opting for a cash purchase is more advantageous than choosing a Power Purchase Agreement (PPA). This conclusion is based on the consideration of existing available incentives (i.e., ITC & MACRS) and relatively higher interest rates.

PV System Sizing

TRC modeled the proposed solar PV system using HelioScope, a meteorologically and location-dependent solar resource, to estimate its available size and component quantities. The software accounts for building shading, tree shading, panel angles, and appropriate spacing. The PV system has sized to achieve Net Zero Energy.

Project Coordination

As per TRC's cost analysis, some of the cost associated with installing the battery system (i.e., trenching, wiring and site preparation) can be shared with PV installation work. The cost estimate assumes the projects will be implemented concurrently.

Energy Generation and Management

A HelioScope model was developed to establish approximate PV system sizing. The output was entered into Energy Toolbase® (ETB), a TOU BESS and utility cost analysis tool that compares the generation profile vs the building's monthly consumption data. Because the site's energy generation rate structure and energy delivery rate structure are provided by different firms, ETB's estimate of baseline utility cost varied from available billing data by 5%, potentially due to rate schedule changes. ETB outputs were supplemented with worksheet calculations to true up the difference.

Cost savings were finalized by applying an 0.5% annual maintenance cost penalty to the solar PV system, and an 0.25% annual maintenance cost penalty to the BESS. The ETB analysis was used to simulate BESS operation throughout the year and to calculate utility cost savings with hourly utility rate sensitivity.

Project Cost

Project cost estimates were calculated using RS Means 2022 Construction Cost Catalogue, along with vendor quotes and guidelines available from the modeling software. Costs include contingencies and markups for all potential project tasks, including design, permitting, taxes, and a 30% contingency for infrastructure upgrades. A line-by-line breakdown of the costs considered is provided in Appendix C.

At a high level, average system costs are $5.32/Watt solar PV, and $1,200/kWh BESS, based on the gross project cost. Please note that while detailed, cost estimates are still at the feasibility stage. Costs may vary by 30% relative to engineering assessments of the electrical and structural infrastructure.

Project Recommendations

Among the three solar design options, the most suitable choice for the site, according to TRC's evaluation, is to install a 4.8 MW capacity Solar PV System at the Tower Field Ground Mount PV (Option 2) along with a 500 MW battery system. Option 1 involves routing wires beneath a public road and railroad, while Option 3's dispersed layout presents significant challenges for implementation and maintenance, rendering them non-viable options.

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available for solar projects. Solar projects may qualify to earn SREC- IIs (Solar Renewable Energy Certificates-II), however, the project owners *must* register their solar projects prior to the start of construction to establish the project's eligibility.

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:

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

7.2 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.

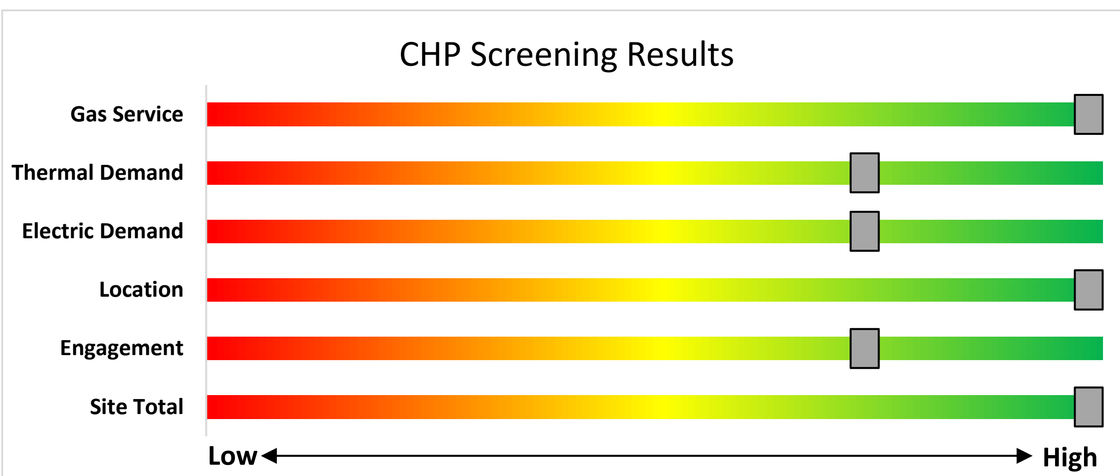
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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

The magnitude, type, and duration of the thermal demand, the coincident electric load, and the ease of interconnection contribute to the potential for CHP at the site. Based on the amount of steam used throughout the year and the concurrent electric demand a Recip Engine may be feasible. If you are interested in pursuing CHP, we recommend performing a detailed feasibility study, which will provide a thorough understanding of the costs and savings associated with this technology.

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.



Potential	High	
System Type	Recip Engine	
System Potential	260	kW
Electric Generation	2,120,560	kWh/yr
Thermal Generation	10,521,240	MBtu/yr
Displaced Cost	$187,243	/yr
Installed Cost	$1,304,000	

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/

8 ELECTRIC VEHICLES

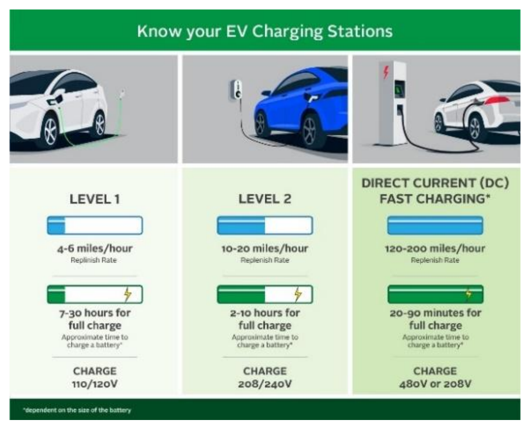
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes all-electric vehicles as zero-emission vehicles because they produce no direct exhaust or tailpipe emissions.

EVs are typically more expensive than similar conventional and hybrid vehicles, although some cost can be recovered through fuel savings, federal tax credit, or state incentives

8.1 EV Charging

EV charging stations provide a means for electric vehicle operators to recharge their batteries at a facility. While many EV drivers charge at home, others do not have access to regular home charging, and the ability to charge at work or in public locations is critical to making EVs practical for more drivers. Charging can also be used for electric fleet vehicles, which can reduce fuel and maintenance costs for fleets that replace gas or diesel vehicles with EVs.

EV charging comes in three main types. For this assessment, the screening considers addition of Level 2 charging, which is most common at workplaces and other public locations. Depending on the site type and usage, other levels of charging power may be more appropriate.



The preliminary assessment of EV charging at the facility shows that there is medium potential for adding EV chargers to the facility's parking, based on potential costs of installation and other site factors.

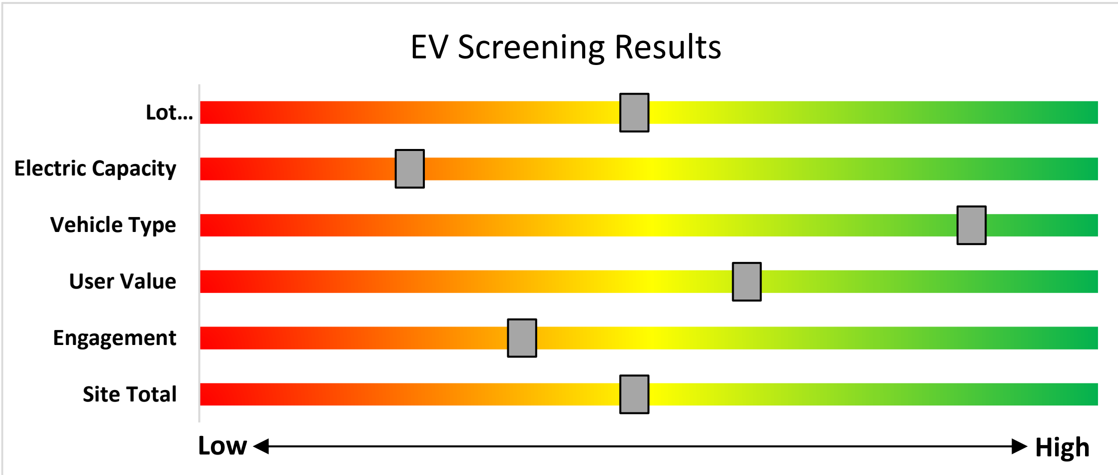
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

The type and size of the parking area impact the costs and feasibility of adding EV charging. Parking structure installations can be less costly than surface lot installations as power may be readily available, and equipment and wiring can be surface mounted. Parking lot installations often require trenching through concrete or asphalt surface. Large parking areas provide greater flexibility in charger siting than smaller lots.

The location and capacity of facility electric panels also impact charger installation costs. A Level 2 charger generally requires a dedicated 208-240V, 40 Amp circuit. The electric panel nearest the planned installation may not have available capacity and may need to be upgraded to serve new EV charging loads. Alternatively, chargers could be powered from a more distant panel. The distance from the panel to the location of charging stations ties directly to costs, as conduits, cables, and potential trenching costs all increase on a per-foot basis. The more charging stations planned, the more likely it is that additional electrical capacity will be needed.

Other factors to consider when planning for EV charging at a facility include who the intended users are, how long they park vehicles at the site, and whether they will need to pay for the electricity they use. Adding EV charging may have a negative financial impact due to increased electric demand charges.

The graphic below displays the results of the EV charging assessment conducted as part of this audit. The position of each slider indicates the impact each factor has on the feasibility of installing EV charging at the site.



EV Charger Screening

Electric Vehicle Programs Available

New Jersey is leading the way on electric vehicle (EV) adoption on the East Coast. There are several programs designed to encourage EV adoption in New Jersey, which is crucial to reaching a 100% clean energy future.

NJCEP offers a variety of EV programs for vehicles, charging stations, and fleets. Certain EV charging stations that receive electric utility service from Atlantic City Electric Company (ACE), Public Service Electric and Gas Company (PSE&G) or Jersey Central Power and Light (JCP&L), may be eligible for additional electric vehicle charging incentives directly from the utility. Projects may be eligible for both the incentives offered by this BPU program and incentives offered by ACE, PSE&G or JCP&L, up to 90% of the combined charger purchase and installation costs. Please check ACE, PSE&G or JCP&L program eligibility requirements before purchasing EV charging equipment, as additional conditions on types of eligible chargers may apply for utility incentives.

EV Charging incentive information is available from Atlantic City Electric, PSE&G and JCP&L.For more information and to keep up to date on all EV programs please visit https://www.njcleanenergy.com/commercial-industrial/programs/electric-vehicle-programs

9 PROJECT FUNDING AND INCENTIVES

Ready to improve your building's performance? New Jersey's Clean Energy Programs and Utility Energy Efficiency Programs can help. Pick the program that works best for you. This section provides an overview of currently available incentive programs in New Jersey.

NJBPU and NJCEP Administered Programs

- New Construction (residential, commercial, industrial, government)
- Large Energy Users
- Energy Savings Improvement Program (financing)
- State Facilities Initiative*
- Local Government Energy Audits
- Combined Heat & Power & Fuel Cells

*State facilities are also eligible for utility programs

Utility Administered Programs

- Existing buildings (residential, commercial, industrial, government)
- Efficient Products
  - Lighting & Marketplace
  - HVAC
  - Appliance Rebates
  - Appliance Recycling

9.1 New Jersey's Clean Energy Program

Save money while saving the planet! New Jersey's Clean Energy Program is a statewide program that offers incentives, programs, and services that benefit New Jersey residents, businesses, educational, non-profit, and government entities to help them save energy, money, and the environment.

Large Energy Users

The Large Energy Users Program (LEUP) is designed to foster self-directed investment in energy projects. This program is offered to New Jersey's largest energy customers. To qualify entities must have incurred at least $5 million in total energy costs in the prior fiscal year.

Incentives

Incentives are based on the specifications below. The maximum incentive per entity is the lesser of:

- $4 million
- 75% of the total project(s) cost
- 90% of total NJCEP fund contribution in previous year
- $0.33 per projected kWh saved; $3.75 per projected Therm saved annually

How to Participate

To participate in LEUP, you will first need submit an enrollment application. This program requires all qualified and approved applicants to submit an energy plan that outlines the proposed energy efficiency work for review and approval. Applicants may submit a Draft Energy Efficiency Plan (DEEP), or a Final Energy Efficiency Plan (FEEP). Once the FEEP is approved, the proposed work can begin.

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

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[12]

<table>
<tr><th>Eligible Technology</th><th>Size (Installed Rated Capacity)</th><th>Incentive ($/Watt)[5]</th><th>% of Total Cost Cap per Project</th><th>$ Cap per Project</th></tr>
<tr><td rowspan="4">CHPs powered by non-renewable or renewable fuel source, or a combination:[4]
- Gas Internal Combustion Engine
- Gas Combustion Turbine
- Microturbine
Fuel Cells ≥60%</td><td>≤500 kW[1]</td><td>$2.00</td><td rowspan="2">30-40%[2]</td><td rowspan="2">$2 million</td></tr>
<tr><td>>500 kW - 1 MW[1]</td><td>$1.00</td></tr>
<tr><td>> 1 MW - 3 MW[1]</td><td>$0.55</td><td rowspan="2">30%</td><td rowspan="2">$3 million</td></tr>
<tr><td>>3 MW[1]</td><td>$0.35</td></tr>
<tr><td>Fuel Cells ≥40%</td><td>Same as above[1]</td><td>Applicable amount above</td><td>30%</td><td>$1 million</td></tr>
<tr><td rowspan="2">Waste Heat to Power (WHP)[3]
Powered by non-renewable fuel source.
Heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine)</td><td>≤1MW[1]</td><td>$1.00</td><td>30%</td><td>$2 million</td></tr>
<tr><td>> 1MW[1]</td><td>$.50</td><td>30%</td><td>$3 million</td></tr>
</table>

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[1] Incentives are tiered, which means the incentive levels vary based upon the installed rated capacity, as listed in the chart above. For example, a 4 MW CHP system would receive $2.00/watt for the first 500 kW, $1.00/watt for the second 500 kW, $0.55/watt for the next 2 MW and $0.35/watt for the last 1 MW (up to the caps listed).

[2] The maximum incentive will be limited to 30% of total project. For CHP projects up to 1 MW, this cap will be increased to 40% where a cooling application is used or included with the CHP system (e.g. absorption chiller).

[3] Projects will be eligible for incentives shown above, not to exceed the lesser of % of total project cost per project cap or maximum $ per project cap. Projects installing CHP or FC with WHP will be eligible for incentive shown above, not to exceed the lesser caps of the CHP or FC incentive. Minimum efficiency will be calculated based on annual total electricity generated, utilized waste heat at the host site (i.e. not lost/rejected), and energy input.

[4] Systems fueled by a Class 1 Renewable Fuel Source, as defined by N.J.A.C. 14:8-2.5, are eligible for a 30% incentive bonus. If the fuel is mixed, the bonus will be prorated accordingly. For example, if the mix is 60/40 (60% being a Class 1 renewable), the bonus will be 18%. This bonus will be included in the final performance incentive payment, based on system performance and fuel mix consumption data. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

[5] CHP-FC systems located at Critical Facility and incorporating blackstart and islanding technology are eligible for a 25% incentive bonus. This bonus incentive will be paid with the second/Installation incentive payment. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

How to Participate

You will 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 http://www.njcleanenergy.com/CHP.

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The program is used to register and certify 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 SREC-IIs (Solar Renewable Energy Certificates-II). SuSI consists of two sub-programs. The Administratively Determined Incentive (ADI) Program and the Competitive Solar Incentive (CSI) Program.

Administratively Determined Incentive (ADI) Program

The ADI Program provides administratively set incentives for net metered residential projects, net metered non-residential projects 5 MW or less, and all community solar projects.

After the registration is accepted, construction is complete, and a complete final as-built packet has been submitted, the project is issued a New Jersey certification number, which enables it to generate New Jersey SREC- IIs.

Market Segments	Size MW dc	Incentive Value ($/SREC II)	Public Entities Incentive Value - $20 Adder ($/SRECII)
Net Metered Residential	All types and sizes	$90	N/A
Small Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects smaller than 1 MW	$100	$120
Large Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects 1 MW to 5 MW	$90	$110
Small Net Metered Non-Residential Ground Mount	Projects smaller than 1 MW	$85	$105
Large Net Metered Non-Residential Ground Mount	Projects 1 MW to 5 MW	$80	$100
LMI Community Solar	Up to 5 MW	$90	N/A
Non-LMI Community Solar	Up to 5 MW	$70	N/A
Interim Subsection (t)	All types and sizes	$100	N/A

Eligible projects may generate SREC-IIs for 15 years following the commencement of commercial operations which is defined as permission to operate (PTO) from the Electric Distribution Company. After 15 years, projects may be eligible for a NJ Class I REC.

SREC-IIs will be purchased monthly by the SREC-II Program Administrator who will allocate the SREC-IIs 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.

The ADI Program online portal is now open to new registrations.

Competitive Solar Incentive (CSI) Program

The CSI Program opened on April 15, 2023, and will serve as the permanent program within the SuSI Program providing incentives to larger solar facilities. The CSI Program is open to qualifying grid supply solar facilities, non-residential net metered solar installations with a capacity greater than five (5) megawatts ("MW"), and to eligible grid supply solar facilities installed in combination with energy storage.

CSI eligible facilities will only be allowed to register in the CSI program upon award of a bid pursuant to N.J.A.C. 14:8-11.10.

The CSI program structure has separate categories, or tranches, to ensure that a range of solar project types, including those on preferred sites, are able to participate despite potentially different project cost profiles. The Board has approved four tranches for grid supply and large net metered solar and an additional fifth tranche for storage in combination with grid supply solar. The following table lists procurement targets for the first solicitation:

Tranche	Project Type	MW (dc) Targets
Tranche 1.	Basic Grid Supply	140
Tranche 2.	Grid Supply on the Built Environment	80
Tranche 3.	Grid Supply on Contaminated Sites and Landfills	40
Tranche 4.	Net Metered Non- Residential	40
Tranche 5.	*Storage Paired with Grid	160 MWh

*The storage tranche of 160 MWh corresponds to a 4-hour storage pairing of 40 MW of solar

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan.

If you are considering installing solar on your building, visit the following link for more information: https://njcleanenergy.com/renewable-energy/programs/susi-program

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 contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the energy conservation measures (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 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.

Demand Response (DR) Energy Aggregator

Demand Response Energy Aggregator is a program designed to reduce the electric load when electric wholesale prices are high or when the reliability of the electric grid is threatened due to peak demand. Grid operators call upon curtailment service providers and commercial facilities to reduce electric usage during times of peak demand, making the grid more reliable and reducing transmission costs for all ratepayers. Curtailment service providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary, and participants receive payments whether or not their facility is called upon to curtail its electric usage.

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

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

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

The first step toward participation in a DR program is to contact a curtailment service provider. A list of these providers is available on the website of the independent system operator, PJM, and it includes contact information for each company, as well as the states where they have active business[13]. PJM also posts training materials for program members interested in specific rules and requirements regarding DR activity along with a variety of other DR program information[14].

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

[13] http://www.pjm.com/markets-and-operations/demand-response.aspx.

[14] http://www.pjm.com/training/training-events.aspx.

9.2 Utility Energy Efficiency Programs

The Clean Energy Act, signed into law by Governor Murphy in 2018, requires New Jersey's investor-owned gas and electric utilities to reduce their customers' use by set percentages over time. To help reach these targets the New Jersey Board of Public Utilities approved a comprehensive suite of energy efficiency programs to be run by the utility companies.

Prescriptive and Custom

The Prescriptive and Custom rebate program through your utility provider 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.

Equipment Examples

Lighting
Lighting Controls
HVAC Equipment
Refrigeration
Gas Heating
Gas Cooling
Commercial Kitchen Equipment
Food Service Equipment
Variable Frequency Drives
Electronically Commutate Motors
Variable Frequency Drives
Plug Loads Controls
Washers and Dryers
Agricultural
Water Heating

The Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type. The Custom program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives.

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 or less 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.

Incentives

The program pays up to 70% of the total installed cost of eligible measures.

How to Participate

To participate in Direct Install, you will work with a participating contractor. The contractor will be paid the measure incentives directly by the program, which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the Direct Install program, subject to program rules and eligibility, while the remaining percent of the cost is paid to the contractor by the customer.

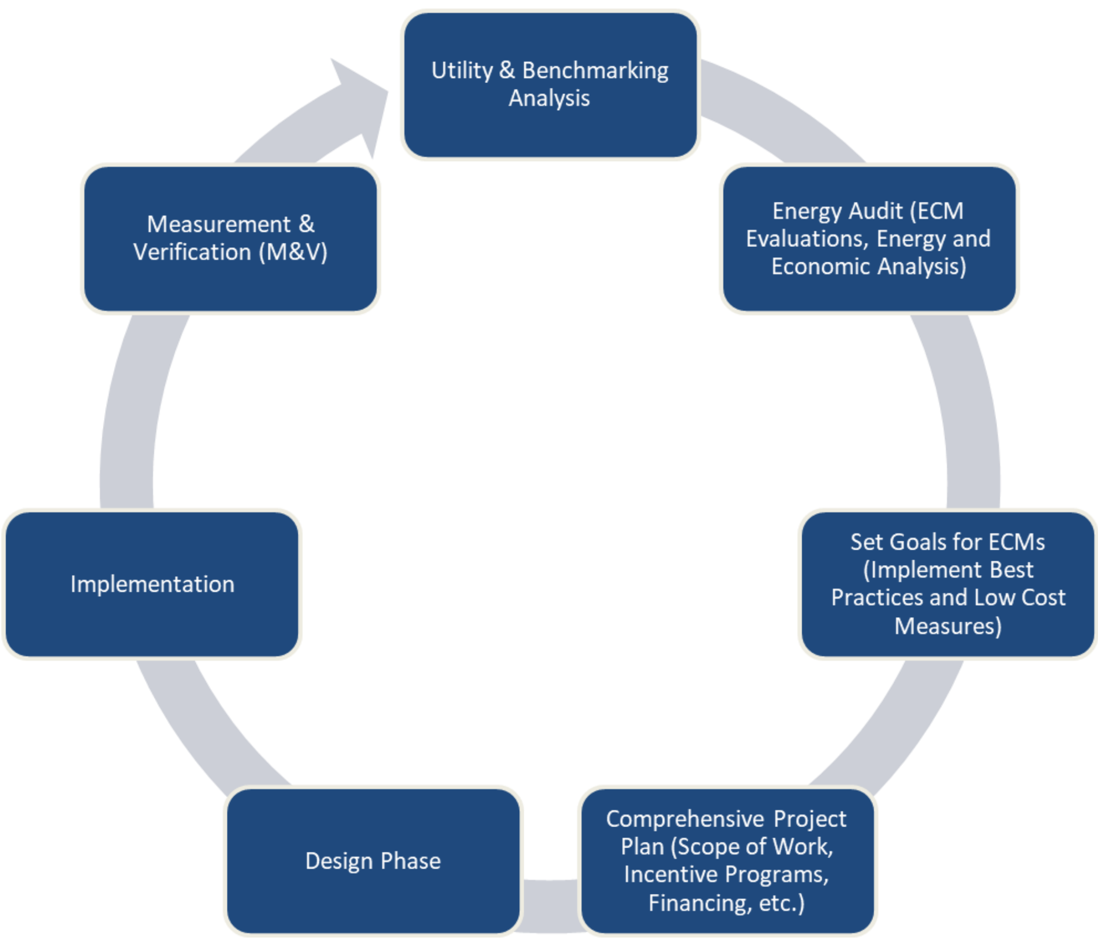
Engineered Solutions

The Engineered Solutions Program provides tailored energy-efficiency assistance and services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. Customers receive expert guided services, including investment-grade energy auditing, engineering design, installation assistance, construction administration, commissioning, and measurement and verification (M&V) services to support the implementation of cost-effective and comprehensive efficiency projects. Engineered Solutions is generally a good option for medium to large sized facilities with a peak demand over 200 kW looking to implement as many measures as possible under a single project to achieve deep energy savings. Engineered Solutions 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. Incentives for this program are based on project scope and energy savings achieved.

For more information on any of these programs, contact your local utility provider or visit https://www.njcleanenergy.com/transition.

10 Project Development

Energy conservation measures (ECMs) have been identified for your site, and their energy and economic analyses are provided within this LGEA report. Note that some of the identified projects may be mutually exclusive, such as replacing equipment versus upgrading motors or controls. 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 that includes the review of multiple bids for project work, incorporates potential operations and maintenance (O&M) cost savings, and maximizes your incentive potential.



Project Development Cycle

11 Energy Purchasing and Procurement Strategies

11.1 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. 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[15].

11.2 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 fluctuate monthly. The utility provides basic gas supply service 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[16].

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

[16] 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
Exterior 1	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell		15	4,380		None	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	15	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 1	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell		75	4,380		None	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	75	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 1	5	Metal Halide: (1) 200W Lamp	Photocell		232	4,380	1	Fixture Replacement	No	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	60	4,380	0.0	3,767	0	$568	$2,650	$250	4.2
Mechanical 1	3	LED - Fixtures: Ceiling Mount	Wall Switch	S	75	4,380		None	No	3	LED - Fixtures: Ceiling Mount	Wall Switch	75	4,380	0.0	0	0	$0	$0	$0	0.0
Mechanical 1	12	LED - Fixtures: Wall Pack	Wall Switch	S	75	4,380		None	No	12	LED - Fixtures: Wall Pack	Wall Switch	75	4,380	0.0	0	0	$0	$0	$0	0.0
Mechanical 1	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	4,380	2, 3	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	3,022	0.6	2,975	-1	$441	$1,460	$250	2.7
Restroom - Unisex 1	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,080		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	2,080	0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex 1	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.1	267	0	$40	$300	$50	6.3

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
Mechanical 1	Air Compressor	1	Air Compressor	0.50	70.0%	No	Thomas	T-617HDN	W	100		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Air Compressor	1	Air Compressor	0.50	70.0%	No	Thomas	T-617HDN	W	100		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Air Compressor	1	Air Compressor	30.00	90.0%	No	Kaeser Compressors	ASD 30	W	1,095		No	90.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Air Compressor	1	Air Compressor	2.00	86.0%	No	Nano	9693	W	100		No	86.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Air Compressor	1	Air Compressor	15.00	93.0%	No	Kaeser Compressors	SK 15	W	1,095		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Boiler Feed Water Pump	1	Boiler Feed Water Pump	20.00	88.5%	No	Baldor	07K250W372G1	W	3,900	5	No	91.0%	Yes	1	10.2	25,875	0	$3,900	$11,800	$1,300	2.7
Mechanical 1	Boiler Feed Water Pump	1	Boiler Feed Water Pump	15.00	86.5%	No	Baldor	07K251W028G1	W	3,900	5	No	91.0%	Yes	1	7.8	20,604	0	$3,106	$10,000	$1,200	2.8
Mechanical 1	Boiler Feed Water Pump	1	Boiler Feed Water Pump	7.50	91.0%	No	Baldor	07H409W280G1	W	3,900	5	No	91.0%	Yes	1	3.7	8,992	0	$1,355	$6,700	$1,000	4.2
Mechanical 1	Boiler Feed Water Pump	2	Boiler Feed Water Pump	15.00	90.2%	No	Baldor	07L548W677H2	W	3,900	5	No	91.0%	Yes	2	15.0	36,861	0	$5,556	$20,100	$2,400	3.2
Mechanical 1	Combustion Air Fan	1	Combustion Air Fan	20.00	93.0%	No	CleaverBrooks	<not visible>	W	2,590	4	No	93.0%	Yes	1	5.9	15,582	0	$2,349	$13,800	$1,300	5.3
Mechanical 1	Combustion Air Fan	1	Combustion Air Fan	50.00	94.0%	No	CleaverBrooks	<not visible>	W	2,590	4	No	94.5%	Yes	1	15.0	38,907	0	$5,865	$27,000	$3,000	4.1
Mechanical 1	Condensate Pump	2	Condensate Pump	2.00	78.5%	No	Marathon Electric	145TTDR16011A A	W	4,380		No	78.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Condensate Pump	2	Condensate Pump	1.50	80.0%	No	Century	P48N2EB7	W	4,380		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Exhaust Fan	2	Exhaust Fan	0.30	65.0%	No	<not visible>	<not visible>	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Process Pump	1	Process Pump	2.00	83.6%	No	WEG	<not visible>	W	500		No	83.6%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Process Pump	3	Process Pump	0.30	83.6%	No	Baldor	34-2140-69	W	500		No	83.6%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Process Pump	2	Process Pump	2.00	82.0%	No	WEG	00218ES3EF56C	W	500		No	82.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Process Pump	1	Process Pump	2.00	82.0%	No	WEG	<not visible>	W	500		No	82.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Combustion Air Fan	1	Combustion Air Fan	20.00	93.0%	No			W	2,590	4	No	93.0%	Yes	1	5.9	15,582	0	$2,349	$13,800	$1,300	5.3

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
Mechanical 1	Electric Resistance Heat	1	Electric Resistance Heat		40.00		1 COP	<not visible>	<not visible>	W		No							0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Unit Heater	4	Unit Heater		N/A			<not visible>	<not visible>	W		No							0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Window Air Conditioner	2	Window AC	1.00		11.00		Friedrich	<not visible>	W		No							0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex 1	Unit Heater	1	Electric Resistance Heat		40.00		1 COP	Dayton	<not visible>	W		No							0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex 1	Window Air Conditioner	1	Window AC	1.00		11.00		GE	<not visible>	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
Mechanical 1	Steam Boiler	1	Natural Draft Steam Boiler	22,861	CleaverBrooks	CBLE-200-700-150ST	W		No						0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Steam Boiler	1	Natural Draft Steam Boiler	16,000	Nebraska Boilers	CP-NB-200-D	W		No						0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Steam Boiler	1	Natural Draft Steam Boiler	16,740	CleaverBrooks	CBLE-200-500-150ST	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
Boiler Room	DHW	6	20	0.75	0.0	170	0	$26	$270	$40	9.0
Storage	Bathroom	6	10	0.75	0.0	170	0	$26	$140	$20	4.7

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 1	DHW	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White Corp.	M112UT6SS-1NAL	W		No						0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex 1	DHW	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White Corp.	MI40S6DS13	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
Mechanical 1	7	1	Faucet Aerator (Lavatory)	2.20	0.50	0.0	42	0	$6	$10	$0	1.6
Restroom - Unisex 1	7	1	Faucet Aerator (Lavatory)	2.20	0.50	0.0	42	0	$6	$10	$0	1.6
Restroom - Unisex 1	7	1	Showerhead	2.50	1.50	0.0	69	0	$10	$100	$20	7.7

Plug Load Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Mechanical 1	1	Desktop	145	No		
Mechanical 1	1	Microwave	900	No		
Mechanical 1	1	Refrigerator (Residential)	400	No		
Mechanical 1	1	Television	200	No		
Mechanical 1	1	Toaster Oven	1,000	No		
Mechanical 1	2	Water Cooler	400	No		

APPENDIX B: ENERGY STAR STATEMENT OF ENERGY PERFORMANCE

Energy use intensity (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]

DHS - Woodbine Developmental Center

Primary Property Type: Residential Care Facility
Gross Floor Area (ft²): 545,251
Built: 1921

For Year Ending: June 30, 2023
Date Generated: July 31, 2024

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
DHS - Woodbine Developmental Center (WDC Campus)
1175 DeHirsch Avenue
Woodbine, New Jersey 08270

Property Owner
State of New Jersey
428 East State Street
Trenton, NJ 08625
(609) 940-4129

Primary Contact
New Jersey Board of Public Utilities State Energy Services
44 South Clinton Ave
Trenton, NJ 08625
(609) 633-9666
BPU.EnergyServices@bpu.nj.gov

Property ID: 29308036
Unique Building Identifier (UBID): 87F765MV+86J-171-167-182-182

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
129.2 kBtu/ft²

Annual Energy by Fuel

Fuel Oil (No. 2) (kBtu)	946,252 (1%)
Natural Gas (kBtu)	52,433,294 (74%)
Propane (kBtu)	545,238 (1%)
Electric - Grid (kBtu)	16,098,148 (23%)
Other: (kBtu)	420,600 (1%)

Source EUI
187.2 kBtu/ft²

National Median Comparison

National Median Site EUI (kBtu/ft²)	74.2
National Median Source EUI (kBtu/ft²)	107.5
% Diff from National Median Source EUI	74%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	N/A

Signature & Stamp of Verifying Professional

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

LP Signature: ______________________Date: ___________

Licensed Professional

____ ________
,
(___)____-______
____

Professional Engineer or Registered Architect Stamp (if applicable)

Summary – Option 1

DER	Gross Project Cost ($)	Energy Generation (kWh)	Demand Reduction (kW)	GHG Reduction (MT CO2)	Total Annual Utility Cost Savings ($/yr)	New Maintenance Penalty ($/yr)	Net Annual Cost Savings ($/yr)	Incentives (ITC) ($)	Depreciation (MACRS) ($)	Net Project Cost ($)	Net Simple Payback (yr)
4.80 MW Solar PV	$25,641,199	6,692,467	-1625	1331.8	$814,583	$128,206	$686,377	$7,692,360	$6,410,300	$11,538,540	16.8
500 kWh Battery	$599,801	0	0	0.0	$6,989	$1,500	$5,490	$179,940	$149,950	$269,910	49.2
Total	$26,241,000	6,692,467	-1625	1331.8	$821,572	$129,705	$691,866	$7,872,300	$6,560,250	$11,808,450	17.1

PPA Alternative:	$89,408	Annual Utility Savings

Baseline kWh	6,766,998
Saved kWh	6,692,467
% NZE	99%
NZE Solar Size kW	4853

Equipment	Estimated Max Demand Savings (kW)	Estimated Annual Energy Generation (kWh)	Estimated Annual GHG Reduction ($MT\text{-}CO_2e$)	Estimated Annual Cost Savings ($)	Estimated Gross Project Cost ($)	Total Incentives ($)	Net Project Cost ($)	Simple Payback Period (yr)
4.80 MW Solar PV	-1625	6,692,467	1,332	$686,377	$25,641,199	$14,102,660	$11,538,540	16.8
500 kWh Battery	0	0	0	$5,490	$599,801	$329,890	$269,910	49.2
Total	-1625	6,692,467	1,332	$691,866	$26,241,000	$14,432,550	$11,808,450	17.1

Ownership Plan	Upfront Cost	Year 1 Cost After Rebates	Annual Savings	Lifetime 30-Year Cost Savings ($)	30-Year ROI
Cash Purchase	$26,241,000	$11,808,450	$691,866	$20,755,995	176%
PPA	$0	$0	$89,408	$2,682,244	-

Equipment	Estimated Gross Project Cost ($)	ITC Rebate	MACRS Rebate	Net Project Cost
4.80 MW Solar PV	$25,641,199	$7,692,360	$6,410,300	$11,538,540
500 kWh Battery	$599,801	$179,940	$149,950	$269,910
Total	$26,241,000	$7,872,300	$6,560,250	$11,808,450

Costing – Option 1

System Description	Quantity	Unit	Equipment Cost per Unit ($)	Labor Cost Per Unit ($)	Material Cost Per Unit ($)	Total Material Cost ($)	Total Equipment Cost ($)	Total Labor Cost ($)	Total Cost ($)	Source	Notes
Solar Array											
PV Modules (LG 400 W)	$4,800,000	Watts DC			$0.45	$2,160,000	$0.00	$0.00	$2,160,000	PV size from ETB, cost from NREL report	https://www.nrel.gov/docs/fy22osti/83586.pdf
Inverter, 33 kW	$116	Ea.		$400.40	$5,620	$651,920	$0.00	$185,785.60	$837,705.60	Inverter size from Helioscope - Cost from online quote Labor - 4 Hrs. Electrician per unit	https://sunwatts.com/33kw-sma-sunny-tripower-core1-inverter-1/
Carport and Ground Structure and Racking Cost/Labor/Installation	$4,800,000	Watts DC		$1.21	$1.00	$4,800,000	$0.00	$5,813,280	$10,613,280	Energy ToolBase	
PV String Combiner Panels	$95	Ea.		$100.10	$568.40	$53,998	$0.00	$19,019	$73,017	Online Quote Labor - 1 Hrs. Electrician per unit	https://www.solaris-shop.com/sma-cu1000-us-11-string-combiner-w-disconnect/ Each 1000V combiner box with disconnect switch can accommodate 8 strings total Project site has up to 70 strings
Electrical BOS Carport	$25,000	m^2	$0.00	$0.00	$50	$1,250,000	$0.00	$0.00	$1,250,000	assumed the same cost as the ground mounted https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Installation rental equipment carport	$25,000	m^2	$14.60	$0.00	$0	$0	$365,000	$0.00	$365,000	assumed the same cost as the ground mounted https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Battery Storage System											
Li-ion Battery + cabinet	$500	kWh		$0.00	$393	$196,500	$0.00	$0.00	$196,500	https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Battery Installation - Labor and equipment	$500	kWh		$265.00	$0.00	$0	$0.00	$132,500	$132,500	https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022 2.91 hrs. @ RS Means labor rate
Electrical BOS	$500	kWh	$0.00	$0.00	$69.16	$34,581.25	$0.00	$0.00	$34,500	https://www.nrel.gov/docs/fy22osti/83586.pdf	
Trenching/Site Prep and Wiring											
Schedule 80 PVC Piping 6" Diameter	$850	LF	$0.00	$45.24	$53	$45,050	$0.00	$38,450.98	$83,500.98	RS means - 221113742560	
Trenching and Backfill 12" wide, 36" Deep	$20	Day.	$425.00	$1,836.40	$0.00	$0.00	$8,500	$36,728	$45,228	Includes B-54 Crew - reference 312316142850	(2) Days of work (2) Laborers (1) 40 HP Chain Trencher (1) Light Equip Operator

System Description	Quantity	Unit	Equipment Cost per Unit ($)	Labor Cost Per Unit ($)	Material Cost Per Unit ($)	Total Material Cost ($)	Total Equipment Cost ($)	Total Labor Cost ($)	Total Cost ($)	Source	Notes
Soil Excavation, Removal, loading, and hauling	$500	L.C.Y	$6.78	$6.15	$0.00	$0.00	$3,390	$3,075	$6,465	Includes B-34D Crew - reference 312323204304	Includes (1) Truck Driver (1) Truck Tractor (1) Dump Trailer
Backfill and Asphalt Paving 8" Thick	$10	Day.	$3,427.86	$6,777.20	$30	$3,213	$34,278.60	$67,772	$105,263.60	Includes B-25 Crew - reference 32 11 26 13 0560	1 Day of Filling Trench and Repaving Asphalt Includes (1) Labor Foreman (7) Laborers (3) Equipment Operators (1) Asphalt Paver, 130 H.P. (1) Tandem Roller, 10 Ton (1) Roller, Pneum. Wheel, 12 Ton
<u>Other Costs</u>											
New ATS - 1200 Amp	$1	Ea.		$1,182.00	$23,339.20	$23,339.20	$0.00	$1,182	$24,521.20	RS means - 263623100070	
Permitting, inspection, and interconnection	$8	Ea.	$10,628.40				$85,027.20	$0.00	$85,027.20	https://www.nrel.gov/docs/fy22osti/83586.pdf	For construction permits fee, interconnection study fees for existing substation, testing, and commissioning For standalone systems - (Rooftop - $105/kW-DC, Ground mount - $46/kW-DC, Battery - $13.6/kWh) For PV+Storage combined - Battery PII*1.02 = $20.84/kWh*1.02
User Training	$40	Hr.		$150.00				$6,000	$6,000		
Total						**$9,222,600**	**$496,200**	**$6,307,800**	**$16,018,508.58**		

Markup	Cost
System Cost	$16,018,509
Tax (6.625%)	$610,997
O&P Cost (10%)	$1,601,851
EPC Markup (10%)	$1,601,851
Contingency (30%)	$4,805,553
2023 Inflation Markup (10%)	$1,601,851
Total Cost	$26,241,000

Battery Cost	$595,474	
Solar Cost	$25,456,238	
Electrical Upgrades, Permitting and Misc...	$189,288	
Battery Cost with Elec Upgrades	$599,801	$1,200
Solar Cost with Elec Upgrades	$25,641,199	$5.34

PPA Analysis – Option 1

	Income			Net		
Year	Cash Purchase	Standard PPA	PPA with Year 10 Buyout	Cash Purchase	Standard PPA	PPA with Year 10 Buyout
0	-$11,808,450	$0	$0	-$11,808,450	$0	$0
1	$691,866	$89,408	$89,408	-$11,116,584	$89,408	$89,408
2	$691,866	$89,408	$89,408	-$10,424,717	$178,816	$178,816
3	$691,866	$89,408	$89,408	-$9,732,851	$268,224	$268,224
4	$691,866	$89,408	$89,408	-$9,040,984	$357,632	$357,632
5	$691,866	$89,408	$89,408	-$8,349,118	$447,041	$447,041
6	$691,866	$89,408	$89,408	-$7,657,251	$536,449	$536,449
7	$691,866	$89,408	$89,408	-$6,965,385	$625,857	$625,857
8	$691,866	$89,408	$89,408	-$6,273,518	$715,265	$715,265
9	$691,866	$89,408	$89,408	-$5,581,652	$804,673	$804,673
10	$691,866	$89,408	$89,408	-$4,889,785	$894,081	$894,081
11	$691,866	$89,408	-$5,959,580	-$4,197,919	$983,489	-$5,065,499
12	$691,866	$89,408	$691,866	-$3,506,052	$1,072,897	-$4,373,632
13	$691,866	$89,408	$691,866	-$2,814,186	$1,162,306	-$3,681,766
14	$691,866	$89,408	$691,866	-$2,122,319	$1,251,714	-$2,989,899
15	$691,866	$89,408	$691,866	-$1,430,453	$1,341,122	-$2,298,033
16	$691,866	$89,408	$691,866	-$738,586	$1,430,530	-$1,606,166
17	$691,866	$89,408	$691,866	-$46,720	$1,519,938	-$914,300
18	$691,866	$89,408	$691,866	$645,147	$1,609,346	-$222,433
19	$691,866	$89,408	$691,866	$1,337,013	$1,698,754	$469,433
20	$691,866	$89,408	$691,866	$2,028,880	$1,788,162	$1,161,300
21	$691,866	$89,408	$691,866	$2,720,746	$1,877,570	$1,853,166
22	$691,866	$89,408	$691,866	$3,412,613	$1,966,979	$2,545,033
23	$691,866	$89,408	$691,866	$4,104,479	$2,056,387	$3,236,899
24	$691,866	$89,408	$691,866	$4,796,346	$2,145,795	$3,928,766
25	$691,866	$89,408	$691,866	$5,488,212	$2,235,203	$4,620,632
26	$691,866	$89,408	$691,866	$6,180,079	$2,324,611	$5,312,499
27	$691,866	$89,408	$691,866	$6,871,945	$2,414,019	$6,004,365
28	$691,866	$89,408	$691,866	$7,563,812	$2,503,427	$6,696,232
29	$691,866	$89,408	$691,866	$8,255,678	$2,592,835	$7,388,098
30	$691,866	$89,408	$691,866	$8,947,545	$2,682,244	$8,079,965

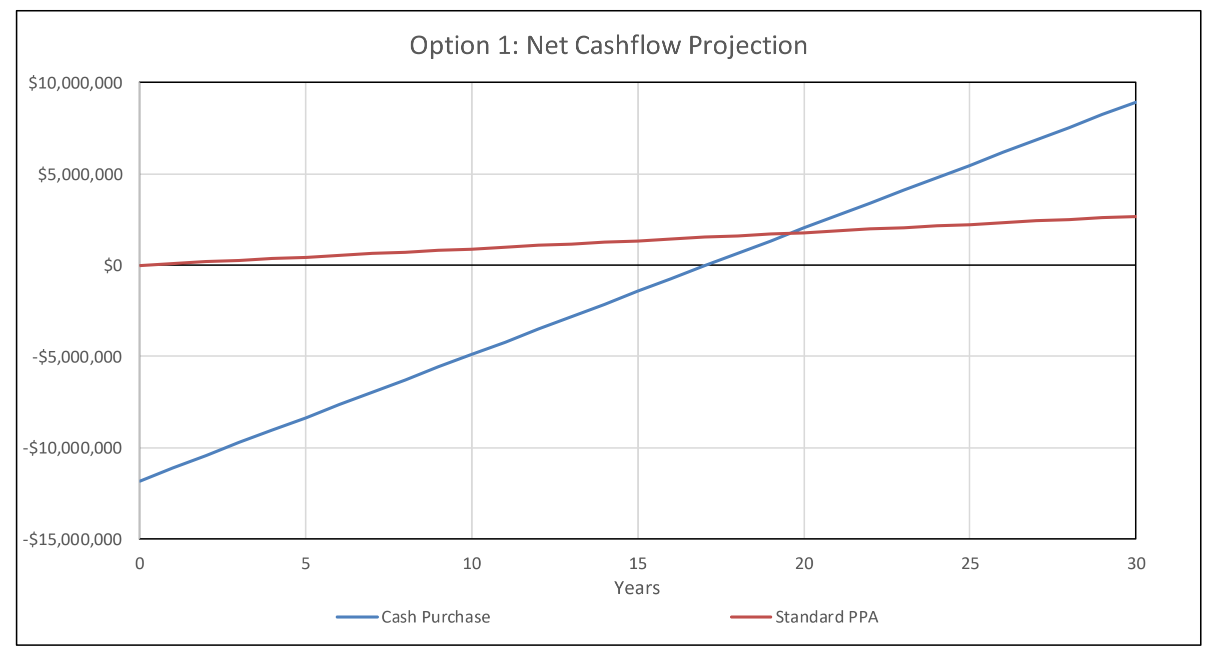
Cash Purchase	
Gross Project Cost	$26,241,000
Rebates	-$7,872,300
85% Depreciation	-$6,560,250
n/a	$0
Final Cost	$11,808,450
Utility Savings	$691,866
Payback	17.1
Financial Life (yr)	30
ROI (Over EUL)	176%

Battery Cost:	$599,801
Solar Cost:	$25,641,199

Standard PPA	
Gross Project Cost	$26,241,000
Rebates	-$7,872,300
85% Depreciation	-$6,560,250
n/a	$0
Final Cost	$11,808,450
Financial Life (yr)	30
Interest Rate	3.0%
Annual Income from Loan	$602,458
Utility Savings	$691,866
Annual Savings	$89,408

Battery Cost:	$599,801
Solar Cost:	$25,641,199

PPA with Year 10 Buyout	
Gross Project Cost	$26,241,000
Rebates	-$7,872,300
85% Depreciation	-$6,560,250
n/a	$0
Final Cost	$11,808,450
Financial Life (yr)	30
Interest Rate	3.0%
Years 1-10	
Contractor's Income	$602,458
Utility Savings	$691,866
Customer Savings	$89,408
Years 11-30	
Contractor O&P	15%
Buyout Cost	$6,651,446
Utility Savings	$691,866
Year 11-25 Payback	9.6
Lifetime Savings	$14,731,411
ROI (Over RUL)	221%



ETB Outputs – Option 1

					Raw Utility Info				-5% Cost Markup			
Bill Date Ranges			Energy Import Before PV/ESS (kWh)	Energy Export Before PV/ESS (kWh)	Charges Before PV/ESS ($)				Charges Before PV/ESS ($)			
Start Date	End Date	Season	Total	Total	Other	Energy	Demand	Total	Other	Energy	Demand	Total
1/29/2023	2/28/2023	W	480886	0	193.22	58446.88	21926.4	80566.5	$ 183.56	$ 55,524.54	$ 20,830.08	$ 76,538.18
2/28/2023	3/29/2023	W	460202	0	193.22	55932.95	22259.2	78385.37	$ 183.56	$ 53,136.30	$ 21,146.24	$ 74,466.10
3/29/2023	4/29/2023	W	490274	0	193.22	59587.9	20889.6	80670.72	$ 183.56	$ 56,608.51	$ 19,845.12	$ 76,637.18
4/29/2023	5/29/2023	W	491577	0	193.22	59746.27	21273.6	81213.09	$ 183.56	$ 56,758.96	$ 20,209.92	$ 77,152.44
5/29/2023	6/1/2023	W	47315	0	18.7	5750.67	2126.86	7896.23	$ 17.77	$ 5,463.14	$ 2,020.52	$ 7,501.42
6/1/2023	6/29/2023	S	551237	0	174.52	66997.34	19850.74	87022.6	$ 165.79	$ 63,647.47	$ 18,858.20	$ 82,671.47
6/29/2022	7/29/2022	S	790609	0	193.22	96090.62	25152	121435.84	$ 183.56	$ 91,286.09	$ 23,894.40	$ 115,364.05
7/29/2022	8/29/2022	S	786142	0	193.22	95547.7	25766.4	121507.32	$ 183.56	$ 90,770.32	$ 24,478.08	$ 115,431.95
8/29/2022	9/29/2022	S	633077	0	193.22	76944.18	23014.4	100151.8	$ 183.56	$ 73,096.97	$ 21,863.68	$ 95,144.21
9/29/2022	10/1/2022	S	34084	0	12.88	4142.57	1465.17	5620.62	$ 12.24	$ 3,935.44	$ 1,391.91	$ 5,339.59
10/1/2022	10/29/2022	W	485194	0	180.34	58970.48	20512.43	79663.24	$ 171.32	$ 56,021.96	$ 19,486.81	$ 75,680.08
10/29/2022	11/29/2022	W	497571	0	193.22	60474.78	23052.8	83720.8	$ 183.56	$ 57,451.04	$ 21,900.16	$ 79,534.76
11/29/2022	12/29/2022	W	520523	0	193.22	63264.37	23884.8	87342.39	$ 183.56	$ 60,101.15	$ 22,690.56	$ 82,975.27
12/29/2022	1/29/2023	W	498307	0	193.22	60564.23	23360	84117.45	$ 183.56	$ 57,536.02	$ 22,192.00	$ 79,911.58
Subtotal			6766998	0	2318.64	822460.94	274534.4	0	$ 2,202.71	$ 781,337.89	$260,807.68	$ -
Adjustments			0	0	0	0	0	0	$ -	$ -	$ -	$ -
Total			6766998	0	2318.64	822460.94	274534.4	1099314	$ 2,202.71	$ 781,337.89	$260,807.68	$ 1,044,348.28

Bill Date Ranges			Energy After PV & Before ESS (kWh)	Max Demand After PV & Before ESS (kW)	Charges After PV & Before ESS ($)				Charges After PV & Before ESS ($)			
Start Date	End Date	Season	Total	NC / Max	Other	Energy	Demand	Total	Other	Energy	Demand	Total
1/29/2023	2/28/2023	W	-30218	1589	193.22	-3672.7	20339.2	16859.72	$ 183.56	$ (3,489.07)	$ 19,322.24	$ 16,016.73
2/28/2023	3/29/2023	W	-160028	1407	193.22	-19449.8	18009.6	-1246.98	$ 183.56	$ (18,477.31)	$ 17,109.12	$ (1,184.63)
3/29/2023	4/29/2023	W	-169469	1298	193.22	-20597.26	16640	-3764.04	$ 183.56	$ (19,567.40)	$ 15,808.00	$ (3,575.84)
4/29/2023	5/29/2023	W	-139514	1305	193.22	-16956.53	16704	-59.31	$ 183.56	$ (16,108.70)	$ 15,868.80	$ (56.34)
5/29/2023	6/1/2023	W	-29311	1356	18.7	-3562.46	1679.69	-1864.07	$ 17.77	$ (3,384.34)	$ 1,595.71	$ (1,770.87)
6/1/2023	6/29/2023	S	-68449	1492	174.52	-8319.29	17249.45	9104.67	$ 165.79	$ (7,903.33)	$ 16,386.98	$ 8,649.44
6/29/2022	7/29/2022	S	149360	1514	193.22	18153.21	19379.2	37725.63	$ 183.56	$ 17,245.55	$ 18,410.24	$ 35,839.35
7/29/2022	8/29/2022	S	120120	1616	193.22	14599.38	20684.8	35477.4	$ 183.56	$ 13,869.41	$ 19,650.56	$ 33,703.53
8/29/2022	9/29/2022	S	34641	1625	193.22	4210.27	20800	25203.49	$ 183.56	$ 3,999.76	$ 19,760.00	$ 23,943.32
9/29/2022	10/1/2022	S	-4458	1358	12.88	-541.83	1158.83	629.88	$ 12.24	$ (514.74)	$ 1,100.89	$ 598.39
10/1/2022	10/29/2022	W	6689	1530	180.34	812.98	18278.4	19271.72	$ 171.32	$ 772.33	$ 17,364.48	$ 18,308.13
10/29/2022	11/29/2022	W	38469	1571	193.22	4675.52	20108.8	24977.54	$ 183.56	$ 4,441.74	$ 19,103.36	$ 23,728.66
11/29/2022	12/29/2022	W	205331	1618	193.22	24955.93	20710.4	45859.55	$ 183.56	$ 23,708.13	$ 19,674.88	$ 43,566.57
12/29/2022	1/29/2023	W	121368	1464	193.22	14751.07	18739.2	33683.49	$ 183.56	$ 14,013.52	$ 17,802.24	$ 31,999.32
Subtotal			74531		2318.64	9058.5	230481.56	0	$ 2,202.71	$ 8,605.58	$218,957.48	$ -
Adjustments			0		0	0	0	0	$ -	$ -	$ -	$ -
Total			74531		2318.64	9058.5	230481.56	241858.7	$ 2,202.71	$ 8,605.58	$218,957.48	$ 229,765.77

Bill Date Ranges			Energy After PV/ESS (kWh)	Max Demand After PV/ESS (kW)	Charges After PV/ESS ($)				Charges After PV/ESS ($)			
Start Date	End Date	Season	Total	NC / Max	Other	Energy	Demand	Total	Other	Energy	Demand	Total
1/29/2023	2/28/2023	W	-26883	1438	193.22	-3267.36	18406.4	15332.26	$ 183.56	$ (3,103.99)	$ 17,486.08	$ 14,565.65
2/28/2023	3/29/2023	W	-156747	1261	193.22	-19051.03	16640	-2217.81	$ 183.56	$ (18,098.48)	$ 15,808.00	$ (2,106.92)
3/29/2023	4/29/2023	W	-166030	1255	193.22	-20179.29	16640	-3346.07	$ 183.56	$ (19,170.33)	$ 15,808.00	$ (3,178.77)
4/29/2023	5/29/2023	W	-136160	1251	193.22	-16548.89	16640	284.33	$ 183.56	$ (15,721.45)	$ 15,808.00	$ 270.11
5/29/2023	6/1/2023	W	-28870	1356	18.7	-3508.86	1679.69	-1810.47	$ 17.77	$ (3,333.42)	$ 1,595.71	$ (1,719.95)
6/1/2023	6/29/2023	S	-65279	1278	174.52	-7934.01	15029.68	7270.19	$ 165.79	$ (7,537.31)	$ 14,278.20	$ 6,906.68
6/29/2022	7/29/2022	S	152395	1402	193.22	18522.09	17945.6	36660.91	$ 183.56	$ 17,595.99	$ 17,048.32	$ 34,827.86
7/29/2022	8/29/2022	S	123521	1448	193.22	15012.74	18534.4	33740.36	$ 183.56	$ 14,262.10	$ 17,607.68	$ 32,053.34
8/29/2022	9/29/2022	S	38265	1625	193.22	4650.73	20800	25643.95	$ 183.56	$ 4,418.19	$ 19,760.00	$ 24,361.75
9/29/2022	10/1/2022	S	-4162	1226	12.88	-505.85	1109.33	616.37	$ 12.24	$ (480.56)	$ 1,053.86	$ 585.55
10/1/2022	10/29/2022	W	9950	1482	180.34	1209.32	17704.96	19094.62	$ 171.32	$ 1,148.85	$ 16,819.71	$ 18,139.89
10/29/2022	11/29/2022	W	41976	1445	193.22	5101.76	18496	23790.98	$ 183.56	$ 4,846.67	$ 17,571.20	$ 22,601.43
11/29/2022	12/29/2022	W	208059	1618	193.22	25287.49	20710.4	46191.11	$ 183.56	$ 24,023.12	$ 19,674.88	$ 43,881.55
12/29/2022	1/29/2023	W	124652	1399	193.22	15150.2	17907.2	33250.62	$ 183.56	$ 14,392.69	$ 17,011.84	$ 31,588.09
Subtotal			114687		2318.64	13939.06	218243.66	0	$ 2,202.71	$ 13,242.11	$207,331.48	$ -
Adjustments			0		0	0	0	0	$ -	$ -	$ -	$ -
Total			114687		2318.64	13939.06	218243.66	234501.36	$ 2,202.71	$ 13,242.11	$207,331.48	$ 222,776.29

Summary – Option 2

DER	Gross Project Cost ($)	Energy Generation (kWh)	Demand Reduction (kW)	GHG Reduction (MT CO2)	Total Annual Utility Cost Savings ($/yr)	New Maintenance Penalty ($/yr)	Net Annual Cost Savings ($/yr)	Incentives (ITC) ($)	Depreciation (MACRS) ($)	Net Project Cost ($)	Net Simple Payback (yr)
4.80 MW Solar PV	$25,742,794	6,692,467	-1625	1331.8	$814,583	$128,714	$685,869	$7,722,838	$6,435,698	$11,584,257	16.9
500 kWh Battery	$598,206	0	0	0.0	$6,989	$1,496	$5,494	$179,462	$149,552	$269,193	49.0
Total	$26,341,000	6,692,467	-1625	1331.8	$821,572	$130,209	$691,363	$7,902,300	$6,585,250	$11,853,450	17.1

PPA Alternative:	$86,608	Annual Utility Savings

Baseline kWh	6,766,998
Saved kWh	6,692,467
% NZE	99%
NZE Solar Size kW	4853

Equipment	Estimated Max Demand Savings (kW)	Estimated Annual Energy Generation (kWh)	Estimated Annual GHG Reduction ($MT\text{-}CO_2e$)	Estimated Annual Cost Savings ($)	Estimated Gross Project Cost ($)	Total Incentives ($)	Net Project Cost ($)	Simple Payback Period (yr)
4.80 MW Solar PV	-1625	6,692,467	1,332	$685,869	$25,742,794	$14,158,537	$11,584,257	16.9
500 kWh Battery	0	0	0	$5,494	$598,206	$329,013	$269,193	49.0
Total	-1625	6,692,467	1,332	$691,363	$26,341,000	$14,487,550	$11,853,450	17.1

Ownership Plan	Upfront Cost	Year 1 Cost After Rebates	Annual Savings	Lifetime 30-Year Cost Savings ($)	30-Year ROI
Cash Purchase	$26,341,000	$11,853,450	$691,363	$20,740,875	175%
PPA	$0	$0	$86,608	$2,598,248	-

Equipment	Estimated Gross Project Cost ($)	ITC Rebate	MACRS Rebate	Net Project Cost
4.80 MW Solar PV	$25,742,794	$7,722,838	$6,435,698	$11,584,257
500 kWh Battery	$598,206	$179,462	$149,552	$269,193
Total	$26,341,000	$7,902,300	$6,585,250	$11,853,450

Costing – Option 2

System Description	Quantity	Unit	Equipment Cost per Unit ($)	Labor Cost Per Unit ($)	Material Cost Per Unit ($)	Total Material Cost ($)	Total Equipment Cost ($)	Total Labor Cost ($)	Total Cost ($)	Source	Notes
Solar Array											
PV Modules (LG 400 W)	4,800,000	Watts DC			$0.45	$2,160,000	$0.00	$0.00	$2,160,000	PV size from ETB, cost from NREL report	https://www.nrel.gov/docs/fy22osti/83586.pdf
Inverter, 33 kW	116	Ea.		$400.40	$5,620	$651,920	$0.00	$185,785.60	$837,705.60	Inverter size from Helioscope - Cost from online quote Labor - 4 Hrs. Electrician per unit	https://sunwatts.com/33kw-sma-sunny-tripower-core1-inverter-1/
Carport and Ground Structure and Racking Cost/Labor/Installation	4,800,000	Watts DC		$1.21	$1.00	$4,800,000	$0.00	$5,813,280	$10,613,280	Energy ToolBase	
PV String Combiner Panels	95	Ea.		$100.10	$568.40	$53,998	$0.00	$19,019	$73,017	Online Quote Labor - 1 Hrs. Electrician per unit	https://www.solaris-shop.com/sma-cu1000-us-11-string-combiner-w-disconnect/ Each 1000V combiner box with disconnect switch can accommodate 8 strings total Project site has up to 70 strings
Electrical BOS Carport	25,000	m^2	$0.00	$0.00	$50	$1,250,000	$0.00	$0.00	$1,250,000	assumed the same cost as the ground mounted https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Installation rental equipment carport	25,000	m^2	$14.60	$0.00	$0.00	$0.00	$365,000	$0.00	$365,000	assumed the same cost as the ground mounted https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Battery Storage System											
Li-ion Battery + cabinet	500	kWh		$0.00	$393	$196,500	$0.00	$0.00	$196,500	https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Battery Installation - Labor and equipment	500	kWh		$265.00	$0.00	$0.00	$0.00	$132,500	$132,500	https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022 2.91 hrs. @ RS Means labor rate
Electrical BOS	500	kWh		$0.00	$69.16	$34,581.25	$0.00	$0.00	$34,500	https://www.nrel.gov/docs/fy22osti/83586.pdf	
Trenching/Site Prep and Wiring											
Schedule 80 PVC Piping 6" Diameter	1,900	LF	$0.00	$45.24	$53	$100,700	$0.00	$85,949.26	$186,649.26	RS means - 221113742560	
Trenching and Backfill 12" wide, 36" Deep	20	Day.	$425	$1,836.40	$0.00	$0.00	$8,500	$36,728	$45,228	Includes B-54 Crew - reference 312316142850	(2) Days of work (2) Laborers (1) 40 HP Chain Trencher (1) Light Equip Operator

System Description	Quantity	Unit	Equipment Cost per Unit ($)	Labor Cost Per Unit ($)	Material Cost Per Unit ($)	Total Material Cost ($)	Total Equipment Cost ($)	Total Labor Cost ($)	Total Cost ($)	Source	Notes
Soil Excavation, Removal, loading, and hauling	500	L.C.Y	$6.78	$6.15	$0.00	$0.00	$3,390	$3,075	$6,465	Includes B-34D Crew - reference 312323204304	Includes (1) Truck Driver (1) Truck Tractor (1) Dump Trailer
Backfill and Asphalt Paving 8" Thick	10	Day.	$3,427.86	$6,777.20	$30	$3,213	$34,278.60	$67,772	$105,263.60	Includes B-25 Crew - reference 32 11 26 13 0560	1 Day of Filling Trench and Repaving Asphalt Includes (1) Labor Foreman (7) Laborers (3) Equipment Operators (1) Asphalt Paver, 130 H.P. (1) Tandem Roller, 10 Ton (1) Roller, Pneum. Wheel, 12 Ton
Other Costs											
New ATS - 1200 Amp	1	Ea.		$1,182	$23,339.20	$23,339.20	$0.00	$1,182	$24,521.20	RS means - 263623100070	
Permitting, inspection, and interconnection	4	Ea.	$10,628.40	$0.00			$42,513.60	$0.00	$42,513.60	https://www.nrel.gov/docs/fy22osti/83586.pdf	For construction permits fee, interconnection study fees for existing substation, testing, and commissioning For standalone systems - (Rooftop - $105/kW-DC, Ground mount - $46/kW-DC, Battery - $13.6/kWh) For PV+Storage combined - Battery PII*1.02 = $20.84/kWh*1.02
User Training	40	Hr.		$150				$6,000.00	$6,000		
Total						$9,278,300	$453,700	$6,355,300	$16,079,143		

Markup	Cost
System Cost	$16,079,143
Tax (6.625%)	$614,687
O&P Cost (10%)	$1,607,914
EPC Markup (10%)	$1,607,914
Contingency (30%)	$4,823,743
2023 Inflation Markup (10%)	$1,607,914
Total Cost	$26,341,000

Battery Cost	$595,489	
Solar Cost	$25,625,865	
Electrical Upgrades, Permitting and Misc...	$119,646	
Battery Cost with Elec Upgrades	$598,206	$1,196
Solar Cost with Elec Upgrades	$25,742,794	$5.36

PPA Analysis – Option 2

	Income			Net		
Year	Cash Purchase	Standard PPA	PPA with Year 10 Buyout	Cash Purchase	Standard PPA	PPA with Year 10 Buyout
0	-$11,853,450	$0	$0	-$11,853,450	$0	$0
1	$691,363	$86,608	$86,608	-$11,162,087	$86,608	$86,608
2	$691,363	$86,608	$86,608	-$10,470,725	$173,217	$173,217
3	$691,363	$86,608	$86,608	-$9,779,362	$259,825	$259,825
4	$691,363	$86,608	$86,608	-$9,088,000	$346,433	$346,433
5	$691,363	$86,608	$86,608	-$8,396,637	$433,041	$433,041
6	$691,363	$86,608	$86,608	-$7,705,275	$519,650	$519,650
7	$691,363	$86,608	$86,608	-$7,013,912	$606,258	$606,258
8	$691,363	$86,608	$86,608	-$6,322,550	$692,866	$692,866
9	$691,363	$86,608	$86,608	-$5,631,187	$779,474	$779,474
10	$691,363	$86,608	$86,608	-$4,939,825	$866,083	$866,083
11	$691,363	$86,608	-$5,985,431	-$4,248,462	$952,691	-$5,119,349
12	$691,363	$86,608	$691,363	-$3,557,100	$1,039,299	-$4,427,986
13	$691,363	$86,608	$691,363	-$2,865,737	$1,125,907	-$3,736,624
14	$691,363	$86,608	$691,363	-$2,174,375	$1,212,516	-$3,045,261
15	$691,363	$86,608	$691,363	-$1,483,012	$1,299,124	-$2,353,899
16	$691,363	$86,608	$691,363	-$791,650	$1,385,732	-$1,662,536
17	$691,363	$86,608	$691,363	-$100,287	$1,472,341	-$971,174
18	$691,363	$86,608	$691,363	$591,075	$1,558,949	-$279,811
19	$691,363	$86,608	$691,363	$1,282,438	$1,645,557	$411,551
20	$691,363	$86,608	$691,363	$1,973,800	$1,732,165	$1,102,914
21	$691,363	$86,608	$691,363	$2,665,163	$1,818,774	$1,794,276
22	$691,363	$86,608	$691,363	$3,356,525	$1,905,382	$2,485,639
23	$691,363	$86,608	$691,363	$4,047,888	$1,991,990	$3,177,001
24	$691,363	$86,608	$691,363	$4,739,250	$2,078,598	$3,868,364
25	$691,363	$86,608	$691,363	$5,430,613	$2,165,207	$4,559,726
26	$691,363	$86,608	$691,363	$6,121,975	$2,251,815	$5,251,089
27	$691,363	$86,608	$691,363	$6,813,338	$2,338,423	$5,942,451
28	$691,363	$86,608	$691,363	$7,504,700	$2,425,031	$6,633,814
29	$691,363	$86,608	$691,363	$8,196,063	$2,511,640	$7,325,176
30	$691,363	$86,608	$691,363	$8,887,425	$2,598,248	$8,016,539

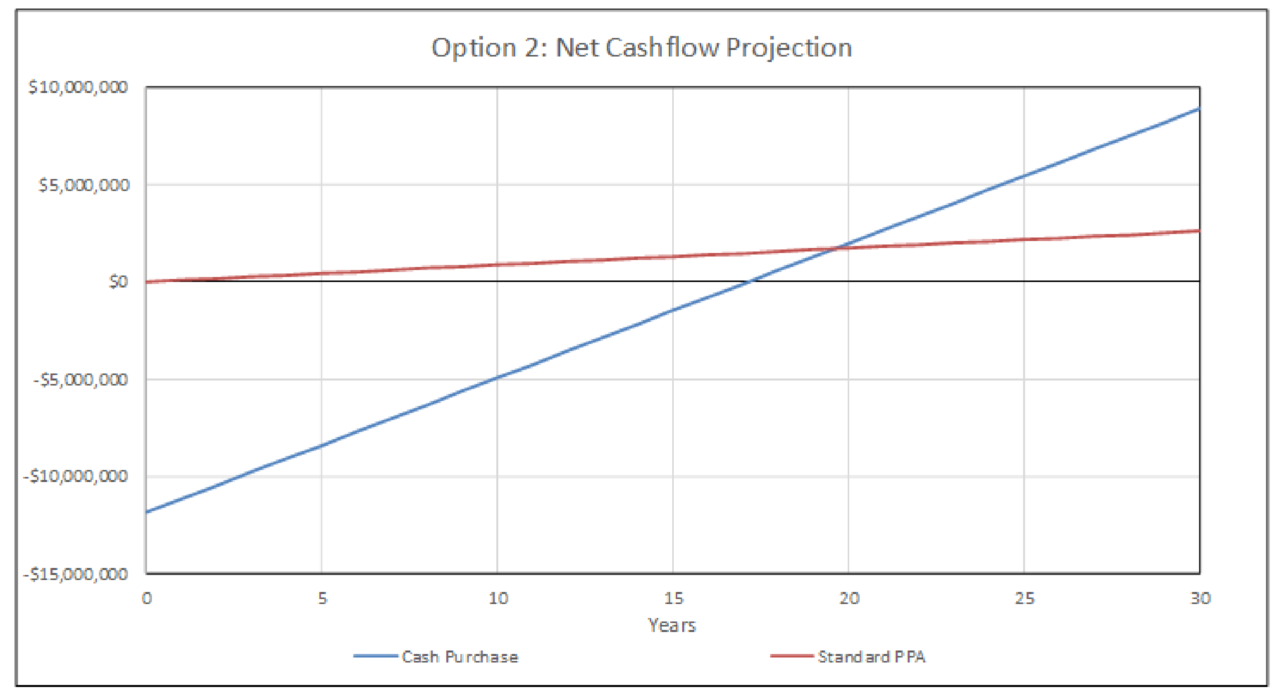
Cash Purchase	
Gross Project Cost	$26,341,000
Rebates	-$7,902,300
85% Depreciation	-$6,585,250
n/a	$0
Final Cost	$11,853,450
Utility Savings	$691,363
Payback	17.1
Financial Life (yr)	30
ROI (Over EUL)	175%

Battery Cost: $598,206
Solar Cost: $25,742,794

Standard PPA	
Gross Project Cost	$26,341,000
Rebates	-$7,902,300
85% Depreciation	-$6,585,250
n/a	$0
Final Cost	$11,853,450
Financial Life (yr)	30
Interest Rate	3.0%
Annual Income from Loan	$604,754
Utility Savings	$691,363
Annual Savings	$86,608

Battery Cost: $598,206
Solar Cost: $25,742,794

PPA with Year 10 Buyout	
Gross Project Cost	$26,341,000
Rebates	-$7,902,300
85% Depreciation	-$6,585,250
n/a	$0
Final Cost	$11,853,450
Financial Life (yr)	30
Interest Rate	3.0%
Years 1-10	
Contractor's Income	$604,754
Utility Savings	$691,363
Customer Savings	$86,608
Years 11-30	
Contractor O&P	15%
Buyout Cost	$6,676,794
Utility Savings	$691,363
Year 11-25 Payback	9.7
Lifetime Savings	$14,693,333
ROI (Over RUL)	220%



ETB Outputs – Option 2

					Raw Utility Info				-5%	Cost Markup		
Bill Date Ranges			Energy Import Before PV/ESS (kWh)	Energy Export Before PV/ESS	Charges Before PV/ESS ($)				Charges Before PV/ESS ($)			
Start Date	End Date	Season	Total	Total	Other	Energy	Demand	Total	Other	Energy	Demand	Total
1/29/2023	2/28/2023	W	480886	0	193.22	58446.88	21926.4	80566.5	$ 183.56	$ 55,524.54	$ 20,830.08	$ 76,538.18
2/28/2023	3/29/2023	W	460202	0	193.22	55932.95	22259.2	78385.37	$ 183.56	$ 53,136.30	$ 21,146.24	$ 74,466.10
3/29/2023	4/29/2023	W	490274	0	193.22	59587.9	20889.6	80670.72	$ 183.56	$ 56,608.51	$ 19,845.12	$ 76,637.18
4/29/2023	5/29/2023	W	491577	0	193.22	59746.27	21273.6	81213.09	$ 183.56	$ 56,758.96	$ 20,209.92	$ 77,152.44
5/29/2023	6/1/2023	W	47315	0	18.7	5750.67	2126.86	7896.23	$ 17.77	$ 5,463.14	$ 2,020.52	$ 7,501.42
6/1/2023	6/29/2023	S	551237	0	174.52	66997.34	19850.74	87022.6	$ 165.79	$ 63,647.47	$ 18,858.20	$ 82,671.47
6/29/2022	7/29/2022	S	790609	0	193.22	96090.62	25152	121435.84	$ 183.56	$ 91,286.09	$ 23,894.40	$ 115,364.05
7/29/2022	8/29/2022	S	786142	0	193.22	95547.7	25766.4	121507.32	$ 183.56	$ 90,770.32	$ 24,478.08	$ 115,431.95
8/29/2022	9/29/2022	S	633077	0	193.22	76944.18	23014.4	100151.8	$ 183.56	$ 73,096.97	$ 21,863.68	$ 95,144.21
9/29/2022	10/1/2022	S	34084	0	12.88	4142.57	1465.17	5620.62	$ 12.24	$ 3,935.44	$ 1,391.91	$ 5,339.59
10/1/2022	10/29/2022	W	485194	0	180.34	58970.48	20512.43	79663.24	$ 171.32	$ 56,021.96	$ 19,486.81	$ 75,680.08
10/29/2022	11/29/2022	W	497571	0	193.22	60474.78	23052.8	83720.8	$ 183.56	$ 57,451.04	$ 21,900.16	$ 79,534.76
11/29/2022	12/29/2022	W	520523	0	193.22	63264.37	23884.8	87342.39	$ 183.56	$ 60,101.15	$ 22,690.56	$ 82,975.27
12/29/2022	1/29/2023	W	498307	0	193.22	60564.23	23360	84117.45	$ 183.56	$ 57,536.02	$ 22,192.00	$ 79,911.58
Subtotal			6766998	0	2318.64	822460.94	274534.4	0	$ 2,202.71	$ 781,337.89	$ 260,807.68	$ -
Adjustments			0	0	0	0	0	0	$ -	$ -	$ -	$ -
Total			6766998	0	2318.64	822460.94	274534.4	1099314	$ 2,202.71	$ 781,337.89	$ 260,807.68	$ 1,044,348.28

Bill Date Ranges			Energy After PV & Before ESS (kWh)	Max Demand After PV & Before ESS	Charges After PV & Before ESS ($)				Charges After PV & Before ESS ($)			
Start Date	End Date	Season	Total	NC / Max	Other	Energy	Demand	Total	Other	Energy	Demand	Total
1/29/2023	2/28/2023	W	-30218	1589	193.22	-3672.7	20339.2	16859.72	$ 183.56	$ (3,489.07)	$ 19,322.24	$ 16,016.73
2/28/2023	3/29/2023	W	-160028	1407	193.22	-19449.8	18009.6	-1246.98	$ 183.56	$ (18,477.31)	$ 17,109.12	$ (1,184.63)
3/29/2023	4/29/2023	W	-169469	1298	193.22	-20597.26	16640	-3764.04	$ 183.56	$ (19,567.40)	$ 15,808.00	$ (3,575.84)
4/29/2023	5/29/2023	W	-139514	1305	193.22	-16956.53	16704	-59.31	$ 183.56	$ (16,108.70)	$ 15,868.80	$ (56.34)
5/29/2023	6/1/2023	W	-29311	1356	18.7	-3562.46	1679.69	-1864.07	$ 17.77	$ (3,384.34)	$ 1,595.71	$ (1,770.87)
6/1/2023	6/29/2023	S	-68449	1492	174.52	-8319.29	17249.45	9104.67	$ 165.79	$ (7,903.33)	$ 16,386.98	$ 8,649.44
6/29/2022	7/29/2022	S	149360	1514	193.22	18153.21	19379.2	37725.63	$ 183.56	$ 17,245.55	$ 18,410.24	$ 35,839.35
7/29/2022	8/29/2022	S	120120	1616	193.22	14599.38	20684.8	35477.4	$ 183.56	$ 13,869.41	$ 19,650.56	$ 33,703.53
8/29/2022	9/29/2022	S	34641	1625	193.22	4210.27	20800	25203.49	$ 183.56	$ 3,999.76	$ 19,760.00	$ 23,943.32
9/29/2022	10/1/2022	S	-4458	1358	12.88	-541.83	1158.83	629.88	$ 12.24	$ (514.74)	$ 1,100.89	$ 598.39
10/1/2022	10/29/2022	W	6689	1530	180.34	812.98	18278.4	19271.72	$ 171.32	$ 772.33	$ 17,364.48	$ 18,308.13
10/29/2022	11/29/2022	W	38469	1571	193.22	4675.52	20108.8	24977.54	$ 183.56	$ 4,441.74	$ 19,103.36	$ 23,728.66
11/29/2022	12/29/2022	W	205331	1618	193.22	24955.93	20710.4	45859.55	$ 183.56	$ 23,708.13	$ 19,674.88	$ 43,566.57
12/29/2022	1/29/2023	W	121368	1464	193.22	14751.07	18739.2	33683.49	$ 183.56	$ 14,013.52	$ 17,802.24	$ 31,999.32
Subtotal			74531		2318.64	9058.5	230481.56	0	$ 2,202.71	$ 8,605.58	$ 218,957.48	$ -
Adjustments			0		0	0	0	0	$ -	$ -	$ -	$ -
Total			74531		2318.64	9058.5	230481.56	241858.7	$ 2,202.71	$ 8,605.58	$ 218,957.48	$ 229,765.77

Bill Date Ranges			Energy After PV/ESS (kWh)	Max Demand After PV/ESS (kW)	Charges After PV/ESS ($)				Charges After PV/ESS ($)			
Start Date	End Date	Season	Total	NC / Max	Other	Energy	Demand	Total	Other	Energy	Demand	Total
1/29/2023	2/28/2023	W	-26883	1438	193.22	-3267.36	18406.4	15332.26	$ 183.56	$ (3,103.99)	$ 17,486.08	$ 14,565.65
2/28/2023	3/29/2023	W	-156747	1261	193.22	-19051.03	16640	-2217.81	$ 183.56	$ (18,098.48)	$ 15,808.00	$ (2,106.92)
3/29/2023	4/29/2023	W	-166030	1255	193.22	-20179.29	16640	-3346.07	$ 183.56	$ (19,170.33)	$ 15,808.00	$ (3,178.77)
4/29/2023	5/29/2023	W	-136160	1251	193.22	-16548.89	16640	284.33	$ 183.56	$ (15,721.45)	$ 15,808.00	$ 270.11
5/29/2023	6/1/2023	W	-28870	1356	18.7	-3508.86	1679.69	-1810.47	$ 17.77	$ (3,333.42)	$ 1,595.71	$ (1,719.95)
6/1/2023	6/29/2023	S	-65279	1278	174.52	-7934.01	15029.68	7270.19	$ 165.79	$ (7,537.31)	$ 14,278.20	$ 6,906.68
6/29/2022	7/29/2022	S	152395	1402	193.22	18522.09	17945.6	36660.91	$ 183.56	$ 17,595.99	$ 17,048.32	$ 34,827.86
7/29/2022	8/29/2022	S	123521	1448	193.22	15012.74	18534.4	33740.36	$ 183.56	$ 14,262.10	$ 17,607.68	$ 32,053.34
8/29/2022	9/29/2022	S	38265	1625	193.22	4650.73	20800	25643.95	$ 183.56	$ 4,418.19	$ 19,760.00	$ 24,361.75
9/29/2022	10/1/2022	S	-4162	1226	12.88	-505.85	1109.33	616.37	$ 12.24	$ (480.56)	$ 1,053.86	$ 585.55
10/1/2022	10/29/2022	W	9950	1482	180.34	1209.32	17704.96	19094.62	$ 171.32	$ 1,148.85	$ 16,819.71	$ 18,139.89
10/29/2022	11/29/2022	W	41976	1445	193.22	5101.76	18496	23790.98	$ 183.56	$ 4,846.67	$ 17,571.20	$ 22,601.43
11/29/2022	12/29/2022	W	208059	1618	193.22	25287.49	20710.4	46191.11	$ 183.56	$ 24,023.12	$ 19,674.88	$ 43,881.55
12/29/2022	1/29/2023	W	124652	1399	193.22	15150.2	17907.2	33250.62	$ 183.56	$ 14,392.69	$ 17,011.84	$ 31,588.09
Subtotal			114687		2318.64	13939.06	218243.66	0	$ 2,202.71	$ 13,242.11	$ 207,331.48	$ -
Adjustments			0		0	0	0	0	$ -	$ -	$ -	$ -
Total			114687		2318.64	13939.06	218243.66	234501.36	$ 2,202.71	$ 13,242.11	$ 207,331.48	$ 222,776.29

Summary – Option 3

DER	Gross Project Cost ($)	Energy Generation (kWh)	Demand Reduction (kW)	GHG Reduction (MT CO2)	Total Annual Utility Cost Savings ($/yr)	New Maintenance Penalty ($/yr)	Net Annual Cost Savings ($/yr)	Incentives (ITC) ($)	Depreciation (MACRS) ($)	Net Project Cost ($)	Net Simple Payback (yr)
4.80 MW Solar PV	$24,968,340	6,681,790	-1625	1329.7	$815,227	$124,842	$690,386	$7,490,502	$6,242,085	$11,235,753	16.3
500 kWh Battery	$599,660	0	0	0.0	$6,804	$1,499	$5,305	$179,898	$149,915	$269,847	50.9
Total	$25,568,000	6,681,790	-1625	1329.7	$822,032	$126,341	$695,691	$7,670,400	$6,392,000	$11,505,600	16.5

PPA Alternative:	$108,684	Annual Utility Savings

Baseline kWh	6,766,998
Saved kWh	6,681,790
% NZE	99%
NZE Solar Size kW	4861

Equipment	Estimated Max Demand Savings (kW)	Estimated Annual Energy Generation (kWh)	Estimated Annual GHG Reduction ($MT-CO_2e$)	Estimated Annual Cost Savings ($)	Estimated Gross Project Cost ($)	Total Incentives ($)	Net Project Cost ($)	Simple Payback Period (yr)
4.80 MW Solar PV	-1625	6,681,790	1,330	$690,386	$24,968,340	$13,732,587	$11,235,753	16.3
500 kWh Battery	0	0	0	$5,305	$599,660	$329,813	$269,847	50.9
Total	-1625	6,681,790	1,330	$695,691	$25,568,000	$14,062,400	$11,505,600	16.5

Ownership Plan	Upfront Cost	Year 1 Cost After Rebates	Annual Savings	Lifetime 30-Year Cost Savings ($)	30-Year ROI
Cash Purchase	$25,568,000	$11,505,600	$695,691	$20,870,726	181%
PPA	$0	$0	$108,684	$3,260,510	-

Equipment	Estimated Gross Project Cost ($)	ITC Rebate	MACRS Rebate	Net Project Cost
4.80 MW Solar PV	$24,968,340	$7,490,502	$6,242,085	$11,235,753
500 kWh Battery	$599,660	$179,898	$149,915	$269,847
Total	$25,568,000	$7,670,400	$6,392,000	$11,505,600

Costing – Option 3

System Description	Quantity	Unit	Equipment Cost per Unit ($)	Labor Cost Per Unit ($)	Material Cost Per Unit ($)	Total Material Cost ($)	Total Equipment Cost ($)	Total Labor Cost ($)	Total Cost ($)	Source	Notes
Solar Array											
PV Modules (LG 400 W)	4,745,000	Watts DC			$0.45	$2,135,250	$0.00	$0.00	$2,135,250	PV size from ETB, cost from NREL report	https://www.nrel.gov/docs/fy22osti/83586.pdf
Inverter, 33 kW	114	Ea.		$400.40	$5,620.00	$640,680	$0.00	$182,582.40	$823,262.40	Inverter size from Helioscope - Cost from online quote Labor - 4 Hrs. Electrician per unit	https://sunwatts.com/33kw-sma-sunny-tripower-core1-inverter-1/
PV Mounting Cost/Labor/Installation	511,800	Watts DC		$1.21	$0.20	$102,360	$0.00	$619,840.98	$722,200.98	Energy ToolBase	Cost associated to core structural upgrades not considered under PV mounting cost.
Carport and Ground Structure and Racking Cost/Labor/Installation	4,233,200	Watts DC		$1.21	$1.00	$4,233,200	$0.00	$5,126,828.52	$9,360,028.52	Energy ToolBase	
PV String Combiner Panels	86	Ea.		$100.10	$568.40	$48,598.20	$0.00	$17,117.10	$65,715.30	Online Quote Labor - 1 Hrs. Electrician per unit	https://www.solaris-shop.com/sma-cu1000-us-11-string-combiner-w-disconnect/ Each 1000V combiner box with disconnect switch can accommodate 8 strings total Project site has up to 70 strings
Electrical BOS Carport	20,400	m^2	$0.00	$0.00	$50	$1,020,000	$0.00	$0.00	$1,020,000	assumed the same cost as the ground mounted https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Electrical BOS Roof mounted	5,800	m^2	$0.00	$0.00	$38	$220,400	$0.00	$0.00	$220,400	https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Carport Linear LED Surface Mount Lighting Fixture	99	Ea.		$100.10	$61.83	$6,090.26	$0.00	$9,859.85	$15,950.11	RS Means Line #: 26 51 13 44 2010 https://www.1000bulbs.com/product/217486/PLT-90093.html	(1) Electrician to install
Installation rental equipment roof mounted	5,800	m^2	$3.95	$0.00	$0.00	$0.00	$22,910	$0.00	$22,910	https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Installation rental equipment carport	20,400	m^2	$14.60	$0.00	$0.00	$0.00	$297,840	$0.00	$297,840	assumed the same cost as the ground mounted https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Battery Storage System											
Li-ion Battery + cabinet	500	kWh		$0.00	$393	$196,500	$0.00	$0.00	$196,500	https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022
Battery Installation - Labor and equipment	500	kWh		$265	$0.00	$0.00	$0.00	$132,500	$132,500	https://www.nrel.gov/docs/fy22osti/83586.pdf	U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022 2.91 hrs. @ RS Means labor rate

System Description	Quantity	Unit	Equipment Cost per Unit ($)	Labor Cost Per Unit ($)	Material Cost Per Unit ($)	Total Material Cost ($)	Total Equipment Cost ($)	Total Labor Cost ($)	Total Cost ($)	Source	Notes
Electrical BOS	500	kWh	$0.00	$0.00	$69.16	$34,581.25	$0.00	$0.00	$34,500	https://www.nrel.gov/docs/fy22osti/83586.pdf	
Trenching/Site Prep and Wiring											
Schedule 80 PVC Piping 6" Diameter	3,000	LF	$0.00	$45.24	$53	$159,000	$0.00	$135,709.35	$294,709.35	RS means - 221113742560	
Trenching and Backfill 12" wide, 36" Deep	20	Day.	$425	$1,836.40	$0.00	$0.00	$8,500	$36,728	$45,228	Includes B-54 Crew - reference 312316142850	(2) Days of work (2) Laborers (1) 40 HP Chain Trencher (1) Light Equip Operator
Soil Excavation, Removal, loading, and hauling	500	L.C.Y	$6.78	$6.15	$0.00	$0.00	$3,390	$3,075	$6,465	Includes B-34D Crew - reference 312323204304	Includes (1) Truck Driver (1) Truck Tractor (1) Dump Trailer
Backfill and Asphalt Paving 8" Thick	10	Day.	$3,427.86	$6,777.20	$30	$3,213.00	$34,278.60	$67,772	$105,263.60	Includes B-25 Crew - reference 32 11 26 13 0560	1 Day of Filling Trench and Repaving Asphalt Includes (1) Labor Foreman (7) Laborers (3) Equipment Operators (1) Asphalt Paver, 130 H.P. (1) Tandem Roller, 10 Ton (1) Roller, Pneum. Wheel, 12 Ton
Other Costs											
New ATS - 1200 Amp	1	Ea.		$1,182	$23,339.20	$23,339.20	$0.00	$1,182	$24,521.20	RS means - 263623100070	
Permitting, inspection, and interconnection	8	Ea.	$10,628.40	$0.00			$85,027.20	$0.00	$85,027.20	https://www.nrel.gov/docs/fy22osti/83586.pdf	For construction permits fee, interconnection study fees for existing substation, testing, and commissioning For standalone systems - (Rooftop - $105/kW-DC, Ground mount - $46/kW-DC, Battery - $13.6/kWh) For PV+Storage combined - Battery PII*1.02 = $20.84/kWh*1.02
User Training	40	Hr.		$150		$0.00	$0.00	$6,000	$6,000		
Total						**$8,827,200**	**$451,900**	**$6,343,200**	**$15,614,271.66**		

PPA Analysis – Option 3

Year	Cash Purchase	Standard PPA	PPA with Year 10 Buyout	Cash Purchase	Standard PPA	PPA with Year 10 Buyout
0	-$11,505,600	$0	$0	-$11,505,600	$0	$0
1	$695,691	$108,684	$108,684	-$10,809,909	$108,684	$108,684
2	$695,691	$108,684	$108,684	-$10,114,218	$217,367	$217,367
3	$695,691	$108,684	$108,684	-$9,418,527	$326,051	$326,051
4	$695,691	$108,684	$108,684	-$8,722,837	$434,735	$434,735
5	$695,691	$108,684	$108,684	-$8,027,146	$543,418	$543,418
6	$695,691	$108,684	$108,684	-$7,331,455	$652,102	$652,102
7	$695,691	$108,684	$108,684	-$6,635,764	$760,786	$760,786
8	$695,691	$108,684	$108,684	-$5,940,073	$869,469	$869,469
9	$695,691	$108,684	$108,684	-$5,244,382	$978,153	$978,153
10	$695,691	$108,684	$108,684	-$4,548,691	$1,086,837	$1,086,837
11	$695,691	$108,684	-$5,785,166	-$3,853,001	$1,195,520	-$4,698,330
12	$695,691	$108,684	$695,691	-$3,157,310	$1,304,204	-$4,002,639
13	$695,691	$108,684	$695,691	-$2,461,619	$1,412,888	-$3,306,948
14	$695,691	$108,684	$695,691	-$1,765,928	$1,521,571	-$2,611,257
15	$695,691	$108,684	$695,691	-$1,070,237	$1,630,255	-$1,915,566
16	$695,691	$108,684	$695,691	-$374,546	$1,738,939	-$1,219,876
17	$695,691	$108,684	$695,691	$321,145	$1,847,622	-$524,185
18	$695,691	$108,684	$695,691	$1,016,835	$1,956,306	$171,506
19	$695,691	$108,684	$695,691	$1,712,526	$2,064,990	$867,197
20	$695,691	$108,684	$695,691	$2,408,217	$2,173,673	$1,562,888
21	$695,691	$108,684	$695,691	$3,103,908	$2,282,357	$2,258,579
22	$695,691	$108,684	$695,691	$3,799,599	$2,391,041	$2,954,270
23	$695,691	$108,684	$695,691	$4,495,290	$2,499,724	$3,649,960
24	$695,691	$108,684	$695,691	$5,190,980	$2,608,408	$4,345,651
25	$695,691	$108,684	$695,691	$5,886,671	$2,717,092	$5,041,342
26	$695,691	$108,684	$695,691	$6,582,362	$2,825,775	$5,737,033
27	$695,691	$108,684	$695,691	$7,278,053	$2,934,459	$6,432,724
28	$695,691	$108,684	$695,691	$7,973,744	$3,043,143	$7,128,415
29	$695,691	$108,684	$695,691	$8,669,435	$3,151,826	$7,824,106
30	$695,691	$108,684	$695,691	$9,365,126	$3,260,510	$8,519,796

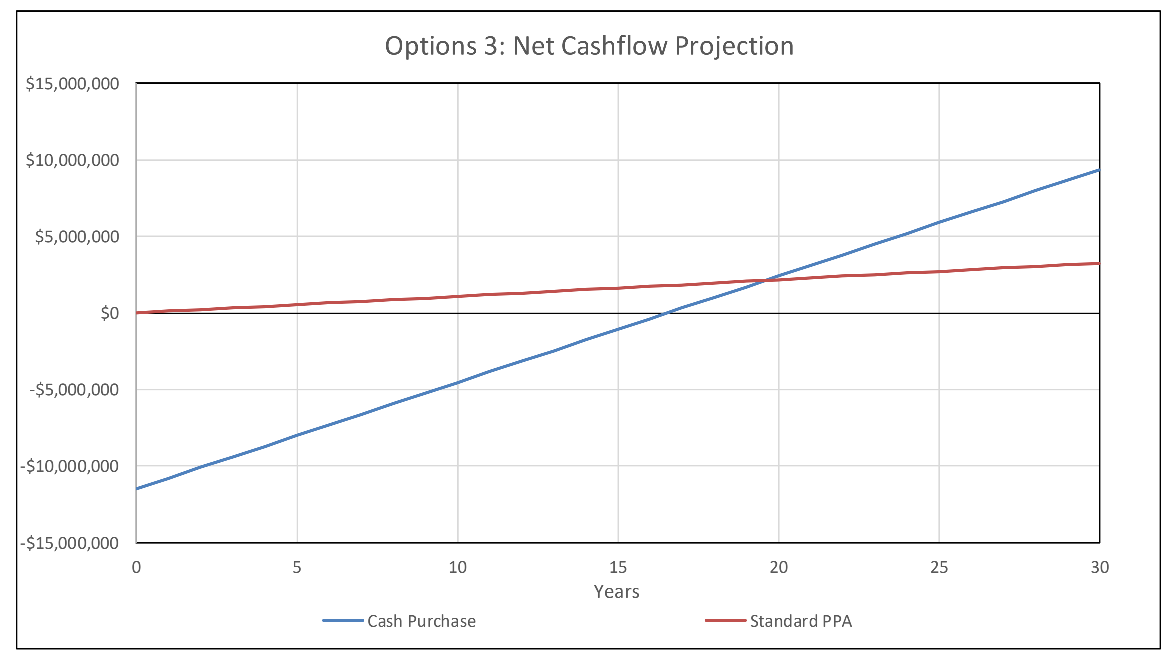
Cash Purchase	
Gross Project Cost	$25,568,000
Rebates	-$7,670,400
85% Depreciation	-$6,392,000
n/a	$0
Final Cost	$11,505,600
Utility Savings	$695,691
Payback	16.5
Financial Life (yr)	30
ROI (Over EUL)	181%

Battery Cost: $599,660
Solar Cost: $24,968,340

Standard PPA	
Gross Project Cost	$25,568,000
Rebates	-$7,670,400
85% Depreciation	-$6,392,000
n/a	$0
Final Cost	$11,505,600
Financial Life (yr)	30
Interest Rate	3.0%
Annual Income from Loan	$587,007
Utility Savings	$695,691
Annual Savings	$108,684

Battery Cost: $599,660
Solar Cost: $24,968,340

PPA with Year 10 Buyout	
Gross Project Cost	$25,568,000
Rebates	-$7,670,400
85% Depreciation	-$6,392,000
n/a	$0
Final Cost	$11,505,600
Financial Life (yr)	30
Interest Rate	3.0%
Years 1-10	
Contractor's Income	$587,007
Utility Savings	$695,691
Customer Savings	$108,684
Years 11-30	
Contractor O&P	15%
Buyout Cost	$6,480,857
Utility Savings	$695,691
Year 11-25 Payback	9.3
Lifetime Savings	$15,000,654
ROI (Over RUL)	231%



ETB Outputs – Option 3

Bill Date Ranges			Energy Import Before PV/ESS (kWh)	Energy Export Before PV/ESS (kWh)	Raw Utility Info Charges Before PV/ESS ($)				-5% Cost Markup Charges Before PV/ESS ($)			
Start Date	End Date	Season	Total	Total	Other	Energy	Demand	Total	Other	Energy	Demand	Total
1/29/2023	2/28/2023	W	480886	0	193.22	58446.88	21926.4	80566.5	$ 183.56	$ 55,524.54	$ 20,830.08	$ 76,538.18
2/28/2023	3/29/2023	W	460202	0	193.22	55932.95	22259.2	78385.37	$ 183.56	$ 53,136.30	$ 21,146.24	$ 74,466.10
3/29/2023	4/29/2023	W	490274	0	193.22	59587.9	20889.6	80670.72	$ 183.56	$ 56,608.51	$ 19,845.12	$ 76,637.18
4/29/2023	5/29/2023	W	491577	0	193.22	59746.27	21273.6	81213.09	$ 183.56	$ 56,758.96	$ 20,209.92	$ 77,152.44
5/29/2023	6/1/2023	W	47315	0	18.7	5750.67	2126.86	7896.23	$ 17.77	$ 5,463.14	$ 2,020.52	$ 7,501.42
6/1/2023	6/29/2023	S	551237	0	174.52	66997.34	19850.74	87022.6	$ 165.79	$ 63,647.47	$ 18,858.20	$ 82,671.47
6/29/2022	7/29/2022	S	790609	0	193.22	96090.62	25152	121435.84	$ 183.56	$ 91,286.09	$ 23,894.40	$ 115,364.05
7/29/2022	8/29/2022	S	786142	0	193.22	95547.7	25766.4	121507.32	$ 183.56	$ 90,770.32	$ 24,478.08	$ 115,431.95
8/29/2022	9/29/2022	S	633077	0	193.22	76944.18	23014.4	100151.8	$ 183.56	$ 73,096.97	$ 21,863.68	$ 95,144.21
9/29/2022	10/1/2022	S	34084	0	12.88	4142.57	1465.17	5620.62	$ 12.24	$ 3,935.44	$ 1,391.91	$ 5,339.59
10/1/2022	10/29/2022	W	485194	0	180.34	58970.48	20512.43	79663.24	$ 171.32	$ 56,021.96	$ 19,486.81	$ 75,680.08
10/29/2022	11/29/2022	W	497571	0	193.22	60474.78	23052.8	83720.8	$ 183.56	$ 57,451.04	$ 21,900.16	$ 79,534.76
11/29/2022	12/29/2022	W	520523	0	193.22	63264.37	23884.8	87342.39	$ 183.56	$ 60,101.15	$ 22,690.56	$ 82,975.27
12/29/2022	1/29/2023	W	498307	0	193.22	60564.23	23360	84117.45	$ 183.56	$ 57,536.02	$ 22,192.00	$ 79,911.58
Subtotal			6766998	0	2318.64	822460.94	274534.4	0	$ 2,202.71	$ 781,337.89	$ 260,807.68	$ -
Adjustments			0	0	0	0	0	0	$ -	$ -	$ -	$ -
Total			6766998	0	2318.64	822460.94	274534.4	1099314	$ 2,202.71	$ 781,337.89	$ 260,807.68	$ 1,044,348.28

Bill Date Ranges			Energy After PV & Before ESS (kWh)	Max Demand After PV & Before ESS (kW)	Charges After PV & Before ESS ($)				Charges After PV & Before ESS ($)			
Start Date	End Date	Season	Total	NC / Max	Other	Energy	Demand	Total	Other	Energy	Demand	Total
1/29/2023	2/28/2023	W	27596	1555	193.22	3354.02	19904	23451.24	$ 183.56	$ 3,186.32	$ 18,908.80	$ 22,278.68
2/28/2023	3/29/2023	W	-112163	1407	193.22	-13632.29	18009.6	4570.53	$ 183.56	$ (12,950.68)	$ 17,109.12	$ 4,342.00
3/29/2023	4/29/2023	W	-182843	1253	193.22	-22222.74	16640	-5389.52	$ 183.56	$ (21,111.60)	$ 15,808.00	$ (5,120.04)
4/29/2023	5/29/2023	W	-196458	1305	193.22	-23877.51	16704	-6980.29	$ 183.56	$ (22,683.63)	$ 15,868.80	$ (6,631.28)
5/29/2023	6/1/2023	W	-37221	1277	18.7	-4523.86	1610.32	-2894.82	$ 17.77	$ (4,297.65)	$ 1,529.80	$ (2,750.08)
6/1/2023	6/29/2023	S	-151525	1483	174.52	-18416.35	17145.39	-1096.43	$ 165.79	$ (17,495.53)	$ 16,288.12	$ (1,041.61)
6/29/2022	7/29/2022	S	70663	1443	193.22	8588.38	18470.4	27252	$ 183.56	$ 8,158.96	$ 17,546.88	$ 25,889.40
7/29/2022	8/29/2022	S	84519	1581	193.22	10272.44	20236.8	30702.46	$ 183.56	$ 9,758.82	$ 19,224.96	$ 29,167.34
8/29/2022	9/29/2022	S	53229	1625	193.22	6469.45	20800	27462.67	$ 183.56	$ 6,145.98	$ 19,760.00	$ 26,089.54
9/29/2022	10/1/2022	S	-840	1277	12.88	-102.09	1109.33	1020.12	$ 12.24	$ (96.99)	$ 1,053.86	$ 969.11
10/1/2022	10/29/2022	W	59098	1530	180.34	7182.77	18278.4	25641.51	$ 171.32	$ 6,823.63	$ 17,364.48	$ 24,359.43
10/29/2022	11/29/2022	W	86762	1586	193.22	10545.05	20300.8	31039.07	$ 183.56	$ 10,017.80	$ 19,285.76	$ 29,487.12
11/29/2022	12/29/2022	W	229734	1621	193.22	27921.87	20748.8	48863.89	$ 183.56	$ 26,525.78	$ 19,711.36	$ 46,420.70
12/29/2022	1/29/2023	W	154657	1449	193.22	18797.01	18547.2	37537.43	$ 183.56	$ 17,857.16	$ 17,619.84	$ 35,660.56
Subtotal			85208		2318.64	10356.18	228505.05	0	$ 2,202.71	$ 9,838.37	$ 217,079.80	$ -
Adjustments			0		0	0	0	0	$ -	$ -	$ -	$ -
Total			85208		2318.64	10356.18	228505.05	241179.87	$ 2,202.71	$ 9,838.37	$ 217,079.80	$ 229,120.88

Bill Date Ranges			Battery Charge & Discharge (kWh)	Max Demand After PV/ESS (kW)	Charges After PV/ESS ($)				Charges After PV/ESS ($)			
Start Date	End Date	Season	Total	NC / Max	Other	Energy	Demand	Total	Other	Energy	Demand	Total
1/29/2023	2/28/2023	W	-3403	1413	193.22	3767.74	18086.4	22047.36	$ 183.56	$ 3,579.35	$ 17,182.08	$ 20,944.99
2/28/2023	3/29/2023	W	-3404	1205	193.22	-13218.45	16640	3614.77	$ 183.56	$ (12,557.53)	$ 15,808.00	$ 3,434.03
3/29/2023	4/29/2023	W	-3373	1210	193.22	-21812.78	16640	-4979.56	$ 183.56	$ (20,722.14)	$ 15,808.00	$ (4,730.58)
4/29/2023	5/29/2023	W	-3389	1233	193.22	-23465.61	16640	-6632.39	$ 183.56	$ (22,292.33)	$ 15,808.00	$ (6,300.77)
5/29/2023	6/1/2023	W	-434	1277	18.7	-4471.09	1610.32	-2842.07	$ 17.77	$ (4,247.54)	$ 1,529.80	$ (2,699.97)
6/1/2023	6/29/2023	S	-3175	1482	174.52	-18030.46	17133.83	-722.11	$ 165.79	$ (17,128.94)	$ 16,277.14	$ (686.00)
6/29/2022	7/29/2022	S	-3007	1280	193.22	8953.97	16640	25787.19	$ 183.56	$ 8,506.27	$ 15,808.00	$ 24,497.83
7/29/2022	8/29/2022	S	-3512	1419	193.22	10699.29	18163.2	29055.71	$ 183.56	$ 10,164.33	$ 17,255.04	$ 27,602.92
8/29/2022	9/29/2022	S	-3577	1625	193.22	6904.2	20800	27897.42	$ 183.56	$ 6,558.99	$ 19,760.00	$ 26,502.55
9/29/2022	10/1/2022	S	-294	1221	12.88	-66.36	1109.33	1055.85	$ 12.24	$ (63.04)	$ 1,053.86	$ 1,003.06
10/1/2022	10/29/2022	W	-3303	1393	180.34	7584.34	16641.71	24406.38	$ 171.32	$ 7,205.12	$ 15,809.62	$ 23,186.06
10/29/2022	11/29/2022	W	-3588	1438	193.22	10981.14	18406.4	29580.76	$ 183.56	$ 10,432.08	$ 17,486.08	$ 28,101.72
11/29/2022	12/29/2022	W	-2753	1621	193.22	28256.35	20748.8	49198.37	$ 183.56	$ 26,843.53	$ 19,711.36	$ 46,738.45
12/29/2022	1/29/2023	W	-3353	1340	193.22	19204.54	17152	36549.76	$ 183.56	$ 18,244.31	$ 16,294.40	$ 34,722.27
Subtotal			-40565		2318.64	15286.82	216411.99	0	$ 2,202.71	$ 14,522.48	$ 205,591.39	$ -
Adjustments			0		0	0	0	0	$ -	$ -	$ -	$ -
Total			-40565		2318.64	15286.82	216411.99	234017.45	$ 2,202.71	$ 14,522.48	$ 205,591.39	$ 222,316.58

Energy Toolbase – Options 1 & 2

PV SYSTEM

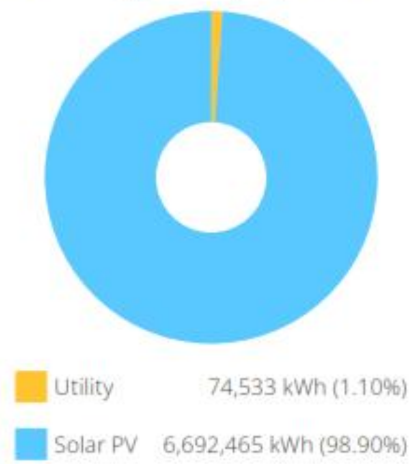
GENERAL INFORMATION
Facility: Woodbine Development Center
Address: 1175 Dehirsch Ave, Woodbine, NJ 08270

SOLAR PV EQUIPMENT DESCRIPTION
Solar Panels: (12000) LG Electronics LG400N2W-V5_R12
Inverters: (116) SMA Sunny Tripower CORE1 33-US

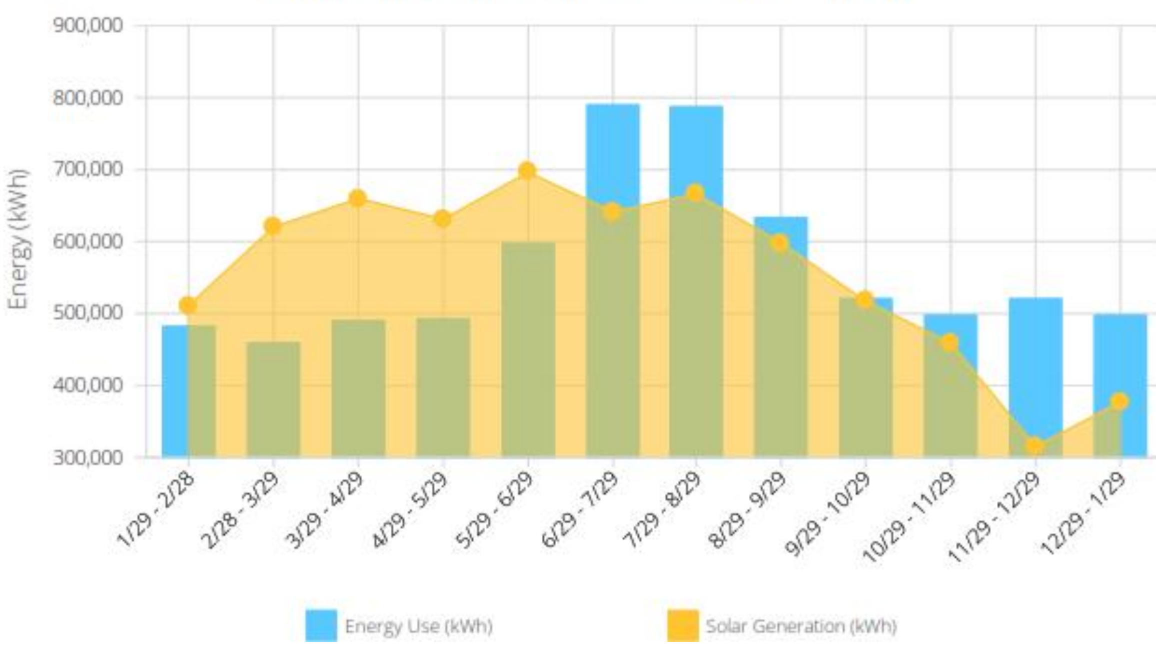
SOLAR PV EQUIPMENT TYPICAL LIFESPAN
Solar Panels: Greater than 30 Years
Inverters: 10 Years

SOLAR PV SYSTEM RATING
Power Rating: 4,800,000 W-DC
Power Rating: 4,224,192 W-AC-CEC

ENERGY CONSUMPTION MIX
Annual Energy Use: 6,766,998 kWh



MONTHLY ENERGY USE VS SOLAR GENERATION



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ENERGY STORAGE SYSTEM (ESS) DETAILS

GENERAL INFORMATION

Facility: Woodbine Development Center
Address: 1175 Dehirsch Ave, Woodbine, NJ 08270

ESS EQUIPMENT DESCRIPTION

Battery Banks: 500kw/500kWh Energy Storage System
Inverters: 500kw/500kWh Energy Storage System

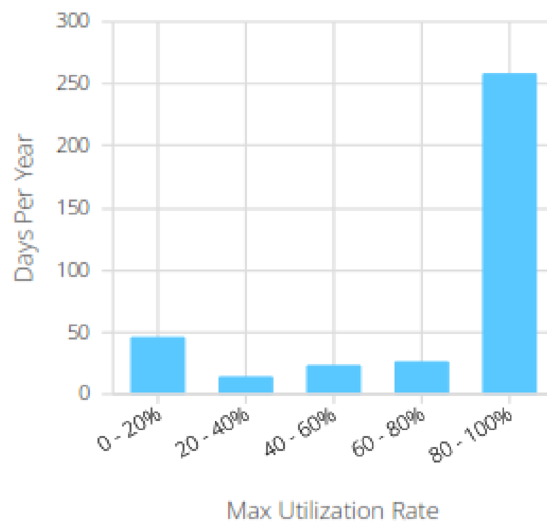
ESS EQUIPMENT TYPICAL LIFESPAN

Battery Banks: 15 Years
Inverters: 15 Years

ESS SYSTEM RATINGS

Energy Capacity: 500.0 kWh
Power Rating: 500.0 kW

ENERGY STORAGE ANNUAL UTILIZATION



Energy Output and Demand Savings From Solar PV and Energy Storage				
Date Range	ESS Energy Discharge (kWh)	Solar PV Generation (kWh)	ESS Energy as % of PV Energy	Total Demand Savings
1/29/2023 - 2/28/2023	8,682	511,104	1.70%	$3,520
2/28/2023 - 3/29/2023	8,542	620,229	1.38%	$5,619
3/29/2023 - 4/29/2023	8,955	659,743	1.36%	$4,250
4/29/2023 - 5/29/2023	8,733	631,091	1.38%	$4,634
5/29/2023 - 6/29/2023	9,400	696,312	1.35%	$5,268
6/29/2022 - 7/29/2022	9,280	641,249	1.45%	$7,206
7/29/2022 - 8/29/2022	8,855	666,022	1.33%	$7,232
8/29/2022 - 9/29/2022	9,436	598,436	1.58%	$2,214
9/29/2022 - 10/29/2022	9,261	517,047	1.79%	$3,163
10/29/2022 - 11/29/2022	9,129	459,101	1.99%	$4,557
11/29/2022 - 12/29/2022	7,100	315,192	2.25%	$3,174
12/29/2022 - 1/29/2023	8,551	376,939	2.27%	$5,453
Total	105,924	6,692,465	1.58%	$56,291

ENVIRONMENTAL BENEFITS

OVER THE NEXT 20 YEARS, YOUR SYSTEM WILL DO MORE THAN JUST SAVE YOU MONEY. ACCORDING TO THE EPA'S GREENHOUSE GAS EQUIVALENCIES CALCULATOR (SOURCE), YOUR SOLAR PV SYSTEM WILL HAVE THE IMPACT OF REDUCING:

104,849	238,396,757	1,572,729
tons of CO2 Offset	Miles Driven By Cars	Trees Planted

energytoolbase

Energy Toolbase – Option 3

PV SYSTEM DETAILS

GENERAL INFORMATION

Facility: Woodbine Development Center

Address: 31175 Dehirsch Ave, Woodbine, NJ 08270

SOLAR PV EQUIPMENT DESCRIPTION

Solar Panels: (11862) LG Electronics LG400N2W-V5_R12

Inverters: (114) SMA Sunny Tripower CORE1 33-US

SOLAR PV EQUIPMENT TYPICAL LIFESPAN

Solar Panels: Greater than 30 Years

Inverters: 10 Years

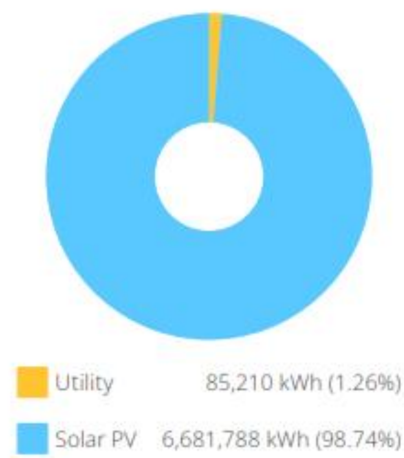
SOLAR PV SYSTEM RATING

Power Rating: 4,744,800 W-DC

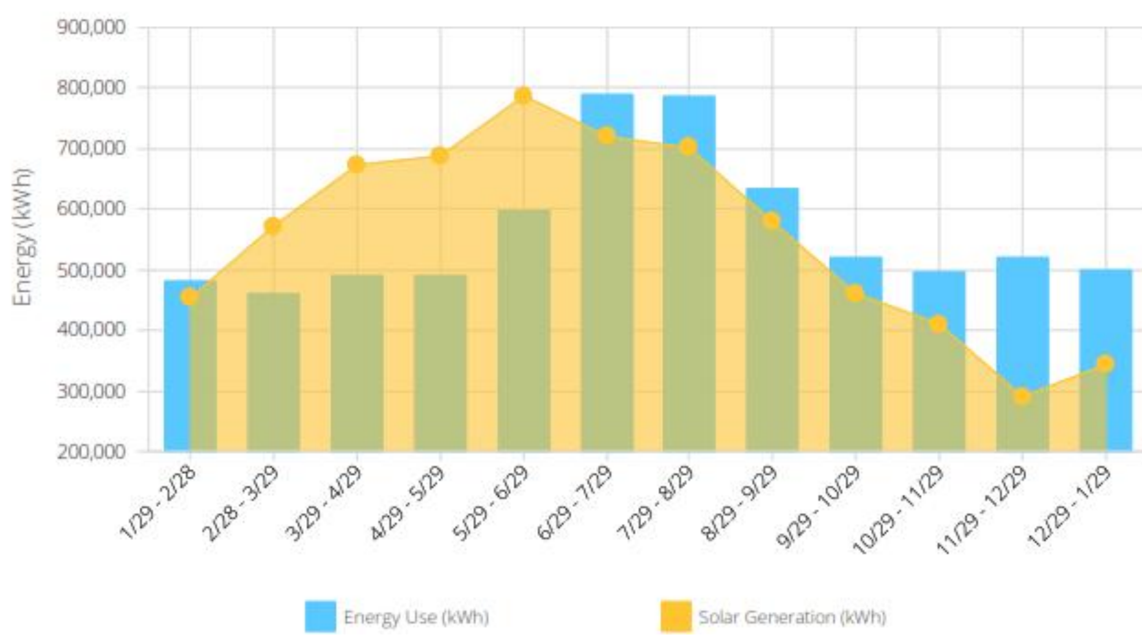
Power Rating: 4,175,614 W-AC-CEC

ENERGY CONSUMPTION MIX

Annual Energy Use: 6,766,998 kWh



MONTHLY ENERGY USE VS SOLAR GENERATION



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ENERGY STORAGE SYSTEM (ESS) DETAILS

GENERAL INFORMATION

Facility: Woodbine Development Center
Address: 1175 Dehirsch Ave, Woodbine, NJ 08270

ESS EQUIPMENT DESCRIPTION

Battery Banks: 500kw/500kWh Energy Storage System
Inverters: 500kw/500kWh Energy Storage System

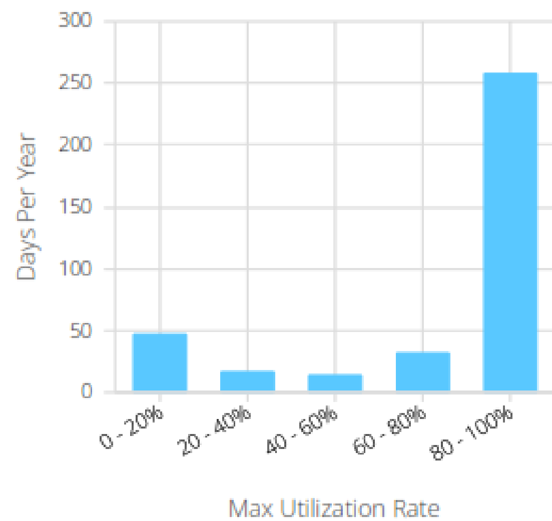
ESS EQUIPMENT TYPICAL LIFESPAN

Battery Banks: 15 Years
Inverters: 15 Years

ESS SYSTEM RATINGS

Energy Capacity: 500.0 kWh
Power Rating: 500.0 kW

ENERGY STORAGE ANNUAL UTILIZATION



Energy Output and Demand Savings From Solar PV and Energy Storage				
Date Range	ESS Energy Discharge (kWh)	Solar PV Generation (kWh)	ESS Energy as % of PV Energy	Total Demand Savings
1/29/2023 - 2/28/2023	8,861	453,289	1.95%	$3,840
2/28/2023 - 3/29/2023	8,863	572,364	1.55%	$5,619
3/29/2023 - 4/29/2023	8,782	673,117	1.30%	$4,250
4/29/2023 - 5/29/2023	8,823	688,035	1.28%	$4,634
5/29/2023 - 6/29/2023	9,398	787,298	1.19%	$3,233
6/29/2022 - 7/29/2022	9,209	719,945	1.28%	$8,512
7/29/2022 - 8/29/2022	9,144	701,623	1.30%	$7,603
8/29/2022 - 9/29/2022	9,313	579,848	1.61%	$2,214
9/29/2022 - 10/29/2022	9,365	461,020	2.03%	$4,227
10/29/2022 - 11/29/2022	9,343	410,809	2.27%	$4,646
11/29/2022 - 12/29/2022	7,167	290,790	2.46%	$3,136
12/29/2022 - 1/29/2023	8,731	343,650	2.54%	$6,208
Total	106,999	6,681,788	1.60%	$58,122

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ENVIRONMENTAL BENEFITS

OVER THE NEXT 20 YEARS, YOUR SYSTEM WILL DO MORE THAN JUST SAVE YOU MONEY. ACCORDING TO THE EPA'S GREENHOUSE GAS EQUIVALENCIES CALCULATOR (SOURCE), YOUR SOLAR PV SYSTEM WILL HAVE THE IMPACT OF REDUCING:

104,681	238,016,425	1,570,220
tons of CO2 Offset	Miles Driven By Cars	Trees Planted

APPENDIX D: 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, which 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 (II)	*Solar renewable energy credit*: a credit 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.