



# Local Government Energy Audit Report

Tark House, Craig House, and Rhea-Applegate House

April 2, 2024

*Prepared for:*

NJ DEP Monmouth Battlefield SP  
333 Freehold - Englishtown Rd.  
Freehold, New Jersey 07728

*Prepared by:*

TRC  
317 George Street  
New Brunswick, New Jersey 08901



## 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.

Copyright ©2024 TRC. All rights reserved.

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

# Table of Contents

---

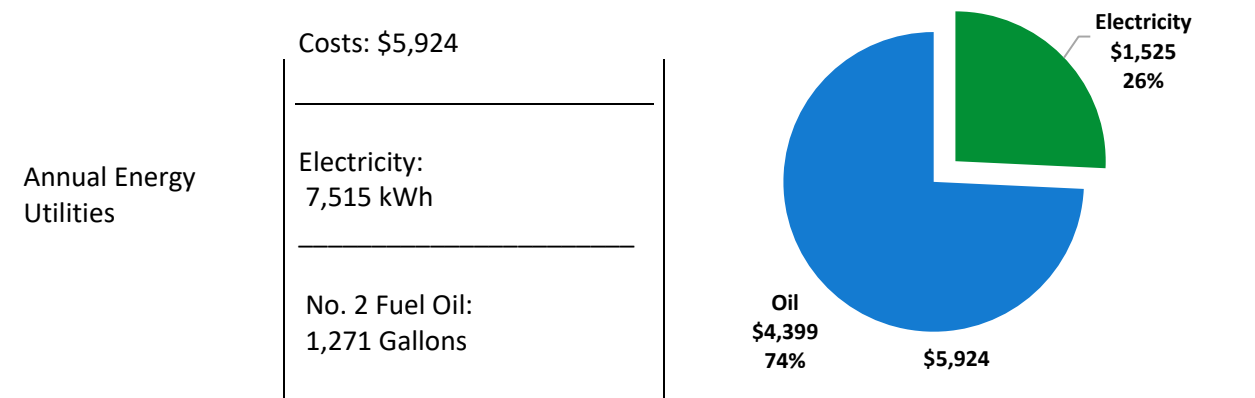
<b>1</b>	<b>Executive Summary</b> .....	<b>1</b>
1.1	Planning Your Project.....	4
	Pick Your Installation Approach .....	4
	Options from Your Utility Company.....	4
	Options from New Jersey’s Clean Energy Program .....	5
<b>2</b>	<b>Existing Conditions</b> .....	<b>6</b>
2.1	Site Overview .....	6
2.2	Building Occupancy.....	6
2.3	Building Envelope.....	7
2.4	Lighting Systems.....	10
2.5	Air Handling Systems .....	11
	Unitary Heating Equipment .....	11
2.6	Heating Steam Systems.....	12
2.7	Domestic Hot Water .....	12
2.8	Plug Load and Vending Machines .....	14
2.9	Water-Using Systems .....	14
<b>3</b>	<b>Energy Use and Costs</b> .....	<b>15</b>
3.1	Electricity.....	17
3.2	No. 2 Fuel Oil.....	18
3.3	Benchmarking .....	19
	Tracking your Energy Performance.....	20
3.4	Understanding Your Utility Bills .....	21
<b>4</b>	<b>Energy Conservation Measures</b> .....	<b>22</b>
4.1	Lighting.....	25
	ECM 1: Retrofit Fluorescent Fixtures with LED Lamps and Drivers .....	25
	ECM 2: Retrofit Fixtures with LED Lamps.....	25
4.2	Lighting Controls .....	26
	ECM 3: Install Occupancy Sensor Lighting Controls.....	26
4.3	Motors.....	27
	ECM 4: Premium Efficiency Motors .....	27
4.4	Gas-Fired Heating.....	27

ECM 5: Install High Efficiency Furnaces .....	27
4.5 HVAC Improvements.....	28
ECM 6: Install Pipe Insulation .....	28
4.6 Domestic Water Heating.....	28
ECM 7: Install Low-Flow DHW Devices .....	28
4.7 Custom Measures .....	29
CM 8: Replace Electric Water Heater with Heat Pump Water Heater .....	29
<b>5 Energy Efficient Best Practices.....</b>	<b>30</b>
Energy Tracking with ENERGY STAR Portfolio Manager .....	30
Weatherization .....	30
Doors and Windows.....	30
Lighting Maintenance .....	30
Boiler Maintenance.....	31
Water Heater Maintenance .....	31
Procurement Strategies .....	31
<b>6 Water Best Practices.....</b>	<b>32</b>
Getting Started.....	32
Leak Detection and Repair .....	32
Toilets and Urinals .....	32
Faucets and Showerheads .....	33
<b>7 On-Site Generation.....</b>	<b>34</b>
7.1 Solar Photovoltaic .....	35
7.2 Combined Heat and Power .....	37
<b>8 Electric Vehicles.....</b>	<b>38</b>
8.1 EV Charging .....	38
<b>9 Project Funding and Incentives .....</b>	<b>40</b>
9.1 New Jersey’s Clean Energy Program.....	41
9.2 Utility Energy Efficiency Programs .....	48
<b>10 Project Development.....</b>	<b>50</b>
<b>11 Energy Purchasing and Procurement Strategies .....</b>	<b>51</b>
11.1 Retail Electric Supply Options .....	51
11.2 Retail Natural Gas Supply Options .....	51
<b>Appendix A: Equipment Inventory &amp; Recommendations .....</b>	<b>A-1</b>
<b>Appendix B: ENERGY STAR Statement of Energy Performance.....</b>	<b>B-1</b>
<b>Appendix C: Glossary .....</b>	<b>C-1</b>

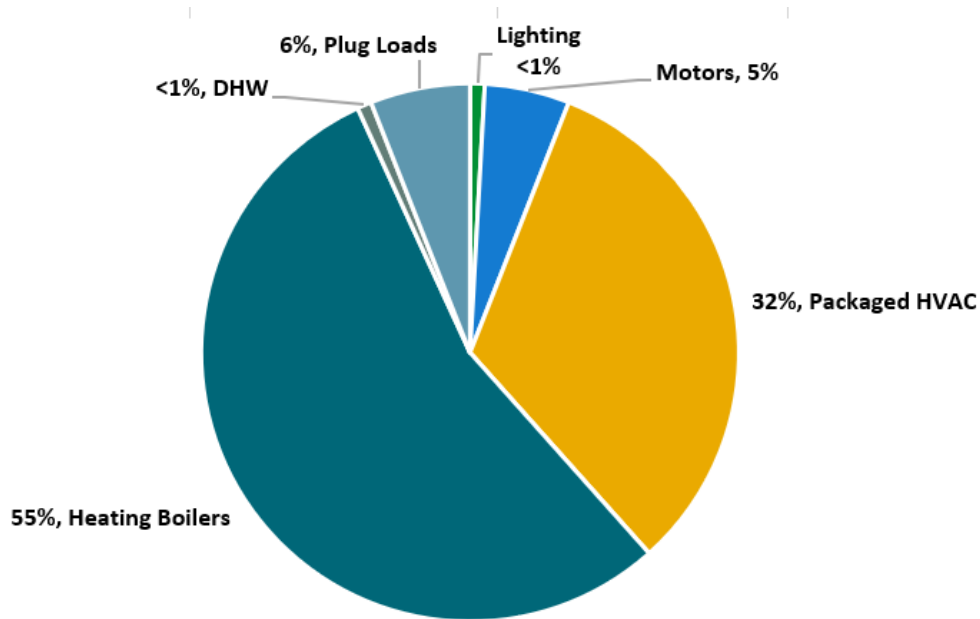
# 1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBP) has sponsored this Local Government Energy Audit (LGEA) report for the Monmouth Battlefield State Park – Tark House, Craig House, and Rhea-Applegate House. 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



ENERGY STAR® Benchmarking Score	N/A <i>(1-100 scale)</i>	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*

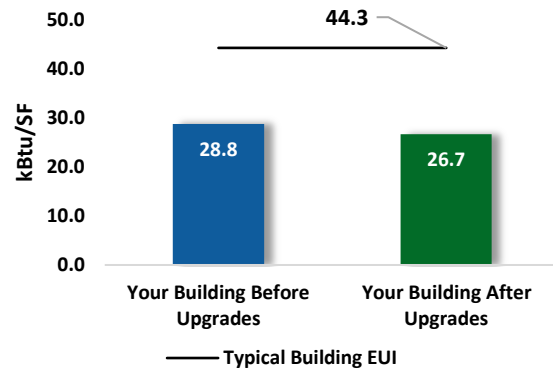
## POTENTIAL IMPROVEMENTS



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.

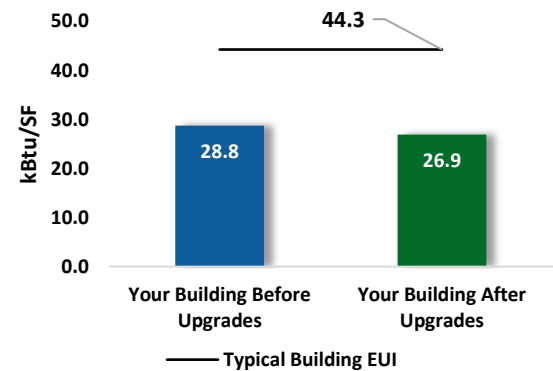
### Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	\$8,460
Potential Rebates & Incentives <sup>1</sup>	\$690
Annual Cost Savings	\$483
Annual Energy Savings	Electricity: 1,002 kWh No. 2 Fuel Oil: 81 Gallons
Greenhouse Gas Emission Savings	1 Tons
Simple Payback	16.1 Years
Site Energy Savings (All Utilities)	7%



### Scenario 2: Cost Effective Package<sup>2</sup>

Installation Cost	\$3,750
Potential Rebates & Incentives	\$510
Annual Cost Savings	\$390
Annual Energy Savings	Electricity: 540 kWh No. 2 Fuel Oil: 81 Gallons
Greenhouse Gas Emission Savings	1 Tons
Simple Payback	8.3 Years
Site Energy Savings (all utilities)	6%



### On-site Generation Potential

Photovoltaic	None
Combined Heat and Power	None

<sup>1</sup> Incentives are based on previously run state rebate programs. Contact your utility provider for current program incentives that may apply.

<sup>2</sup> 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>			<b>358</b>	<b>0.5</b>	<b>0</b>	<b>\$69</b>	<b>\$460</b>	<b>\$30</b>	<b>\$430</b>	<b>6.3</b>	<b>333</b>
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	No	6	0.1	0	\$1	\$140	\$20	\$120	106.2	5
ECM 2	Retrofit Fixtures with LED Lamps	Yes	352	0.4	0	\$67	\$320	\$10	\$310	4.6	328
<b>Lighting Control Measures</b>			<b>17</b>	<b>0.0</b>	<b>0</b>	<b>\$3</b>	<b>\$270</b>	<b>\$40</b>	<b>\$230</b>	<b>71.7</b>	<b>16</b>
ECM 3	Install Occupancy Sensor Lighting Controls	No	17	0.0	0	\$3	\$270	\$40	\$230	71.7	16
<b>Motor Upgrades</b>			<b>95</b>	<b>0.0</b>	<b>0</b>	<b>\$19</b>	<b>\$1,200</b>	<b>\$0</b>	<b>\$1,200</b>	<b>62.1</b>	<b>96</b>
ECM 4	Premium Efficiency Motors	No	95	0.0	0	\$19	\$1,200	\$0	\$1,200	62.1	96
<b>Gas Heating (HVAC/Process) Replacement</b>			<b>0</b>	<b>0.0</b>	<b>11</b>	<b>\$284</b>	<b>\$3,400</b>	<b>\$500</b>	<b>\$2,900</b>	<b>10.2</b>	<b>1,863</b>
ECM 5	Install High Efficiency Furnaces	Yes	0	0.0	11	\$284	\$3,400	\$500	\$2,900	10.2	1,863
<b>HVAC System Improvements</b>			<b>101</b>	<b>0.0</b>	<b>0</b>	<b>\$21</b>	<b>\$700</b>	<b>\$120</b>	<b>\$580</b>	<b>28.3</b>	<b>102</b>
ECM 6	Install Pipe Insulation	No	101	0.0	0	\$21	\$700	\$120	\$580	28.3	102
<b>Domestic Water Heating Upgrade</b>			<b>188</b>	<b>0.0</b>	<b>0</b>	<b>\$38</b>	<b>\$30</b>	<b>\$0</b>	<b>\$30</b>	<b>0.8</b>	<b>189</b>
ECM 7	Install Low-Flow DHW Devices	Yes	188	0.0	0	\$38	\$30	\$0	\$30	0.8	189
<b>Custom Measures</b>			<b>243</b>	<b>0.0</b>	<b>0</b>	<b>\$49</b>	<b>\$2,400</b>	<b>\$0</b>	<b>\$2,400</b>	<b>49.0</b>	<b>245</b>
ECM 8	Replace Electric Water Heater with Heat Pump Water Heater	No	243	0.0	0	\$49	\$2,400	\$0	\$2,400	49.0	245
<b>TOTALS (COST EFFECTIVE MEASURES)</b>			<b>540</b>	<b>0.4</b>	<b>11</b>	<b>\$390</b>	<b>\$3,750</b>	<b>\$510</b>	<b>\$3,240</b>	<b>8.3</b>	<b>2,380</b>
<b>TOTALS (ALL MEASURES)</b>			<b>1,002</b>	<b>0.5</b>	<b>11</b>	<b>\$483</b>	<b>\$8,460</b>	<b>\$690</b>	<b>\$7,770</b>	<b>16.1</b>	<b>2,844</b>

\* - 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<sup>3</sup>*

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

<sup>3</sup> 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 (NJBPUB) has sponsored this Local Government Energy Audit (LGEA) report for the Monmouth Battlefield State Park – Tark House, Craig House, and Rhea-Applegate House. 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 August 30, 2023, TRC performed an energy audit at the Tark House, Craig House, and Rhea-Applegate House located in Freehold, New Jersey. TRC met with Kenneth Genieczko to review the facility operations and help focus our investigation on specific energy-using systems.

The Tark House is a historical, two-story, 2,838 square foot building built in 1840. Spaces include, a basement, kitchen, living room, side entrance, stairwell, and upstairs restroom. Other sections of the house use no electricity. The house is 100% heated by a No.2 fuel oil steam boiler. No cooling is present at the site.

The Craig House is a historical, two-story, 2,490 square foot building built in 1746. Spaces include, a basement, DHW utility room, office, and restroom. Other sections of the house use no electricity. The building is 100% heated by a No.2 fuel oil forced hot air furnace. No cooling is present at the site.

The Rhea Applegate House is a historical, two-story, 1,682 square foot building built in 1745. The house has no electrical consuming equipment and was inaccessible at the time of the audit. Only the exterior will be commented on.

#### **Recent Improvements and Facility Concerns**

In the past, the Tark House has been rented out to tenants, however, it is currently vacant and facility staff are interested in converting the house into a storage space.

Facility staff are interested in reglazing and replacing the wooden window frames for the Craig House. The installation of a parking lot is also being explored.

The Rhea-Applegate house is currently unused and there are no plans for remodeling or construction.

### 2.2 Building Occupancy

The Tark House is occupied intermittently/as needed for maintenance of the space.

The Craig House is occupied on Sunday afternoons during the summer to allow for historical tours. The facility is not open during the winter. Facility staff occupy the space as needed for maintenance and operations.

The Rhea-Applegate house is occupied intermittently/as needed for maintenance of the space.

Building Name	Weekday/Weekend	Operating Schedule
Tark House	Weekday	12:00 AM - 12:00 PM
	Weekend	12:00 AM - 12:00 PM
Craig House - Sunday	Weekday	N/A
	Weekend	1:00 PM - 4:00 PM
Rhea Applegate House	Weekday	12:00 AM - 12:00 PM
	Weekend	12:00 AM - 12:00 PM

*Building Occupancy Schedule*

### 2.3 Building Envelope

The Tark House envelope is comprised of a wood frame with a gypsum drywall interior and a wood plank exterior. The roof is pitched with asphalt shingles covering the deck. The building envelope and roof are in fair condition. Building windows are single pane, operable, and use wooden frames. The wooden frames are in fair condition and the windows seals are in fair condition. Exterior doors consist of wood units with glass windows which are in good condition.



*Tark House Envelope*



*Tark House Asphalt Shingle Roof*



*Tark House Windows*



*Exterior Door*

The Craig House is comprised of a wood frame with a wood plank exterior and stone foundation. The roof is pitched, clad with cedar shingles, and was recently restored. The roof and the exterior are in good condition. The windows are single pane, operable, and with wood frames. The windows appear to be in good condition. Exterior doors are solid wood and are in good condition.



*Craig House Envelope*



*Craig House Cedar Shingle Roof*



*Craig House Windows*



*Solid Wood Doors*

The Rhea-Applegate House structure is comprised of a wood frame. Exterior walls consist of a wood plank construction and ribbed concrete wall supporting the backside of the house. The pitched roof is clad with cedar shingles. The building envelope and roof are in poor condition. Facility windows and doors are currently boarded up and are inaccessible.



*Rhea-Applegate House Wood and Concrete Envelope*

## 2.4 Lighting Systems

The primary interior lighting system for the Tark House uses a mix of 4-foot linear fluorescent T12 lamps, 4-foot linear fluorescent T8 lamps, A19 LED lamps, and A19 compact fluorescent lamps (CFL). Fixture types include acrylic surface mounted fixtures and socket-lamp fixtures. Wall switches control the lighting system. Overall, the interior lighting system is in good condition.

Exterior lighting is provided by one A19 LED screw-in lamp. A wall switch controls the light, and it appears to be in good condition.



*Tark House 4-Foot Linear Fluorescent T12 Lamps*



*A19 LED Lamp*



*A19 CFL Lamp*



*Tark House Exterior LED Lamp*

The primary interior lighting system for the Craig House consists of incandescent A19 lamps. Fixture types include socket-lamp and a restroom vanity wall sconce. Wall switches control the lighting system. Overall, the interior lighting system is in fair condition due to some non-functioning interior lamps.

No exterior lighting is present at the Craig House.



*Craig House A19 Incandescent Lamp*



*Restroom Vanity Lighting*

## 2.5 Air Handling Systems

### Unitary Heating Equipment

A Low Boy, 99 MBh, forced hot air furnace serves the Craig House heating load. The furnace operates at an efficiency of 80% and uses No.2 fuel oil. A 1.0 hp, constant speed, Beckett oil burner controls the furnace. Temperature is controlled by local thermostat. The furnace and the oil burner are from 1999, are in fair condition, and have been evaluated for replacement.



*Craig House Forced Hot Air Furnace (Left) and No. 2 Fuel Oil Storage Tank (Right)*



Craig House Beckett Oil Burner



Thermostat

## 2.6 Heating Steam Systems

A Crown Boiler KSV150, 133 MBh, forced draft steam boiler serves the Tark House heating load. The boiler operates at a nominal efficiency of 80% and uses No.2 fuel oil. A 1.0 hp, constant speed, Beckett oil burner system controls the boiler. The boiler serves residential-style radiators located throughout the building. Room temperature is controlled by a thermostat and is maintained around 60°F. However, at the time of the audit, interior space temperature was set to 75°F. The boiler system is from 2005 and in fair condition. The unit has been evaluated for replacement.



Tark House Steam Boiler



Tark House Beckett Oil Burner

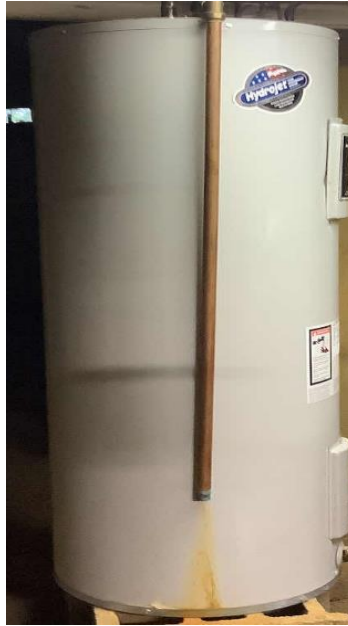


Thermostat

## 2.7 Domestic Hot Water

The Tark House is equipped with a Bradford White, electric, 50-gallon domestic hot water (DHW) tank. DHW piping is partially insulated and the installation of 50 feet of insulation has been evaluated. The unit is from 2009 and is in good condition and operating within its rated useful life.





*Tark House DHW Tank*

The Craig House is equipped with an A.O. Smith, electric, 30-gallon domestic hot water (DHW) tank. DHW piping is partially insulated and the installation of 8 feet of insulation has been evaluated. The unit's manufacture date is unknown; however, the tank appears to be in fair condition and operating beyond its rated useful life.



*Craig House DHW Tank*

## 2.8 Plug Load and Vending Machines

Plug loads at the Tark House include a dehumidifier and radio that runs continuously to mimic occupancy in the vacant residence. No other plug loads were present in the building at the time of the audit.

Craig House plug loads include a dehumidifier and an electric resistance heater both of which are located in the basement. No other plug loads were present at the site.



*Radio Plug Load*



*Dehumidifier Plug Load*

## 2.9 Water-Using Systems

Water is provided by Veolia, a municipal water supplier. Potable water is used for drinking, cleaning, cooking, and sanitary fixtures. No water leaks were observed/reported at the time of the audit.

EPA WaterSense® has set maximum flow rates for sanitary fixtures. They are: 1.28 gallons per flush (gpf) for toilets, 0.5 gpf for urinals, 1.5 gallons per minute (gpm) for lavatory faucets, and 2.0 gpm for showerheads. Restrooms across the Tark and Craig house feature toilets and sinks. Faucet flow rates are at 2.0 gpm or lower. Toilets are rated at 2.5 gpf and urinals are rated at 2.5 gpf.

Note: Provided water billing data is campus wide, meaning individual site water consumption data is unavailable. Water consumption included in the visitor center report represents the entire Monmouth Battlefield State Park.



*"Kitchen" Style Faucet*

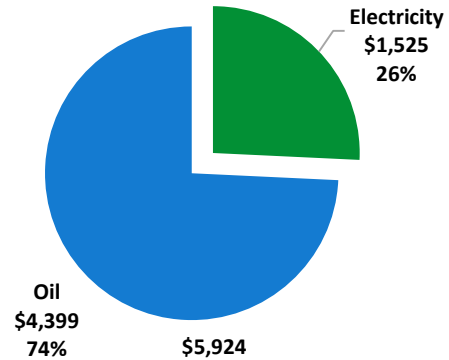


*Restroom Faucet*

### 3 ENERGY USE AND COSTS

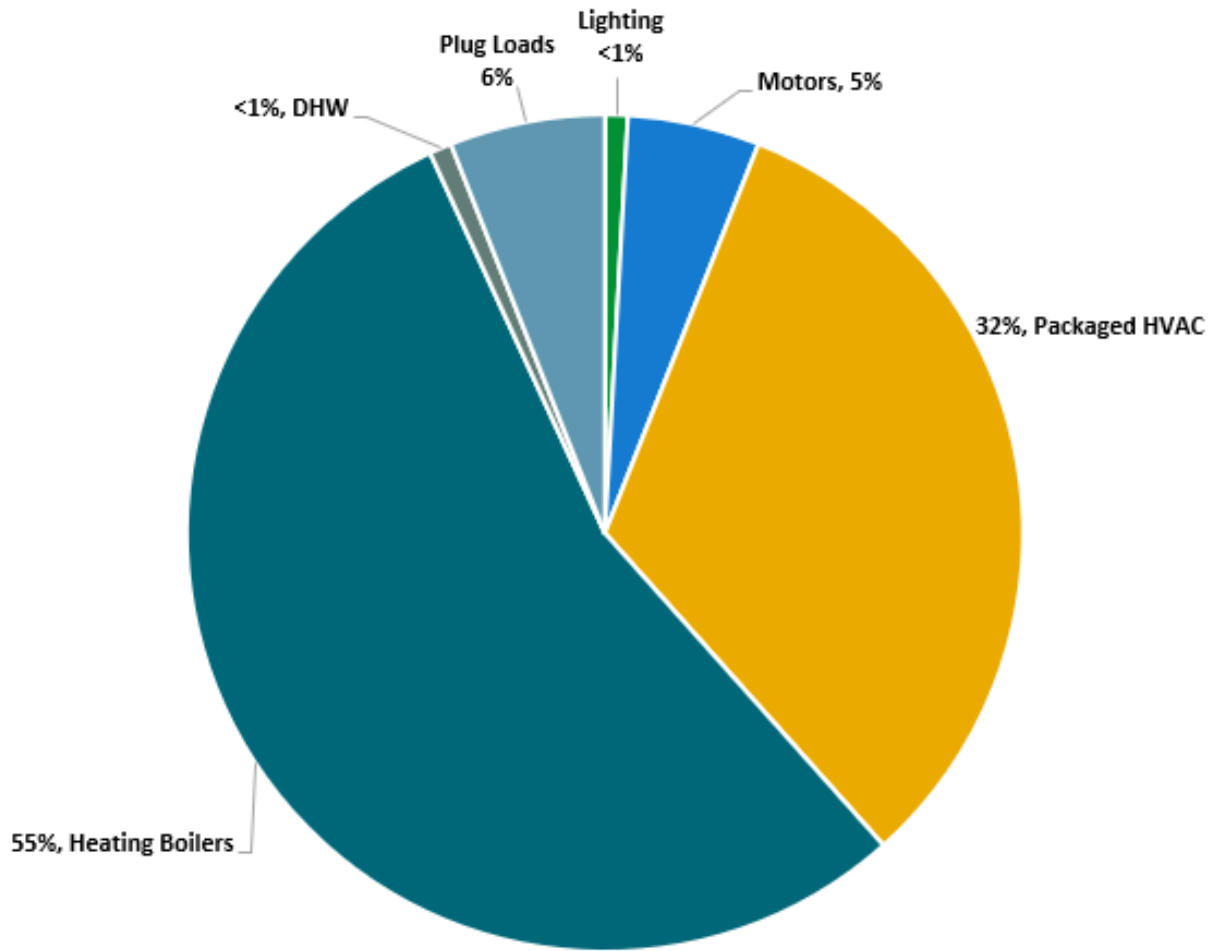
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	Usage	Cost
Electricity	7,515 kWh	\$1,525
No. 2 fuel oil	1,271 Gallons	\$4,399
<b>Total</b>		<b>\$5,924</b>



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.

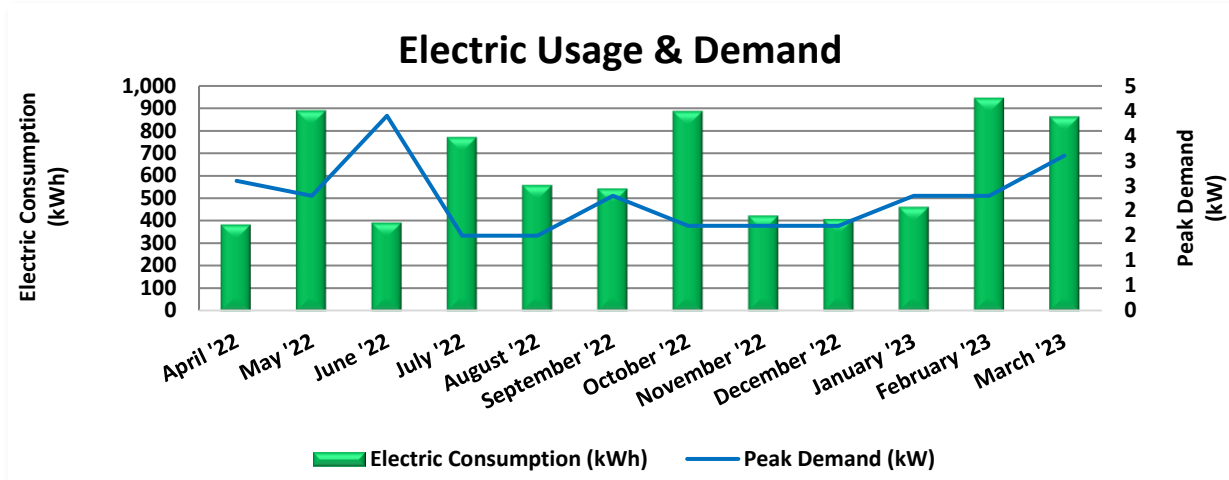
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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

JCP&L delivers electricity under rate class General Service Secondary 3 Phase (JC\_GS1\_01D), with electric production provided by Champion, a third-party supplier.



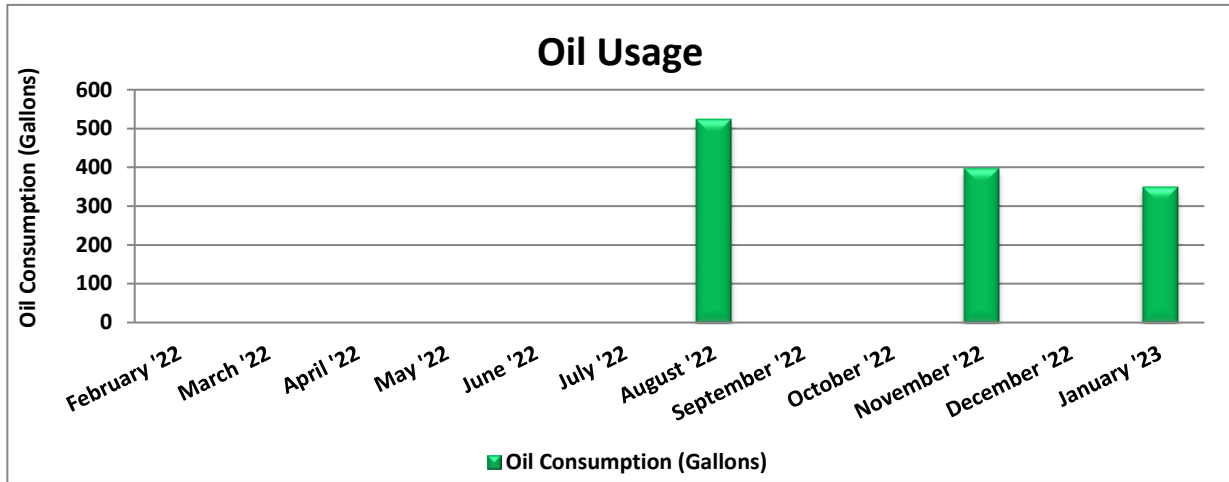
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
4/26/22	30	384	3	0	79
5/26/22	30	887	2	0	172
6/28/22	33	392	4	0	82
7/28/22	30	770	2	0	154
8/26/22	29	558	2	0	114
9/27/22	32	542	2	0	111
10/26/22	29	885	2	0	172
11/23/22	28	423	2	0	86
12/23/22	30	408	2	0	83
1/26/23	34	462	2	0	99
2/23/23	28	943	2	0	196
3/27/23	32	861	3	0	179
<b>Totals</b>	<b>365</b>	<b>7,515</b>	<b>4</b>	<b>\$0</b>	<b>\$1,525</b>
<b>Annual</b>	<b>365</b>	<b>7,515</b>	<b>4</b>	<b>\$0</b>	<b>\$1,525</b>

Notes:

- Peak demand of 4 kW occurred in June '22.
- Average demand over the past 12 months was 2 kW.
- The average electric cost over the past 12 months was \$0.203/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 No. 2 Fuel Oil

Taylor Oil Company delivers No. 2 fuel oil to the project site.



No. 2 fuel oil Billing Data			
Period Ending	Days in Period	Oil Usage (Gallons)	Fuel Cost
3/1/22	28	0	0
4/1/22	31	0	0
5/1/22	30	0	0
6/1/22	31	0	0
7/1/22	30	0	0
8/1/22	31	0	0
9/1/22	31	524	\$1,831
10/1/22	30	0	\$0
11/1/22	31	0	\$0
12/1/22	30	398	\$1,366
1/1/23	31	0	\$0
2/1/23	31	350	\$1,202
<b>Totals</b>	<b>365</b>	<b>1,271</b>	<b>\$4,399</b>
<b>Annual</b>	<b>365</b>	<b>1,271</b>	<b>\$4,399</b>

Notes:

- The average No. 2 fuel oil cost for the past 12 months is \$3.460/Gallon, which is the blended rate used throughout the analysis.
- Fuel deliveries do not necessarily correspond to periods of use.

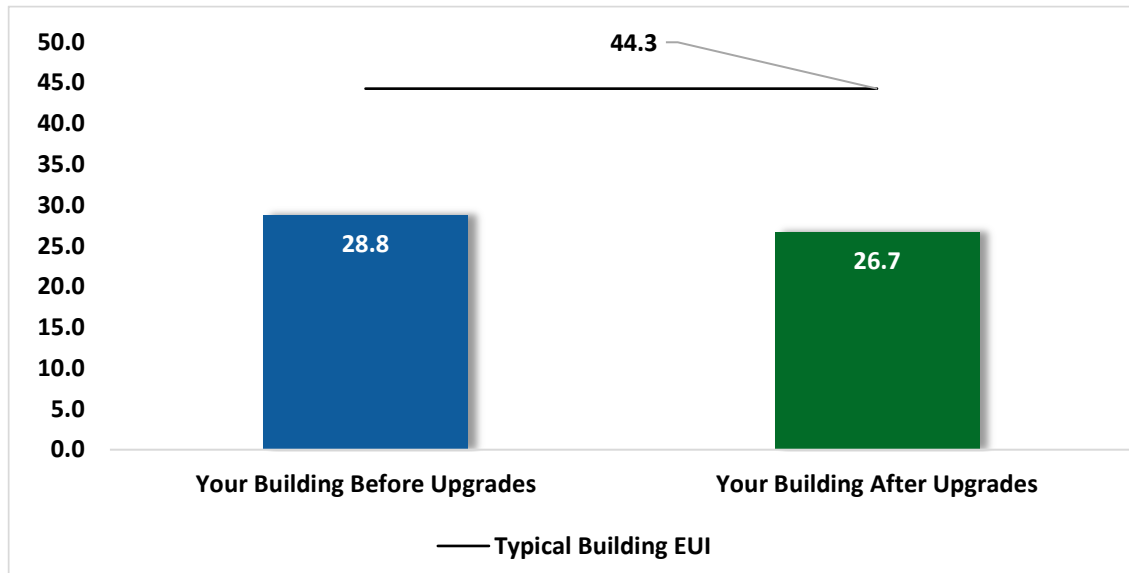
### 3.3 Benchmarking

Your buildings were 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.

<b>Benchmarking Score</b>	<b>N/A</b>
---------------------------	------------

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<sup>4</sup>*

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.

<sup>4</sup> Based on all evaluated ECMs



### **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](#).



### 3.4 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_Electric_Bill.pdf)

[https://www.nj.gov/rpa/docs/Understanding\\_Gas\\_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 or 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>			<b>358</b>	<b>0.5</b>	<b>0</b>	<b>\$69</b>	<b>\$460</b>	<b>\$30</b>	<b>\$430</b>	<b>6.3</b>	<b>333</b>
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	No	6	0.1	0	\$1	\$140	\$20	\$120	106.2	5
ECM 2	Retrofit Fixtures with LED Lamps	Yes	352	0.4	0	\$67	\$320	\$10	\$310	4.6	328
<b>Lighting Control Measures</b>			<b>17</b>	<b>0.0</b>	<b>0</b>	<b>\$3</b>	<b>\$270</b>	<b>\$40</b>	<b>\$230</b>	<b>71.7</b>	<b>16</b>
ECM 3	Install Occupancy Sensor Lighting Controls	No	17	0.0	0	\$3	\$270	\$40	\$230	71.7	16
<b>Motor Upgrades</b>			<b>95</b>	<b>0.0</b>	<b>0</b>	<b>\$19</b>	<b>\$1,200</b>	<b>\$0</b>	<b>\$1,200</b>	<b>62.1</b>	<b>96</b>
ECM 4	Premium Efficiency Motors	No	95	0.0	0	\$19	\$1,200	\$0	\$1,200	62.1	96
<b>Gas Heating (HVAC/Process) Replacement</b>			<b>0</b>	<b>0.0</b>	<b>11</b>	<b>\$284</b>	<b>\$3,400</b>	<b>\$500</b>	<b>\$2,900</b>	<b>10.2</b>	<b>1,863</b>
ECM 5	Install High Efficiency Furnaces	Yes	0	0.0	11	\$284	\$3,400	\$500	\$2,900	10.2	1,863
<b>HVAC System Improvements</b>			<b>101</b>	<b>0.0</b>	<b>0</b>	<b>\$21</b>	<b>\$700</b>	<b>\$120</b>	<b>\$580</b>	<b>28.3</b>	<b>102</b>
ECM 6	Install Pipe Insulation	No	101	0.0	0	\$21	\$700	\$120	\$580	28.3	102
<b>Domestic Water Heating Upgrade</b>			<b>188</b>	<b>0.0</b>	<b>0</b>	<b>\$38</b>	<b>\$30</b>	<b>\$0</b>	<b>\$30</b>	<b>0.8</b>	<b>189</b>
ECM 7	Install Low-Flow DHW Devices	Yes	188	0.0	0	\$38	\$30	\$0	\$30	0.8	189
<b>Custom Measures</b>			<b>243</b>	<b>0.0</b>	<b>0</b>	<b>\$49</b>	<b>\$2,400</b>	<b>\$0</b>	<b>\$2,400</b>	<b>49.0</b>	<b>245</b>
ECM 8	Replace Electric Water Heater with Heat Pump Water Heater	No	243	0.0	0	\$49	\$2,400	\$0	\$2,400	49.0	245
<b>TOTALS</b>			<b>1,002</b>	<b>0.5</b>	<b>11</b>	<b>\$483</b>	<b>\$8,460</b>	<b>\$690</b>	<b>\$7,770</b>	<b>16.1</b>	<b>2,844</b>

\* - 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>		<b>352</b>	<b>0.4</b>	<b>0</b>	<b>\$67</b>	<b>\$320</b>	<b>\$10</b>	<b>\$310</b>	<b>4.6</b>	<b>328</b>
ECM 2	Retrofit Fixtures with LED Lamps	352	0.4	0	\$67	\$320	\$10	\$310	4.6	328
<b>Gas Heating (HVAC/Process) Replacement</b>		<b>0</b>	<b>0.0</b>	<b>11</b>	<b>\$284</b>	<b>\$3,400</b>	<b>\$500</b>	<b>\$2,900</b>	<b>10.2</b>	<b>1,863</b>
ECM 5	Install High Efficiency Furnaces	0	0.0	11	\$284	\$3,400	\$500	\$2,900	10.2	1,863
<b>Domestic Water Heating Upgrade</b>		<b>188</b>	<b>0.0</b>	<b>0</b>	<b>\$38</b>	<b>\$30</b>	<b>\$0</b>	<b>\$30</b>	<b>0.8</b>	<b>189</b>
ECM 7	Install Low-Flow DHW Devices	188	0.0	0	\$38	\$30	\$0	\$30	0.8	189
<b>TOTALS</b>		<b>540</b>	<b>0.4</b>	<b>11</b>	<b>\$390</b>	<b>\$3,750</b>	<b>\$510</b>	<b>\$3,240</b>	<b>8.3</b>	<b>2,380</b>

\* - 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>		<b>358</b>	<b>0.5</b>	<b>0</b>	<b>\$69</b>	<b>\$460</b>	<b>\$30</b>	<b>\$430</b>	<b>6.3</b>	<b>333</b>
ECM 1	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	6	0.1	0	\$1	\$140	\$20	\$120	106.2	5
ECM 2	Retrofit Fixtures with LED Lamps	352	0.4	0	\$67	\$320	\$10	\$310	4.6	328

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: Retrofit Fluorescent Fixtures with LED Lamps and Drivers**

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

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

**Affected Building Areas:** outlined below.

*Tark House:* basement T12 fixtures

### **ECM 2: Retrofit Fixtures with LED Lamps**

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

*Tark House:* basement, side entrance, stairwell, and upstairs restroom

*Craig House:* basement, DHW utility room, office, and restroom

## 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Control Measures</b>		<b>17</b>	<b>0.0</b>	<b>0</b>	<b>\$3</b>	<b>\$270</b>	<b>\$40</b>	<b>\$230</b>	<b>71.7</b>	<b>16</b>
ECM 3	Install Occupancy Sensor Lighting Controls	17	0.0	0	\$3	\$270	\$40	\$230	71.7	16

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**

We evaluated installing 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:** outlined below.

*Craig House:* office

### 4.3 Motors

#	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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Motor Upgrades</b>		<b>95</b>	<b>0.0</b>	<b>0</b>	<b>\$19</b>	<b>\$1,200</b>	<b>\$0</b>	<b>\$1,200</b>	<b>62.1</b>	<b>96</b>
ECM 4	Premium Efficiency Motors	95	0.0	0	\$19	\$1,200	\$0	\$1,200	62.1	96

#### **ECM 4: Premium Efficiency Motors**

We evaluated replacing standard efficiency motors with IHP 2014 efficiency motors. This evaluation assumes that existing motors will be replaced with motors of equivalent size and type. In some cases, additional savings may be possible by downsizing motors to better meet the motor’s current load requirements.

#### **Affected Motors:**

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Basement - Tark House	Oil Burner	1	Other	1.0	Oil Burner
Basement - Craig House	Oil Burner	1	Other	1.0	Oil Burner

Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours. The base case motor energy consumption is estimated using the efficiencies found on nameplates or estimated based on the age of the motor and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the current *New Jersey’s Clean Energy Program Protocols to Measure Resource Savings*.

### 4.4 Gas-Fired 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Gas Heating (HVAC/Process) Replacement</b>		<b>0</b>	<b>0.0</b>	<b>11</b>	<b>\$284</b>	<b>\$3,400</b>	<b>\$500</b>	<b>\$2,900</b>	<b>10.2</b>	<b>1,863</b>
ECM 5	Install High Efficiency Furnaces	0	0.0	11	\$284	\$3,400	\$500	\$2,900	10.2	1,863

#### **ECM 5: Install High Efficiency Furnaces**

Replace standard efficiency furnaces with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases, which can significantly improve furnace efficiency. Savings result from improved system efficiency.

Note: these units produce acidic condensate that require proper drainage.

**Affected Units:** outlined below.

*Craig House:* forced hot air furnace

## 4.5 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>HVAC System Improvements</b>		<b>101</b>	<b>0.0</b>	<b>0</b>	<b>\$21</b>	<b>\$700</b>	<b>\$120</b>	<b>\$580</b>	<b>28.3</b>	<b>102</b>
ECM 6	Install Pipe Insulation	101	0.0	0	\$21	\$700	\$120	\$580	28.3	102

### **ECM 6: Install Pipe Insulation**

We evaluated installing 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:** outlined below.

*Tark House:* DHW tank pipes

*Craig House:* DHW tank pipes

## 4.6 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Domestic Water Heating Upgrade</b>		<b>188</b>	<b>0.0</b>	<b>0</b>	<b>\$38</b>	<b>\$30</b>	<b>\$0</b>	<b>\$30</b>	<b>0.8</b>	<b>189</b>
ECM 7	Install Low-Flow DHW Devices***	188	0.0	0	\$38	\$30	\$0	\$30	0.8	189

### **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
Faucet aerator (kitchen)	1.5 gpm
Showerhead	2.0 gpm
Pre-rinse spray valve (kitchen)	1.28 gpm

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



## 4.7 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Custom Measures</b>		<b>243</b>	<b>0.0</b>	<b>0</b>	<b>\$49</b>	<b>\$2,400</b>	<b>\$0</b>	<b>\$2,400</b>	<b>49.0</b>	<b>245</b>
ECM 8	Replace Electric Water Heater with Heat Pump Water Heater	243	0.0	0	\$49	\$2,400	\$0	\$2,400	49.0	245

### **CM 8: Replace Electric Water Heater with Heat Pump Water Heater**

Replace the existing electric water heater with a heat pump water heater (HPWH).

A typical electric water heater uses electric resistance coils to heat water at a coefficient of performance (COP) of 1. Air source heat pump water heaters use a refrigeration cycle to transfer heat from the surrounding air to the domestic water. The typical average COP for a HPWH is about 2.5, so they require significantly less electricity to produce the same amount of hot water as a traditional electric water heater. There are two types of HPWH, those integrated with the heat pump and storage tank in the same unit, and those that are split into two sections (with the storage tank separate from the heat pump). The following addresses integrated HPWH.

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation. Ideal locations are garages, large enclosed, unconditioned storage areas, or areas with excess heat such as a furnace or boiler room.<sup>5</sup> The HPWH will also produce condensate so accommodations for draining the condensate need to be provided.

Most HPWH operate effectively down to an air temperature of 40 °F. Below that temperature, an electric resistance booster heater is typically required to achieve full heating capacity. It is critical that the HPWH controls are set up so that the electric resistance heat only engages when the air temperature is too cold for the HPWH to extract heat from it. HPWHs have a slow recovery. During periods of high demand, the electric resistance heating element, if enabled, may be energized to maintain set point, thus reducing the overall efficiency of the unit. It is recommended that a careful analysis of the hot water demand be conducted to determine if the application makes economic sense, and the HPWH heating capacity and storage are properly sized.

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

**Affected Units:** outlined below.

*Tark House:* DHW tank

<sup>5</sup><https://basc.pnnl.gov/code-compliance/heat-pump-water-heaters-code-compliance-brief#:~:text=HPWH%20must%20have%20unrestricted%20airflow,depending%20on%20size%20of%20system>

## 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<sup>6</sup>. 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.

### **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.

<sup>6</sup> <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager>

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.

### **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.

### **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.

### **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 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<sup>7</sup>. 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<sup>8</sup>.

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<sup>9</sup> or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"<sup>10</sup> to get ideas for creating a water management plan and best practices for a wide range of water using systems.

### 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

<sup>7</sup> 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, \(1998\)](#)

<sup>8</sup> <https://dep.nj.gov/wp-content/uploads/dsr/trends-water-supply.pdf>

<sup>9</sup> <https://www.epa.gov/watersense>

<sup>10</sup> <https://www.epa.gov/watersense/watersense-work-0>

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.

## 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.

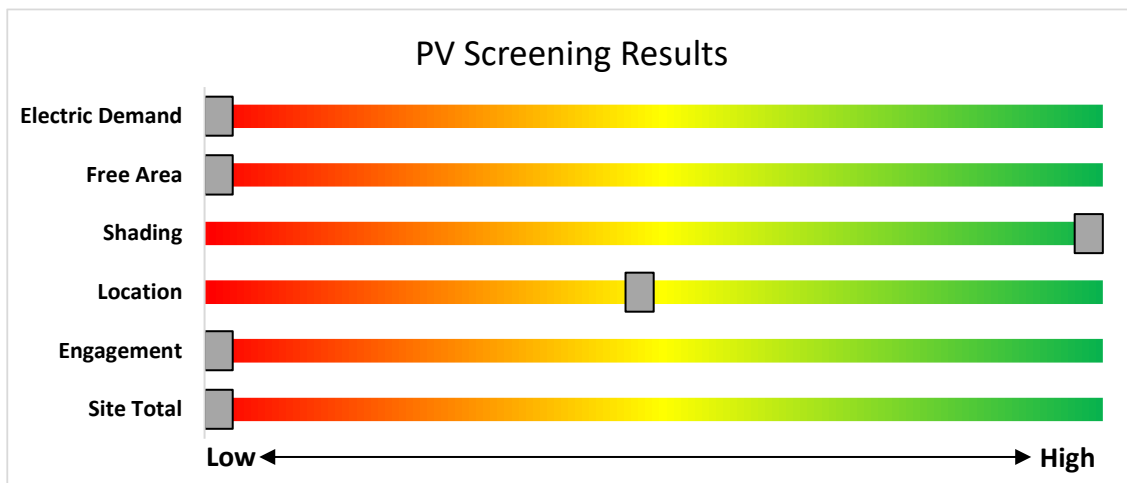
## 7.1 Solar Photovoltaic

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.

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

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

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



*Photovoltaic Screening*

### 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:** <http://www.njcleanenergy.com/whysolar>
- ◆ **NJ Solar Market FAQs:** [www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs](http://www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs)
- ◆ **Approved Solar Installers in the NJ Market:** [http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved\\_vendorsearch/?id=60&start=1](http://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.

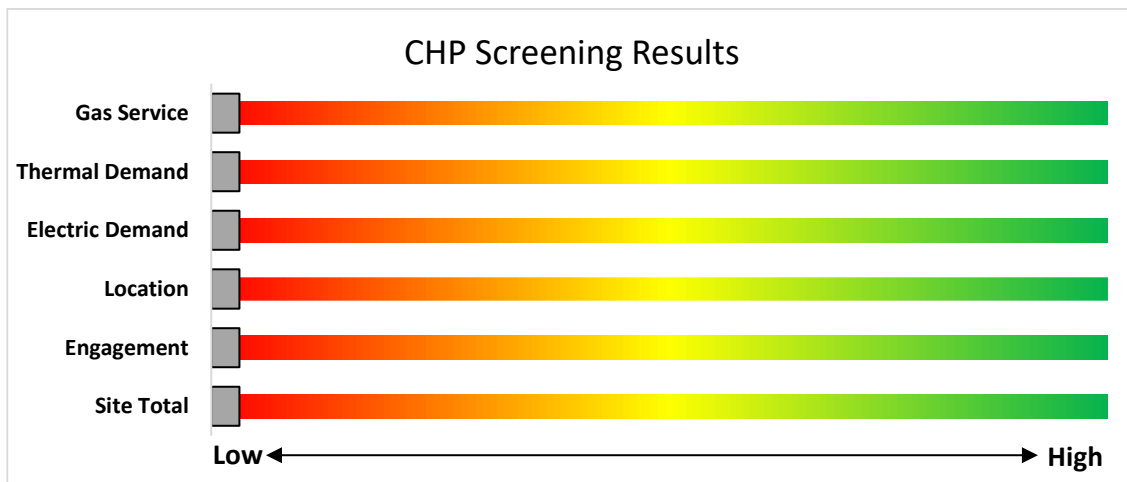
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be 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 no potential for installing a cost-effective CHP system.

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

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



*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/](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.

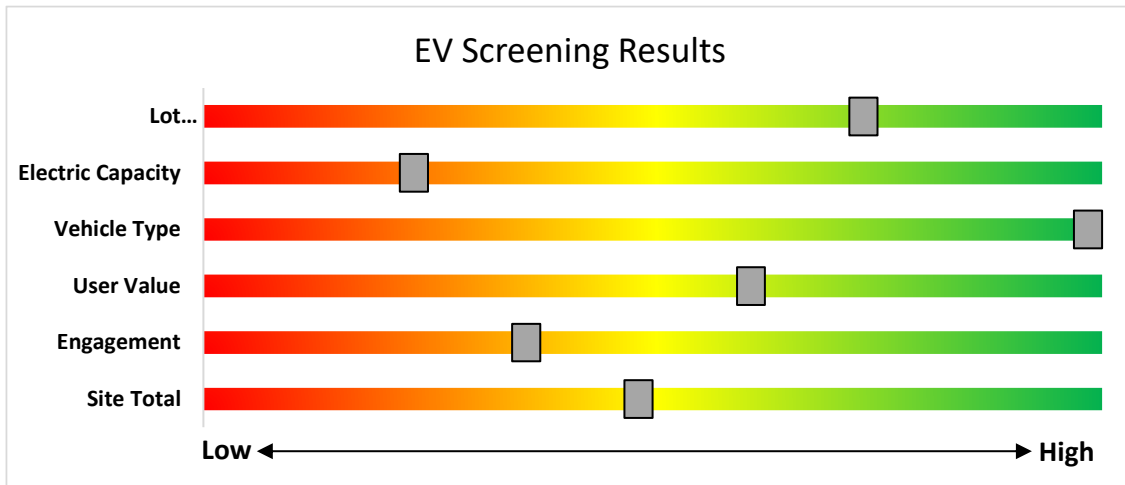
The type and size of the parking area impact the costs and feasibility of adding EV charging. Parking structure installations can be less costly than surface lot installations as power may be readily available, and equipment and wiring can be surface mounted. Parking lot installations often require trenching 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 (FEED). Once the FEED 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<sup>11</sup>

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

<sup>11</sup>

<sup>1</sup> 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).

<sup>2</sup> 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).

<sup>3</sup> 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.

<sup>4</sup> 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.

<sup>5</sup> 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](http://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<sup>12</sup>. 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<sup>13</sup>.

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.

---

<sup>12</sup> <http://www.pjm.com/markets-and-operations/demand-response.aspx>.

<sup>13</sup> <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	Variable Frequency Drives
Lighting Controls	Electronically Commutate Motors
HVAC Equipment	Variable Frequency Drives
Refrigeration	Plug Load Controls
Gas Heating	Washers and Dryers
Gas Cooling	Agricultural
Commercial Kitchen Equipment	Water Heating
Food Service Equipment	

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 incentive

### 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

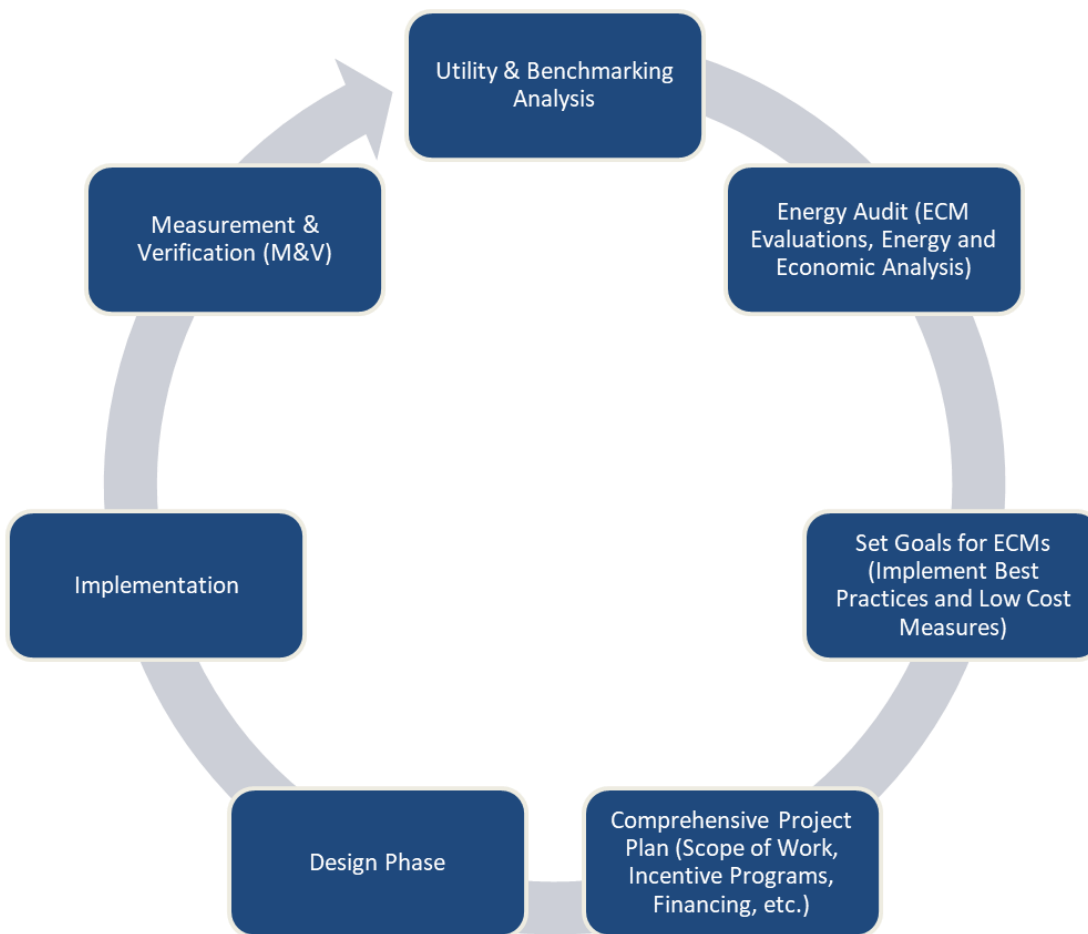
The Engineered Solutions Program provides tailored energy-efficiency assistance and services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. Customers receive expert guided services, including investment-grade energy 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<sup>14</sup>.

### 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<sup>15</sup>.

---

<sup>14</sup> [www.state.nj.us/bpu/commercial/shopping.html](http://www.state.nj.us/bpu/commercial/shopping.html)

<sup>15</sup> [www.state.nj.us/bpu/commercial/shopping.html](http://www.state.nj.us/bpu/commercial/shopping.html)

## APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

### Lighting Inventory & Recommendations

Location	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
	Fixture Quantity	Fixture Description	Control System	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
Basement - Tark House	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	50	1	Relamp & Reballast	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	50	0.1	6	0	\$1	\$140	\$20	106.2
Basement - Tark House	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	50	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	50	0.0	2	0	\$0	\$40	\$10	94.9
Exterior Socket - Tark House	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	20		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	20	0.0	0	0	\$0	\$0	\$0	0.0
Kitchen - Tark House	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	150		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	150	0.0	0	0	\$0	\$0	\$0	0.0
Living Room - Tark House	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	8,760		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Side Entrance - Tark House	1	Compact Fluorescent: (1) 26W A19 Screw-In Lamp	Wall Switch	S	26	20	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	19	20	0.0	0	0	\$0	\$20	\$0	746.0
Stairwell - Tark House	1	Compact Fluorescent: (1) 26W A19 Screw-In Lamp	Wall Switch	S	26	20	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	19	20	0.0	0	0	\$0	\$20	\$0	746.0
Upstairs Restroom - Tark House	1	Compact Fluorescent: (1) 26W A19 Screw-In Lamp	Wall Switch	S	26	150	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	19	150	0.0	1	0	\$0	\$20	\$0	99.5
Basement - Craig House	4	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	50	2	Relamp	No	4	LED Lamps: A19 Lamps	Wall Switch	9	50	0.1	10	0	\$2	\$80	\$0	41.0
DHW Utility Room - Craig House	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	20	2	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	9	20	0.1	2	0	\$0	\$40	\$0	102.4
Office - Craig House	3	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,000	2, 3	Relamp	Yes	3	LED Lamps: A19 Lamps	Occupancy Sensor	9	1,380	0.1	323	0	\$62	\$330	\$40	4.7
Restroom - Craig House	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	300	2	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	9	300	0.1	31	0	\$6	\$40	\$0	6.8



**Motor Inventory & Recommendations**

Location	Area(s)/System(s) Served	Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
		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
Basement - Tark House	Oil Burner	1	Other	1.00	82.5%	No	Beckett	AFG70MDAS	B	2,000	4	Yes	85.5%	No		0.0	48	0	\$10	\$600	\$0	62.1
Basement - Craig House	Oil Burner	1	Other	1.00	82.5%	No	Beckett	AF53XN	B	2,000	4	Yes	85.5%	No		0.0	48	0	\$10	\$600	\$0	62.1
Basement - Craig House	Sump Pump	1	Other	0.10	65.0%	No			W	2,500		No	65.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Restroom - Craig House	Exhaust Fan	1	Exhaust Fan	0.30	65.0%	No			W	300		No	65.0%	No		0.0	0	0	\$0	\$0	\$0	0.0

**Packaged HVAC Inventory & Recommendations**

Location	Area(s)/System(s) Served	Existing Conditions										Proposed Conditions							Energy Impact & Financial Analysis						
		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
Basement - Craig House	Forced Air Furnace	1	Forced Air Furnace		99.00		0.8 AFUE	Low-Boy	367AAN060120A ABG	B	5	Yes	1	Forced Air Furnace		99.00		0.97 AFUE	0.0	0	11	\$284	\$3,400	\$500	10.2

**Space Heating Boiler Inventory & Recommendations**

Location	Area(s)/System(s) Served	Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis									
		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			
Basement - Tark House	Steam Boiler	1	Forced Draft Steam Boiler	133	Crown Boiler	KSZ150	B		No									0.0	0	0	\$0	\$0	\$0	0.0

**Pipe Insulation Recommendations**

Location	Area(s)/System(s) Affected	Recommendation Inputs			Energy Impact & Financial Analysis						
		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
Basement - Tark House	DHW Tank	6	50	1.00	0.0	51	0	\$10	\$600	\$100	48.7
DHW Utility Room - Craig House	DHW Tank	6	8	1.00	0.0	51	0	\$10	\$100	\$20	7.8

**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
Basement - Tark House	DHW Tank	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White	M250T6DS-1NCWW	B		No						0.0	0	0	\$0	\$0	\$0	0.0
DHW Utility Room - Craig House	DHW Tank	1	Storage Tank Water Heater (≤ 50 Gal)	A.O. Smith	KEN 30 780	B		No						0.0	0	0	\$0	\$0	\$0	0.0

**Low-Flow Device Recommendations**

		Recommendation 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
Kitchen - Tark House	7	1	Faucet Aerator (Kitchen)	1.80	1.50	0.0	25	0	\$5	\$10	\$0	2.0
Restroom - Craig House	7	1	Faucet Aerator (Lavatory)	2.00	0.50	0.0	123	0	\$25	\$10	\$0	0.4
Restroom - Craig House	7	1	Faucet Aerator (Kitchen)	2.00	1.50	0.0	41	0	\$8	\$10	\$0	1.2

**Plug Load Inventory**

		Existing Conditions				
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified ?	Manufacturer	Model
Basement - Tark House	1	Dehumidifier	350	No		
Living Room - Tark House	1	Radio	10	No		
Basement - Craig House	1	Dehumidifier	350	No		
Basement - Craig House	1	Electric Space Heater	1,500	No		

**Custom (High Level) Measure Analysis**

Electric Tank Water Heater to HPWH

**NOTE: HPWH calculation should not be used for existing water heaters with a storage capacity greater than 120 gal or less than 30 gal.**

Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis										
Description	Area(s)/System(s) Served	SF of Area Served	Fuel Type	Input Capacity per Unit (kW)	Tank Capacity per Unit (Gal)	Description	COP	Tank Capacity per Unit (Gal)	Estimated Unit Cost	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost (\$)	Base Incentives	Enhanced Incentives	Total Incentives	Total Net Cost	Payback w/o Incentives in Years	Payback w/ Incentives in Years
Storage Tank Water Heater (≤50 Gal)	DHW Tank - Tark House	600	Electric	4.5	50	Heat Pump Water Heater	2.5	50	\$2,383.17	0.00	243	0	\$49	\$2,400	\$0	\$0	\$0	\$2,400	48.98	48.98
			Electric																	
			Electric																	

# 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.

NJCEP uses the EPA's ENERGY STAR Portfolio Manager system to generate baseline energy usage results and comparable building EUIs. Portfolio Manager is specifically designed for benchmarking energy consumption within a building. SEPs have been provided individually for the Tark and Craig houses. Due to the building type the Rhea house has been evaluated based on the entire Monmouth Battlefield State Park campus.

## ENERGY STAR® Statement of Energy Performance

LEARN MORE AT [energystar.gov](http://energystar.gov)

N/A

### DEP - Monmouth Battlefield State Park (MBSP Campus)

Primary Property Type: Other - Public Services  
Gross Floor Area (ft<sup>2</sup>): 54,698  
Built: 1800

**ENERGY STAR®**  
Score<sup>1</sup>

For Year Ending: February 28, 2023  
Date Generated: February 05, 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		
<p><b>Property Address</b> DEP - Monmouth Battlefield State Park (MBSP Campus) 20 State Route 33 / 333 Freehold Manalapan, New Jersey 07728</p>	<p><b>Property Owner</b> State of New Jersey 428 East State Street Trenton, NJ 08625 (609) 940-4129</p>	<p><b>Primary Contact</b> New Jersey Board of Public Utilities State Energy Services 44 South Clinton Ave Trenton, NJ 08625 6096339666 BPU.EnergyServices@bpu.nj.gov</p>
Property ID: 28034796		

Energy Consumption and Energy Use Intensity (EUI)			
<b>Site EUI</b>	<b>Annual Energy by Fuel</b>		<b>National Median Comparison</b>
39.2 kBtu/ft <sup>2</sup>	Propane (kBtu)	602,223 (28%)	National Median Site EUI (kBtu/ft <sup>2</sup> ) 44.3
	Fuel Oil (No. 2) (kBtu)	337,369 (16%)	National Median Source EUI (kBtu/R <sup>2</sup> ) 89.3
	Electric - Grid (kBtu)	1,207,164 (56%)	% Diff from National Median Source EUI -11%
<b>Source EUI</b>			<b>Annual Emissions</b>
79.1 kBtu/ft <sup>2</sup>			Total (Location-Based) GHG Emissions (Metric Tons CO <sub>2</sub> e/year) 172

### 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)

# ENERGY STAR<sup>®</sup> Statement of Energy Performance

N/A

## MBSP - Craig House

Primary Property Type: Other - Public Services  
Gross Floor Area (ft<sup>2</sup>): 2,490  
Built: 1840

ENERGY STAR<sup>®</sup>  
Score<sup>1</sup>

For Year Ending: February 28, 2023  
Date Generated: February 05, 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		
<b>Property Address</b> MBSP - Craig House 333 Freehold / Englishtown Road Freehold, New Jersey 07728	<b>Property Owner</b> State of New Jersey 428 East State Street Trenton, NJ 08625 (609) 940-4129	<b>Primary Contact</b> New Jersey Board of Public Utilities State Energy Services 44 South Clinton Ave Trenton, NJ 08625 6096339666 BPU.EnergyServices@bpu.nj.gov
Property ID: 28034803		

Energy Consumption and Energy Use Intensity (EUI)			
<b>Site EUI</b> 18.8 kBtu/ft <sup>2</sup>	<b>Annual Energy by Fuel</b> Fuel Oil (No. 2) (kBtu) 21,404 (46%) Electric - Grid (kBtu) 25,449 (54%)	<b>National Median Comparison</b>	
		National Median Site EUI (kBtu/ft <sup>2</sup> )	45
		National Median Source EUI (kBtu/ft <sup>2</sup> )	89.3
		% Diff from National Median Source EUI	-58%
<b>Source EUI</b> 37.3 kBtu/ft <sup>2</sup>		<b>Annual Emissions</b>	
		Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	4

### 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)**

**ENERGY STAR® Statement of Energy Performance**

LEARN MORE AT [energystar.gov](http://energystar.gov)

**N/A**

**MBSP - Tark House**

Primary Property Type: Other - Public Services  
 Gross Floor Area (ft<sup>2</sup>): 2,838  
 Built: 1840

ENERGY STAR®  
 Score<sup>1</sup>

For Year Ending: February 28, 2023  
 Date Generated: February 05, 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		
<b>Property Address</b> MBSP - Tark House 333 Freehold / Englishtown Road Freehold, New Jersey 07728	<b>Property Owner</b> State of New Jersey 428 East State Street Trenton, NJ 08625 (609) 940-4129	<b>Primary Contact</b> New Jersey Board of Public Utilities State Energy Services 44 South Clinton Ave Trenton, NJ 08625 6096339666 BPU.EnergyServices@bpu.nj.gov
<b>Property ID:</b> 28034804		

Energy Consumption and Energy Use Intensity (EUI)				
<b>Site EUI</b> 59.6 kBtu/ft <sup>2</sup>	<b>Annual Energy by Fuel</b>		<b>National Median Comparison</b>	
	Electric - Grid (kBtu)	15,122 (9%)		National Median Site EUI (kBtu/ft <sup>2</sup> )
	Fuel Oil (No. 2) (kBtu)	154,049 (91%)	National Median Source EUI (kBtu/ft <sup>2</sup> )	89.3
			% Diff from National Median Source EUI	-22%
<b>Source EUI</b> 69.7 kBtu/ft <sup>2</sup>	<b>Annual Emissions</b>			
	Total (Location-Based) GHG Emissions (Metric Tons CO <sub>2</sub> e/year)			13

**Signature & Stamp of Verifying Professional**

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

LP Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Licensed Professional

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



Professional Engineer or Registered Architect Stamp (if applicable)

## APPENDIX C: GLOSSARY

TERM	DEFINITION
<b>Blended Rate</b>	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.
<b>Btu</b>	<i>British thermal unit</i> : a unit of energy equal to the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
<b>CHP</b>	<i>Combined heat and power</i> . Also referred to as cogeneration.
<b>COP</b>	<i>Coefficient of performance</i> : a measure of efficiency in terms of useful energy delivered divided by total energy input.
<b>Demand Response</b>	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.
<b>DCV</b>	<i>Demand control ventilation</i> : a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need.
<b>US DOE</b>	<i>United States Department of Energy</i>
<b>EC Motor</b>	<i>Electronically commutated motor</i>
<b>ECM</b>	<i>Energy conservation measure</i>
<b>EER</b>	<i>Energy efficiency ratio</i> : a measure of efficiency in terms of cooling energy provided divided by electric input.
<b>EUI</b>	<i>Energy Use Intensity</i> : measures energy consumption per square foot and is a standard metric for comparing buildings' energy performance.
<b>Energy Efficiency</b>	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.
<b>ENERGY STAR</b>	ENERGY STAR is the government-backed symbol for energy efficiency. The ENERGY STAR program is managed by the EPA.
<b>EPA</b>	<i>United States Environmental Protection Agency</i>
<b>Generation</b>	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
<b>GHG</b>	<i>Greenhouse gas</i> 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.
<b>gpf</b>	<i>Gallons per flush</i>

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



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