ENERGY EVALUATION

Gunstock Acres Village District
Water System Pump Stations

Gilford, New Hampshire

PROCESS ENERGY SERVICES, LLC
WATER ♦ WASTEWATER ♦ INDUSTRIAL

ENERGY EVALUATION

for the

GUNSTOCK ACRES VILLAGE DISTRICT WATER SYSTEM

Gilford, New Hampshire

October 2023

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Supported by:

New Hampshire Department of Environmental Services

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While the recommendations in this report have been reviewed for technical accuracy, Process Energy Services is not liable if the projected savings are not achieved. The recommendations are based on an analysis of conditions observed at the time of the evaluation, information provided by facility staff and estimated costs for equipment and labor based on similar projects. Actual savings and project costs will depend on many factors, including varying process flows and loads, recommendations implemented, seasonal variations in fuel costs and weather, and proper equipment operation. Before implementation of the measures presented in this report, Process Energy Services recommends a more detailed analysis to verify savings and project costs.

SECTION 1. EXECUTIVE SUMMARY

1.1 Overview

In 2016, the New Hampshire Department of Environmental Services (NHDES), the New Hampshire Office of Energy and Planning (NHOEP) and New Hampshire electric utilities secured funding to perform comprehensive and preliminary process energy evaluations at selected New Hampshire Wastewater Treatment Facilities. Due to the success of this initial program, NHDES Clean Water State Revolving Fund (CWSRF) provided funding to continue conducting energy audits at New Hampshire's water and wastewater treatment facilities and pump stations. The NHDES CWSRF program is also providing loan forgiveness to encourage implementation of the energy audit findings. The loan forgiveness is in addition to any incentives offered by NHSaves.

Process Energy Services (PES) was selected as the consultant to perform the energy evaluation. PES specializes in water and wastewater system process energy evaluations and has performed evaluations throughout New England.

The enclosed energy saving recommendations for the Gunstock Acres Village Water District is based on a site visit to review the station pumping equipment and building systems.

1.2 Energy Initiatives

The Gunstock Acres Village Water District (GAVWD) has made upgrades over the years to improve system reliability and reduce energy costs.

1.3 Report Organization

As cost savings projects were developed, each measure was prioritized based on ease of implementation, cost effectiveness and ability for each project to support subsequent measures. The projects have been categorized as energy conservation measures (ECMs) for projects that require a capital investment, operational measures (OMs) for fast payback improvements (1 year or less) and energy supply measures (ESMs) for improvements that may reduce energy costs without reducing energy consumption (i.e. alternative energy sources and rate schedule changes). Energy management practices (EMPs) that are essential for a successful energy management program have also been included.

The report organization includes an Executive Summary to provide an overview of the recommended project savings and costs. Section 2 reviews energy management initiatives and benchmarking facility energy use. Section 3 contains an energy related overview of each pump house and Section 4 includes a detailed review of each proposed energy measure.

1.4 Electric Utility Rates

The pump stations are on the Eversource "G" Rate Schedule for single-phase power delivery and the Eversource default rate for the energy supply portion of the bill. The "G" Rate Schedule includes a service charge and a demand charge when demand exceeds 5 kW.

In November 2022, the District signed up for a new energy supply contract that increased the supply portion of the energy bill from $0.0929/kWh to $0.1645/kWh. This increase has been the case for many new municipal supply contracts due to the significant increase in the Eversource default supply rate in 2022.

1.5 Measure Cost Estimates

Once potential energy savings are identified, there are often multiple ways to improve equipment operation to realize the projected energy savings. Process Energy Services makes an effort to select the simplest, lowest cost solution for municipalities to insure the projects are cost effective and potentially qualify for utility incentives.

The project evaluation summary is presented in Table 1.1 and a summary of the qualified measures and their associated savings is presented in Table 1.2.

Table 1.1: Project Evaluation Summary

Annual Electric Energy Costs	2022 Costs	2023 Projected Costs
Pump Station #7	$ 43,292	$ 58,787
Pump Station #1	$ 16,768	$ 22,975
Pump Station #3	$ 2,977	$ 4,130
Pump Station #6	$ 7,564	$ 10,575
Pump Station #5	$ 689	$ 0
Total	**$ 71,290**	**$ 96,467**
Baseline Propane Costs		
Pump Station #7	$ 430	$ 430
Total	**$ 430**	**$ 430**
Energy Efficiency Cost and Savings Summary	Calculated Savings	Percent of 2023 Costs
Electric Cost Savings	$ 324	Minimal
Propane Savings	$ 0	0 %
Net Savings/Percent of Energy Costs	**$ 324**	**Minimal**
Energy Efficiency Project Costs/Payback		
Estimated Cost of Projects		$ 0
Simple Payback		Immediate
Renewable Energy Project Costs/Payback		
Value of Power Generated (using 2023 rates)		$ 17,254
Estimated Cost of Solar PV Project		$ 390,752
Simple Payback		21.3 years
With 30% Federal Credit Payment		
New Solar PV Project Cost		$ 273,400
New Simple Payback		14.5 years

Electric Energy Reduced Power Plant Emissions

In addition to the energy cost savings, reducing station energy use will also provide environmental benefits by reducing greenhouse gas emissions (GHG) that include CO_2, N_2O and CH_4. The information in this evaluation can be used by the GAVWD to develop a GHG inventory plan in accordance with the EPA's Climate Leadership Program. Reduced power plant emission is based on 110,118 kWh annual utility power savings (this value includes the proposed solar PV array).

Carbon Dioxide (1.37 lbs/kWh)	150,862	lbs/year
Sulfur Oxides (0.0035 lbs/kWh)	385	lbs/year
Nitrous Oxides (0.0010 lbs/kWh)	110	lbs/year

A summary of the qualified measures in the original report and their associated savings is presented in Table 1.2.

Table 1.2: Recommended Energy Efficiency Cost Saving Measures

No.	Recommended Measures	Annual Electric Energy Savings (kWh)	Annual Cost Savings	Estimated Cost	Simple Payback (years)
EMP #1	Collect Equipment Data & Benchmark Energy	--	--	--	--
OM #1	Reduce Thermostat Settings	2,280	$324	--	--
ESM #1	Investigate Solar PV Array	See Below			
Total		**2,280**	$324	--	--

After implementing the above energy saving measures, a portion of the plant's energy requirements could be met by installing solar photovoltaic (PV) panels. The cost and savings for a proposed solar PV array is summarized below.

Table 1.3: Proposed Renewable Energy Cost Savings Measure

No.	Recommended Measures	Annual Electric Energy Generation (kWh)	Annual Cost Savings	Estimated Cost	10 years of REC Payments	Simple Payback (years)
ESM #1	Investigate Solar PV Array	107,838	$17,254	$390,752	$23,440	21.3
With 30% Federal Credit		107,838	$17,254	$273,400	$23,440	14.5

SECTION 2. ENERGY MANAGEMENT

2.1 Energy Management Program

An effective energy management program provides a systematic approach to reducing facility energy use and costs. A successful program is structured to provide an on-going process that can be used to continually evaluate new projects, track savings and encourage efforts within the organization to improve efficiency.

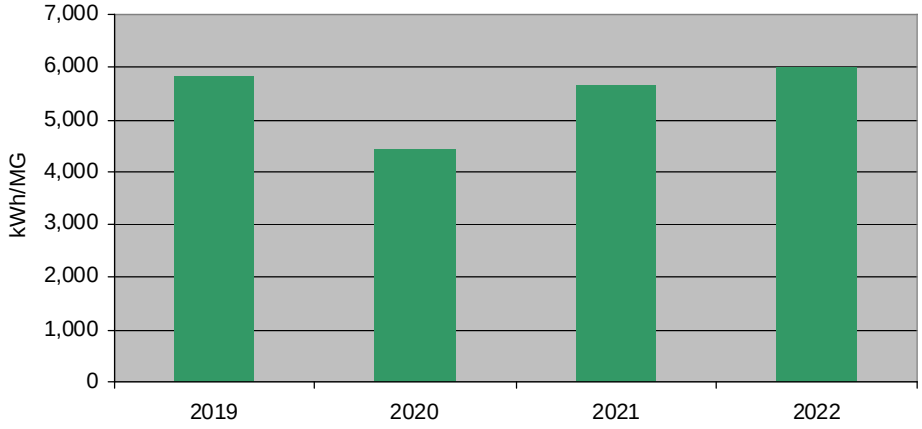
The EPA 2008 Energy Management Guidebook for Water and Wastewater Utilities presents a management system approach for water and wastewater utilities for energy conservation. Based on the successful Plan-Do-Check-Act process, the guidebook provides information on establishing and prioritizing energy conservation targets (Plan), implementing specific practices to meet these targets (Do), monitoring and measuring energy performance improvements and cost savings (Check), and periodically reviewing progress and making adjustments to energy programs (Act).

The most effective way to monitor system efficiency is to summarize electric bill data monthly and benchmark energy use with flow (kWh/MG). EMP #1 reviews the benefits of collecting the following data each month.

Four years of energy use and flow are summarized below. The kWh/MG value provides the true measure of annual system efficiency as shown in the graph. Since 2021, this benchmark value has increased, which in part was due to decommissioning Pump Station #5 in 2021 and lower pump efficiency at Pump Stations #1 and #7.

Table 2.1: Four Years of Gunstock Acres Energy Use & Flow

Year	Total Energy Use (kWh)	Total Flow (MG)	kWh/MG
2019	332,783	57.15	5,823
2020	262,977	58.95	4,461
2021	286,672	50.52	5,674
2022	387,286	64.27	6,026



2.2 Benchmarking Facility Energy Use

Energy benchmarking can be accomplished using internal or external comparisons. Internal benchmarking allows an organization to evaluate facility energy use year to year to monitor facility efficiency changes. The results can be used within an organization to track performance over time, identify best practices and increase management's understanding of how to analyze and interpret energy data.

For external benchmarking, a facility can be compared to similar regional facilities. When process and energy use data is assembled, the information can be used to assess performance and encourage staff to investigate why performance is lower than expected, or to confirm efficiency efforts by receiving a high performance rating relative to other facilities.

The benchmarking data for the GAVWD Water System is compared in Table 2.3 with other New Hampshire Water Systems. This simple comparison does not account for elevation differences or the type of heating system (electric, propane, fuel oil or natural gas), but helps encourage staff to evaluate system energy use in more detail to determine why system benchmark data is higher or lower compared to other New Hampshire communities.

As shown in Table 2.3, the kWh/MG for the GAVWD Water System is high compared to other New Hampshire groundwater type systems. The primary reason for this disparity is the significant elevation head that must be overcome for the GAVWD pump systems.

Potential New Benchmark Value

If the identified measures in Table 1.2 are implemented, annual system electric energy use could be reduced by approximately 2,280 kWh. The new kWh/MG benchmark value, after implementing the proposed projects, is summarized below.

Table 2.2: New Potential Benchmark Value after Energy Project Implementation

Total Annual Energy Usage (kWh)	Total Annual Flow Pumped (MG)	Annual kWh/MG	Total New Electrical Energy Cost	Annual Energy Cost/MG
385,006	64.3	5,987	$70,860	$1,102

The projected energy (kWh) savings will continue progress towards improving system efficiency and reduce the GAVWD Water System benchmark value.

Table 2.3: New Hampshire Water System Benchmarking Data

Water System	Total Annual System Energy (kWh)	Annual Flow (MG)	Annual kWh/MG	Type of System
Chalk Pond Water System	9,860	1.3	7,585	Wells / 1 Zone
GAVWD Water System	153,102	22.9	6,686	Wells / 1 Zone
Gunstock Acres Village District	**387,286**	**64.3**	**6,023**	**Wells / 3 Zones**
Georges Mills System	56,766	11.7	4,852	Wells / 1 Zone
District of Enfield	86,757	25.4	3,416	Wells / 1 Zone
District of Lincoln	757,615	200.8	3,773	Surface Water Treatment /Well/ 3 Zones
District of Whitefield	230,944	74.8	3,087	Wells / 3 Zones
Warner Village Water District	48,342	18.9	2,557	Wells / 1 Zone
District of Peterborough	544,915	214.4	2,541	Wells / 2 Zones
District of Woodstock	323,161	133.6	2,419	Wells/1 Zone
Hooksett Village	263,431	121.8	2,163	Wells/2 Zones
Milford	557,280	261	2,137	Wells/2 Zones
North Conway (NCWP)	604,458	283.5	2,132	Wells / 3 Zones
Conway Village (CVFD)	180,023	90.3	1,994	Wells/1 Zone
Newmarket	270,836	138.0	1,961	Wells / 2 Zones
District of Jaffrey	295,117	151.8	1,944	Wells / 2 Zones
City of Lebanon	1,048,409	544.1	1,927	Surface Water Treatment /4 Zones
District of Colebrook	229,741	122.0	1,883	Wells / 1 Zone
Rollinsford	64,058	34.6	1,851	Wells/1 Zone
Salem Water	1,438,353	779	1,846	Surface Water Treatment/3 zones
North Hinsdale	104,829	59.59	1,759	Wells / 1 Zone
Plymouth (PVW&SD)	224,786	128.9	1,744	Wells / 2 Zones
Antrim/Bennington System	87,792	50.8	1,728	Wells / 2 Zones
Hinsdale Village	38,700	23.02	1,681	Wells / 1 Zone
District of Bristol	146,271	95.3	1,535	Wells/2 Zones
City of Rochester	1,058,854	745.4	1,432	Surface Water / Well/ 4 Zones
District of Hanover	427,289	298.3	1,407	Surface Water Treatment / 3 Zones
Winchester Water Department	159,812	114.6	1,394	Wells / 1 Zone
Contoocook Village System	60,000	54.0	1,111	Surface Water Treatment/1 zone
City of Concord	1,540,339	1,546	996	Surface Water Treatment/3 zones
Sunapee Water System (2020)	49,282	51.1	964	Surface Water Treatment / 1 Zone
*City of Keene	695,226	752.3	924	Surface Water Treatment/ Wells/5 Zones
*City of Claremont	210,455	326.0	646	Surface Water Treatment/3 zones
*District of Gorham	29,578	106.9	277	Surface Water Treatment/ Wells/2 Zones
*District Of Wolfeboro	37,056	142.4	260	Surface Water Treatment / 2 Zones

*These water systems benefit from no raw water pumping.

2.3 Commissioner Input

The Gunstock Acres Commissioners have been very interested in improving system efficiency. Some of these ideas (with PES comments related to energy savings) are summarized below.

- For Pump Station #7, there are three wells 30-50' above the station. There are two wells with 10 hp motors (7C and D) that are approximately 400' lower down a cliff next to the station close to Poor Brook Farm. All the wells have VFDs except for Well #7. The station is backed up with a 100 kW Kohler single-phase 240V 100 amp generator. One of the commissioners believes that if three-phase power were brought in through Poor Book Farm, that well efficiency would be improved.

  PES Response: PES reviewed the potential energy savings for this upgrade and did not identify energy savings to support the three-phase project.

- Pump Station #7 provides approximately 85% of the system water. The station includes a booster pump system that consists of two 10 hp booster pumps with across the line starters and one 10 hp jockey pump equipped with a VFD that converts the station single phase power to three phase. One of the commissioners indicated that during periods of high demand, one of the booster pumps cycles on and off very quickly (up to 160 times/day) and that the high starting amperage is causing a high electrical demand charge. The commissioner recommended installing VFDs for these pumps to reduce the demand surge and provide smoother on and off operation.

  PES Response: PES agrees that installing VFDs would be a worthwhile project to extend the life of the pumps. However, the short amperage spikes do not appear to impact the station electrical demand significantly (based on 2022 bills) since Eversource measures the average demand based on a 30-minute period.

- The five wells at Pump Station #7 discharge water to a 25,000-gallon tank, which is undersized for the typical water demand of 100,000 to 160,000 gallons per day. The small tank size results in short cycling of the wells that could be impacting station energy costs. This would be consistent with the current upgrade at Pump Station #1 that includes a larger tank to avoid frequent pump cycling.

  PES Response: PES agrees that a larger tank would be worthwhile and could potentially reduce energy use. Operating fewer pumps at one time could also reduce energy (kWh) use with slightly lower piping friction head in the common manifold. However, this could not be quantified and would most likely be minimal savings for these high head pump systems.

- Add more building insulation and LED lights to reduce costs.

  PES Response: The operating hours for the lighting would not make new LEDs cost effective. To reduce heating system energy costs, tighter temperature control is reviewed in OM #1 since the driving heat loss factor in the pump stations is the large steel tank wall for the storage/pressure tanks in the stations. Reducing room temperature with tight thermostat settings is the most effective approach to reduce heating costs for the stations.

- Pump Station #7 is currently supplying Pump Station #1 with flow (estimated by GA to be 25% to 30% of demand). Pump Station #1 has four bedrock wells and a 50,000-gallon underground tank that is being replaced with an 80,000-gallon tank. When the station upgrade is complete, a flow meter will be installed to quantify the flow from PS #7. The PS #1 upgrade project is $1.3 million and this zone has 100 users compared to PS #7 which serves 511 users. PS #7 was originally installed 35 years ago and has had minimal upgrades.

  PES Response: There are no energy related savings for the flow meter installation.

A review of the water pumping systems, along with supporting data for the recommended improvements identified by Process Energy Services, has been presented in Section 3.

SECTION 3. WATER SYSTEM

3.1 System Overview

The Gunstock Acres Village Water District (GAVWD) provides domestic water to approximately 600 service connections in the Gunstock Acres Village in the Town of Gilford. The initial water system infrastructure was built in 1967 by the developer. As houses within the development were built, they were connected to the system. The population varies by season since many of the connections are second homes.

The water system is comprised of two well fields containing nine active bedrock wells. The one dug well previously used is no longer in service. In 2022, the average daily water use was approximately 180,000 gallons per day. The system includes four pump station sites, two pressure reducing valve (PRV) vaults, four atmospheric storage tanks, and five pressure tanks. There is approximately 15.5 miles of water distribution mains plus associated valves, blow-offs, bleeders, and service laterals.

The water system is grouped into two areas with a closed isolation valve off Silver St separating the two systems. Pump Station 1 and Booster Station 3 serve the East side of the system (15% of the services) while Pump Station 7 and Booster Station 6 serves the West side (85% of the services). As a result of the topography, the two additional booster stations (PS #3 and 6) help decrease excessive pressures in the system, but the operating pressure in several locations remains above 100 psi. .

Pump Station #1 is located on Mountain Drive with four bedrock wells and two booster pumps. Pump Station #3 is also on Mountain Drive and includes three booster pumps. Booster Station #6 is on Sagamore Road with two booster pumps and one jockey pump, and Pump Station #7 includes five bedrock wells and three booster pumps. Pump Station #5 on Silver Street is for the dug well that is no longer in service. The stations include storage tanks and hydro pneumatic tanks.

Pump Station #1 and the site tank are currently being replaced. Work has started for the new storage tank and the work will be completed in 2023. Pump Station #7 is also scheduled for new pumps and controls in 2023.

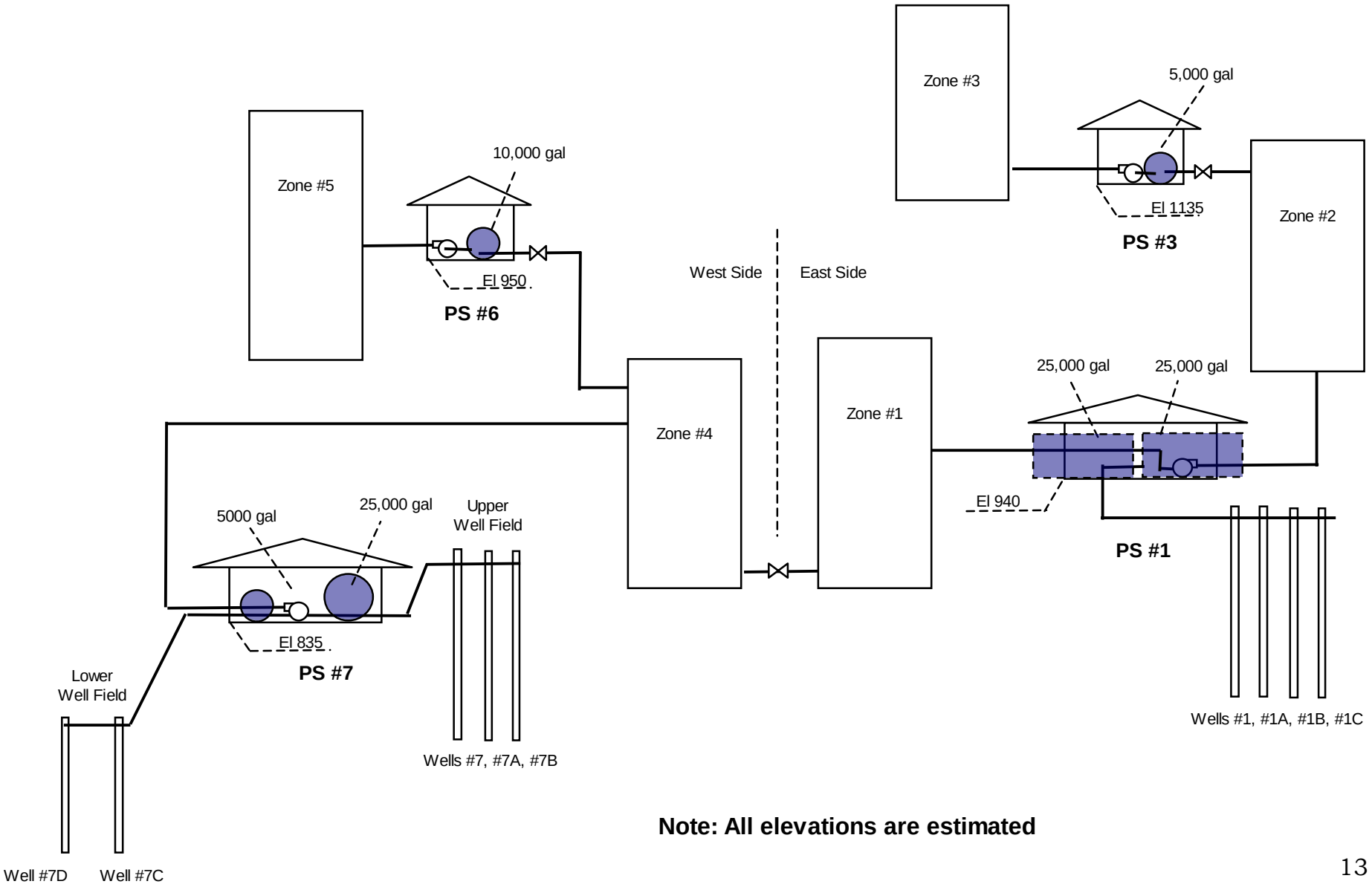
A summary of the 2022 electric and propane energy costs is shown below.

Table 3.1: 2022 District Water System Energy Use and Costs

Pump Station	Location	Annual Electric Energy Use (kWh)	Estimated Annual Electric Cost	Annual Propane Use (gallons)	Annual Propane Cost
PS #1	Mountain Road	93,931	$16,768	--	--
PS #3	Mountain Road	17,504	$2,977	--	--
PS #5	Silver Street	3,517	$689	--	--
PS #6	Sagamore Road	44,454	$7,564	--	--
PS #7	Leisure Drive	227,880	$43,292	200 (est)	$430 (est)
Total		**387,286**	**$71,290**	**200**	**$430 (est)**

A simple schematic of the water system with tank elevations is shown in Figure 3.1.

Figure 3.1: Gunstock Acres Village Water District Water System Schematic



Note: All elevations are estimated

3.2 Non-Revenue Water

Water loss control represents the efforts of water utilities to provide accountability in their operation by reliably auditing their water supplies and implementing controls to minimize system losses. Utilities incur real losses from pipeline leakage and apparent losses when customer water consumption is not properly measured or billed.

Losses in utilities include the physical escape of water from the pressurized piping system as leakage (real losses). Losses also occur due to inaccurate metering of customer consumption, theft of service, and the utility's own errant billing and accounting practices, all of which are collectively known as apparent losses. Non-revenue Water (NRW) includes the real plus apparent losses, along with unbilled authorized consumption, which represents water used in miscellaneous activities such as hydrant flushing.

To begin the process of becoming more aware of non-revenue water (leakage, un-metered municipal use, flushing), the NHDES recommends comparing pumped gallons with billed gallons to help quantify NRW. The GAVWD has a continuous leak detection reporting system that provides an indication of high water use in the system. These reports are automatically generated and make it easy for the commissioners to identify leaks and notify the contract operator.

The NHDES water conservation goal of 15% can be compared with the collected data to justify pursuing leak detection grants or more accountability to meter flow for flushing or other maintenance activities. A sample water loss table is provided below.

Table 3.2: Example Water Production & Non Revenue Water Summary

Parameter	Annual Data (MG)
Water Pumped:	64.3
Water Billed:	
Breaks/Flushing/Non-metered flow	
Total Water Use	
Unaccounted for Water	
Annual Percent Unaccounted for Water	
Average Pump Station Energy Benchmark	**6,023 kWh/MG**
Annual Energy Cost of NRW (using $0.18/kWh)	

The above energy cost for NRW is a simplified value based on electric bill data. The actual pumping related energy value will be lower since the billed energy includes miscellaneous electric loads.

There are other economical and environmental benefits that come with the reduction of water loss that are not included in this report. More information on water loss audits can be found at the following site: https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control.

3.3 Pump Station #1

Pump Station #1 is located on Mountain Drive and pumps flow to Pump Station #3. The station includes four bedrock wells and two booster pumps originally installed in the 1980s. Pump Station #1 includes two 25,000-gallon on-site atmospheric storage tanks between the well pump discharge and the booster pump suction.

The station was not reviewed in detail by PES since the tanks/station was in the process of being upgraded. However, a summary of station 2022 energy use and costs are included as well as a review of recommended data that can be collected for future pump system optimization.

According to the last NHDES Sanitary Survey, Pump Station #1 is a two level structure with chemical storage and feed pump located on the first level and piping and controls in the lower level. The pump station site includes four bedrock wells designated as Well 1, 1A, 1B and 1C. Normal operation is to have two or three wells operating in parallel. The flow is fed into a common manifold and treated with NaOH for pH adjustment and an ortho-polyphosphate blend for corrosion control.

Electric service for the station is provided on the Eversource "G" single-phase rate schedule. The 2022 station flow, runtime and electric billed energy use data is summarized below. Well hours vary between 349 and 733 hours each month based on an assumed flow of 60 gpm. The booster pump hours are estimated to be 175 and 400 based on a flow rate of 120 gpm. These are rough estimates since pump run time is not recorded on a regular basis (addressed in EMP #1) and flow rates were not available.

Table 3.3: Pump Station #1 2022 Energy & Operating Data

Month	Billed Energy Use (kWh)	Peak Demand (kW)	Estimated Well Energy Use (kWh)	Estimated Booster Energy Use (kWh)	Misc. Energy Use (kWh)	Total Flow (MG)	**Estimated** Total Well Hours	Well KWh/MG	**Estimated** Total Booster Hours	Booster KWh/MG
Jan	7,680	23.1	2,922	3,507	1,251	2.10	584	1389	292	1,667
Feb	8,078	19.4	2,754	3,305	2,019	1.98	551	1389	275	1,667
Mar	9,361	19.8	3,665	4,398	1,298	2.64	733	1389	366	1,667
Apr	9,981	17.6	1,746	2,095	6,141	1.26	349	1389	175	1,667
May	4,034	20.4	2,033	2,439	-438	1.46	407	1389	203	1,667
Jun	6,829	20.1	3,178	3,813	-162	2.29	636	1389	318	1,667
Jul	9,322	22.1	4,011	4,813	498	2.89	802	1389	401	1,667
Aug	9,086	21.2	3,029	3,635	2,423	2.18	606	1389	303	1,667
Sep	9,127	20.9	2,846	3,416	2,865	2.05	569	1389	285	1,667
Oct	6,832	19.2	1,857	2,229	2,746	1.34	371	1389	186	1,667
Nov	6,091	19.2	2,495	2,993	603	1.80	499	1389	249	1,667
Dec	7,510	15.9	2,193	2,631	2,686	1.58	439	1389	219	1,667
Totals/Avg	**93,931**	**238.9**	**32,728**	**39,273**	**21,930**	**23.56**	**6,546**	**1389**	**3,273**	**1,667**

As shown in Table 3.3, when the well is operated fewer hours in the month, the flow rate (gpm) increases and the pump energy intensity (kWh/MG) decreases.

The station building was not reviewed but miscellaneous electrical equipment at the station appears to include chemical feed pumps, exhaust fan, dehumidifier, electric heater, and instrumentation.

The miscellaneous energy column in Table 3.3 shows a seasonal energy use profile that reflects electric heater use. The new station upgrade is expected to include a heat pump or propane heating system that will reduce this portion of station energy use.

Pump Station #1 2022 energy costs are summarized below.

Table 3.4: Pump Station #1 2022 Estimated Energy Costs

Month	Billed Energy Use (kWh)	Billed Demand (kW)	Demand Cost	KWh Cost	Monthly Fee	Supply Cost	Delivery Cost	Total Bill
Jan	7,680	18.1	$326	$287	$16	$641	$629	$1,270
Feb	8,078	14.4	$259	$360	$16	$675	$635	$1,309
Mar	9,361	14.8	$266	$436	$16	$999	$718	$1,717
Apr	9,981	12.6	$227	$462	$16	$927	$705	$1,632
May	4,034	15.4	$277	$189	$16	$375	$482	$857
Jun	6,829	15.1	$272	$315	$16	$634	$603	$1,237
Jul	9,322	17.1	$308	$430	$16	$866	$754	$1,620
Aug	9,086	16.2	$292	$391	$16	$844	$698	$1,542
Sep	9,127	15.9	$286	$383	$16	$848	$685	$1,533
Oct	6,832	14.2	$256	$288	$16	$635	$560	$1,194
Nov	6,091	14.2	$256	$257	$16	$566	$529	$1,095
Dec	7,510	10.9	$196	$315	$16	$1,235	$527	$1,762
Totals	**93,931**	**178.9**	**$3,220**	**$4,111**	**$192**	**$9,245**	**$7,524**	**$16,768**

Potential Energy Saving Measures

As discussed, the pump station upgrade will include larger tanks and new well/booster pump systems and controls. To help optimize future station optimization, the following energy measures should be considered.

EMP #1: Track well and booster monthly run time hours and install electric submeters for the well and booster pump systems. This will help develop a kWh/MG benchmark value to identify future pump efficiency issues. The new wells should also include well depth transducers to calculate total dynamic head. This will allow operators (and energy auditors) to check pump system efficiency.

OM #1: The energy savings impact of adjusting pump station electric thermostats to a lower value is reviewed in this measure. Maintaining the new heating system thermostat setpoint at 50 degrees will help reduce station heating costs.

A new propane generator is scheduled to be installed as part of the station upgrade. Typically generator operation does not impact station electric bills. However, a generator block heater can add up to 10,000 kWh in annual energy use. Maintaining the block heater thermostat to maintain a typical 100 to 120 degree range (or lower) will help reduce heater energy use.

3.4 Pump Station #3

Pump Station #3 is located on Mountain Road and includes a small station building with two booster pumps and one jockey pump. A 10,000-gallon steel water storage tank is fed from Pump Station #1 on the suction side of the three pumps. Flow into the tank is controlled with a motorized valve.

The building construction includes a concrete slab, block walls, steel entry doors and wood frame/metal roof. The amount of insulation in the block wall cavity and ceiling are unknown. The building is heated with a 3 kW wall mounted electric heater controlled with a wall thermostat that was set at 52 degrees during the site visit.

The pump system includes a Grundfos Model CR 4-60 for the jockey pump with a nameplate rating of 22 gpm @ 288' TDH. The booster pumps are Franklin Model 10RV08 and Grundfos Model CR-8 pumps. The jockey pump includes a 3 hp motor and both booster pumps include 7.5 hp Baldor motors. All the pumps are equipped with VFDs and controlled with a local PLC to maintain system pressure for Zone #3. The pump VFDs modulate as needed to maintain the pressure setpoints.

The 2022 electric billed energy use data is summarized below. Total flow was estimated based on a 5 gpm average flow for the jockey pump (with 200 to 400 hours/month) and 20 gpm for the booster pumps (40 to 80 hours each/month). These are preliminary values since pump run time is not recorded on a regular basis (addressed in EMP #1).

Table 3.5: Pump Station #3 2022 Energy & Estimated Operating Data

Month	Energy Use (kWh)	Peak Demand (kW)	Jockey Pump **ESTIMATED** Hours	Booster #1 **ESTIMATED** Hours	Booster #2 **ESTIMATED** Hours	Pump Energy Use (kWh)	Misc. Energy Use (kWh)	Total **ESTIMATED** Flow (MG)	Booster KWh/MG
Jan	2,220	7.9	300	40	40	698	1,522	0.186	3,753
Feb	2,472	7.0	300	40	40	698	1,774	0.186	3,753
Mar	2,291	7.6	300	40	40	698	1,593	0.186	3,753
Apr	1,598	5.9	300	40	40	698	900	0.186	3,753
May	960	5.7	300	40	40	698	262	0.186	3,753
Jun	902	5.3	300	40	40	698	204	0.186	3,753
Jul	1,199	6.7	400	80	80	1,176	23	0.312	3,769
Aug	1,413	6.9	400	80	80	1,176	237	0.312	3,769
Sep	1,376	6.7	400	80	80	1,176	200	0.312	3,769
Oct	889	4.9	300	40	40	698	191	0.186	3,753
Nov	602	1.8	200	20	20	404	198	0.108	3,741
Dec	1,582	6.7	300	40	40	698	884	0.186	3,753
Totals/Avg	**17,504**	**73.1**	**3,800**	**580**	**580**	**9,516**	**7,988**	**2.53**	**3,756**

The miscellaneous energy use column is primarily for the electric unit heater based on the seasonal energy use. With the thermostat maintained at 52 degrees, the heating unit energy use is reasonable for this size station.

The station 2022 billed electric energy costs are shown below. Electric service for the station is provided on the Eversource "G" single-phase rate schedule. This is the standard rate schedule available for commercial accounts. For this rate, there is no charge for the first 5 kW of demand. The billed demand shown below is for the excess kW over 5 kW, which amounted to $295 in 2022.

Table 3.6: Pump Station #3 2022 Energy Costs

Month	Billed Energy Use (kWh)	Billed Demand (kW)	Demand Cost	KWh Cost	Monthly Fee	Supply Cost	Delivery Cost	Total Bill
Jan	2,220	2.9	$52	$83	$16	$185	$151	$337
Feb	2,472	2.0	$36	$110	$16	$206	$162	$368
Mar	2,291	2.6	$47	$107	$16	$244	$169	$414
Apr	1,598	0.9	$16	$74	$16	$148	$106	$255
May	960	0.7	$13	$45	$16	$89	$73	$163
Jun	902	0.3	$5	$42	$16	$84	$63	$147
Jul	1,199	1.7	$31	$55	$16	$111	$102	$213
Aug	1,413	1.9	$34	$61	$16	$131	$111	$242
Sep	1,376	1.7	$31	$58	$16	$128	$104	$232
Oct	889	0.0	$0	$37	$16	$83	$53	$136
Nov	602	0.0	$0	$25	$16	$56	$41	$97
Dec	1,582	1.7	$31	$66	$16	$260	$113	$373
Totals	**17,504**	**16.4**	**$295**	**$763**	**$192**	**$1,727**	**$1,250**	**$2,977**

Potential Energy Saving Measures

As discussed, for Pump Station #1, the following energy measures are recommended. These measures are reviewed in more detail in Section 4.

EMP #1: Track monthly flow and booster run time hours. This will help develop a kWh/MG benchmark value to identify future pump efficiency issues.

OM #1: The energy savings impact of adjusting pump station electric thermostats to a lower value is reviewed in this measure. Maintaining the thermostat setpoint slightly lower (50 degrees) will help reduce station heating costs. With less than 7,000 kWh estimated for the electric heat, a new propane heater could not be justified based on energy cost savings.

A new propane generator is scheduled to be installed in 2023. Typically generator operation does not impact station electric bills. However, a generator block heater can add up to 10,000 kWh in annual energy use. Maintaining the block heater thermostat to maintain a typical 100 to 120 degree range (or lower) will help reduce heater energy use.

3.5 Pump Station #6

Pump Station #6 is located on Sagamore Road and includes a small station building with two booster pumps and one jockey pump. The 10,000-gallon steel water storage tank at the station is fed from the Pump Station #7 boosters.

The building includes a concrete slab, block walls, bulkhead door and wood frame/shingle roof. The ceiling and a portion of the walls have rigid board insulation. The building is heated with a 3 kW wall mounted electric heater controlled with a wall thermostat that was set at 60 degrees during the site visit. The station is scheduled for a new generator this year and a new building will be constructed in 2024-2025.

The pump system includes three Goulds pump. The 5 hp jockey pump is a Model 3SV and the two 15 hp booster pumps are Model 4SVC and Model 15SV. The booster pumps are equipped with VFDs and operate as required to maintain system pressure. During the site visit, the on-line pump was operating 40 to 50 Hz producing 50 to 65 gpm with a power draw of 5 kW. The pumps/motors have been replaced over the last two years and appear to be performing well.

The 2022 electric billed energy use data is summarized below. The jockey pump run time was estimated to be between 300 and 400 hours/month at a 5 gpm flow and the each booster pump was estimated to be 200 to 300 hours/month @ a 60 gpm flow. These are preliminary values since pump run time is not recorded on a regular basis (addressed in EMP #1).

Table 3.7: Pump Station #6 2022 Energy & Estimated Operating Data

Month	Energy Use (kWh)	Peak Demand (kW)	Pump Energy Use (kWh)	Misc. Energy Use (kWh)	**Estimated** Jockey Pump Hours	**Estimated** Booster Pump #1Hours	**Estimated** Booster Pump #2Hours	**Estimated** Total Flow (MG)	KWh/MG
Jan	4,584	14.1	2,330	2,254	300	200	200	1.65	1,412
Feb	3,799	12.6	2,330	1,469	300	200	200	1.65	1,412
Mar	4,127	8.8	2,330	1,797	300	200	200	1.65	1,412
Apr	3,920	6.1	2,330	1,590	300	200	200	1.65	1,412
May	4,480	9.4	3,440	1,040	400	300	300	2.46	1,398
Jun	4,025	11.5	3,440	585	400	300	300	2.46	1,398
Jul	3,744	10.8	3,440	304	400	300	300	2.46	1,398
Aug	3,686	10.7	3,440	246	400	300	300	2.46	1,398
Sep	3,687	11.3	3,440	247	400	300	300	2.46	1,398
Oct	3,037	7.9	2,330	707	300	200	200	1.65	1,412
Nov	2,661	5.8	2,220	441	200	200	200	1.62	1,370
Dec	2,704	13.3	2,220	484	200	200	200	1.62	1,370
Totals/Avg	**44,454**	**122.3**	**33,290**	**11,164**	**3,900**	**2,900**	**2,900**	**23.79**	**1,399**

The miscellaneous equipment energy column was estimated based on subtracting pump energy use from the monthly energy bill. The energy use included electric heater high energy use in the winter months and dehumidifier power draw during the remaining months. OM #1 reviews the potential savings for reducing the electric heater thermostat from 60 to 50 degrees.

Electric service for the station is provided on the Eversource "G" single-phase rate schedule. The estimated billed electric energy costs are shown below.

Table 3.8: Pump Station #6 2022 Estimated Energy Costs

Month	Billed Energy Use (kWh)	Actual Demand (kW)	Billed Demand (kW)	Demand Cost	KWh Cost	Monthly Fee	Supply Cost	Delivery Cost	Total Bill
Jan	4,584	14.1	9.1	$164	$171	$16	$383	$351	$734
Feb	3,799	12.6	7.6	$137	$169	$16	$317	$322	$639
Mar	4,127	8.8	3.8	$68	$192	$16	$440	$276	$717
Apr	3,920	6.1	1.1	$20	$181	$16	$364	$217	$581
May	4,480	9.4	4.4	$79	$209	$16	$416	$305	$721
Jun	4,025	11.5	6.5	$117	$186	$16	$374	$319	$693
Jul	3,744	10.8	5.8	$104	$173	$16	$348	$293	$641
Aug	3,686	10.7	5.7	$103	$158	$16	$342	$277	$620
Sep	3,687	11.3	6.3	$113	$155	$16	$343	$284	$627
Oct	3,037	7.9	2.9	$52	$128	$16	$282	$196	$478
Nov	2,661	5.8	0.8	$14	$112	$16	$247	$143	$390
Dec	2,704	13.3	8.3	$149	$113	$16	$445	$279	$724
Totals	**44,454**	**122.3**	**62.3**	**$1,121**	**$1,949**	**$192**	**$4,301**	**$3,262**	**$7,564**

The actual demand shows that the jockey pump and one booster pump are occasionally required at the same time. With the use of VFDs and a pressure control system, the only opportunity to reduce electric demand charges would be to install a propane heater to replace the 3 kW unit heater that currently contributes to demand during the winter months. However, the annual energy/demand savings are not enough to justify this improvement.

Potential Energy Saving Measures

To help optimize future station optimization, the following energy measures are recommended. These measures are reviewed in more detail in Section 4.

EMP #1: Track monthly flow and booster run time hours. This will help develop a kWh/MG benchmark value to identify future pump efficiency issues.

OM #1: The energy savings impact of adjusting pump station electric thermostats to a lower value is reviewed in this measure. Maintaining the thermostat setpoint slightly lower (50 degrees) will help reduce station heating energy use from 11,000 kWh to the 7,000 kWh value estimated for Pump Station #3.

A new propane generator is scheduled to be installed in 2023. Typically generator operation does not impact station electric bills. However, a generator block heater can add up to 10,000 kWh in annual energy use. Maintaining the block heater thermostat to maintain a typical 100 to 120 degree range (or lower) will help reduce heater energy use.

3.6 Pump Station #7

Pump Station #7 includes five bedrock wells and three booster pumps that serve Pressure Zone #4. During the winter months the pumps typically supply 100,000 gallons per day (GPD). During the summer the average flow is 180,000 GPD.

The station wells include Wells # 7, 7A, 7B, 7C, and 7D. Well pumps alternate as lead/lag, where one or two wells are normally online based on demand/tank level. Raw water at the station passes through source meters and ortho-polyphosphate is added for corrosion control. Sodium hydroxide (NaOH) and sulfuric acid (H2SO4) are available for pH adjustment but not used.

The station includes a 25,000-gallon atmospheric tank to supply three booster pumps to pressurize the zone. The pump system includes a 5000-gallon hydro pneumatic tank, one jockey pump and two booster pumps.

The 22' x 24' building includes a concrete slab, block walls, and wood frame/shingle roof. The building is heated with a propane unit heater and a 10 kW backup electric heater. A 3 kW wall mounted electric heater is controlled with a wall thermostat that was set at 60 degrees during the site visit.

The 2022 station energy balance is summarized below. Flow data was available for the wells but all pump monthly hours are estimated at this time. Collecting this data in the future will help evaluate pump energy use and system efficiency.

Table 3.9: Pump Station #7 2022 Energy & Estimated Operating Data

Month	**Estimated** Well #7 Hours	**Estimated** Well #7A Hours	**Estimated** Well #7B Hours	**Estimated** Well 7C Hours	**Estimated** Well 7D Hours	Total Well Flow (MG)	**Estimated** Jockey Pump #1 Hours	**Estimated** Booster Pump #2 Hours	**Estimated** Booster Pump #3 Hours	Total Booster Flow (MG)
Jan	400	500	500	300	200	3.33	250	0	100	3.33
Feb	300	400	400	300	200	3.38	250	0	100	3.38
Mar	400	500	400	300	200	2.91	250	0	100	2.91
Apr	300	400	300	200	200	4.02	300	0	100	4.02
May	500	500	400	300	400	4.55	400	0	100	4.55
Jun	400	400	400	400	400	3.54	300	0	100	3.54
Jul	400	400	400	300	400	3.54	300	0	100	3.54
Aug	600	500	400	200	300	4.19	300	0	100	4.19
Sep	400	400	400	300	300	3.33	300	0	100	3.33
Oct	300	300	300	200	300	2.89	200	0	100	2.89
Nov	200	200	200	200	200	2.52	200	0	100	2.52
Dec	200	200	200	200	200	2.51	200	0	100	2.51
Totals/Avg	**4400**	**4700**	**4300**	**3200**	**3300**	**40.70**	**3250**	**0**	**1200**	**40.70**

Electric service for the station is provided on the Eversource "G" single-phase rate schedule. The 2022 station flow and electric billed energy use data is summarized below.

Table 3.10: Pump Station #7 2022 Energy & Estimated Operating Data

Month	Energy Use (kWh)	Peak Demand (kW)	Well Pump Energy Use (kWh)	Booster Pump Energy Use (kWh)	Misc. Energy Use (kWh)	Well / Bstr Flow (MG)	Well kWh/MG	Booster kWh/MG
Jan	20,600	42.0	17,300	2,800	500	3.33	5,202	842
Feb	17,240	36.9	14,680	2,800	-240	3.38	4,338	827
Mar	17,600	60.2	16,260	2,800	-1,460	2.91	5,578	961
Apr	16,040	66.1	12,640	3,200	200	4.02	3,148	797
May	28,600	64.3	23,100	4,000	1,500	4.55	5,076	879
Jun	26,720	65.7	23,100	3,200	420	3.54	6,530	905
Jul	19,760	65.8	17,480	3,200	-920	3.54	4,941	905
Aug	20,680	66.4	17,860	3,200	-380	4.19	4,263	764
Sep	19,440	66.6	16,480	3,200	-240	3.33	4,944	960
Oct	15,120	43.5	12,860	2,400	-140	2.89	4,453	831
Nov	13,040	49.0	10,040	2,400	600	2.52	3,983	952
Dec	13,040	49.6	10,040	2,400	600	2.51	4,007	958
Totals/Avg	**227,880**	**676.1**	**191,840**	**35,600**	**440**	**40.70**	**4,705**	**882**

The billed electric energy costs are shown below.

Table 3.11: Pump Station #7 2022 Estimated Energy Costs

Month	Billed Energy Use (kWh)	Billed Demand (kW)	Demand Cost	KWh Cost	Monthly Fee	Supply Cost	Delivery Cost	Total Bill
Jan	20,600	37.0	$666	$770	$16	$1,720	$1,452	$3,172
Feb	17,240	31.9	$574	$767	$16	$1,440	$1,358	$2,797
Mar	17,600	55.2	$994	$819	$16	$1,878	$1,829	$3,706
Apr	16,040	61.1	$1,100	$742	$16	$1,490	$1,858	$3,348
May	28,600	59.3	$1,067	$1,337	$16	$2,657	$2,420	$5,077
Jun	26,720	60.7	$1,093	$1,232	$16	$2,482	$2,341	$4,823
Jul	19,760	60.8	$1,094	$911	$16	$1,836	$2,022	$3,858
Aug	20,680	61.4	$1,105	$889	$16	$1,921	$2,010	$3,932
Sep	19,440	61.6	$1,109	$815	$16	$1,806	$1,940	$3,746
Oct	15,120	38.5	$693	$638	$16	$1,405	$1,347	$2,751
Nov	13,040	44.0	$792	$551	$16	$1,211	$1,359	$2,570
Dec	13,040	44.6	$803	$547	$16	$2,145	$1,365	$3,511
Totals	**227,880**	**616.1**	**$11,090**	**$10,019**	**$192**	**$21,991**	**$21,301**	**$43,292**

Well Pump Testing

Process Energy Services was not able to develop pump system energy savings measures without a well level height, or the ability to modulate VFD speed (operator did not know how to put the VFDs in manual). Pump curves and past test reports were also not available.

Potential Energy Saving Measures

As discussed, the pump station upgrade will include larger tanks and new well/booster pump systems and controls. To help optimize future station optimization, the following energy measures should be considered.

EMP #1: Track well and booster monthly run time hours and install electric submeters for the well and booster pump systems. This will help develop a kWh/MG benchmark value to identify future pump efficiency issues. The new wells should also include well depth transducers to calculate total dynamic head. This will allow operators (and energy auditors) to calculate pump system efficiency

SECTION 4. RECOMMENDED MEASURES

This section describes the proposed energy management practices (EMPs), operational measures (OMs), energy conservation measures (ECMs) and energy supply measures (ESMs) discussed in the report. The measures are interactive in the order they are listed. All project costs and savings figures are preliminary and should be verified before proceeding with each project.

4.1 Energy Management Practices

Energy management practices (EMPs) cannot be justified based on quantifiable energy savings, but considered to be good energy efficient practices that will provide long-term benefits.

4.1.1 EMP #1 Benchmark Energy Use with Operational Data

Description

An effective energy management program provides a systematic approach to reducing facility energy use and costs. A successful program is structured to provide an on-going process that can be used to continually evaluate new projects, track savings and encourage efforts within the organization to improve efficiency.

The most effective way to monitor system efficiency is to summarize electric bill data monthly and benchmark energy use with pump hours and flow (kWh/MG).

Currently flow data is collected by the District's contract operator and entered into a spreadsheet. This measure recommends collecting additional data to help evaluate pump system efficiencies.

- Benchmark monthly energy use with flow
- Track monthly energy use and costs

In addition, the GAVWD should work with manufacturers and well contractors to track down pump curves/original specifications and well test reports.

Some well level data is recorded in the SCADA system but wellhead or transducer elevation is not available. This information is needed to evaluate the total system pump head/efficiency and should be researched for future pump performance calculations.

Calculations

This measure is an important part of a successful efficiency program.

Preliminary Cost Estimate

Cost is expected to minimal.

4.2 Operational Measures

Operational measures (OMs) are low cost improvements that can be made without a substantial capital investment and typically pay for themselves in less than one year.

4.2.1 OM #1 Reduce Thermostat Settings

The booster stations are heated with electric wall heaters. A summary of the 2022 system energy use/costs and observed setpoints is shown below.

Table 4.1: 2022 Pump Station #3 and #6 Heating Energy

Facility	Annual Station Miscellaneous Energy Use (kWh)	Estimated Heater Energy Use (kWh)	Observed Thermostat Setting (Deg F)	Proposed Thermostat Setting (Deg F)
Pump Station #3	7,988	7,000	52	50
Pump Station #6	11,164	10,000	60	50

To reduce heating costs, this measure recommends adjusting station thermostats to 50 degrees.

Savings Calculations

A facility can realize approximately 2% heating cost savings for every one degree that the temperature can be reduced (Washington State University Extension Energy Program). Based on this, the following savings could be realized.

PS #3
52º F degrees average existing – 50º F degrees proposed * 2% = 4% savings
For 7,000 annual kWh, savings would be approximately 280 kWh

PS #6
60º F degrees average existing – 50º F degrees proposed * 2% = 20% savings
For 10,000 annual kWh, savings would be approximately 2,000 kWh

Preliminary Cost Estimate

Cost is expected to be minimal for this measure.

Cost and Savings Summary

The cost and savings estimate for this measure is summarized below using 2022 unit costs.

Annual Energy (kWh) Savings	2,280 kWh	$0.142/kWh	$ 324
Annual Demand (kW) Savings	0 kW	$18.00/kW	$ 0
Total Energy Cost Savings			**$ 324**
Project Cost			**Minimal**
Simple Payback			**Immediate**

4.3 Energy Supply Measures

Energy supply measures are recommended improvements such as renewable energy, fuel switching and demand savings that do not qualify as energy conservation measures.

4.3.1 ESM #1 Investigate Solar PV Array

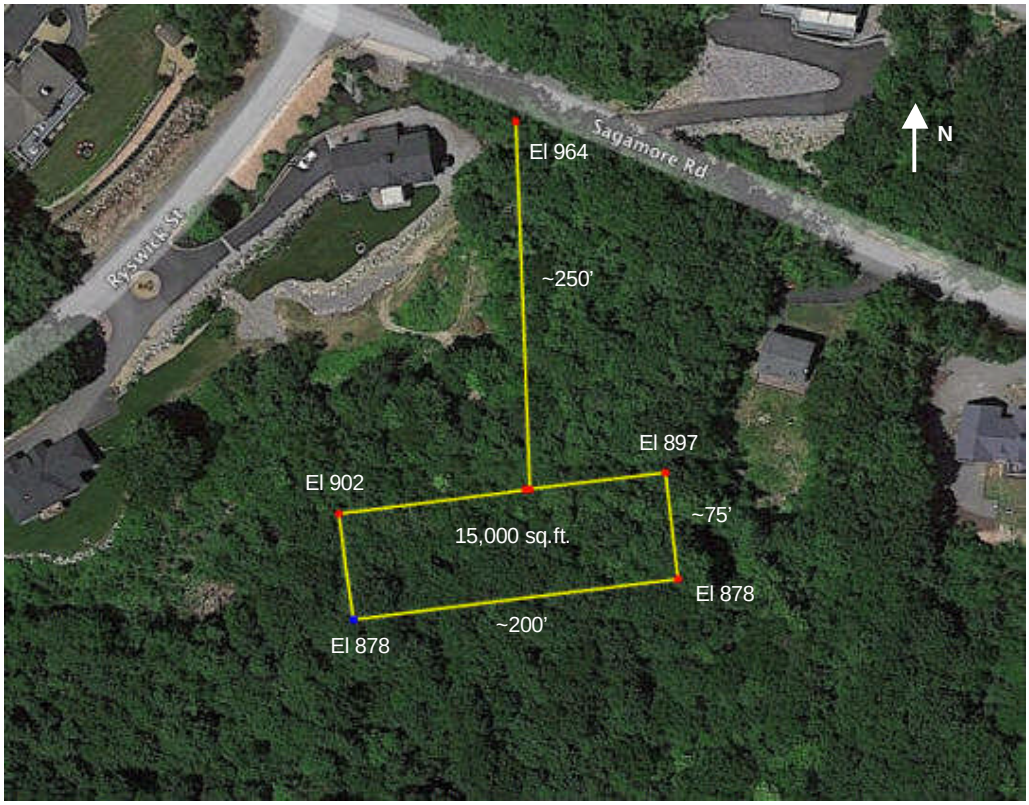
Description

The Gunstock Acres Common Property Trust (CAPCT) has over 100 acres that could be available to install a solar array. Based on discussions with the GAVWD commissioners, the most favorable location for the proposed array would be a 16-acre parcel off of Sagamore Road shown below. Although there is a 20'+ drop in elevation (26% grade) down the 75' slope, it becomes steeper if the array is moved further south.

ReVision Energy recently completed a proposal to install a ground mounted solar array in Hillsborough, NH for the Emerald Lake Village Water District (ELVD). As is the case for the GAVWD, only single-phase power was available and the size of the system would be limited to approximately 91.2 kW DC / 65.7 kW AC (based on ReVision's experience working with Eversource). This size array would require approximately 8,000 square feet.

The ELVD proposal submitted by ReVision estimated annual first year power production of approximately 107,838 kWh. This can be compared to the GAVWD 2022 total system energy use of 387,300 kWh.

Figure 4.1: Proposed Solar PV Array



The ReVision proposal included the following data:

- Components: (190) Q-Cell 480W Modules, (9) SMA Inverters
- Annual Generation: 107,838 kWh
- Proposal included a new 400A single-phase electric service cost and code compliant fencing around the perimeter of the project.
- $9,300 allowance for Eversource utility upgrades
- The timeline from contract to completion would be 9-12 months.
- Total project cost: $390,572 ($3.62/kWh first year generation)

The economics for the solar PV system is summarized with and without the 30% renewable energy federal grant for municipalities. The cost/kWh is based on the most recent supply energy cost.

Cost and Savings Summary

Annual Energy (kWh) Savings	107,838 kWh	$0.16/kWh	$ 17,254
Annual Demand (kW) Savings	0 kW	$18.39/kW	$ 0
Total Cost Savings			$ 17,254
Project Cost			$ 390,572
10 Years of Renewable Energy Credits			($ 23,440)
Simple Payback			21.3 years

Simple payback with 30% federal credit payment included is shown below.

30% Federal Credit Payment			$ 117,172
Net Cost			$ 273,400
10 Years of Renewable Energy Credits			($ 23,440)
New Simple Payback			14.5 years

The above figures are preliminary and should be updated after solar PV contractors review the site and provide firm cost proposals.

APPENDIX A: ELECTRIC RATE SCHEDULE

2022 Summary of Electric Rates

Last Updated: December 15, 2022

Your bill includes charges for Delivery Service and, if you have not selected a competitive energy supplier, for Eversource Energy Service. However, if you have selected a competitive energy supplier and if the supplier has made arrangements for Eversource to provide billing services, the supplier's charges for Energy Service will also be included on your Eversource bill. Any Energy Service charges will appear in the Supplier Services section of your bill. This summary of rates is based on a monthly billing cycle.

Definition of Terms

Customer Charge - This charge recovers costs Eversource incurs in providing service to a customer, such as the installation, maintenance and replacement of your meter(s), reading your meter(s), maintaining your account records, and Eversource's 24-hour customer service center.

Distribution Charge - This charge recovers costs related to the maintenance and operation of Eversource's distribution system, and Eversource's power restoration and service operations. The kWh charge is based on the amount of kilowatt-hours (kWh) of electricity used during a billing period. The kW charge* is based on the greatest amount of electricity used in any half-hour period during a billing period.

Regulatory Reconciliattion Adjustment - This charge (or credit) reconciles costs related to the maintenance and operation of Eversource's distribution system not included in the distribution charge, such as vegetation management, property tax expenses, revenue lost due to net metering, storm restoration costs, and assessments and consultants hired by regulators . The kWh charge (or credit) is based on the amount of kilowatt-hours (kWh) of electricity used during a billing period. The kW charge* is based on the greatest amount of electricity used in any half-hour period during a billing period.

Transmission Charge - This charge recovers costs related to the delivery of electricity over the high-voltage or transmission system power lines. The kWh charge is based on the amount of kWh of electricity used during a billing period. The kW charge* is based on the greatest amount of electricity used in any half-hour period during a billing period.

Stranded Cost Recovery Charge - This charge helps fund the recovery of Eversource's past investment costs, including expenses incurred through mandated power contracts and other long-term investments and obligations. The kWh charge is based on the amount of kWh of electricity used during a billing period. The kW charge* is based on the greatest amount of electricity used in any half-hour period during a billing period.

Energy Charge - This charge is based on the amount of kWh of electricity used during a billing period. It includes Eversource's costs, or a competitive supplier's costs to generate and/or buy power.

* *The kW charge, or "demand" charge, applies to non-residential rates.*

Taxes & Surcharges

System Benefits Charge - This charge funds energy efficiency programs for all customers as well as assistance programs for residential customers within certain income guidelines.

Late Payment Charge

A late payment charge of 1.5 percent is applied to amounts previously billed but remaining unpaid after the due date for customers receiving service under Rate GV, Rate LG or Rate B. For all other customers, the late payment charge is 1 percent. This charge is not applicable to income-eligible customers or certain customers who are abiding by the terms of an extended payment arrangement.

Service Charges

When you establish or re-establish an electric service account for residential or general service, one of the following service charges will be applied to your electric bill:

- **$10** - When it is not necessary to send an employee to the meter location to obtain a new meter reading to establish service.
- **$35 -** When it is necessary to send an employee to the meter location during normal business hours to obtain a new meter reading or to connect a meter.
- **$80** - When it is necessary to send an employee to a meter location outside of normal business hours to obtain a new meter reading or to connect a meter.

Field Collection Fee

When it is necessary to send an employee to your location (residential or general service account) to collect a delinquent bill, a $26 field collection fee will be applied to your electric bill.

Available Rates

Rate R, Residential Standard Service

Available to customers living in individual residences and apartments.

• Customer Charge (per month):	$13.81
• Distribution Charge (per kWh):	5.41 ¢
• Regulatory Reconciliation Adjustment (per kWh):	0.046 ¢
• Transmission Charge (per kWh):	2.36 ¢
• Stranded Cost Recovery Charge (per kWh):	0.273 ¢
• System Benefits Charge (per kWh):	0.863 ¢
• Energy Charge (per kWh):	22.566 ¢

Rate R, Residential Uncontrolled Water Heating Rate
Closed to new customers. *Minimum tank size requirement of 40 gallons.*

- Meter Charge (per month): $4.87
- Distribution Charge (per kWh): 2.504 ¢
- Regulatory Reconciliation Adjustment (per kWh): 0.026 ¢
- Transmission Charge (per kWh): 1.827 ¢
- Stranded Cost Recovery Charge (per kWh): 0.273 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

Rate R, Residential Controlled Water Heating Rate
Closed to new customers. *Minimum tank size requirement of 40 gallons.*

- Meter Charge (per month): $4.87
- Distribution Charge (per kWh): 2.504 ¢
- Regulatory Reconciliation Adjustment (per kWh): 0.026 ¢
- Transmission Charge (per kWh): 1.827 ¢
- Stranded Cost Recovery Charge (per kWh): -0.028 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

Rate R - LCS, Thermal Storage Heating

Closed to new customers. For service to electric thermal storage devices used for water heating or space heating. Separately metered, must be taken along with Rate R.

- Customer Charges
  - 8-Hour or 10-Hour or 11-Hour Option [Closed] (per month)*: $4.87
  - Switching Option [Closed] (per month)**: $4.87
  - HEATSMART, Radio-Controlled Option [Closed] (per month)***: $6.99
- Distribution Charges
  - 8-Hour Option [Closed] (per kWh)*: 2.504 ¢
  - 10-Hour or 11-Hour Option [Closed] (per kWh)*: 2.504 ¢
  - HEATSMART, Radio-Controlled Option [Closed] (per kWh)***: 1.384 ¢
- Regulatory Reconciliation Adjustment (per kWh): 0.026 ¢
- Transmission Charge (per kWh): 1.827 ¢
- Stranded Cost Recovery Charge (per kWh): -0.028 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

** Only available to locations that have continuously received service under one of the listed options since October 1, 2004.*
*** Only available to locations that have continuously received service under the Switching Option since January 1, 1994.*
**** Only available to locations that have continuously received service under the Radio Controlled Option since January 1, 2021.*

Rate R-OTOD, Residential Time-of-Day Service
Closed to new customers
Off-peak hours: 8 p.m. to 7 a.m. weekdays; all day weekends and holidays.

- Customer Charge (per month): $32.08
- Distribution Charges
  - On-Peak Hours (per kWh): 15.288 ¢
  - Off-Peak Hours (per kWh): 1.011 ¢
- Regulatory Reconciliation Adjustment (per kWh): 0.046 ¢
- Transmission Charges
  - On-Peak Hours (per kWh): 2.360 ¢
  - Off-Peak Hours (per kWh): 1.541 ¢
- Stranded Cost Recovery Charge (per kWh): 0.173 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

Rate R-OTOD 2, Residential Time-of-Day Service Rate 2
Available to customers living in individual residences and apartments – varies by time of day.
On-peak hours: 1 p.m. to 7 p.m. weekdays; no weekends or holidays.
Off-peak hours: 7 p.m. to 1 p.m. weekdays; all day weekends and holidays.

- Customer Charge (per month): $16.50
- Distribution Charges
  - On-Peak Hours (per kWh): 6.518 ¢
  - Off-Peak Hours (per kWh): 4.780 ¢
- Regulatory Reconciliation Adjustment (per kWh): 0.046 ¢
- Transmission Charges
  - On-Peak Hours (per kWh): 7.925 ¢
  - Off-Peak Hours (per kWh): 0.925 ¢
- Stranded Cost Recovery Charge (per kWh): 0.173 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

Rate EAP (Electric Assistance Program)

Income-eligible residential customers may qualify for a discount of 8 percent or more off their monthly electric bill. Call us at 800-662-7764 for details.

Rate G, General Service
For customers whose demand does not exceed 100 kilowatts (kW).

- Customer Charge
  - Single-Phase Service (per month): $16.21
  - Three-Phase Service (per month): $32.39
- Distribution Demand Charge (per kW of demand above 5 kW): $12.39
- Distribution Energy Charges
  - First 500 kWh (per kWh): 2.82 ¢
  - Next 1,000 kWh (per kWh): 2.283 ¢
  - All Additional kWh (per kWh): 1.724 ¢
- Regulatory Reconciliation Adjustment (per kW of demand above 5 kW): 15.00 ¢
- Transmission Demand Charge (per kW of demand above 5 kW): $6.09
- Transmission Energy Charges
  - First 500 kWh (per kWh): 2.201 ¢
  - Next 1,000 kWh (per kWh): 0.828 ¢
  - All Additional kWh (per kWh): 0.444 ¢
- Stranded Cost Recovery Demand Charge (per kW of demand above 5 kW): $0.46 ¢
- Stranded Cost Recovery Energy Charges (per kWh) 0.036 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

Rate G, Uncontrolled Water Heating Rate
Closed to new customers. *Minimum tank size requirement of 40 gallons.*

- Meter Charge (per month): $4.87
- Distribution Charge (per kWh): 2.504 ¢
- Regulatory Reconciliation Adjustment (per kWh): 0.026 ¢
- Transmission Charge (per kWh): 1.827 ¢
- Stranded Cost Recovery Charge (per kWh): 0.163 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

Rate G, Controlled Water Heating Rate
Closed to new customers. *Minimum tank size requirement of 40 gallons.*

- Meter Charge (per month): $4.87
- Distribution Charge (per kWh): 2.504 ¢
- Regulatory Reconciliation Adjustment (per kWh): 0.026 ¢
- Transmission Charge (per kWh): 1.827 ¢
- Stranded Cost Recovery Charge (per kWh): -0.097 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

Rate G - LCS, Thermal Storage Heating

Closed to new customers. For service to electric thermal storage devices used for water heating or space heating. Separately metered, must be taken along with Rate G.

- Customer Charges
  - 8-Hour or 10-Hour or 11-Hour Option [Closed] (per month)*: $4.87
  - Switching Option [Closed] (per month)**: $4.87
  - HEATSMART, Radio-Controlled Option [Closed] (per month)***: $6.99
- Distribution Charges
  - 8-Hour Option [Closed] (per kWh)*: 2.504 ¢
  - 10-Hour or 11-Hour Option [Closed] (per kWh)*: 2.504 ¢
  - HEATSMART, Radio-Controlled Option [Closed] (per kWh)***: 1.384 ¢
- Regulatory Reconciliation Adjustment (per kWh): 0.026 ¢
- Transmission Charge (per kWh): 1.827 ¢
- Stranded Cost Recovery Charge (per kWh): -0.097 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

** Only available to locations that have continuously received service under one of the listed options since October 1, 2004.*
*** Only available to locations that have continuously received service under the Switching Option since January 1, 1994.*
**** Only available to locations that have continuously received service under the Switching Option since January 1, 2021.*

Rate G - Space Heating Service

Only available to certain Rate G customers who have continuously received service under the Transitional Space Heating rate in effect prior to June 1, 1992. Call us at 866-554-6025 for details.

Rate G-OTOD, General Time-of-Day Service
Available to customers with electric thermal storage devices whose demand does not exceed 100 kilowatts (kW).
Off-peak hours: 8 p.m. to 7 a.m. weekdays; all day weekends and holidays.

- Customer Charge
  - Single-Phase Service (per month): $41.98
  - Three-Phase Service (per month): $60.00
- Distribution Demand Charge (per kW of on-peak demand) : $15.82
- Distribution Charges
  - On-Peak Hours (per kWh): 5.350 ¢
  - Off-Peak Hours (per kWh): 0.851 ¢
- Regulatory Reconciliation Adjustment per kW of on-peak demand) : 15.000 ¢
- Transmission Demand Charge (per kW of on-peak demand) : $4.01
- Stranded Cost Recovery Demand Charges (per kW of on-peak demand) : $0.23
- Stranded Cost Recovery Energy Charges (per kWh) : -0.097 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh): 22.566 ¢

Rate GV, Commercial and Industrial

For commercial or industrial customers with demands not exceeding 1,000 kW. Customers must pay for necessary transforming, regulating and controlling apparatus.

- Customer Charge (per month): $211.21
- Distribution Demand Charges
  - First 100 (per kW): $7.27
  - Excess over 100 kW (per kW): $7.01
- Distribution Energy Charges
  - First 200,000 (per kWh): 0.663 ¢
  - All Additional kWh (per kWh): 0.590 ¢
- Regulatory Reconciliation Adjustment (per kW): 6.00 ¢
- Transmission Demand Charge (per kW): $8.15
- Stranded Cost Recovery Demand Charge (per kW): $0.41
- Stranded Cost Recovery Charge (per kWh): -0.047 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh)
  - August 2022 22.423 ¢
  - September 2022 19.322 ¢
  - October 2022 17.523 ¢
  - November 2022 24.575 ¢
  - December 2022 41.884 ¢
  - January 2023 48.550 ¢

Rate EV-2, Commercial and Industrial
For electric vehicle charging stations with demands not exceeding 1,000 kW. Customers must pay for necessary transforming, regulating and controlling apparatus. Available to serve the entire requirements of electric vehicle (EV) charging stations, which are available to the public. Must have separately metered service, with at least 90 percent of the load at that meter dedicated to EV charging. Must be “publicly accessible” EV charging equipment, meaning that the charging equipment is available to the public without restriction.

- Customer Charge (per month): $211.21
- Distribution Charge (per kWh): 10.593 ¢
- Regulatory Reconciliation Adjustment (per kWh): 0.084 ¢
- Transmission Charge (per kWh): 11.400 ¢
- Stranded Cost Recovery Charge (per kWh): 0.526 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh):
  - August 2022 22.423 ¢
  - September 2022 19.322 ¢
  - October 2022 17.523 ¢
  - November 2022 24.575 ¢
  - December 2022 41.884 ¢
  - January 2023 48.550 ¢

Rate LG, Commercial and Industrial Service
For commercial and industrial customers with demands in excess of 1,000 KW. Customers must pay for necessary transforming, regulating and controlling apparatus. Off-peak hours: 8 p.m. to 7 a.m. weekdays; all day weekends and holidays.

- Customer Charge (per month): $660.15
- Distribution Demand Charge (per kVa): $6.18
- Distribution Energy Charges
  - On-Peak (per kWh): 0.559 ¢
  - Off-Peak (per kWh): 0.473 ¢
- Regulatory Reconciliation Adjustment (per kWh): 5.000 ¢
- Transmission Demand Charge (per kVa): $8.03
- Stranded Cost Recovery Demand Charge (per kVa): $0.26
- Stranded Cost Recovery Charges
  - On-Peak (per kWh): -0.198 ¢
  - Off-Peak (per kWh): -0.270 ¢
- System Benefits Charge (per kWh): 0.863 ¢
- Energy Charge (per kWh)
  - August 2022 22.423 ¢
  - September 2022 19.322 ¢
  - October 2022 17.523 ¢
  - November 2022 24.575 ¢
  - December 2022 41.884 ¢
  - January 2023 48.550 ¢

Rate B, Backup Service

For commercial and industrial customers who sometimes require backup and standby service from Eversource along with their own source of generation. Optional for customers with generation installed on or before January 1, 1985, or whose generation is used only for emergency situations. Call us at 866-554-6025 for details.

Rates EOL and EOL-2, Energy Efficient Outdoor Lighting

Available only to municipalities and governmental bodies that want to convert street and highway lighting to high pressure sodium vapor, metal halide, or Light Emitting Diode (LED) technology. Call us at 866-554-6025 for details.

Rate OL, Outdoor Lighting

Available for street and area lighting. For more information on the size and types of lighting fixtures available and the monthly costs, call us at 800-662-7764.

PROCESS ENERGY SERVICES, LLC

WATER ♦ WASTEWATER ♦ INDUSTRIAL