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Village of Johnson Water & Light Department

2019 Integrated Resource Plan

VPPSA
Vermont Public Power Supply Authority

Executive Summary

Incorporated in 1894, the Village of Johnson Water & Light Department (JW&L) serves approximately 970 retail customers in the Village of Johnson as well as part of the Town of Johnson. Its largest customer is Northern Vermont University (previously Johnson State College), which makes up about 30% of its retail sales. JW&L's small municipal system has a large residential customer base of elderly and below median income residents, including a high percentage of renters. JW&L remains guided by the Vermont Public Utility Commission (PUC) rules as well as by the American Public Power Association's (APPA) safety manual. As a small municipal utility JW&L is careful to balance maintaining reliability and reasonable cost levels with the need to deliver innovative programs to customers that provide practical value.

JW&L's distribution system serves a mix of residential, small commercial, and large commercial customers. Residential customers make up over 82% of the customer mix while accounting for 41% of JW&L's retail kWh sales. Approximately 112 small commercial and large commercial customers (about 11%) make up a little over 50% of retail usage. Northern Vermont University (NVU) makes up approximately 30% of the 50%, with the remaining retail sales going to public street and highway lighting customers.

Consistent with regulatory requirements, every 3 years JW&L is required to prepare and implement a least cost integrated plan (also called an Integrated Resource Plan, or IRP) for provision of energy services to its Vermont customers. JW&L's Integrated Resource Plan (IRP) is intended to meet the public's need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including environmental and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs.

ELECTRICITY DEMAND

JW&L is facing a period of relatively flat demand influenced by several competing factors, all of which carry some uncertainty. Continued adoption of solar net metering reduces demand although the pace at which net metering will grow in JW&L's territory is uncertain. As various incentives aimed at transitioning from fossil fuels to cleaner electricity are made available, increasing acceptance of cold climate heat pumps and similar appliances will likely increase demand, as will an expected increase in the use of electric vehicles.

While no significant change in the demand associated with JW&L's largest customers is currently anticipated, the potential does exist. The spring 2020 proposal to close NVU represents a major uncertainty for JW&L. In the case of a significant expansion by one or

more customers, detailed engineering studies may be needed to identify necessary system upgrades.

ELECTRICITY SUPPLY

JW&L's current power supply portfolio includes entitlements in a mixture of baseload, firm and intermittent resources through ownership or contractual arrangements of varying duration, with most contracts carrying a fixed price feature. Designed to meet anticipated demand, as well as acting as a hedge against exposure to volatile ISO-New England spot prices, the portfolio is heavily weighted toward hydro, solar, and other renewable sources.

When considering future electricity demand, JW&L seeks to supplement its existing resources with market contracts as well as new demand-side and supply resources. JW&L believes that in addition to working with financially stable counterparties, it is important for new resource decisions to balance four important characteristics: new resources should be low cost, locally located, renewable and reliable. Market contracts have the advantage of being both scalable and customizable in terms of delivery at specific times and locations. JW&L anticipates regional availability of competitively priced renewable resources including solar, wind, and hydro. In addition to being a factor in meeting future electricity requirements, this category of resource contributes to meeting Renewable Energy Standard goals. Gas fired generation may have a role to play in the future portfolio for reliability purposes. As battery storage technology matures and proves economically feasible JW&L sees potential for storage to play an important load management role and to enhance the local impact of distributed generation.

RESOURCE PLANS

Looking ahead to evaluating major policy and resource acquisition decisions, JW&L employs an integrated financial model that takes into account impacts on load and subsequent effects on revenue and power supply costs, as well effects on investment, financing and operating costs. Use of the integrated model allows for evaluation of uncertainty related to key variables, on the way to identifying anticipated rate impacts over time. While rate trajectory is the primary metric JW&L relies on to evaluate resource decisions on an individual or portfolio basis there are other more subjective factors to consider, including resource diversity or exposure to major changes in market rules.

There are three major resource decisions facing JW&L over the next five to ten years beginning with the need for a 2023-2027 energy-only PPA to replace significant market contracts expiring in the 2022-2024 timeframe. With additional contracts expiring at the end of 2027, JW&L will evaluate the purchase of a long term hydro PPA with associated TIER I RECs commencing in 2028 to hedge energy requirements and meet rising TIER I RES

obligations. The third major decision arises from a need to procure additional TIER II resources beginning in 2023; toward this end JW&L will evaluate the purchase of a long term, TIER II eligible, solar PPA.

The main sources of uncertainty expected to impact these decisions are the potential loss of NVU's load, followed by the price of natural gas and pipeline transportation prices, load growth, the cost of regional transmission service and, to a lesser extent, REC prices. Because JW&L is largely hedged for the long run in the capacity market, capacity prices are not a large source of uncertainty.

Analysis of these major resource decisions also addresses two load-related questions: 1) what is the rate impact of losing NVU's load? 2) what is the rate impact of 1% compound annual load growth? While the loss of NVU's load is not expected at this time, an 30% reduction in load due to a loss of NVU has the potential to drive a 26% rate increase. An additional 1% increase in compound annual growth, relative to the reference case, could reduce average rates by 8% by 2032.

RENEWABLE ENERGY STANDARD

JW&L is subject to the Vermont Renewable Energy Standard (RES) which imposes an obligation for JW&L to obtain a portion of its energy requirements from renewable resources. The RES obligation increases over time and is stratified into three categories, Tier I, TIER II and TIER III. JW&L' s obligations under TIER I can be satisfied by owning or purchasing RECs from qualifying regional resources. TIER II obligations must be satisfied by owning or purchasing RECs from renewable resources located within Vermont. Satisfaction of JW&L's TIER III obligation involves energy transformation, or reduction of fossil fuel use within its territory. TIER III programs can consist of thermal efficiency measures, electrification of the transportation sector, and converting customers that rely on diesel generation to electric service, among other things. By providing incentive programs to encourage conversion of traditional fossil fuel applications JW&L receives credits toward its TIER III obligation. JW&L will be exploring custom electrification opportunities with some of its larger customers, although no proposal has yet taken shape. JW&L was recently awarded a grant through the Volkswagen Environmental Mitigation Trust that will enable the utility to purchase an all-electric bucket truck, replacing an aging 2008 diesel vehicle. VPPSA will be working with JW&L to provide a custom TIER III incentive and assist in completion of the purchase by 2022. More detail regarding JW&L's plans to meet its TIER III obligation is available in Appendix B to this document.

ELECTRICITY TRANSMISSION AND DISTRIBUTION

JW&L has a compact service territory as a result of being a small, municipal-owned electric utility and has benefitted from several major system improvements over the past 15 years.

JW&L's system is approximately 5 square miles of service territory, consisting of 28 miles of distribution line operating at 4160/2400 volts, one substation, and one back-up substation. JW&L purchased a 15% interest in Morrisville Water & Light's (MW&L) 34.5 kV transmission line that runs from the Green Mountain Power substation in Johnson, to MW&L's Substation #3 in Morrisville, to the Vermont Transco, LLC 115kV substation in Stowe.

In addition to upgrading and routinely maintaining the system to ensure efficiency and reliability, JW&L is examining the need to modernize in order to support beneficial electrification and additional distributed generation on the system and to provide more customer-oriented services, including load management programs that reduce costs for both JW&L and its customers. JW&L is currently engaged with VPPSA in a multi-phased process designed to assess its readiness for AMI, guide it through an RFP process culminating in vendor and equipment selection and ultimately resulting in implementation of an AMI system, provided the resulting cost estimates gained through the RFP process are not prohibitive.

JW&L sees potential value to customers from utilizing rate design, direct load control or other incentive programs as tools to manage both system and customer peak loads in unison. Implementation of an AMI system is expected to enhance JW&L's ability to deliver these benefits and capture economic development/retention opportunities where possible.

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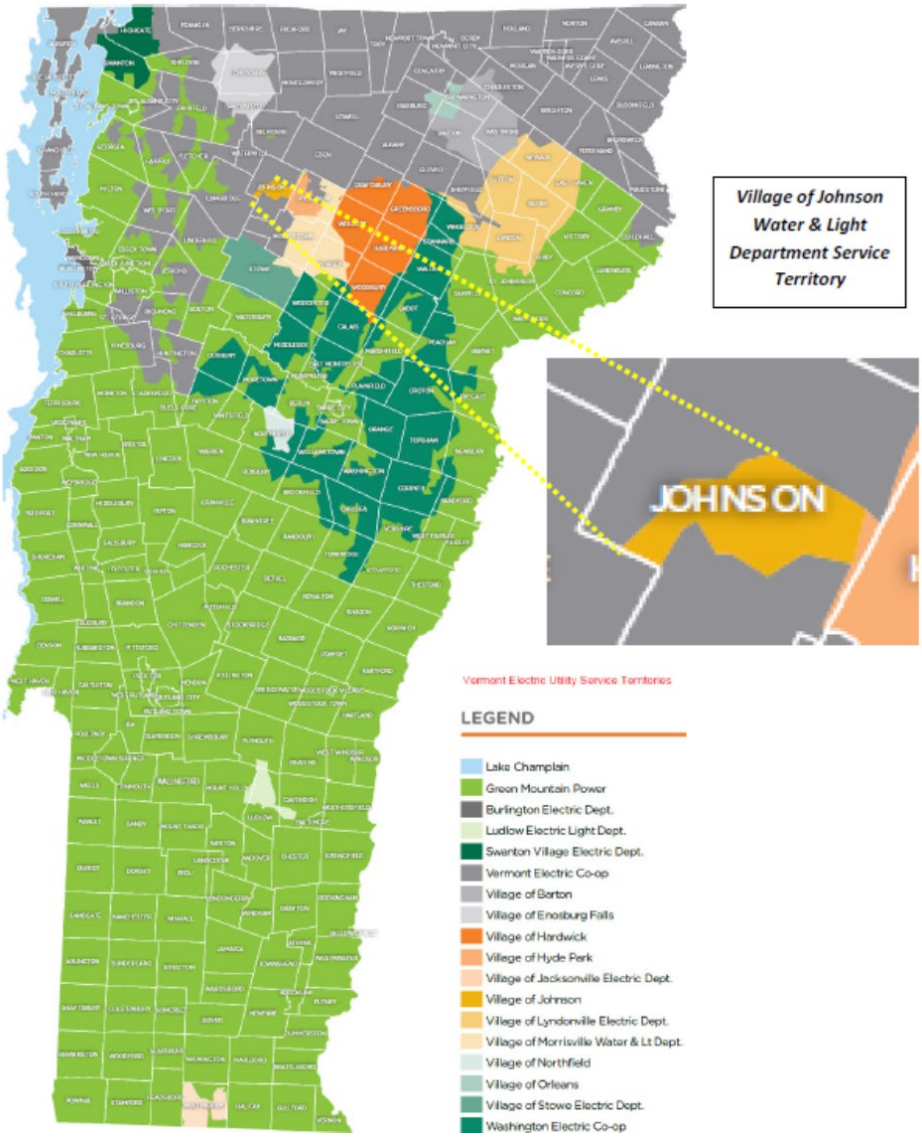
Introduction

JW&L's service territory is located in Lamoille County in north central Vermont. Its 5 square mile service territory can be seen on the Vermont Utility Service Territory map found below, and it encompasses the Village of Johnson as well as part of the Town of Johnson. JW&L serves approximately 970 retail customers, with its largest customer being Northern Vermont University (previously Johnson State College), which makes up about 30% of its retail sales. JW&L's small municipal system has a large residential customer base of elderly and below median income residents, including a high percentage of renters. JW&L remains guided by the Vermont Public Utility Commission (PUC) rules as well as by the American Public Power Association's (APPA) safety manual. Well-established practices keep JW&L operating safely, efficiently, and reliably.

Figure 1: JW&L's Distribution Territory



Vermont Public Power Supply Authority:

The Vermont Public Power Supply Authority (VPPSA) is a joint action agency established by the Vermont General Assembly in 1979 under Title 30 VSA, Chapter 84. It provides its members with a broad spectrum of services including power aggregation, financial support, IT support, rate planning support and legislative and regulatory representation. VPPSA is focused on helping local public power utilities remain competitive and thrive in a rapidly changing electric utility environment.

JW&L is one of eleven member utilities of VPPSA, who is governed by a board of directors that consists of one appointed director from each member. This gives each municipality equal representation. VPPSA's membership includes:

- Village of Johnson Water & Light Department
- Barton Village Inc.
- Village of Enosburg Falls Electric Light Department
- Hardwick Electric Department
- Village of Jacksonville Electric Company
- Ludlow Electric Light Department
- Lyndonville Electric Department
- Morrisville Water & Light Department
- Northfield Electric Department
- Village of Orleans
- Swanton Village Electric Department

JW&L and VPPSA are parties to a broad Master Supply Agreement (MSA). Under the MSA, VPPSA manages JW&L's electricity loads and power supply resources, which are pooled with the loads and resources of other VPPSA members under VPPSA's Independent System Operator – New England (ISO-NE) identification number. This enables VPPSA to administer JW&L's loads and power supply resources in the New England power markets.

System Overview

In 2018 JW&L's peak demand in the winter months was 2,401 kW and 2,264 kW during the summer and shoulder months. Annual energy retail sales for 2018 were 12,509,491 kWh and the annual load factor for 2018 was 63.4%.

For many years, JW&L was a sub-transmission customer of Green Mountain Power (GMP) and received service via a 34.5kV connection to the GMP Johnson substation. After obtaining regulatory approval, in 2014, JW&L became interconnected to the Morrisville Water & Light Department (MW&L) 34.5kV transmission line that enters the Johnson substation. This change provides enhanced reliability by allowing an alternative transmission path in the event of a failure of either the MW&L or GMP lines.

Table 1: JW&L's Retail Customer Counts

Data Element	2014	2015	2016	2017	2018
Residential (440)	770	772	776	788	802
Small C&I (442) 1000 kW or less	98	97	95	95	96
Large C&I (442) above 1,000 kW	12	12	12	12	14
Street Lighting (444)	32	31	32	33	33
Public Authorities (445)	31	30	29	29	30
Northern Vermont University	1	1	1	1	1
Total	**944**	**943**	**945**	**958**	**977**

Table 2: JW&L's Retail Sales

Data Element	2014	2015	2016	2017	2018
Residential (440)	5,039,478	5,042,634	5,030,503	4,928,055	5,152,903
Small C&I (442) 1000 kW or less	989,393	1,017,479	1,022,582	1,013,546	889,067
Large C&I (442) above 1,000 kW	2,502,912	2,439,292	2,216,194	1,744,040	1,845,609
Street Lighting (444)	67,300	66,638	67,146	67,208	65,597
Public Authorities (445)	836,229	850,852	856,263	777,978	704,938
Northern Vermont University	4,003,200	3,789,412	3,753,542	3,718,057	3,851,377
Total	**13,438,512**	**13,206,307**	**12,946,230**	**12,248,884**	**12,509,491**
YOY	1%	-2%	-2%	-5%	2%

Table 3: JW&L's Annual System Peak Demand (kW)

Data Element	2014	2015	2016	2017	2018
Peak Demand kW	2,681	2,563	2,485	2,340	2,401
Peak Demand Date	01/22/14	02/02/15	02/15/16	12/13/17	01/24/18
Peak Demand Hour	10	14	8	18	18

Structure of Report

This report is organized into six major sections plus an appendix and a glossary.

I. **Electricity Demand**
This chapter describes how JW&L's electricity requirements were determined and discusses sources of uncertainty in the load forecast.

II. **Electricity Supply**
This chapter describes JW&L's electricity supply resources, and the options that are being considered to supply the electricity needs of JW&L's customers.

III. **Resource Plans**
This chapter compares JW&L's electricity demand to its supply and discusses how JW&L will comply with the Renewable Energy Standard.

IV. **Electricity Transmission and Distribution**
This chapter describes JW&L's distribution system and discusses how it is being maintained to provide reliable service to its customers.

V. **Financial Analysis**
This chapter presents a high-level forecast of JW&L's power supply costs and cost of service.

VI. **Action Plan**
This chapter outlines specific actions the JW&L expects to take as a result of this Integrated Resource Plan.

Appendix : Letters List
The appendix includes a series of supporting documents and reports, as listed in the Table of Contents.

Glossary

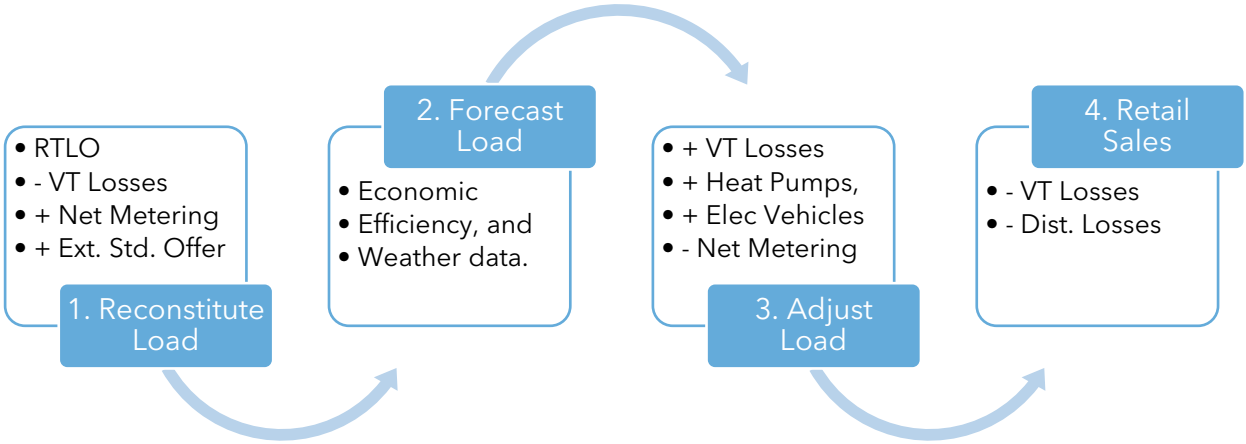
Electricity Demand

I. Electricity Demand

Energy Forecast Methodology: Regression with Adjustments

VPPSA uses Itron's Metrix ND software package and a pair of multiple regression equations to forecast JW&L's peak and energy requirements. Importantly, the peak and energy forecasts are based on the same underlying data sets and the same methodologies that are used to set JW&L's annual power budget. As a result, the forecasts are updated annually, and variances are evaluated monthly as actual loads become available. The forecast methodology follows a four-step process.

Figure 2: Forecasting Process



Reconstitute Load

In the past, metered load at the distribution system's tie points (boundaries) was used as the 'dependent' variable in the regression equations. However, the growing impact of the net metering and Standard Offer Programs has effectively obscured the historical trends in this data, and this would cause the accuracy of the regression equations to decrease. To preserve the accuracy of the regression forecast, VPPSA "reconstitutes" the Real-Time Load Obligation (RTLO) data by 1.) adding back generation from the net metering and Standard Offer Programs, and 2.) subtracting Vermont's transmission losses. This results in a data set that can be accurately modeled using multiple regression, and creates consistency with the historical data.

The resulting, reconstituted load is used as the dependent variable in the regression equations and forms a historical time series data that the regression equations use to predict future loads. The following table summarizes the data that is used to reconstitute the load.

Table 4: Data Sources for Reconstituting RTLO

Data Element	Source
RTLO	ISO-NE
– Vermont Transmission Losses	VELCO[1]
+ Net Metering Program Generation	VPPSA
+ Standard Offer Program Generation	VELCO
= Reconstituted Load	

Forecast Load

The regression equations use a series of independent or "explanatory" variables to explain the trends in the reconstituted load data. The equations themselves consist of the explanatory variables that are listed in Table 5.

Table 5: Load Forecast Explanatory Variables

Data Category	Explanatory Variable	Source
Dummy Variables	These variables consist of zeros and ones that capture seasonal, holiday-related, and large, one-time changes in demand.	Not applicable. Determined by the forecast analyst.
Economic Indicators	Unemployment Rate (%)	Vermont Department of Labor
	Eating and Drinking Sales ($)	Woods and Poole
Energy Efficiency	Cumulative EE Savings Claims (kWh)	Efficiency Vermont Reports and Demand Resource Plan
Weather Variables	Temperature – 10-year average heating & cooling degree days.	National Oceanic and Atmospheric Administration (NOAA)

The forecast accuracy of the regression model is very good. Based on monthly data, it has an adjusted R-squared of 96.8%, and a Mean Absolute Percent Error (MAPE) of 1.43%.

[1] Vermont Electric Power Company

Adjust Load

Once the regression models are complete and the forecast accuracy is maximized, the load forecast is adjusted to account for the impact (both historical and forward-looking) of cold climate heat pumps (CCHP), electric vehicles (EV), and net metering. As new electricity-using devices, CCHPs and EVs increase the load. However, by its nature, net metering decreases it[2].

Because the historical trends for these three items are still nascent, they cannot be effectively captured in the regression equations. In the case of net metering, VPPSA used the most recent three-year average to determine the rate of net metering growth in JW&L. For CCHPs and EVs, we used the same data (provided by Itron) that the Vermont System Planning Committee (VSPC) used in VELCO's 2018 Long Range Transmission Plan.

Notice that the adjusted load does not account for the presence of the Standard Offer Program. This is a deliberate choice that enables the resource planning model to treat the Standard Offer Program as a supply-side resource instead of a load-reducer.

Retail Sales

A forecast of retail sales is required to estimate compliance with the Renewable Energy Standard (RES) and is calculated by subtracting Vermont transmission and local distribution losses from the Adjusted Forecast.

[2] For more information on net-metering, please refer to https://vppsa.com/energy/net-metering/.

Energy Forecast Results

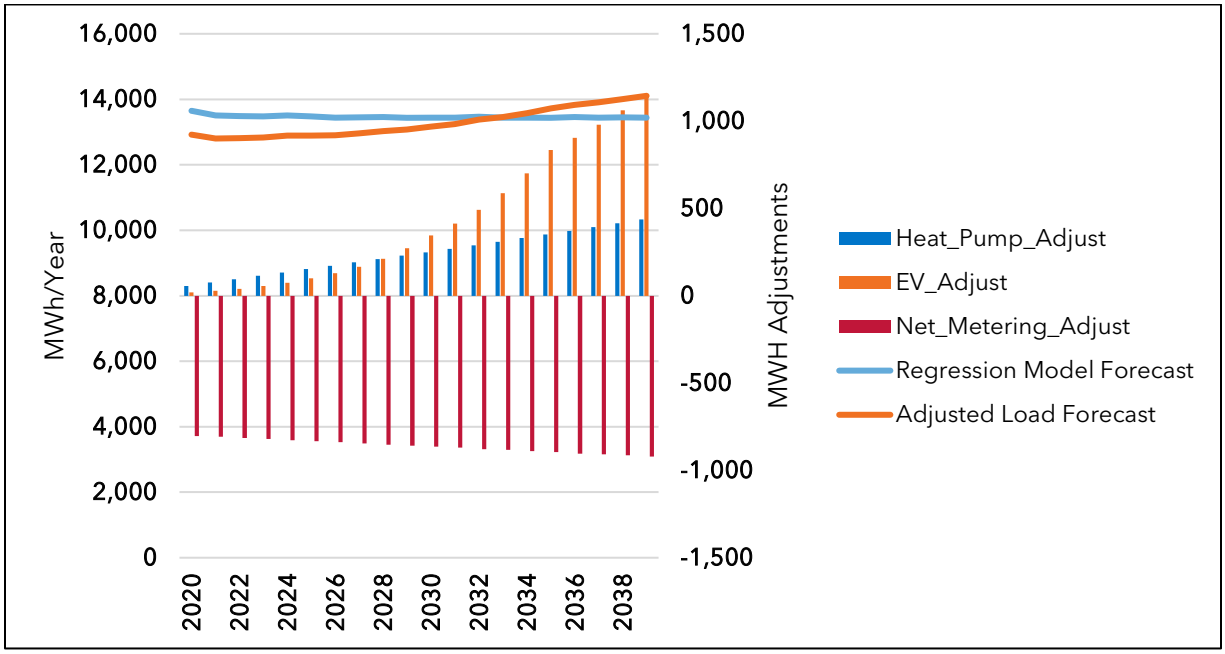
Table 6 shows the results of the Regression Forecast for energy, as well as the adjustments that are made to arrive at the Adjusted Forecast. The Compound Annual Growth Rates (CAGR) at the bottom of the table illustrate the trends in each of the columns. Notice that the Regression Forecast itself is decreasing by 0.1% per year. After making adjustments for CCHPs, EVs, and net metering, the Adjusted Forecast increases by 0.4% per year.

Table 6: Adjusted Energy Forecast (MWh/Year)

Year	Year #	Regression Fcst. (MWh)	CCHP Adjustment (MWh)	EV Adjustment (MWh)	Net Metering Adjustment (MWh)	Adjusted Fcst. (MWh)
2020	**1**	13,649	57	20	-803	12,922
2025	**6**	13,473	152	100	-833	12,893
2030	**11**	13,435	249	346	-864	13,165
2035	**16**	13,435	351	834	-895	13,724
2039	**20**	13,440	436	1,150	-920	14,106
CAGR		**-0.1%**	**10.7%**	**22.5%**	**0.7%**	**0.4%**

The Adjusted Forecast is the result of high CAGRs for CCHPs (10.7%) and EVs (22.5%). During the first eight years of the forecast, these two trends are more than offset by the net metering program, which grows by the historical three-year average of 0.7% per year. By 2032, the impact of CCHPs and EVs is on part with the impact of net metering, and the load growth accelerates from that year forward.

Figure 3: Adjusted Energy Forecast (MWh/Year)



Energy Forecast – High & Low Cases

To form a high case, we assumed that the CAGR for CCHPs and EV's about doubles to 25% and 40% respectively. Simultaneously, we assume that net metering penetration stops at today's levels. At these growth rates, 2039 energy demand rises by over 200% compared to 2020 electricity use, a result that is driven by the 40% CAGR for EVs. Because of the nature of compound growth, the increase in energy demand does not start to accelerate until 2030. As a result, there is ample opportunity to monitor these trends during the annual budget and the tri-annual IRP cycles.

Table 7: Energy Forecast – High Case

Year	Year #	Regression Fcst. (MWh)	CCHP Adjustment (MWh)	EV Adjustment (MWh)	Net Metering Adjustment (MWh)	Adjusted Fcst. (MWh)
2020	1	13,649	57	20	-803	12,922
2025	6	13,473	173	106	-803	12,949
2030	11	13,435	527	571	-803	13,730
2035	16	13,435	1,609	3,072	-803	17,314
2039	20	13,440	3,929	11,803	-803	28,369
CAGR		-0.1%	23.6%	37.7%	0.0%	4.0%

To form a low case, we assumed that the CAGRs for CCHPs and EVs decreases by more than 50% from the base case. In addition, we assumed that the CAGR for net metering triples. This combination of trends is a plausible worst-case scenario, and results in a forecast that *decreases* by 0.2% per year.

Table 8: Energy Forecast - Low Case

Year	Year #	Regression Fcst. (MWh)	CCHP Adjustment (MWh)	EV Adjustment (MWh)	Net Metering Adjustment (MWh)	Adjusted Fcst. (MWh)
2020	1	13,649	57	20	-803	12,922
2025	6	13,473	72	32	-889	12,688
2030	11	13,435	92	51	-984	12,594
2035	16	13,435	118	83	-1090	12,545
2039	20	13,440	143	121	-1182	12,522
CAGR		-0.1%	4.7%	9.5%	2.0%	-0.2%

Peak Forecast Methodology: The Peak & Average Method

The peak forecast regression model forecasts the load during the peak hour each day. Because utility loads are strongly influenced by temperature, this peak usually occurs during an hour of relatively extreme temperatures. In winter, this is during a very cold hour, and in summer it is during a very hot hour.

Unlike the energy forecast model, using average weather in the peak forecast model is not appropriate. Why? By definition, the coldest day and hour is always colder than average, and the hottest day and hour is always hotter than average. As a result, using average weather in the peak forecast model would result in a forecast that is biased and too low. In this context, the key question is, "How can historical weather data be used to develop an accurate representation of future weather, while still maintaining the extremes?"

The answer is the rank-and-average method, which is widely accepted[3] and effectively represents the random, real-life extremes in average historical weather. This method assigns a temperature to each day of the year that is representative of the average of the coldest (or hottest) days. It is important to highlight that the rank and average method produces a "50/50" forecast. While one may expect this to be a method for forecasting extreme weather conditions, in reality extreme weather *is* normal.

Finally, the accuracy of the peak forecast regression model is good. Based on daily data, it has an R-squared of 78.6%, and a MAPE of 3.05%.

[3] For a more in-depth discussion of the method, please refer to Itron's white paper on the topic. https://www1.itron.com/PublishedContent/Defining%20Normal%20Weather%20for%20Energy%20and%20Peak%20Normalization.pdf

Peak Forecast Results

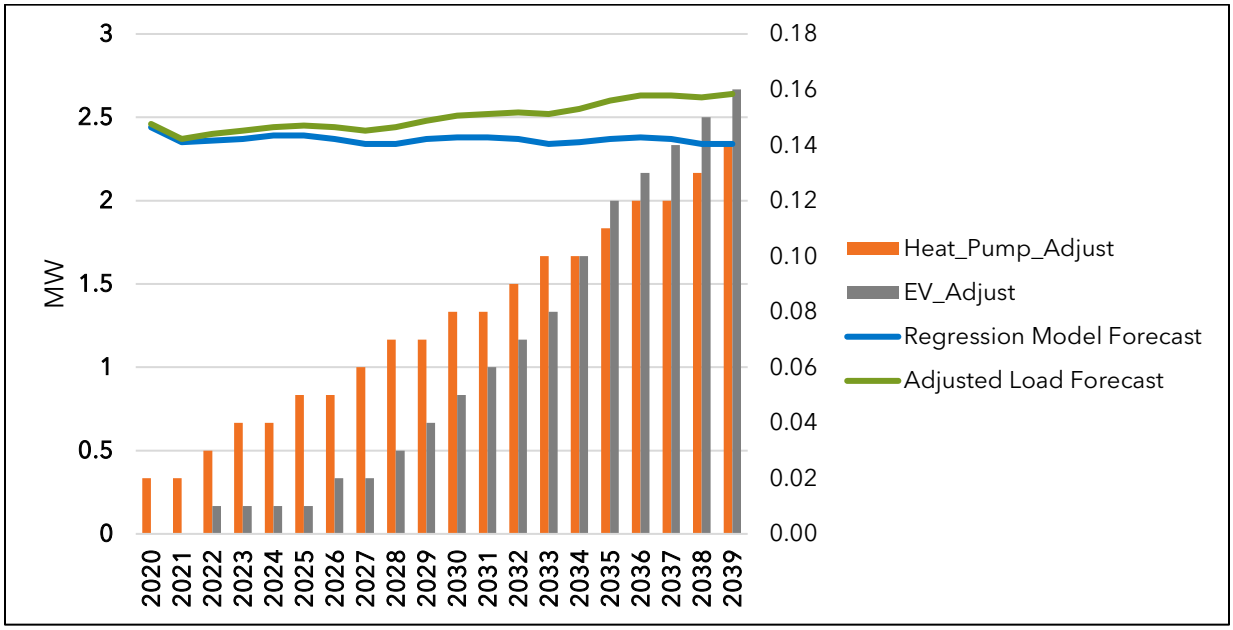
Table 9 shows the results of the Regression Forecast of peak loads, as well as the adjustments that are made to arrive at the Adjusted Forecast. The CAGR at the bottom of the table illustrate the trends in each of the columns. Notice that the Regression Forecast itself is decreasing by 0.2% per year. After making adjustments for CCHPs, EVs, and net metering, the Adjusted Forecast actually increases by 0.4% per year. Finally, the table shows that the timing of JW&L's peak load is forecast to stay in January at 1800 (6:00 PM).

Table 9: Peak Forecast (MW)

MMM-YY	Peak Hour	Regression Forecast	EV Adjustment	CCHP Adjustment	Net Metering Adjustment	Adjusted Forecast
Jan-20	1800	2.44	0.00	0.02	0.00	2.46
Jan-25	1800	2.39	0.01	0.05	0.00	2.45
Jan-30	1800	2.38	0.05	0.08	0.00	2.51
Jan-35	1800	2.37	0.12	0.11	0.00	2.60
Jan-39	1800	2.34	0.16	0.14	0.00	2.64
CAGR		-0.2%	20.3%	10.2%	0.0%	0.4%

The peak load forecast starts at 2.46 MW and ends at 2.64 MW. The Adjusted Forecast exceeds the Regression Forecast immediately in 2020 due to high CAGRs for CCHPs (10%). By 2034, EV's are forecast to be responsible for as much peak load growth as CCHP's, and can be seen in Figure 4.

Figure 4: Adjusted Peak Forecast (MW)



Peak Forecast – High & Low Cases

To form a high-case, we assumed that neither load controls nor Time-of-Use (TOU) rates are implemented, and then we adopt the same CAGR assumptions from the high case as in the energy forecast. Even under these assumptions, peak load growth does not start to materially impact the system until after 2030. Absent a step change in consumer adoption of CCHPs and EVs, electrification is not likely to produce any appreciable peak load growth for the next ten years. However, we will continue to monitor these trends annually.

Table 10: Peak Forecast – High Case

MMM-YY	Peak Hour	Regression Forecast	CCHP Adjustment (MW)	EV Adjustment (MW)	Net Metering Adj. (MW)	Adjusted Fcst. (MW)
Jan-20	**1800**	2.44	0.02	0.00	0.00	2.46
Jan-25	**1800**	2.39	0.06	0.01	0.00	2.46
Jan-30	**1800**	2.38	0.19	0.05	0.00	2.62
Jan-35	**1800**	2.37	0.57	0.29	0.00	3.23
Jan-39	**1800**	2.34	1.39	1.11	0.00	4.84
CAGR		**-0.2%**	**23.6%**	**36.9%**	**0.0%**	**3.4%**

A plausible low case for the peak forecast would involve applying TOU electric rates and load control devices on all of the major end uses, especially CCHPs and EVs. In theory, this strategy could completely offset any peak load growth resulting from CCHPs and EVs. As a result, it is not necessary to quantify a low case scenario. Peak loads would simply match the Regression Forecast without any adjustments.

Forecast Uncertainties & Considerations

The uncertainties facing JW&L stem from the growth rate of net-metering, CCHPs and EVs all of which are nascent trends that will almost certainly progress at different rates than forecast.

Net Metering

JW&L presently has nine residential scale (< 15 kW) net metered customers with a total installed capacity of about 56 kW. In addition, there are four customers who have arrays between 15 and 150 kW. They total 500 kW. All in, JW&L has about 556 kW of net-metered capacity, which is 23% of JW&L's 2020 peak load (2.46 MW).

As solar net metering costs continue to decline, the cost of net metered solar could reach parity with the price of grid power. If state policy continues to be supportive of net metering, it could lead to a step change in the adoption rate of net metering, and a quicker erosion of retail revenues for the utility.

Given the small size of the customer base and the nascent trends involved, net-metering represents a key uncertainty for JW&L to monitor, especially if larger net metered projects are proposed. For example, a 500 kW net metered solar project built in 2020 would represent an almost 100% increase in the base of installed, net metered capacity on the system. In this event, the impact would be captured in interconnection and annual power budgeting processes and managed accordingly.

Northern Vermont University (NVU)

As JW&L's largest customer, NVU represents about 30% of its retail sales and wholesale load obligations (MWH). Because of the spring 2020 proposal to close the campus, it represents a major uncertainty to the load forecast.

The impact that this uncertainty has on this IRP is two-fold.

1. First, the deficit between hedged energy supply and energy demand between 2023 and 2027 has been allowed to increase to about 30% by 2025. This is illustrated in Section III – Energy Resource Plan. The first resource decision to be considered is whether to reduce this deficit with a 5-year purchase.

2. Second, this IRP explicitly estimates the impact of NVU's departure in the Financial Analysis chapters by reducing the load and peak forecasts by 30% on 1/1/23.

Electricity Supply

II. Electricity Supply

JW&L's power supply is made up of owned generation, long-term contracts, and short-term contracts. The resources in JW&L's portfolio represent a range of fuel types and technologies. In addition, they are located throughout Vermont and New England, and many of their expiration dates have been chosen not to overlap. As a result, they act as a diversified portfolio that effectively hedges JW&L's power supply costs against the cost of serving load in ISO New England's energy, capacity and ancillary markets. The following sections describe each of JW&L's power supply resources, both in bulleted and in table formats.

Existing Power Supply Resources

1. Brookfield 2023-2027

- Size: 0.6 MW On-Peak, 0.3 MW Off-Peak
- Fuel: Hydro
- Location: MA HUB
- Entitlement: 7.5% of the PPA's total MWH
- Products: Energy, Tier I RECs
- End Date: 12/31/27
- Notes: The contract includes Tier I RECs.

2. Chester Solar

- Size: 4.8 MW
- Fuel: Solar
- Location: Chester, MA
- Entitlement: 6.6% (0.317 MW), PPA
- Products: Energy, capacity
- End Date: 6/30/39
- Notes: The contract does not include the environmental attributes.

3. Fitchburg Landfill

- Size: 4.5 MW
- Fuel: Landfill Gas
- Location: Westminster, MA
- Entitlement: 5.112%, 0.153MW, PPA
- Products: Energy, capacity, renewable energy credits (MA I)
- End Date: 12/31/31

4. Kruger Hydro

- Size: 6.7 MW
- Fuel: Hydro
- Location: Maine and Rhode Island
- Entitlement: 5.48%, PPA
- Products: Energy, capacity
- End Date: 12/31/37
- Notes: The Electric Department has an agreement with VPPSA to

purchase unit contingent energy and capacity from six hydroelectric generators. The contract does not include the environmental attributes.

5. Market Contracts

- Size: Varies
- Fuel: New England System Mix
- Location: New England
- Entitlement: Varies (PPA)
- Products: Energy or renewable energy credits
- End Date: Varies, less than 5 years.
- Notes: In addition to the above resources, the Electric Department purchases system power from various other entities under short-term (5 year or less) agreements. These contracts are described as Planned and Market Purchases in the tables below.

6. NextEra 2018-22

- Size: 1,250 MW
- Fuel: Nuclear
- Location: Seabrook, NH
- Entitlement: 3.7%, 0.2262MW On-Peak, 3.7%, 0.444MW Off-Peak (PPA)
- Products: Energy, capacity, environmental attributes (Carbon-free nuclear)
- End Date: 12/31/2022

7. New York Power Authority (NYPA)

- Size: 2,675 MW (Niagara), 1,957 MW (St. Lawrence)
- Fuel: Hydro
- Location: New York State
- Entitlement: 0.797%. 0.064MW (Nia. PPA), 0.199%, 0.003MW (St. Law PPA)
- Products: Energy, capacity, renewable energy credits (NY System Mix)
- End Date: 9/1/25 (Niagara), 4/30/2032 (St. Lawrence)
- Notes: NYPA provides hydro power to the Electric Department under two contracts, which will be extended at the end of their term.

8. Project 10

- Size: 40 MW
- Fuel: Oil
- Location: Swanton, VT
- Entitlement: 7.2%, joint-owned through VPPSA
- Products: Energy, capacity, reserves
- End Date: Life of unit
- Notes: As the joint-owner, VPPSA has agreements with the Electric Department pay for and purchase 7.2% of the unit's output.

9. PUC Rule 4.100 Program (VEPPI Program)

- Size: Small hydro < 80 MW
- Fuel: Hydro
- Location: Vermont
- Entitlement: 0.226% (Statutory)
- Products: Energy, capacity
- End Date: 10/31/2020
- Notes: The Electric Department is required to purchase hydro power from small power producers through Vermont Electric Power Producers, Inc. ("VEPPI"), in accordance with PUC Rule #4.100. The entitlement percentage fluctuates slightly each year with the Electric Department's pro rata share of Vermont's retail energy sales and does not include the renewable energy credits.

10. PUC Rule 4.300 Program (Standard Offer Program)

- Size: Small renewables, primarily solar < 2.2 MW
- Fuel: Mostly solar, but also some wind, biogas and micro-hydro
- Location: Vermont
- Entitlement: 0.244% (Statutory)
- Products: Energy, capacity, renewable energy credits
- End Date: Varies
- Notes: The Electric Department is required to purchase power from small power producers through the Vermont Standard Offer Program in 2019, in accordance with PUC Rule #4.300. The entitlement percentage fluctuates slightly each year with the Electric Department's pro rata share of Vermont's retail energy sales.

11. Ryegate

- Size: 20.5 MW
- Fuel: Wood
- Location: East Ryegate, VT
- Entitlement: 0.241% PPA
- Products: Energy, capacity, renewable energy credits (CT Class I)
- End Date: 10/31/2021
- Notes: We expect that the State will extend the term of the PPA beyond 2021.

Table 11 summarizes JW&L's resources based on a series of important attributes. First the megawatt hours (MWH) and megawatts (MW) show the relative size of each resource. The delivery pattern indicates what time of the day and week the resource delivers energy, and the price pattern indicates how the resource is priced. Notice that most of the resources are fixed price. This feature provides the hedge against spot market prices. If the resource produces Renewable Energy Credits[4] (RECs), that is indicated in the seventh column, followed by the resource's expiration date and whether we assumed that it would be renewed until 2039.

Table 11: Existing Power Supply Resources

Resource	2020 MWH	% of MWH	2020 MW	Delivery Pattern	Price Pattern	REC[5]	Expiration Date	Renewal to 2039
1. Brookfield 2023-2027	0	0%	0	Firm	Fixed	✓	12/31/2027	No
2. Chester Solar	441	3.6%	0.126	Intermittent	Fixed		6/30/2039	No
3. Fitchburg Landfill	1,725	14.1%	0.206	Firm	Fixed	✓	12/31/2031	No
4. Kruger Hydro	1,388	11.4%	0.081	Intermittent	Fixed		12/31/2037	No
5. Market Contracts	2,368	19.4%	0	Firm, Shaped	Fixed		6/30/2024	No
6. NextEra 2018-22	4,661	38.2%	0	Firm, Shaped	Fixed	✓	12/31/2022	No
7. NYPA Niagara	804	6.6%	0.114	Baseload	Fixed	✓	04/30/2032	Yes
6.1 NYPA St. Lawrence	18	0.1%	0.003	Firm	Fixed		12/31/2022	No
8. Project 10	43	0.4%	2.783	Dispatchable	Variable		Life of unit.	Yes
9. PUC Rule 4.100	65	0.5%	0	Intermittent	Fixed		2020	No
10. PUC Rule 4.300	308	2.5%	0.003	Intermittent	Fixed	✓	Varies	No
11. Ryegate	393	3.2%	0.046	Baseload	Fixed	✓	10/31/2021	Yes
Total MWH	12,214	100.0%	3.36					

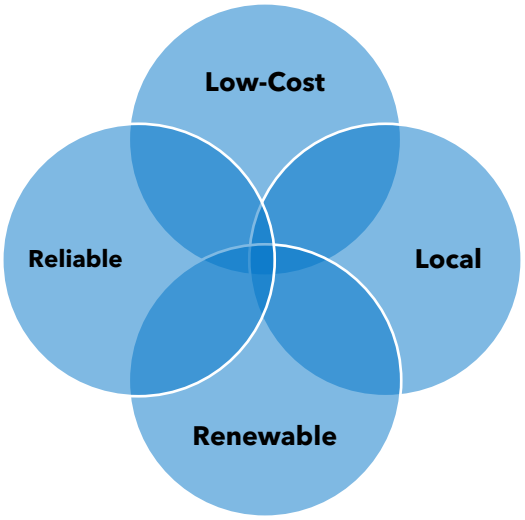
[4] Note that RECs are defined broadly in this table, and the "emissions attributes" from non-renewable (but also non-carbon emitting) resources such as nuclear are included in this table.

[5] Please note that the NextEra 2018-22 contract includes carbon free nuclear attributes, which are not technically considered "RECs".

Future Resources

JW&L will seek out future resources that meet as many of the following criteria as possible. Ideally, future resources will meet four criteria by being low-cost, local, renewable and reliable.

Figure 5: Resource Criteria



- ✓ **Low-Cost** resources reduce and stabilize electric rates.
- ✓ **Local** resources are located within the Lamoille County Planning Commission area or within Vermont.
- ✓ **Renewable** resources meet or exceed RES requirements
- ✓ **Reliable** resources not only provide operational reliability, but are also owned and operated by financially strong and experienced companies.

These criteria enable JW&L to focus on a subset of generation technologies, and to exclude coal, geothermal and solar thermal generation which do not meet them. Resources that JW&L may consider fall into three categories: 1.) Existing resources in Table 11 , 2.) Demand-side resources, and 3.) New resources.

Category 1: Extensions of Existing Resources

This plan assumes that three existing resources are extended past their current expiration date. These include NYPA, Project 10, and Ryegate. The most crucial of these is Project 10, which supplies over 95% of JW&L's capacity. Where resource needs remain, market contracts will be used to supply them.

1.1 Market Contracts

Market contracts are expected to be the most readily available source of electric supply for energy, capacity, ancillary services and renewable attributes (RECs). By conducting competitive solicitations through VPPSA, JW&L can not only get access to competitive prices (low-cost), but it also can structure the contracts to reduce volatility (stable rates) and potentially include contracts for RECs for RES compliance. Market contracts are also scalable and can be right-sized to match JW&L's incremental electric demands by month, season and year. In many cases, the delivery point for market contracts can be set to the Vermont Zone reducing potential price differential risks between loads and resources. Finally, the financial strength of the suppliers in the solicitation can be predetermined. The combination of these attributes makes market contracts a good fit for procuring future resources.

Category 2: Demand-Side Resources

The lowest cost, most local source of energy is often energy that is conserved or never consumed. As a result, JW&L will continue to welcome the work of the Efficiency Vermont (EVT) in its service territory. JW&L will also continue to work with its customers, both large and small, to uncover demand response opportunities. This includes best practices for demand management as JW&L continues to implement its energy transformation programs under RES.

Category 3: New Resources

VPPSA regularly meets with developers throughout New England, and through VPPSA staff, JW&L will continue to monitor and evaluate new generation resources in the New England region.

3.1 Wind Generation (On and Off-Shore)

On-shore wind projects continue to be developed in New England, and entitlements to such projects can often be negotiated at competitive prices. RECs are often bundled into the PPA, making this resource a good fit for the low-cost and renewable criteria. Off-shore wind projects are in development, but the costs remain substantially higher than for on-shore wind. As a result, JW&L would approach such projects with more reserve.

3.2 Gas-Fired Generation

As Project 10 approaches an investment in a major overhaul and the requirements for reserves, voltage support and other ancillary services shift, JW&L will investigate simple and combined cycle (CC) generation. This includes entitlements to new or existing plants in New England, and to traditional peaking generation which continues to provide reliable peak-day service to the New England region. It should be noted that as a participant in ISO New England's markets, the marginal cost of supply is set by these same resources, and that the benefit of owning an entitlement in one is primarily to reduce heat rate risk.

3.3 Solar Generation

Solar development is increasingly common and cost-effective, particularly at utility scales. Plus, it can be deployed locally. Furthermore, solar is expected to be the primary technology that is employed to meet its Distributed Renewable Energy (Tier II) requirements under RES. For these reasons, solar is likely to be a leading resource option, and JW&L will continue to investigate solar developments both within its service territory and outside of it.

3.31 Solar Net Metering

While net metering participation rates are presently modest and are forecast to grow modestly, JW&L will monitor the participation rate closely as solar costs approach grid parity. Should grid parity occur, not only would net metered solar penetration be expected to increase, but the costs of the existing program would likely cause upward rate pressure[6]. As a result, net metered solar is an inferior option when compared to lower-cost, utility scale solar projects.

3.4 Hydroelectric Generation

Hydroelectric generation is widely available in the New England region, and can be purchased within the region or imported from New York and Quebec. Furthermore, it can be sourced from either small or large facilities. Like all existing resources, price negotiations begin at or near prevailing market prices. As a result, existing hydro generation could be both low-cost (or at least at market) and renewable.

3.5 Battery Storage

VPPSA issued a Request for Proposals (RFP) for Electricity Storage in October 2020[7]. Like VPPSA's 2017 Solar RFP, the purpose of the Storage RFP is to identify a potential development partner who would develop storage projects in its Member's service territories.

Nine proposals were received in December. While VPPSA and its members remain open to a variety of proposals, the present proposals are for MW scale, peak-shaving storage systems. The purpose of these systems would be to reduce monthly and annual peak loads that are coincident with ISO New England, thereby reducing ISO-NE transmission and capacity costs.

At the writing of this IRP, VPPSA has chosen four companies to participate in the second round. The second-round process is now on a slower timeline than was anticipated in the RFP, but it is expected to conclude in the spring of 2021.

[6] An excellent discussion of net metering and rate-design policy issues by Dr. Ahmad Faruqui can be found in the October 2018 issue of Public Utilities Fortnightly.
https://www.fortnightly.com/fortnightly/2018/10/net metering-faq

[7] Please refer to Appendix G for a copy of the VPSPA Storage RFP.

Regional Energy Planning (Act 174)

As part of the Lamoille County Planning Commission (LCPC), JW&L is part of a Regional Energy Plan[8] that was amended in 2018. According to the Plan, the

"Lamoille County's Energy Plan is guided by two broad state energy goals. These goals - set for year 2050 – are to decrease the overall energy consumption in Vermont by 33% and transition the state's energy use from 75% non-renewable to 90% renewable. Meeting these energy goals will set the state on a path to meet its greenhouse gas emission reduction targets."[9]

The full plan is included in the appendix, and all future resource decisions will be made with this plan in mind. Specifically, JW&L will consult with the LCPC on resource decisions that involve potential siting of new resource in Vermont.

[8] The full plan can be found at https://www.lcpcvt.org/?SEC=77A0A7C5-D81B-4DAB-AC09-D59CA8D9A347.

[9] 2015-2023 Lamoille County Regional Plan, Section 3: Where We Live, LCRP 2018, Page 93

Resource Plan

III. Resource Plans

Resource Acquisition Strategy

JW&L evaluates resource acquisitions on three different time scales.

Short-Term (< 1 year)

VPPSA's Power Supply Authorities Policy requires that energy supplies be within +/-5% of the forecasted demand in each month of the year. This is known as the hedge ratio, and it is simply the ratio of the forecasted supply to the forecasted demand. Any imbalances between supply and demand are hedged to these levels before the operating month begins. In practice, changes in weather, generator availability and forecast error sometimes combine to push the actual percentage outside of the +/-5% threshold.

At least seasonally (four times a year), VPPSA uses a 7x24 energy product to refine the energy hedge ratio for JW&L. The following three-step process is used to balance supply and demand on a monthly basis within the current budget (calendar) year.

1. Update Budget Forecast
    a. The budgeted volumes (MWH) are updated to reflect known changes to demand and supply including unit availability, fuel supply, and hydrological conditions.
2. Hydroelectric Adjustment
    a. Supply is reduced by one standard deviation from the long-term average in order to avoid making sales that could end up being unhedged by supply in the event of a dryer-than-normal month.
3. Execute Purchases or Sales
    a. Internal Transactions: VPPSA seeks first to make internal transactions between its members to balance supply and demand. The transactions are designed to result in a hedge ratio that falls within the +/-5% range that is required by VPPSA's Power Supply Authorities Policy.
    b. External Transactions: In the event that internal transactions cannot bring JW&L into the +/-5% range, external transactions are placed with power marketers, either directly or through a broker.
    c. Price: For Internal Transactions, the price of the transaction is set by an average of the bid-ask spread as reported by brokers on the date of the transaction. For External Transactions, the price is set through a negotiation with the counterparty.

Medium Term (1-5 years)

Known within VPPSA as "planned purchases", these transactions are almost always purchases. They typically take place no more than once a year, usually carry a 1-5 year term, and if possible, are executed at a time when market prices are at or below budgeted levels.

These purchases are designed to fit the on and off-peak energy needs in each month of the year as precisely as possible. As a result, they minimize the need for monthly 7x24 hedging transactions under VPPSA's Power Supply Authorities Policy.

The solicitation method is an informal Request for Proposals (RFP), and follows a three-step process.

1. Pre-Approval Term Sheet: First, the proposed purchase volumes and anticipated prices are documented in a standardized term sheet. This document is distributed to each VPPSA member for their pre-approval, and it defines their share of the total purchase.

2. Issue RFP: Once all of the pre-approvals are received, the term sheet is distributed to three or more power marketers, who are asked to make their best offer by a deadline, typically within 5 business days.

3. Evaluate & Execute: When all of the bids are received, VPPSA evaluates them to determine the lowest cost bid, and executes the purchase with that counterparty. Then the purchase is allocated to each VPPSA member according to their pre-approved term sheet, and the data is entered into VPPSA's database for scheduling, delivery and invoice tracking.

Long Term (> 5 years)

JW&L evaluates long-term Purchased Power Agreements (PPAs) for bundled energy, capacity, renewable energy credits, and/or ancillary products on an ongoing basis. Because long-term PPAs are subject to PUC approval, the acquisition strategy is to identify the optimal size and shape of the desired products (energy, capacity, RECs, ancillary services), and then negotiate the best possible terms with creditworthy counterparties. Once the rate impact of these terms is determined and the requirements of Act 248 are met, then JW&L would file for PUC approval. In all circumstances, the resource acquisition would be made contingent on PUC approval.

Resource Decisions

As the following sections will explain, JW&L faces a series of potential resource decisions that can prudently fulfill its energy, capacity and RES obligations in the coming years. These include:

1. 2023–2027 Energy Only PPA

   Because of the potential for NVU to shut down, purchasing additional energy in this time frame carries the risk of creating surplus energy supplies. However, if NVU continues to operate, present-day energy prices are very attractive. As a result, the first resource decision is to evaluate the cost and benefits of purchasing this energy, and quantifying the impact of a potential NVU closure on 1/1/23.

2. 2028-2040 Hydro Energy + Tier I RECs PPA

   JW&L will need to purchase energy and Tier I RECs to hedge its energy costs and meet the RES requirements regardless of NVU's potential closure. As a result, the second resource decision is to evaluate the cost and benefits of purchasing energy and Tier I RECs in quantities that will meet the RES requirements leading up to 2032.

3. 25-Year Solar PPA

   The Tier II Resource Plan in this chapter identifies the need for a 500 kW solar resource to fulfill JW&L's Tier II and Tier II RES requirements. The array is needed immediately and is assumed to come online 1/1/23.

Energy Resource Plan

Figure 6 compares JW&L's energy supply resources to its adjusted load. There are two resources that are set to expire in the coming two and a half years. The first is the expiration of the NextEra 2018-2022 contract ("Seabrook" in Figure 6) on 12/31/2022. This resource represents about 38% of JW&L's energy supply. The second is the expiration of the current market contracts on 6/30/2024, which represents about 19% of JW&L's energy supply.

Table 12: Energy Resource Decision Summary

Resource	Years Impacted	% of MWH	Rate Impact	RES Impact
1. NextEra 2018-2022	2023+	38%	Beneficial	None
2. Market Contracts	2024+	19%	Neutral	None

The next resource that is set to expire is the recently acquired Brookfield contract, which was purchased in December 2020 to replace part of the NextEra contract. It was acquired at a significant discount to the NextEra price, and importantly, the price included both firm energy and Tier I RECs. This five-year contract expires on 12/31/2027.

In Figure 6, the deficit between energy supply and energy demand rises from 10% of JW&L's load in 2023 to about 30% of its load in 2025. Because of the uncertainty surrounding NVU's continued operation, this level of committed supply is desirable. In the event that NVU stops operating, JW&L will not be overcommitted to long-term energy supplies.

Figure 6: Energy Supply & Demand by Fuel Type

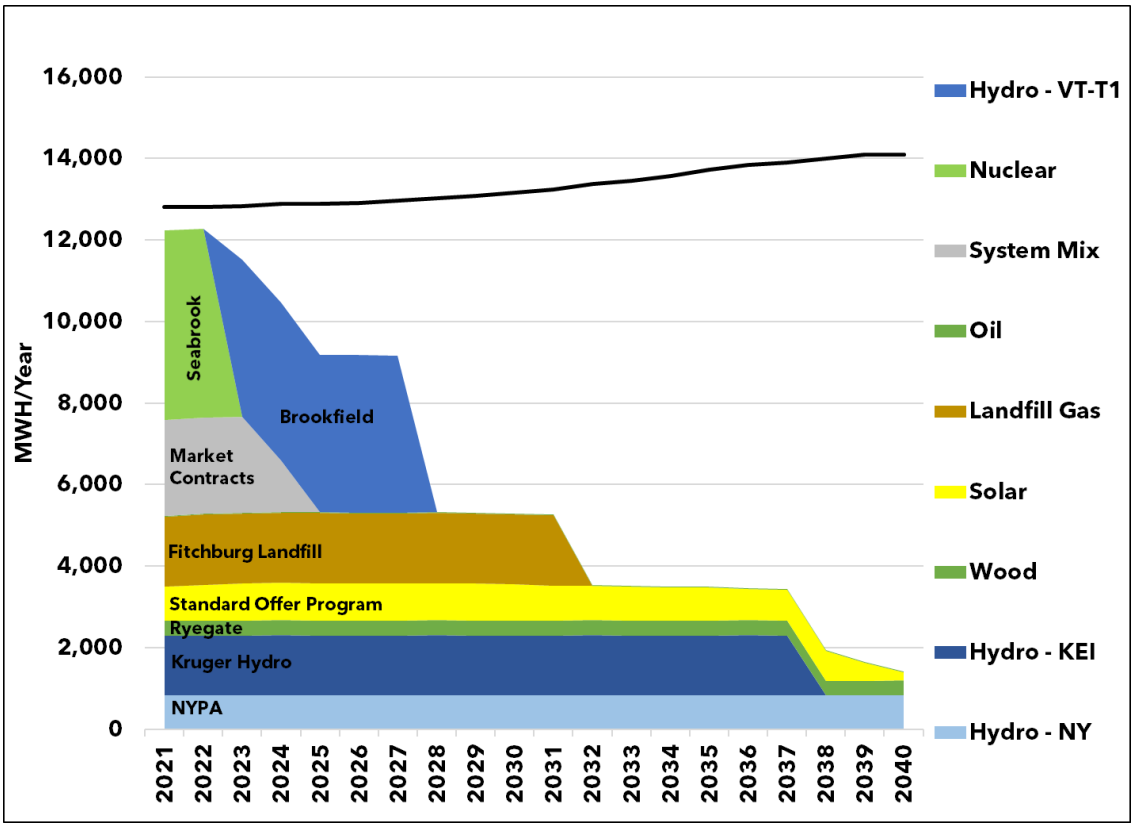
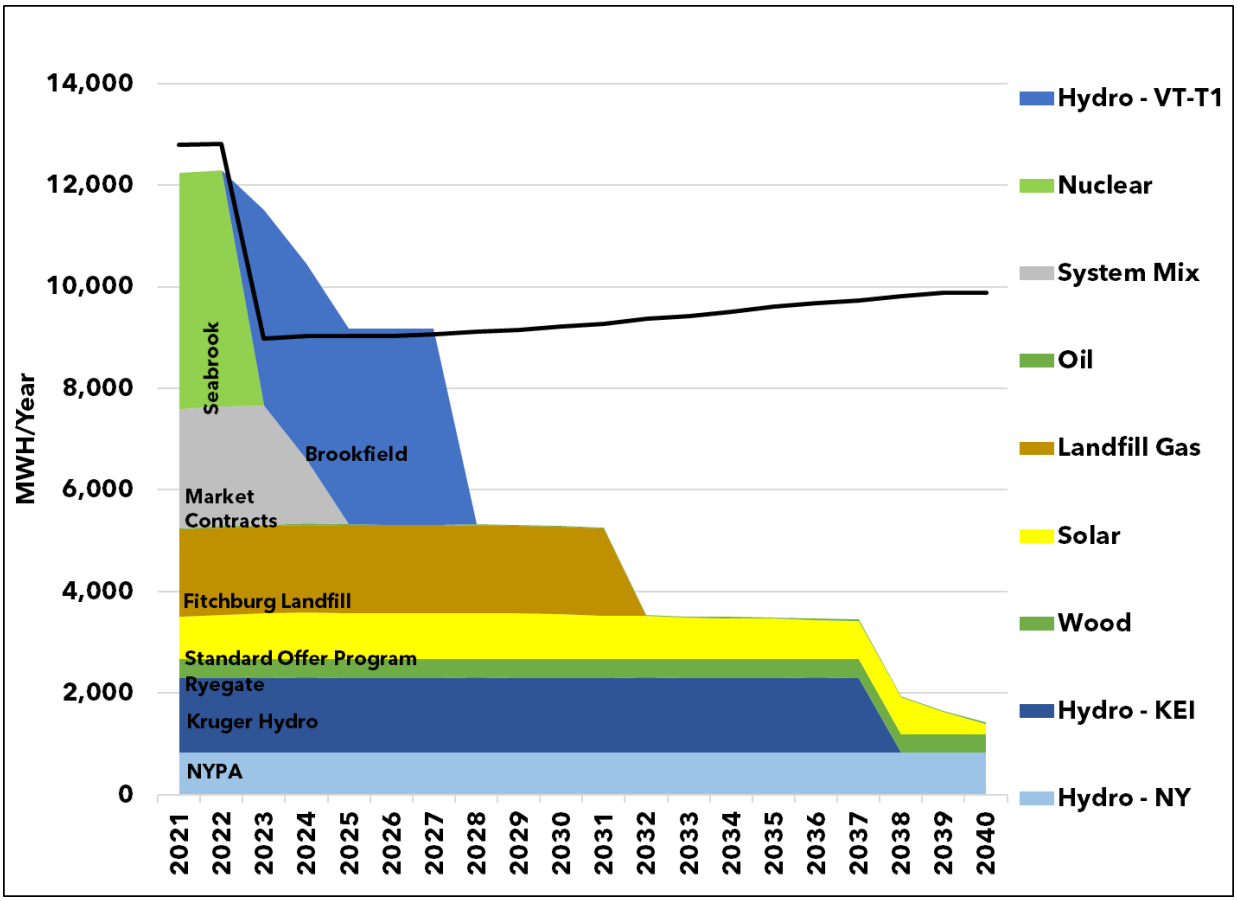


Figure 7 shows the impact of NVU's closure on JW&L's energy supply and demand balance. We assume that the load drops by 30% effective 1/1/23. This would result in surplus energy for two years; 2024 and 2025. The annual coverage ratio in 2023 would be 128%, but it would fall to 116% in 2024 before coming into balance at 102% in 2025. This level of supply-demand imbalance is well within VPPSA's existing Power Supply Authorities Policy, and could be managed using the processes described in the Resource Acquisition Strategy section.

Figure 7: Energy Supply & Demand If Loads Drop by 30%



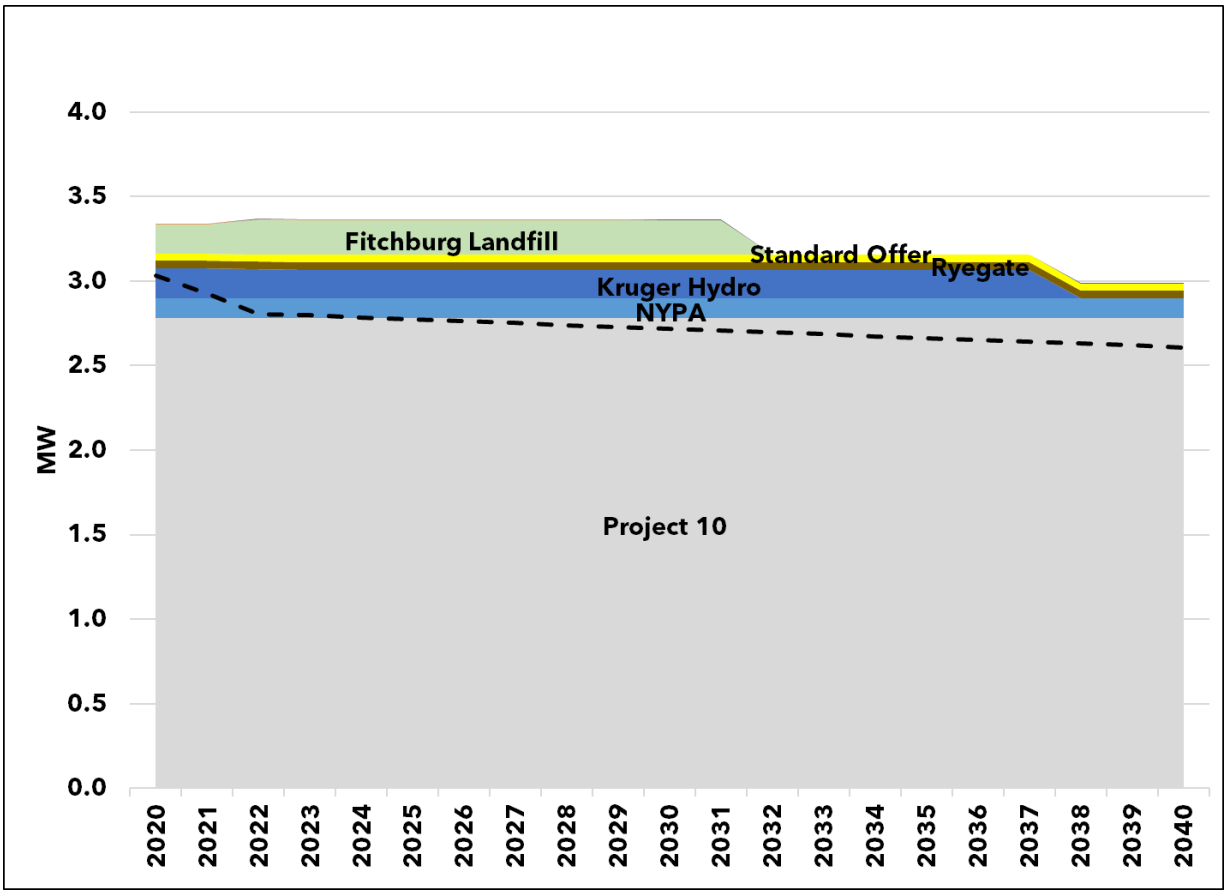
In this context, **the primary resource decision facing JW&L is whether to purchase market contracts to hedge its medium-term (2023-2027) energy demand.** If NVU continues to operate, the supplies are needed, but if NVU closes, they are not. As a result, the Financial Analysis will include a decision to purchase a five-year, fixed price market contract, and will assess the impact of an NVU closure on the cost and risk associated with such a PPA.

The next resource decision facing JW&L is in the 2028-2032 timeframe. This period of time is expected to be characterized by increasing load growth due to electrification, and it will culminate in the 75% Tier I renewable requirement under the RES in 2032. **The second resource decision in this IRP measures the costs and benefits of** meeting these needs though a long term Hydro PPA with TIER I RECs over the 2028-2040 period**.** This decision could be made regardless of NVU's continued operation and would hedge both JW&L's energy and Tier I RES requirements.

Capacity Resource Plan

Figure 8 compares JW&L's capacity supply to its demand. Project 10 provides practically all of JW&L's capacity, with minor contributions from NYPA, Kruger Hydro, Ryegate, the PUC Rule 4.300 (Standard Offer) Program, and the Fitchburg Landfill.

Figure 8: Capacity Supply & Demand (Summer MW)



The gap between supply and demand is about 0.5 MW or a 20% surplus. This surplus is contingent on JW&L's annual coincident peak with ISO-NE, which has varied by as much as 30% in a single year. As a result, this surplus is not out of scale with JW&L's peak loads, and in any case, any imbalances will be settled through the Forward Capacity Market.

As the largest part of the capacity supply, the reliability of Project 10 is the primary concern for JW&L. As a result, maintaining the reliability of Project 10 will be the key to minimizing JW&L's capacity costs, as explained in the next section.

ISO New England's Pay for Performance Program

Because JW&L is part of ISO New England, its capacity requirements are pooled with all of the other utilities in the region. As a result, if Project 10 is not available, JW&L will be provided with (energy and) capacity by ISO New England. However, ISO New England's Pay for Performance[10] (PFP) program creates financial payments (and potential penalties) for generators to perform when the grid is experiencing a scarcity event.

The following table illustrates the range of performance payments that JW&L's 7.2% (2.8 MW) share of Project 10 creates in ISO New England's PFP Program. Depending on ISO-NE's load at the time of the scarcity event and Project 10's performance level, JW&L could receive up to a $6,500 payment or pay up to a $7,400 penalty during a one-hour scarcity event. This represents a range of plus or minus 40% of JW&L's monthly capacity budget. However, such events are not expected to occur more than a few times a year (if at all), and frequently last less than one hour.

Table 13: Pay for Performance Ranges for One Hour of Project 10 Operation[11]

ISO-NE Load	Performance Payment Rate	0% Performance	50% Performance	100% Performance
10,000	$3,500/MWH[12]	-$3,200	$1,700	$6,500
15,000	$3,500/MWH	-$4,600	$300	$5,100
20,000	$3,500/MWH	-$6,000	-$1,100	$3,800
25,000	$3,500/MWH	-$7,400	-$2,500	$2,400

[10] For an overview of the PFP program, please visit https://www.iso-ne.com/participate/support/customer-readiness-outlook/fcm-pfp-project.

[11] Please refer to the following presentation from ISO-NE for the details of how the performance payments are calculated. https://www.iso-ne.com/static-assets/documents/2018/06/2018-06-14-egoc-a4.0-iso-ne-fcm-pay-for-performance.pdf

[12] Please note that the Payment Performance Rate is set to rise to about $6,000/MWH by 6/1/2025.

Renewable Energy Standard Requirements

JW&L's obligations under the Renewable Energy Standard[13] (RES) are shown in Table 14. Under RES, JW&L must purchase increasing amounts of electricity from renewable sources. Specifically, its Total Renewable Energy (Tier I) requirements rise from 59% in 2020 to 75% in 2032, and the Distributed Renewable Energy[14] (Tier II) requirement rises from 2.8% in 2020 to 10% in 2032. Note that this IRP assumes that these requirements are maintained at their 2032 levels throughout the rest of the study period.

Table 14: RES Requirements (% of Retail Sales)

Year	Tier I (A)	Tier II (B)	Net Tier I (A) - (B)	Tier III
2020	59%	2.80%	56.20%	2.67%
2021	59%	3.40%	55.60%	3.33%
2022	59%	4.00%	55.00%	4.00%
2023	63%	4.60%	58.40%	4.67%
2024	63%	5.20%	57.80%	5.34%
2025	63%	5.80%	57.20%	6.00%
2026	67%	6.40%	60.60%	6.67%
2027	67%	7.00%	60.00%	7.34%
2028	67%	7.60%	59.40%	8.00%
2029	71%	8.20%	62.80%	8.67%
2030	71%	8.80%	62.20%	9.34%
2031	71%	9.40%	61.60%	10.00%
2032	75%	10.00%	65.00%	10.67%
2033-2039	75%	10.00%	65.00%	10.67%

Under RES, Tier II is a subset of Tier I. As a result, we subtract the Tier II percentage from the Tier I percentage to get the Net Tier I requirement in the fourth column. Notice that the net Tier I requirement declines every 2nd and 3rd year until the Tier I requirement increases. When these percentages are multiplied by the forecast of retail sales, the result is a seesaw effect where the Net Tier I requirement declines every 2nd and 3rd year. This can be seen more clearly in Figure 9 in the next section.

The final column shows the Energy Transformation (Tier III) requirement. Because it is designed to reduce fossil fuel use, the Tier III requirement is fundamentally different from Tier I and Tier II requirements. And unlike the Tier I & II requirements…which count only electricity that is produced and consumed in an individual year[15]…Tier III programs account for the "lifetime" the fossil fuel savings. For example, if a Tier III program installs a CCHP in 2020, the fossil fuel savings from that CCHP are counted such that the full ten-years of the CCHP's expected useful life accrue to the 2020 Tier III requirement.

[13] For more information on the RES program, please visit https://vppsa.com/energy/renewable-energy-standard/.

[14] Distributed Renewable Energy must come from projects that are located in Vermont, are less than five MW in size, and are built after June 30th, 2015.

[15] For simplicity, we assume that no banking occurs in this example. In practice, banking excess TIER I and TIER II credits for use in future years is permitted under RES.

Table 15: Alternative Compliance Payment[16] ($/MWH)

Year	Tier I	Tier II & III
2020	$10.00	$60.00
2021	$10.22	$61.32
2022	$10.44	$62.67
2023	$10.67	$64.05
2024	$10.91	$65.46
2025	$11.15	$66.90
2026	$11.39	$68.37
2027	$11.65	$69.87
2028	$11.90	$71.41
2029	$12.16	$72.98
2030	$12.43	$74.59
2031	$12.70	$76.23
2032	$12.98	$77.90

The RES statute provides a second way to comply with its requirements, the Alternative Compliance Payment (ACP). In the event that a utility has not achieved the requisite amount of Tier I, II or III credits in a particular year, then any deficit is multiplied by the ACP, and the funds are remitted to the Clean Energy Development Fund (CEDF).

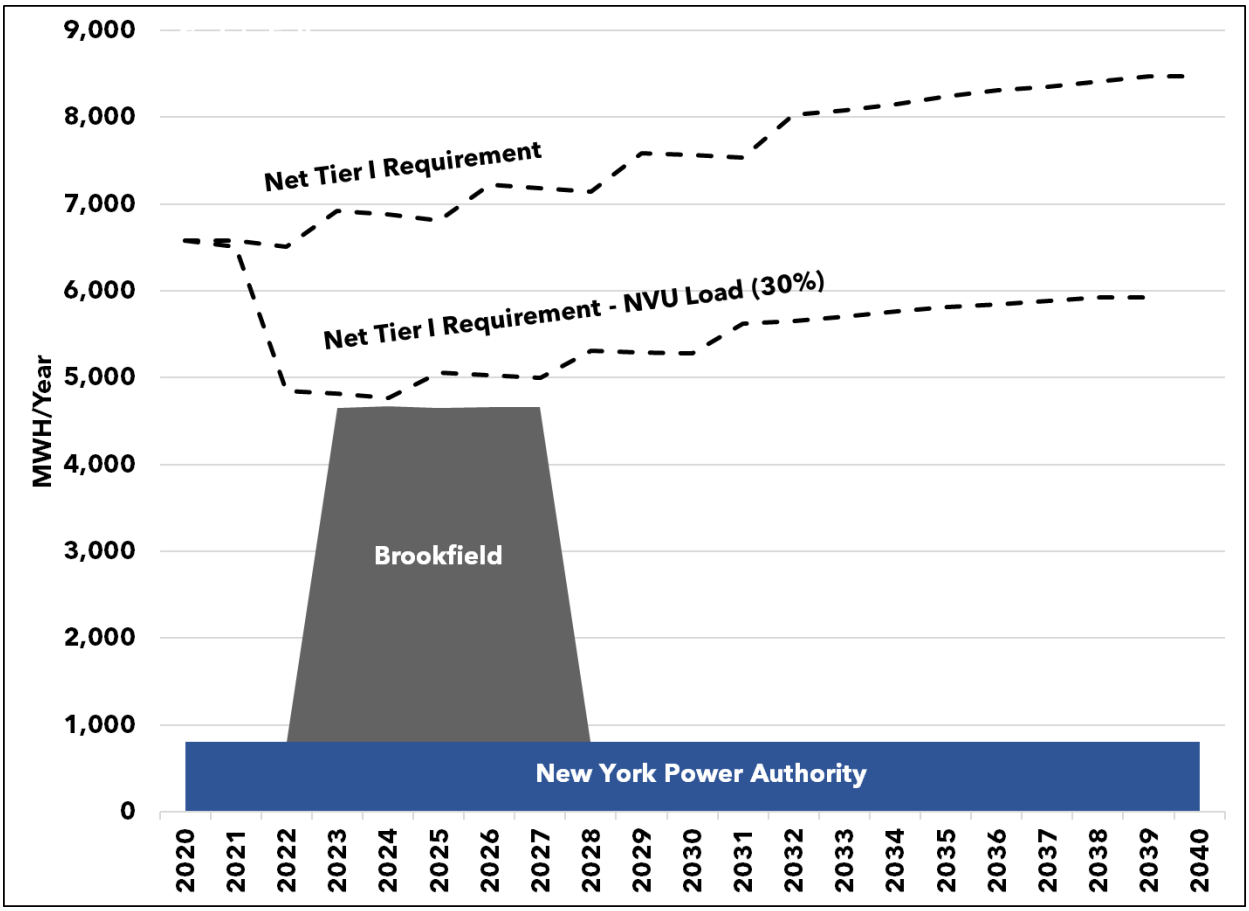
Finally, utilities with a RES deficit may also petition the Public Utilities Commission (PUC) for relief from the ACP. Alternatively, utilities may petition PUC to roll the deficit into subsequent compliance years. As a result, there are multiple ways to comply with RES requirements.

[16] Please note that these are estimates and grow at inflation.

Tier I - Total Renewable Energy Plan

Between 2021 and 2022, JW&L's Net Tier I requirement is about 6,600 MWH per year. The resource (NYPA) that contributes to meeting it is shown in Figure 9, and it represents about 800 MWH per year or 12% of JW&L's Net Tier I requirement.

Figure 9: Tier I - Demand & Supply (MWH)



Between 2023-2027, the Tier I requirement rises to about 7,000 MWH/Yr, and the Brookfield resource will supply about 3,800 MWH/Yr or about 55% of it. After 2027, the only Tier I resource is NYPA.

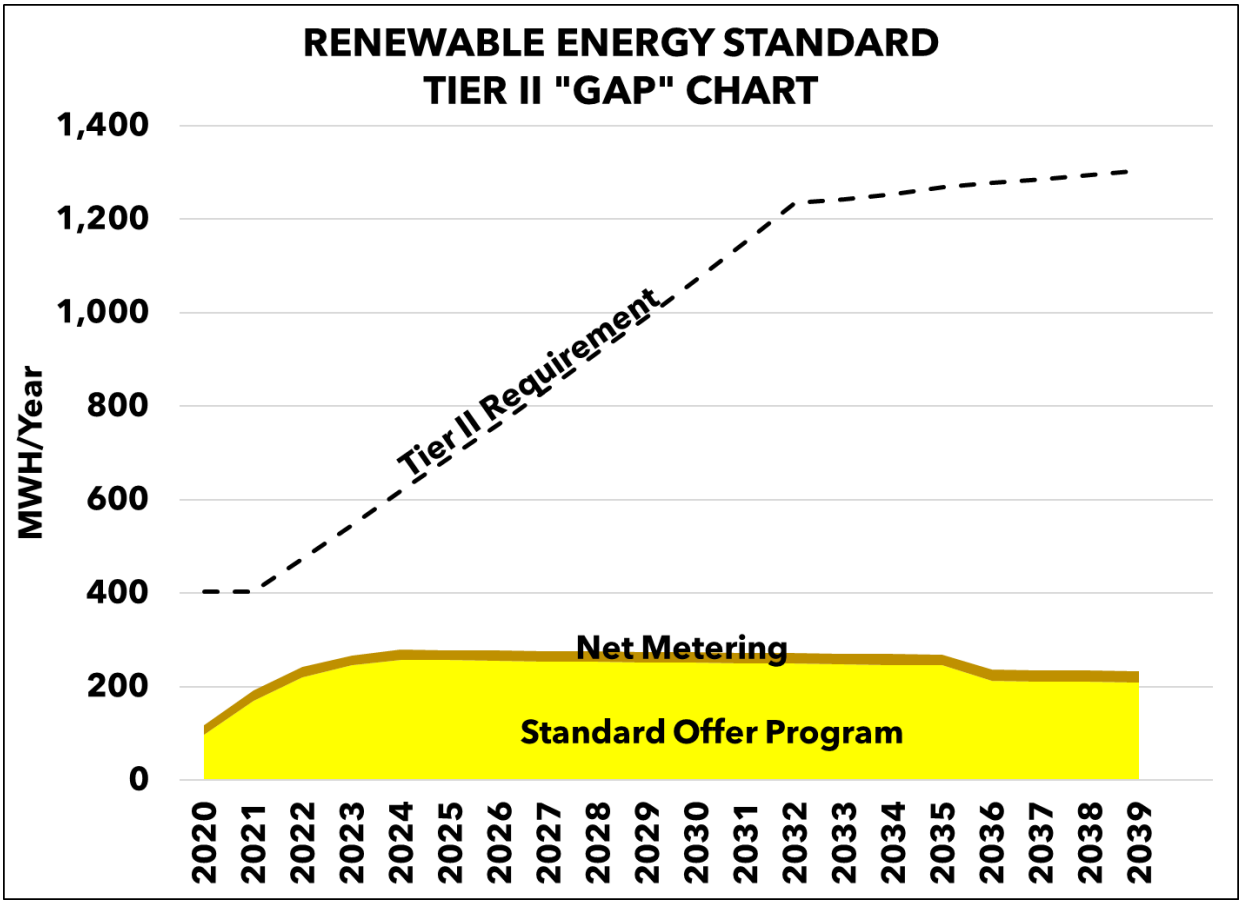
JW&L is likely to meet its Net Tier I requirements by purchasing Maine Class II (ME II) Renewable Energy Credits (RECs). These are presently the lowest cost source of Tier I compliant RECs in the region, and their price has ranged from a low of $1.00 to a high of $2.50 per MWH over the past four years. At the current price of $1.5/MWH, the cost of complying with Net Tier I in the 2020 to 2024 period would be about $9,000 per year.

Finally, the second dashed line shows the requirement that would result if NVU closes. JW&L's Tier I supply would fall just short of its requirements from 2023-2027, which would set up a potential decision to extend the Brookfield contract or replace it with a similarly sized resource. As mentioned in the Energy Resource Plan, this is the second major resource decision that this IRP will consider.

Tier II - Distributed Renewable Energy Plan

The dashed line in Figure 10 shows JW&L's Distributed Renewable Energy[17] (Tier II) requirement, which rises steadily from 330 MWH in 2020 to 1,200 MWH in 2032. JW&L's demand exceeds the supply despite the net metering program and the standard offer (PUC Rule 4.300) program. In the short-term, market REC purchases will likely be used to fulfill the Tier II requirement. In the long-term, a 250-500 kW solar project could meet the requirement.

Figure 10: Tier II – Demand & Supply (MWH)

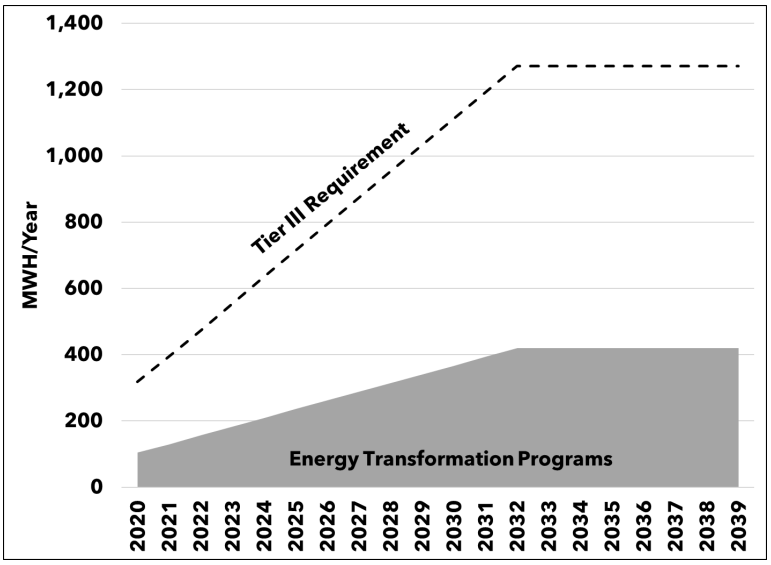


[17] The TIER II requirement is also known as "Tier 2".

Tier III - Energy Transformation Plan

The dashed line in Figure 11 shows JW&L's Tier III requirements, which rise from about 300 MWH in 2020 to about 1,300 MWH in 2032. Energy Transformation programs are presently budgeted to fulfill about a third of the requirement in the early 2020s,and are shown in the gray-shaded area of Figure 11. These programs[18] cover a range of qualifying technologies including EVs, CCHPs, and HPWHs. For perspective, the Tier III requirement is equivalent to installing 15-30 CCHP[19] per year between 2020 and 2025.

Figure 11: Energy Transformation Supplies



In the early and mid 2020s, JW&L is expected to have a substantial deficit which is illustrated in Figure 11. This deficit is likely to be fulfilled with market purchase of Tier II RECs. However, whatever the deficit or surplus position, JW&L will follow a four-part strategy to fulfill its Tier III requirements.

1. Identify and deliver *prescriptive* Energy Transformation ("Base Program") programs, and/or

2. Identify and deliver *custom* Energy Transformation ("Custom Program") programs, and/or

3. Develop and complete the Lawrence Brook Solar or a comparable, Vermont-based solar project, and/or

4. Purchase a surplus of Tier II qualifying renewable energy credits.

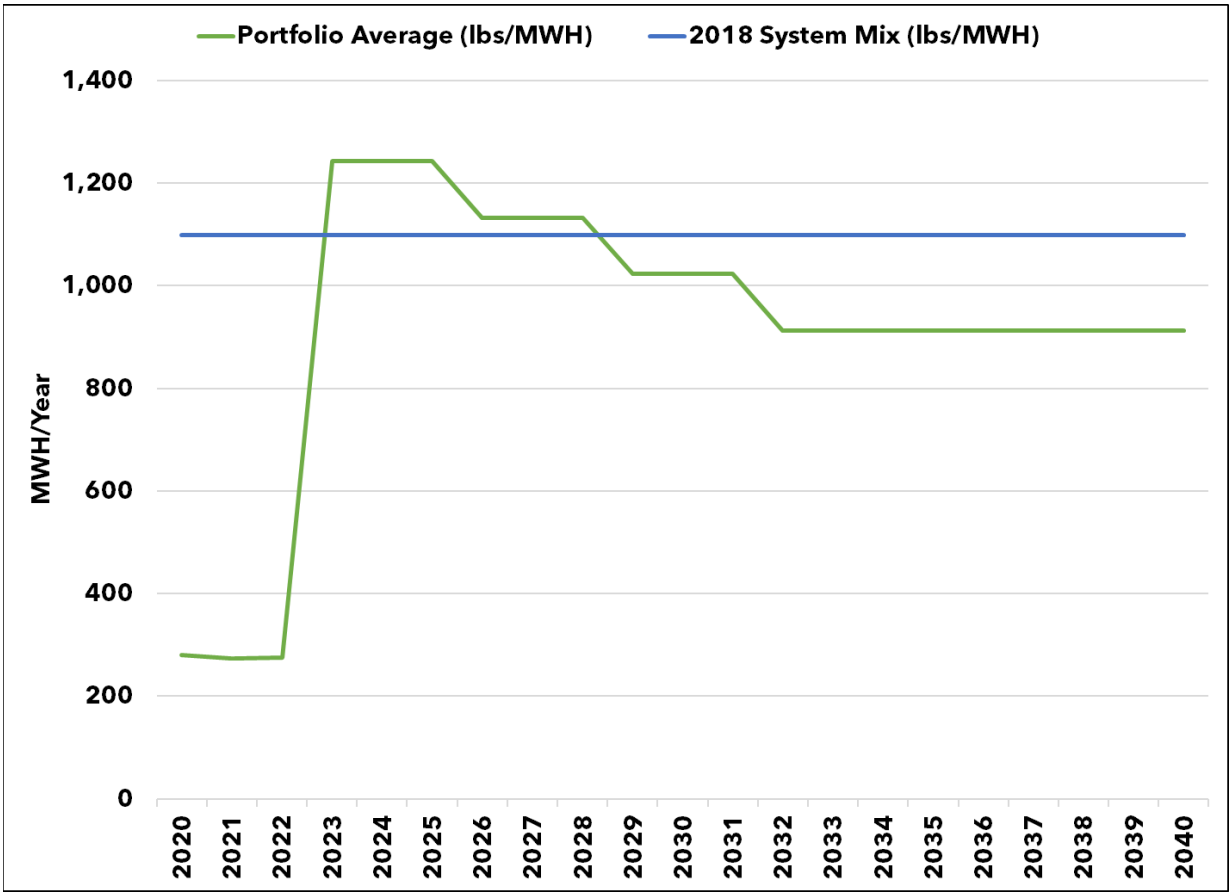
[18] More detail on these programs can be found in Appendix B (VPPSA's 2020 Tier 3 Annual Plan) and on VPPSA's website.

[19] This estimate is based on 15 MWH/CCHP of net lifetime savings, which is an average of all listed single-zone CCHP measures in the 'Act 56 Tier III Planning Tool FINAL PY2019.xls' spreadsheet.

Carbon Emissions and Costs

Figure 12 shows an estimate of JW&L's carbon emissions rate compared to the 2018 system average emissions rate in the New England region[20]. The emissions rate between 2020 and 2022 is less than 300 lbs/MWH. However, the emissions level rises to over 1,200 lbs/MWH in 2023, which is a level that is slightly above the 2018 system mix. This is due to the expiration of the NextEra 2018-2022 contract, whose MWHs are being replaced by fossil fuels[21]. Thereafter, the carbon emissions rate declines until 2032 as the RES requirements increase.

Figure 12: Portfolio Average Carbon Emissions Rate (lbs/MWH)



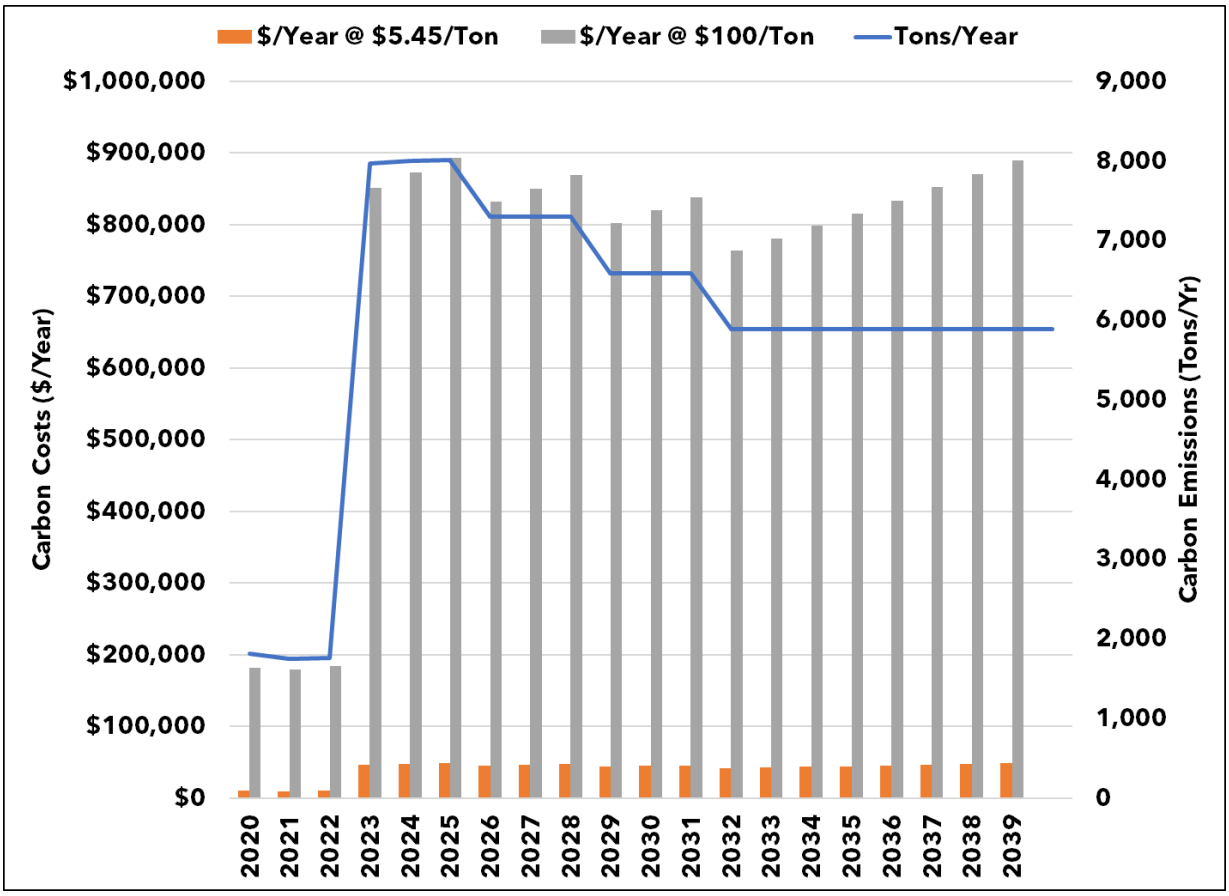
These emissions rates were multiplied by the Adjusted Load Forecast from Section I. Electricity Demand to arrive at an estimate of carbon emissions in tons per year. The following figure shows that carbon emissions range from 2,000 tons/year in 2020 up to 8,000 tons/year in 2023, and then decline as the RES requirement increase through 2032.

[20] The source of this data is the NEPOOL GIS. https://www1.nepoolgis.com/

[21] We assume that the carbon emissions rate of these MWH will be equal to the 2018 NEPOOL Residual Mix, which is a proxy for the fossil fuel emissions rate in the region. For the current value of the NEPOOL Residual Mix, please visit https://www.nepoolgis.com/public-reports/.

The costs of these emissions were calculated using two sources, the 2019 Regional Greenhouse Initiative Auction[22] (RGGI) results ($5.45/ton) and the 2018 Avoided Cost of Energy Supply[23] (AESC) study ($100/ton). Using RGGI prices (plus inflation), the cost of carbon emissions in 2020 is $10,000/year and about $41,000/year in 2032. Using AESC prices, the range is $181,000 million per year in 2023 up to almost $764,000 million per year in 2032.

Figure 13: Carbon Emissions (Tons/Year) and Costs ($)



[22] https://www.rggi.org/auctions/auction-results/prices-volumes

[23] https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080.pdf

Conclusions

There are three decisions facing JW&L that the financial analysis will quantify.

1. 2023 – 2027 Market Energy PPA
   Q1: What are the costs and benefits of hedging NVU's load between 2023 and 2027?

2. New Long-Term Hydro PPA with TIER I RECs
   Q2: What are the costs and benefits of a dispatchable, Tier I qualifying hydro PPA that would supplant the extension of the NextEra PPA starting on 1/1/28?

3. New Solar PPA
   Q3: What are the costs and benefits of a 500 kW solar PPA that includes both energy and Tier II RECs starting on 1/1/23?

In addition, we quantify two load-related questions.

4. 1% CAGR

   Q4: What is the rate impact of 1% compound annual load growth?

5. NVU Shuts Down - 30% Reduction in Load
   Q5: What is the rate impact of a 30% reduction in load?

Transmission & Distribution

IV. Electricity Transmission & Distribution

Transmission and Distribution System Description:

Detail regarding JW&L transmission supply, sub-transmission and distribution facilities is provided below.

Transmission System Description:

JW&L purchased a 15% interest in MW&L's 34.5 kV transmission line that runs from the GMP substation in Johnson, to MW&L's Substation #3 in Morrisville, to the Vermont Transco, LLC 115kV substation in Stowe. As a result of obtaining a direct connection to Vermont Transco's high-voltage network at Stowe, JW&L will avoid charges for sub transmission service of approximately $90,000 per year that it had been paying to GMP. Once the initial purchase of the 15% interest in the MW&L 34.5 kV line is paid off, savings will accrue to the JW&L and MW&L.

Distribution System Description:

The distribution system includes approximately 28 miles of line currently operating at 4160/2400 volts. There are currently three circuits out of the substation. Circuit R1 is the Johnson East circuit, circuit R2 is the NVU circuit (NVU owns its own underground system and its primary meter is on this circuit.), and circuit R4 is the Johnson West circuit.

An Electric System Study and Cost Benefit Analysis was performed for JW&L by GMP in 2009. The study provided good baseline data for undertaking capital improvements on its system. Study results include the following recommendations:

> Transformer Consolidation - While doing this work, new dual voltage transformers could be put out on the line to start preparing for conversion. JW&L also could improve balance on circuits 1 & 3 by moving transformers to different phases.

For the last five years any transformer replacement has been done with both the eventual voltage conversion and transformer consolidation in mind.

> Voltage Conversion – Benefits could include reduced line losses, improved voltage quality and viable feeder backup (neighboring utilities bordering the JW&L Distribution System are presently at 12KV). This would eliminate the need to replace the overloaded step-down transformers on the R4 Feeder at the substation, as they would be removed. At present, only circuit #R4 is overloaded for short periods of time throughout the year. This overloading is not significant enough at this point to require replacement, but load growth should be watched to determine when these should be upgraded. However, JW&L is currently experiencing decreasing system load. It must be noted that circuit #2 (NVU) is owned by NVU and will not be targeted for voltage conversion, as this would require a major capital project of the university, which they have no plans to undertake.

Feeder Backup - Not mentioned in the System Study is the possibility of adding a fourth circuit (R3) and split some of the load from the present R4 Feeder in the future. Some of the necessary distribution work has been completed to accomplish this plan and the substation improvements were made with that in mind as well. However, JW&L is not actively pursuing this at this time.

A more recent evaluation has shown that current load levels do not indicate that adding a fourth circuit is warranted at this time. JW&L's peak load is the same as, if not less than, the peak load in the previous IRP. NVU is a large portion of JW&L's peak, therefore JW&L's peak would be dramatically lower if NVU were to go away.

Capacitors - The Village has already installed over 600 KVAR of fixed capacitors to mitigate power factor issues on its distribution feeders. Capacitors are voltage specific and losses would be reduced with conversion. The study also recommends the removal of the 600 KVAR fixed capacitor bank and the installation of a three-phase 50 KVAR per a phase capacitor if and when Manchester Lumber is no longer a customer.

Manchester Lumber ceased lumber mill operations in December 2016. The 600 KVAR fixed capacitor is currently still in use as advised by the system impact studies for a 150-kW solar array on the same circuit. Another reason to keep the capacitor is the potential redevelopment of the property for other commercial uses.

JW&L Substations:

JW&L currently operates one substation with three circuits. A permanent back-up substation is present at the same location. The back-up substation has its own transformer, fence, ground grid, oil containment system, etc., offering full system functionality. JW&L is currently reviewing the voltage regulation ability of the back-up substation. JW&L has also installed Supervisory Control and Data Acquisition (SCADA) at the substation, allowing JW&L to gather data from the respective feeders and utilize remote access to the breaker functions.

Johnson Substation:

The Johnson substation was originally built in 1965 as a cooperative effort between NVU and JW&L, when NVU was undertaking a major expansion. It is located on land owned by the University and leased to JW&L. The location is somewhat challenging from an access standpoint and is on a relatively steep embankment with a steep and narrow access road leading to the substation. In the event of a catastrophic transformer failure in the substation, especially in winter, getting access to the site could be difficult.

The substation was completely rebuilt between 2007 and 2008. The project included re-building the substation superstructure, correction of applicable standards and codes issues, expansion of the fence line to provide for required clearances from live electrical equipment, replacement of the existing 2,400/4,160 volt transformer with a 7,200/12,470 volt transformer, installation of step down transformers for exit circuits, installation of an oil

containment system and ground grid, and related site work. The design employed a creative ring buss feature that allows great flexibility in switching and circuit maintenance and transfer of load from one circuit to another as well as one substation transformer to another.

Figure 14: Main Substation

Figure 15: MW&L's Feed (on right)

Figure 16: Back-up Substation

Circuit Description:

Table 16: JW&L Circuit Description

Circuit Name	Description	Length [24](Miles)	# of Customers by Circuit	Outages by Circuit 2018
R1	Johnson East circuit	14.77	432	8
R2	Northern Vermont University) circuit (NVU owns its own underground system and its primary meter is on this circuit)	0 (NVU is primary metered and the circuit becomes NVU's about 50 feet outside the substation gate)	1	0
R4	Johnson West circuit	13.21	544	5

There are currently three circuits out of the substation. Circuit R1 is the Johnson East circuit, circuit R2 is the Northern Vermont University (NVU) circuit (NVU owns its own underground system and its primary meter is on this circuit) and circuit R4 is the Johnson West circuit. The voltage of the circuits is regulated at the substation bus. JW&L does not consider any of its circuits to be particularly long. JW&L operates its system to maintain 114 to 123 volts at the customer's outlets.

T&D System Evaluation:

System reliability is important to JW&L and its customers. JW&L has a number of initiatives underway to improve reliability. Each of these initiatives is summarized below.

Outage Statistics

JW&L evaluates T&D circuits on an ongoing basis in order to identify the optimum economic and engineering configuration for each circuit. The evaluations include the review of the Rule 4.900 Outage Reports and data collected from voltage and amp readers. JW&L has also borrowed load loggers from other utilities to perform specific readings and analysis when needed. In addition, JW&L periodically completes long-term system planning studies to develop overall strategies for improving the performance of the T&D facilities. JW&L has not recently done a long-term system planning study, but it has done many smaller system impact studies as solar installations have been added.

[24] Estimated from circuit maps

The terms of JW&L's ownership share in the MW&L 34.5kV transmission line include JW&L's participation in line maintenance activities and planning. Specifically, the Joint Ownership Agreement indicates JW&L and MW&L will meet annually to discuss the operation of the facility and to plan and budget for line maintenance and upgrades. As part of the SHEI constraint solution, GMP is leading a project to upgrade a section of the B-22 line. JW&L is contributing toward the project.

JW&L's Public Utility Commission Rule 4.900 Electricity Outage Reports, reflecting the last five years (2014-2018) in their entirety, can be found in Appendix D, at the end of this document.

JW&L has committed to performance standards for reliability that measure the frequency and duration of outages affecting its customers. There are two primary measures for the frequency and duration of outages. The PUC Rule 4.900 defines them as:

System Average Interruption Frequency Index (SAIFI): Customers Out, divided by Customers Served. SAIFI is a measure of the average number of times that the average customer experienced an Outage.

Customer Average Interruption Duration Index (CAIDI): Customer Hours Out, divided by Customers Out. CAIDI is a measure of the average length of time, in hours, that was required to restore service to customers who experienced an Outage.

JW&L has committed to achieve performance levels for its distribution system below an index of 1.0 for SAIFI and 2.7 for CAIDI. JW&L maintains a record of and reports on all its system outages, including the root cause of an outage. While some outages cannot be prevented, there are a number of specific, cost-effective steps that can be taken to maintain or improve system reliability by working to eliminate the potential for some outages to occur and making changes that will promote reduced outage times when an unavoidable outage does occur.

The following table summarizes JW&L's SAIFI and CAIDI values for the years 2014 – 2019.

Table 17: JW&L Outage Statistics

	Goals	2014[25]	2015	2016	2017	2018	2019
SAIFI[26]	1.0	1.4	1.2	2.6	0.5	0.2	0.3
CAIDI[27]	2.7	2.6	0.7	3.2	5.4	3.5	2.3

[25] SAIFI and CAIDI statistics shown are net of major storm outages

[26] System Average Interruption Frequency Index

[27] Customer Average Interruption Duration Index

JW&L has a number of initiatives underway to improve reliability. Each of these initiatives is described below.

Animal Guards

JW&L has implemented a policy to install animal guards on all new construction and line rebuilds. In addition, while changing out a number of porcelain cutouts, JW&L took the opportunity to install animal guards at the same time. JW&L believes that animal guards are a cost-effective means of reducing animal contact and the associated service interruptions.

Fault Indicators

JW&L uses fault locators on 4KV Distribution Feeders to isolate faults and reduce outage time. There are three fault locators at the Johnson substation.

Automatic reclosers/Fusing

All three switches in the substation have automatic reclosers, but elsewhere, the system is fuse coordinated.

Feeder back-up

JW&L has a method of temporarily back-feeding in the case of a circuit failure at the substation. The substation is set up in a radial feed allowing for feeder back-up. In JW&L's substation, there are switches located in a circular fashion that allow JW&L to easily switch a circuit that is out to another energized source.

Power Factor Measurement and Correction

The most recently available power factor for JW&L is approximately 99%.

Other

Vegetation management, tree trimming and relocating cross-country lines to roadside are also important initiatives that JW&L takes in order to meet reliability and safety criteria. Those topics will be discussed in further detail later in this document.

Distribution Circuit Configuration

Voltage Upgrades

JW&L has contemplated converting its 2,400/4,160 volt system to 7,200/12,470 volts. The substation improvements already completed would allow for this to be done if and when JW&L determines conversion is in the best interest of the system. JW&L's decision to implement voltage conversion will be based on several factors including load levels (currently decreasing), capital costs, resulting reduced losses, reliability changes and preceded by completion of a system study.

Phase balancing

While the 2009 System Study identified small phase balancing issues, JW&L has addressed many of these already. Therefore, currently, the phases are in balance to a large degree. The study also indicated that future corrective balancing can be accomplished by first adding new load to the unbalanced phases and then splitting load equally between phases, a practice JW&L has employed since 2009.

JW&L staff has begun to map customers to phases for improved outage response capabilities.

System Protection Practices and Methodologies;

Protection Philosophy

JW&L's system protection includes transmission, distribution, and substation protection. Each is discussed briefly below.

Transmission:

MW&L employs system protection practices on the jointly owned 34.5 kV transmission line. JW&L has a direct feed from the 34.5 kV line and therefore does not have any transmission breakers on its side of the transmission feed.

Distribution:

JW&L uses distribution arrestors on equipment in the field.

Substation:

JW&L uses station class arrestors in its substation. The makeup of these devices is now polymer not porcelain, due to safety concerns. All structures within the substation are metal for reduced fire risk. All equipment is also protected with fusing on the high side with a fuse saving philosophy in place due to the breaker protection programming.

Smart Grid Initiatives

Planned Smart Grid

Beginning in 2018, JW&L began participating in a multi-phased, VPPSA joint-action project intended to (1) assess individual member readiness for AMI, (2) guide participating members through an RFP process culminating in vendor and equipment selection and (3) guide members through the implementation phase. At the end of the initial assessment phase individual members will make the choice to go forward with the RFP process, or not. Upon completion of the RFP phase of the project, individual members will have the information needed to examine the business case and make a decision to commit to implementation of an AMI system, or not.

At this time JW&L is participating in the initial readiness assessment phase of the project, gaining information pertaining to its initial readiness, potential required changes to staffing and operating processes, as well as potential benefits to municipal electric, water and wastewater systems. As the assessment phase wraps up later in 2020, JW&L will decide whether to proceed to the RFP phase of the process.

JW&L is mindful of the many facets of the evolving grid and their impact on the value of implementing AMI. Advanced metering may play a key role in taking advantage of more sophisticated rate design and load management/retention opportunities as we see continued expansion of net metering, heat pump installations, and adoption of electric vehicles.

JW&L recognizes the potential value of utilizing rate design, direct load control or other incentive programs as tools to manage both system and customer peak loads in unison to create value for both the utility and the customer. In the absence of an AMI system, or pending development and implementation of an AMI system, JW&L will explore the use of pilot programs or tariffs that may be implemented using currently available technology. Initial efforts in this area will focus on larger customers with the greatest opportunity to manage loads in a way that will reduce both system and customer costs, capture economic development/retention opportunities and reduce carbon footprint where possible.

Working with VPPSA, Efficiency Vermont, and other stakeholders, JW&L stays abreast of these developments and the strategies needed to maintain a safe, reliable, and economically viable distribution system.

JW&L is also mindful of the increasing importance of cybersecurity concerns, and the relationship of those concerns to technology selection and protection. While JW&L is not presently required to undertake NERC or NPCC registration, VPPSA is a registered entity, and JW&L's membership in VPPSA provides JW&L with knowledge and insight regarding ongoing cybersecurity developments and risks. On a more local level, JW&L endeavors to purchase and protect its IT systems (with assistance from VPPSA as needed), in a manner intended to minimize security risks to the system and its ratepayers. JW&L remains mindful of the balance between the levels of cyber security risk protection and the associated costs to its ratepayers.

Other System Maintenance and Operation:

Reconductoring for Loss Reduction

JW&L has been gradually replacing small and or aged conductor over the last twenty years and plans to continue to replace small aged conductor over the next ten years. Most conductor being used now is 1/0 aluminum AAAC but sized according to present and future load requirements. When re-conductoring, JW&L is framing for compliance with 7,200/12,470 volt construction standards. Generally, in JW&L's system, "small conductor" means #8 copper wire and "aged conductor" means weak or stretched wire. JW&L's decisions to replace equipment are primarily based on functionality (consistent problems) and safety concerns. Of course, when functionality or safety concerns arise, JW&L aims to replace the equipment in the most economical method possible (considering upfront and life-cycle costs).

Transformer Acquisition

JW&L currently purchases new transformers that are dual-voltage transformers to allow for voltage conversion in the future. JW&L does not currently use the Department's spreadsheet as part of its decision-making process but is certainly open to evaluating whether it could use it in the future (JW&L is not familiar with it at this time). Life-cycle cost is considered when JW&L looks to purchase transformers. If possible, JW&L will purchase a new transformer that comes with a warranty. JW&L is willing to purchase a more expensive unit with greater reliability.

Conservation Voltage Regulation

JW&L does not have conservation voltage regulation. JW&L's voltage setting is done with voltage regulators in substations only; voltage is set between 120 and 121.5 volts to provide proper voltage to the first and last customers. JW&L does not have voltage regulators outside the substations due to the short distance to last customers.
JW&L also participates in the spring and fall voltage reduction tests.

Distribution Transformer Load Management (DTLM)

JW&L does not have a formal DTLM program. The biggest concern is ensuring that transformers are not overloaded and operating too hot. JW&L checks transformers when there is a failure and considers current and anticipated load when ordering new transformers.

Substations within the 100- and 500-YEAR Flood Plains

JW&L's substation and back-up substation are located outside of the 500 year flood plain and were not affected by the floods of Tropical Storm Irene.

The Utility Underground Damage Prevention Plan (DPP)

The majority of JW&L's lines are overhead lines. As the quantity of JW&L's underground lines increase, JW&L will become increasingly more involved with the Damage Prevention Plan. JW&L requires inspection of all underground lines prior to burial. This is performed by JW&L employees. JW&L participates in Dig Safe and responds with line personnel to mark all utility-owned underground lines. All primary underground is installed per JW&L's specifications. JW&L pulls all wire with its line crews. All underground is located on JW&L's Outage Management System/GIS and gets updated as needed. JW&L does the same thing for itself (internally) as it does for Dig Safe. JW&L follows and will continue to follow the Dig Safe rules.

JW&L has a Damage Prevention Plan (DPP) in place and filed it with the department in July 2018. JW&L's 2,400/4,160 volt system tends to be more resistant to damage and failure than 7,200/12,470 systems. Approximately 5% of JW&L's lines are underground.

Selecting Transmission and Distribution Equipment

When replacing transmission and distribution equipment, JW&L solicits three different quotes, when possible, before making a purchase. JW&L installs equipment that has proven to be effective and reliable based upon experience. These purchases are based on pricing and reliability. Equipment purchases are evaluated based upon actual experience of JW&L staff and the experience of other utilities.

Maintaining Optimal T&D Efficiency

System Maintenance

JW&L's system maintenance includes a very active annual vegetation effort as well as a plan for annual upgrades developed as part of the annual municipal budgeting process. JW&L is a small municipal system with one large customer and a large residential customer base of elderly and below median income residents, including a high percentage of renters. Resources can be limited at times and JW&L is cognizant of the impact rate increases have on its rate payers. So far JW&L is able to continue to invest in plant upgrades. Currently, JW&L's annual budgeting process is the primary method to identify system needs and prioritize projects for completion (construction or equipment upgrades/replacement). Staff meets to discuss the most important equipment and infrastructure needs in the system and works with the Trustees to determine a method to fund the improvement(s). JW&L acknowledges that a more formal asset management plan or database to track system equipment and infrastructure would assist in planning for future upgrades. JW&L will work with VPPSA to evaluate developing an appropriate asset management plan and schedule for implementation between now and its next IRP.

Substation Maintenance

JW&L uses infrared analyzers annually to identify hot connections and prioritize maintenance. Additionally, JW&L utilizes a contractor for oil analysis every year. JW&L crew performs regular weekly inspections of the substation utilizing an inspection checklist and also performs additional inspections after high-wind events and other inclement weather.

Figure 17: JW&L's Substation Maintenance Checklist:

Substation Weekly Check Log Initial and Date under each Column....Comments.....		
Breaker R1 / Re-Boot / Battery Test		
Breaker R2 / Re-Boot / Battery Test		
Breaker R3 / Re-Boot / Battery Test		
Breaker R4 / Re-Boot / Battery Test		
Breaker R5 / Re-Boot / Battery Test		
LTC / Test Fans / Check Light / Re-Set Drag Hands		
B-22 Tie A.B.		
Main St. Tie A.B.		
Containment Main Sub		
Containment Back-Up Sub		
OIL LEAKS?		
FENCE ISSUES?		
GROUND GRID ISSUES?		
OTHER?		
OTHER?		

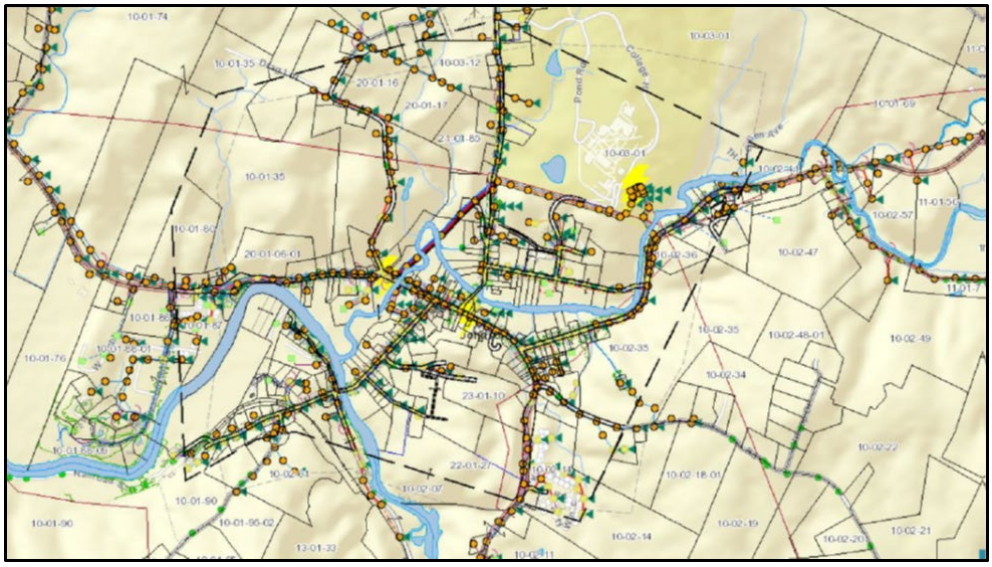
Pole Inspection

JW&L does not currently have a formal inspection or treatment program for its distribution poles. The system is quite small geographically and staff is able to complete an inspection of the system on a regular basis. Any poles that are observed to need replacement are dealt with as annual maintenance work. JW&L does have an active and ongoing right-of-way tree trimming program, which provides an ongoing opportunity for staff to inspect many of the poles in the system.

JW&L has also completed and maintains a GIS based Electric System Map and associated database inventory, which provides detailed system information in map, database and report formats. Data collected includes: pole location, heights, class, age, construction type and condition, all manner of pole attachments, conductor phasing, size and type, pole and pad mount transformer size, location, age and type, underground infrastructure, etc. This data is maintained on the town-wide mapping software system, which also includes parcel data, roads and bridges, sewer and water line infrastructure. Storm water systems, flood plains, wetlands, surfaces waters, E911 data, orthophotos, satellite images, etc. This makes for a very powerful planning and maintenance tool for all Village utilities. The following map demonstrates the information available from the system. Pole inspection data, protection equipment, and vegetation management are not included in the GIS database. JW&L will look

into the cost to add pole inspection information to the GIS database. Recently, VPPSA has begun working on a GIS database which will include a wide range of valuable system data, including pole inspection data, for JW&L and its other members.

Figure 18: JW&L GIS Map:



Equipment

JW&L currently performs regular inspections on all equipment and distribution lines. JW&L has established an annual gas testing program for all of its larger power transformers. JW&L performs oil sample testing regularly and also contracts with an outside entity to perform Doble testing approximately every five years.

System Losses

JW&L is committed to providing efficient electric service to its customers. JW&L's plan for improving system efficiency is to undertake a systematic capital improvement program that includes projects that will reduce losses.

Actual System Losses:

For 2018, actual total line losses were about 6.9%. This is a reduction from the previous relatively steady historical loss average of 9%. Starting in 2014, the sub transmission losses dropped due to JW&L's purchase of MW&L's 34.5 kV transmission line.

Efforts to Reduce Losses:

JW&L has considered converting portions of its 2,400/4,160 volt system to 7,200/12,470 volts as potential method to improve system efficiency. Substation improvements already completed would allow for the conversion to take place in the future. However, future conversion projects will be targeted by evaluating the cost-effectiveness of such a conversion. JW&L does not currently have a specific quantitative loss reduction plan but is prepared to work with VPPSA to systematically evaluate and address opportunities to economically reduce losses. For 2018, actual total line losses were approximately 6.9%.

Tracking Transfer of Utilities and Dual pole Removal (NJUNS)

JW&L does not use NJUNS. JW&L has a direct relationship with Comcast, Consolidated Communications, and VTeL and it has not been problematic.

Relocating cross-country lines to road-side

JW&L recognizes the significant cost associated with maintaining off-road assets. JW&L has a policy in place where every attempt shall be made to make all new construction road-side. Additionally, when rebuilding off-road infrastructure JW&L looks carefully at relocating assets to road-side when possible.

Distributed Generation Impact:

JW&L presently has 9 residential scale (< 15 kW) net metered customers with a total installed capacity of about 60.5 kW. In addition, there are 4 customers who have arrays between 15 and 150 kW, and the total is 504 kW.

Interconnection of Distributed Generation

JW&L recognizes the unique challenges brought on by increasing penetration levels of distributed generation. JW&L adheres to the procedures set forth in Rule 5.500 for the interconnection of new generation. Per rule 5.500, a fast track screening process is utilized to expedite the installation of smaller generators which are less likely to result in issues that affect existing distribution customers. If a proposed installation fails the screening criteria, a Feasibility Study and/or System Impact Study is performed to fully identify and address any adverse effects that are a direct result of the proposed interconnection. These studies, performed by JW&L or their representatives, typically

include a review of the following issues that may arise as a result of a new generator interconnection:

- Steady state voltage (per ANSI C84.1)
- Flicker (per IEEE 1453)
- Temporary overvoltage due to load rejection and/or neutral shift
- Effective grounding (per IEEE 1547 & IEEE C62.91.1)
- Overcurrent coordination
- Equipment short circuit ratings
- Effect of distributed generation on reverse power and directional overcurrent relays
- Voltage regulator and load tap changer control settings (bi-directional operation)
- Unintentional Islanding
- Thermal loading of utility equipment
- Power factor and reactive compensation strategy
- Impact to underfrequency load shed
- Increased incident energy exposure (arc flash)

In addition, recognizing that the aggregate of many smaller installations which individually pass Rule 5.500 screening criteria can present problems that would otherwise go unnoticed, JW&L will maintain detailed records of installed generation including location, type, and generating capacity. This information will allow JW&L to periodically review how much generating capacity is installed on a particular feeder or substation transformer and identify any concerns as penetration increases over time.

For example, one issue of growing concern is the aggregate of smaller distributed generators being large enough to require voltage sensing on the primary side of substation power transformers for ground fault overvoltage protection. If a transmission (or sub-transmission) ground fault occurs and the remote terminals operate to clear the fault, an overvoltage due to neutral shift can occur when the ratio of generation to load in the islanded portion of the system is greater than 66% (presumes a standard delta primary, grounded-wye secondary substation power transformer). JW&L continues to monitor trends for interconnection protection for abnormal conditions. Supplementing the process outlined in Rule 5.500 with detailed recordkeeping and periodic reviews of how much distributed generation is installed by feeder will help member utilities identify these types of issues before they occur.

As distributed generation penetration increases within JW&L's service territory, JW&L may consider performing a system-wide hosting capacity study and/or providing hosting capacity maps as a tool to steer development of future medium to large-scale distributed generation to the most suitable locations. This type of hosting study can result in significant up-front costs that must be borne by JW&L. As a reasonable compromise, JW&L may suggest that potential developers locate facilities within

reasonable proximity to an existing substation and within portions of the system with low penetration levels of existing distributed generation, both of which should increase the likelihood that the facility will be able to successfully interconnect.

Inverter requirements

Consistent with ISO New England requirements related to inverter "ride-through" settings, JW&L now requires owners/developers of all new DER installations to self-certify installation of inverters compliant with the Inverter Source Requirement Document (SRD) of ISO New England, with settings consistent with IEEE 1547-2018 and UL 1741 SA. This document is included as Appendix E at the end of this document. JW&L recognizes the need to standardize efforts aimed at certifying inverter compliance with the ISO SRD and will work with VPPSA and the PSD to achieve use of common forms and process in this regard.

Vegetation Management/Tree Trimming:

Annual vegetation management work is performed throughout the year. Line clearing is rotational and typically has a timeline of 4 to 5 years. Trimming has historically been performed with JW&L's personnel or use of part-time help, except for large trees, where JW&L hires professional tree services to remove them. JW&L tracks the areas trimmed in a spreadsheet. JW&L specifically performs preventive right-of-way cutting and performs annual ground clearing to prevent tree growth. In most areas, JW&L has a 30-foot right-of-way (15 feet on either side of the pole) and trims to the edge of the right-of-way. JW&L does not use herbicides in its trimming program and has no plans to change this policy in the near future.

The following Figure 19 and Table 18 use tree inventory information collected in 2014.

Figure 19: JW&L Tree Species Inventory

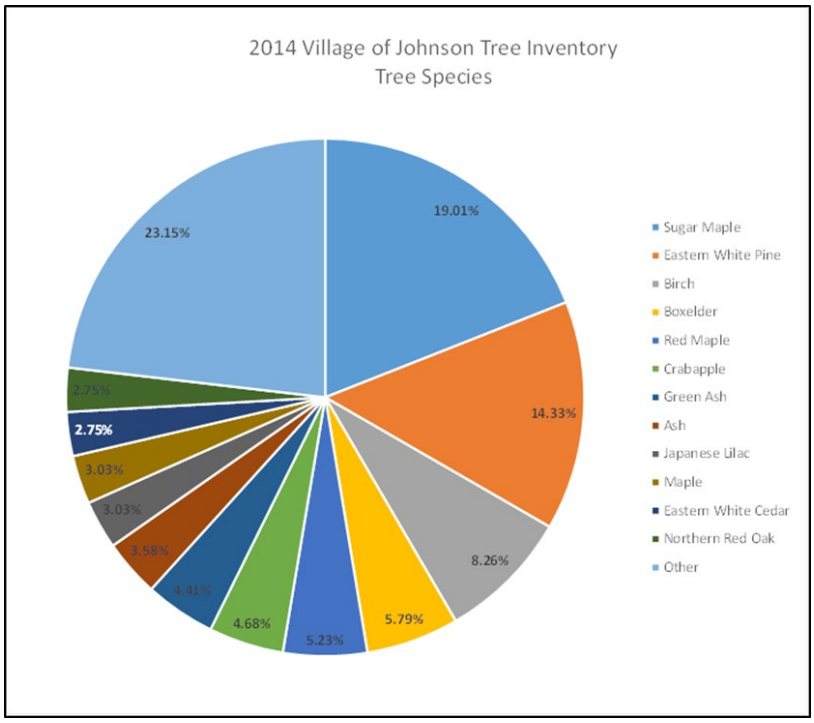


Table 18: JW&L Tree Species & Growth Rates

Tree Species	% of Village Trees	Annual Height Growth
Sugar Maple	19.01%	1 foot
Eastern White Pine	14.33%	2 feet
Birch	8.26%	1 to 2 feet
Boxelder	5.79%	1 foot
Red Maple	5.23%	1 to 2 feet
Crabapple	4.68%	under 1 foot
Green Ash	4.41%	2 feet
Ash	3.58%	1 to 2 feet
Japanese Lilac	3.03%	1 to 2 feet
Maple	3.03%	1 to 2 feet
Eastern White Cedar	2.75%	under 1 foot
Northern Red Oak	2.75%	2 feet
Other	23.15%	NA

JW&L recognizes the correlation between tree trimming spending with strategic planning and delivery of service. As a result, JW&L has committed itself to an annual budget of approximately $50,000 for tree trimming. JW&L staff met with the Town Tree Warden in the fall of 2016 to discuss the removal of danger trees and the JW&L Trustees passed a policy regarding the removal of danger trees as well.

JW&L has a program to identify danger trees within its rights-of-way and to either prune or remove those trees. Again, the success of this program is measured by whether danger trees are a root cause of system outages. Danger trees are identified by utility personnel while patrolling the lines, reading meters, or inspecting the system. Once a danger tree is identified, it is promptly removed if it is within JW&L's right-of-way. For danger trees outside of the right-of-way, JW&L contacts the property owner, explains the hazard, and with the owner's permission removes them. Where permission is not granted, JW&L will periodically follow up with the property owner to attempt to obtain permission.

The emerald ash borer has not yet become an active issue in JW&L's territory. JW&L is monitoring developments and coordinating efforts with VPPSA and VELCO and will make use of any guidance that becomes available as a result. If and when the emerald ash borer does surface in JW&L's territory, affected trees will be cut down, chipped and properly disposed of.

Table 19: JW&L Vegetation Trimming Cycles

	Total Miles	Miles Needing Trimming	Trimming Cycle
Distribution	Approximately 28 miles	22	5-year average cycle

Table 20: JW&L Vegetation Management Costs

	2016	2017	2018	2019	2020	2021	2022
Amount Budgeted	$42,000	$43,000	$55,000	$50,000	$50,000	$50,000	$50,000
Amount Spent (FY)	$35,050	$25,347	$36,439	$53,077	Deliberately left blank	Deliberately left blank	Deliberately left blank
Miles Trimmed	3.1 miles	4.41 miles	4.49 miles	4.32 miles	4.5 miles to be trimmed	4.5 miles to be trimmed	4.5 miles to be trimmed

Table 21: JW&L Tree Related Outages

	2014	2015	2016	2017	2018
Tree Related Outages	2	1	3	3	0
Total Outages	14	13	12	14	13
Tree-related outages as % of total outages	14%	8%	25%	21%	0%

The tree-related outages are primarily due to danger/hazard trees outside the right-of-way (ROW) and are not associated with JW&L's ROW trimming schedule. While many of the danger trees are outside the JW&L ROW and are not directly addressed by JW&L's scheduled ROW trimming, the JW&L does monitor their presence and strives to quickly address those that appear to be a threat. JW&L staff perform weekly ROW inspections of JW&L's system and when danger trees are identified outside the ROW, JW&L works closely with private property owners. In the fall of 2016, JW&L staff met with the Town of JW&L Tree Warden to specifically discuss danger trees and to reach an understanding about how the removal of trees outside the JW&L ROW (but within the Town ROW) would be handled. JW&L also adopted a Tree Removal Policy in October 2016 in order to clearly define the payment procedures for the removal of danger trees, which will help expedite the removal of danger trees in the future.

Storm/Emergency Procedures:

Like other Vermont municipal electric utilities, JW&L is an active participant in the Northeast Public Power Association (NEPPA) mutual aid system, which allows JW&L to coordinate not only with public power systems in Vermont, but with those throughout New England. A JW&L representative is also on the state emergency preparedness conference calls, which facilitate in-state coordination between utilities, state regulators and other interested parties. JW&L uses the https://vtoutages.org/ site during major storms especially if it experiences a large outage that is expected to have a long duration. JW&L believes it is beneficial to inform the Public Service Department if it is experiencing these types of outages. JW&L partners with neighboring municipals and cooperative when extra crew power is required. JW&L does not typically use contract crews. Beginning in October 2016, JW&: contracted with Cooperative Response Center (CRC) for after-hours dispatch services, including call-taking and line crew dispatching.

Previous and Planned T&D Studies:

Fuse Coordination Study

With several large solar arrays under construction or proposed for JW&L, JW&L believes a study of fuse coordination will be needed. JW&L anticipates some of this analysis will be completed as part of the system impact studies done for the solar arrays and that the issue will also be included in the electric system study when it is performed. However, a recent evaluation has shown that JW&L fuse coordination is functioning properly and there is no imminent need for a full study.

System Planning and Efficiency Studies

JW&L will evaluate the need for another T&D study over the next several years especially in light of the impact of net metering on the system.

Capital Spending:

Construction Cost (2016-2018):

Table 22: JW&L Historic Construction Costs

Village of Johnson Water & Light Department		Historic Construction		
Historic Construction		**2016**	**2017**	**2018**
Functional Summary:				
Production		$ -	$ -	$ -
General		$ 73,085	$ 68,566	$ 70,974
Distribution		$ 11,838	$ 677	$ 5,425
Transmission		$ 475	$ -	$ -
Total Construction		**$ 85,398**	**$ 69,243**	**$ 76,398**

Projected Construction Cost (2020-2022):

Table 23: JW&L Projected Construction Costs

Village of Johnson Water & Light Department		Projected Construction		
Projected Construction		**2020**	**2021**	**2022**
Functional Summary:				
Production		-	-	-
General		-	138,000	50,000
Distribution		40,000	100,000	80,000
Transmission		6,000	6,000	6,000
Total Construction		46,000	244,000	136,000

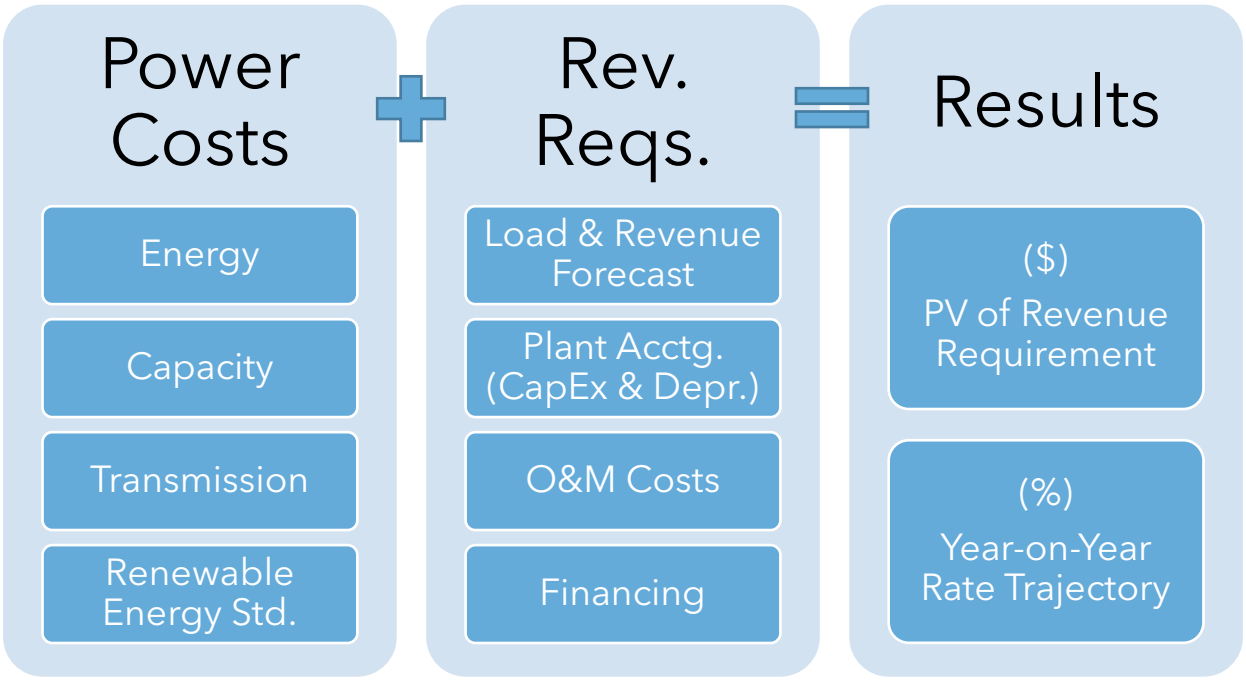
Financial Analysis

V. Financial Analysis

Components

The financial analysis represents an integrated analysis of JW&L's power supply costs and its revenue requirements. The results include the present value of JW&L's revenue requirements (a proxy for least cost) and the annual change in retail rates. The following figure illustrates the primary components of the analysis.

Figure 20: Primary Components of the Financial Analysis



The power supply cost models consist of four primary spreadsheets that estimate the cost of energy, capacity, transmission, and the costs of complying with the Renewable Energy Standard. The power supply models are monthly and roll up to annual numbers for integration with the revenue requirements model. The revenue requirements model contains annual estimates of JW&L's load, revenue, plant accounting activity (including capital expenditures and depreciation), O&M costs, and ultimately, a profit and loss statement. Its outputs are annual revenue requirements, average rates, and the annual change in rates.

Importantly, the power cost spreadsheets are the same models that are used to create JW&L's annual power cost budget and are formatted to be consistent with the spreadsheets that are used for monthly budget to actual analysis. As a result, they are operational as well as planning tools.

Methodology

The financial analysis estimates the costs and benefits of three major decisions that were identified in Section III. Resource Plans, and one load-related uncertainty. These include:

Decisions

There are three decisions facing JW&L that the financial analysis will quantify.

1. 2023–2027 Energy Only PPA

   Q1: What are the costs and benefits of signing a 5-year energy-only PPA in the context of potentially losing NVU's load?

2. 2028-2040 Hydro Energy + Tier I RECs PPA

   Q2: What are the costs and benefits of signing a long-term hydro energy plus Tier I REC PPA in the context of potentially losing NVU's load?

3. 25-Year Solar PPA

   Q3: What are the costs and benefits of a 25-year solar PPA?

In addition, we quantify two load-related questions.

4. 1% CAGR

   Q5: What is the rate impact of adding 1% compound annual load growth to the load forecast?

5. NVU Shuts Down - 30% Reduction in Load

   Q5: What is the rate impact of NVU shutting down?

Pathways

This IRP quantifies twelve different combinations of the three decisions and two load-related questions, as shown in Table 24.

Table 24: Event and Decision Pathways

Pathway	Name	2023-2027 Energy Only PPA	2028-2032 Hydro & Tier I REC PPA	25 Year Solar PPA
1	Reference Case w/o NVU Closure			
2	1% Load Growth			
3	NVU Closure (-30% Load)			
4	2023-2027 Energy Only PPA	✓		
5	2028-2040 Hydro & Tier I REC PPA		✓	
6	25 Year Solar PPA (1/1/23)			✓
7	4+3	✓	✓	
8	4+5	✓	✓	
9	4+5+3	✓	✓	
10	4+5+6	✓	✓	✓
11	4+5+6+3	✓	✓	✓
12	5+3		✓	

The financial analysis estimates the cost of each of these pathways, and then runs sensitivity analysis on ten different variables that are known to have a material impact on JW&L's revenue requirements. Low, base and high ranges were set up using historical data for each of these variables, as shown in the following sections.

Revenue Requirement Results

The high-level results of the financial analysis appear in Figure 21. The figure shows the present value of the revenue requirement (PVRR), which is one of two cost-related outputs.

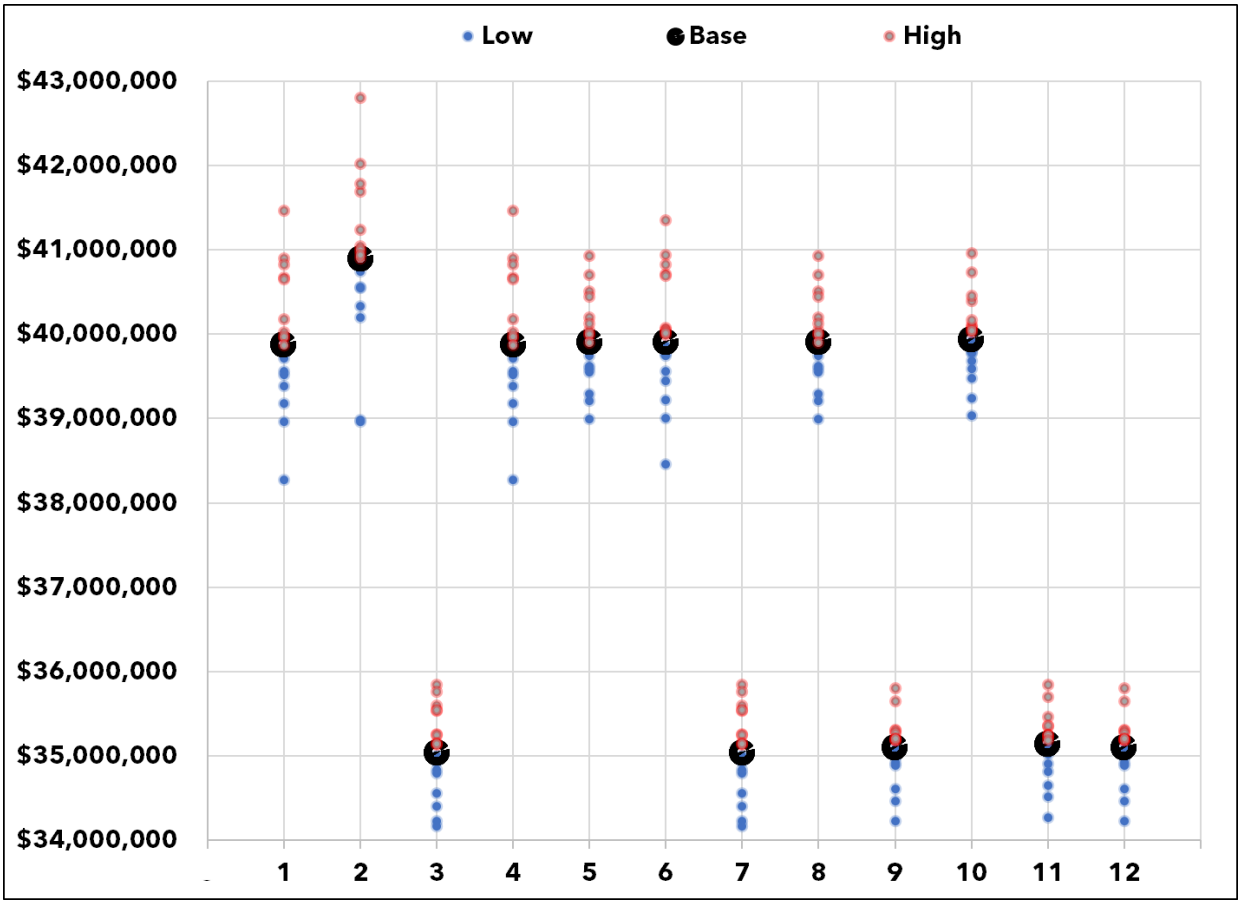
- **Pathway 1:** This range of outcomes is the reference case and it shows how much variability JW&L can expect from changes in load growth and in market conditions over time.

- **Pathways 2-3**: Pathway 2 shows this impact of a +1% change in load annual growth, and Pathway 3 shows the impact of NVU closing, a 30% drop in load.

- **Pathways 4-6**: These pathways show the impact of the three primary resource decisions. The analysis shows that these decisions primarily reduce risk, and do not strongly change cost.

- **Pathways 7-12**: These pathways represent combinations of Pathways 3-6 as described in

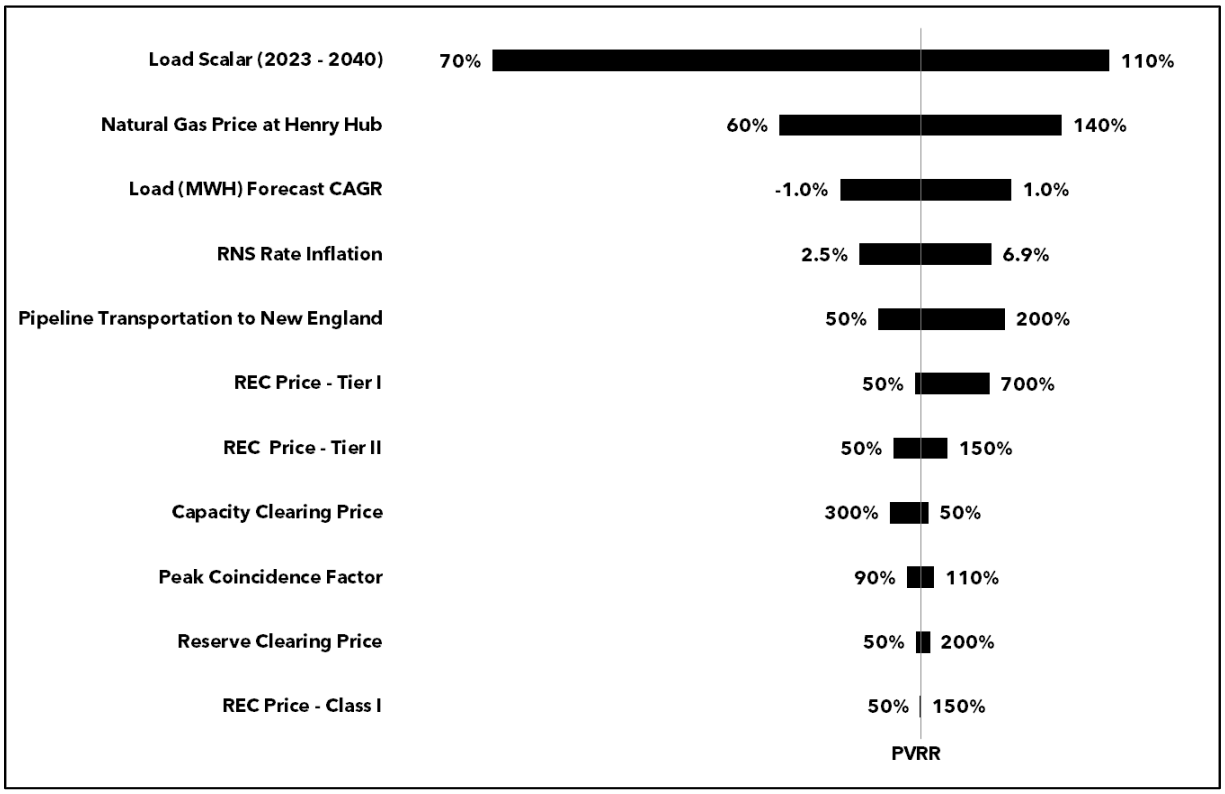
Figure 21: Scatter Plot of Financial Analysis Results (PV of Revenue Requirement)



Sensitivity Analysis

Changes in load and load growth represent the first and third largest variables impacting JW&L's cost of service, as measured by the Present Value of its Revenue Requirement (PVRR). The ranges that were modeled here were chosen for two reasons. First, a 30% drop in load is plausible if NVU closes. Second, a +/-1 percent change is load growth is likely due to the ongoing trends in energy efficiency (-1%) and electrification (+1%).

Figure 22: Sensitivity Analysis of Key Variables



Changes in natural gas prices and gas transportation represent the next significant pairing of cost drivers. This is not surprising because natural gas fired power plants determine the cost of electricity in New England during most hours of the year, and the cost of natural gas pipeline transportation to New England has been known to spike in the winter months. Assuming NVU continues to operate as usual, these two variables are the largest risks facing JW&L.

The price of regional network service (RNS) is the third most important variable and is important because it is growing at 2-3 times inflation.

The cost of RECs are the next most important variables. JW&L is naturally short on Tier I and Tier II RECs, and as the RES requirements increase, so too does JW&L's costs of compliance and exposure to these market prices.

The remaining variables are of comparatively little consequence to the PVRR. Note that capacity is well hedged, and that JW&L's costs are not sensitive to it as a result.

Impact of Supply – Demand Imbalances

The impact of supply-demand imbalances are summarized in Figure 23. Any time the supply of energy is less than the demand, lower market prices also lower JW&L's cost of service. Conversely, any time the supply is greater than the demand, higher market prices lower JW&L's cost of service. As a result, the financial impact of supply-demand imbalances are indeterminant, and depend on the market price of energy. Said differently, we cannot say with certainty that an imbalance (surplus or deficit of energy) is cost minimizing.

However, as we just learned in the previous section, the *size* of the imbalance has a direct impact on the price risk that JW&L faces. As a result, minimizing supply-demand imbalances minimized price risk.

Figure 23: Quadrant Analysis of Market Price & Surplus/Deficit Outcomes

	SURPLUS	*DEFICIT*
Market Prices are HIGHER than Contract Price	*PVRR DECREASES*	*PVRR INCREASES*
Market Prices are LOWER than Contract Price	*PVRR INCREASES*	*PVRR DECREASES*

Pathway Results

The lowest cost outcomes occur when NVU closes, as illustrated by Pathways 3,7,9,11 and 12. However, these are also the outcomes that carry the $/kWh highest rates, as illustrated in Table 25. Because the loss of NVU would cause a loss of retail revenue, rates could be expected to rise by about 26%. As a result, these outcomes are not considered least cost.

Table 25: Average Retail Rates in 2027 by Pathway

Path	Pathway Name	2027 Ave. Rate ($/kWh)	% of Ref. Case
1	Reference Case	$0.235	100%
2	1% Load Growth	$0.224	95%
3	NVU Closure (-30% Load)	$0.295	126%
4	2023-2027 Energy Only PPA	$0.235	100.0%
5	2028-2040 Hydro & Tier I REC PPA	$0.235	100.0%
6	25 Year Solar PPA (1/1/23)	$0.236	100.5%
7	4+3	$0.295	126%
8	4+5	$0.235	100.0%
9	4+5+3	$0.295	126%
10	4+5+6	$0.236	100.5%
11	4+5+6+3	$0.297	127%
12	5+3	$0.295	126%

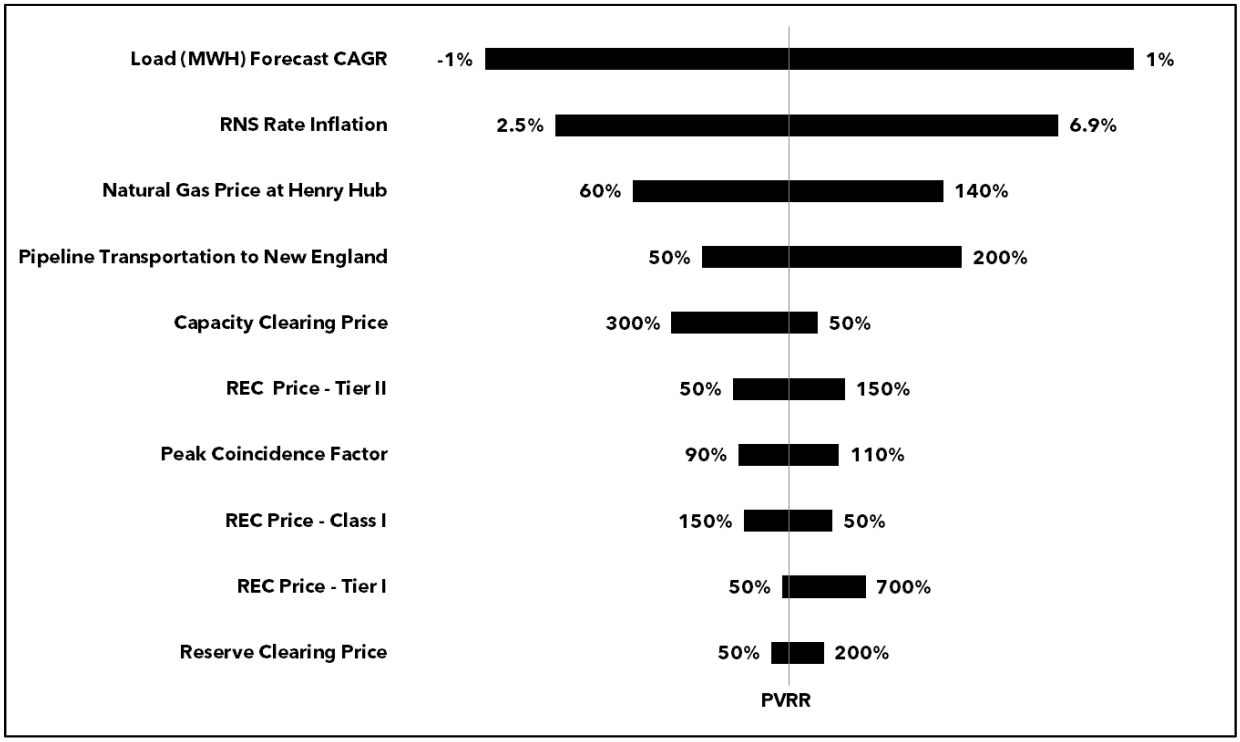
The reverse is also true. When loads grow by 1% per year, this causes the PVRR to rise, as shown in Pathway 3 of Figure 21. However, because of the extra retail revenue, this pathway is the lowest cost in terms of retail rates. As a result, encouraging load growth through electrification is a beneficial strategy for JW&L to follow as long as peak loads are controlled and do not cause investment in new distribution infrastructure.

The remaining pathways all involve a resource decision, and they are very similar in terms of both PVRR and average retail rates. The differences between these pathways are in the order and size of the risks that are inherent to the pathway. For example, in the sensitivity analysis of the Reference Case (Figure 22), changes in load and natural gas prices are the primary risks to the PVRR.

However, the risks are reordered and lower when a resource decision is made. This effect is most pronounced in Pathway 10, where all three resources are acquired. This pathway has:

- The narrowest range of financial outcomes in Figure 21,
- The lowest exposure to natural gas prices, which drop from position 1 to 3 in the tornado charts,
- The lowest exposure to Tier I and II REC prices, which drop from position 6 & 7 to 6 & 9.

Figure 24: Sensitivity Analysis of Key Variables – Pathway 10



If NVU were to stay open over the long-term, Pathway 10 would appear to be preferred because it is both low cost and low risk as show in green in Table 26. Notice, however, that almost all of the green shaded pathways are a result of losing NVU's load, which is not least cost in terms of electric rates.

Table 26: PVRR and Risk Proxy Measures by Pathway

Path	Pathway Name	PVRR	PVRR as % of Ref Case	Risk Proxy: Sum of Swing / Ref. Case
1	Reference Case	$39,872,768	100%	26.1%
2	1% Load Growth	$40,896,585	103%	28.3%
3	NVU Closure (-30% Load)	$35,040,458	88%	21.0%
4	2023-2027 Energy Only PPA	$39,872,914	100.0%	26.1%
5	2028-2040 Hydro & Tier I REC PPA	$39,901,003	100.1%	18.1%
6	25 Year Solar PPA (1/1/23)	$39,910,212	100.1%	25.1%
7	4+3	$35,040,604	88%	21.0%
8	4+5	$39,901,149	100.1%	18.1%
9	4+5+3	$35,095,439	88%	14.4%
10	4+5+6	$39,938,592	100.2%	17.1%
11	4+5+6+3	$35,137,359	88%	15.1%
12	5+3	$35,095,293	88%	14.4%

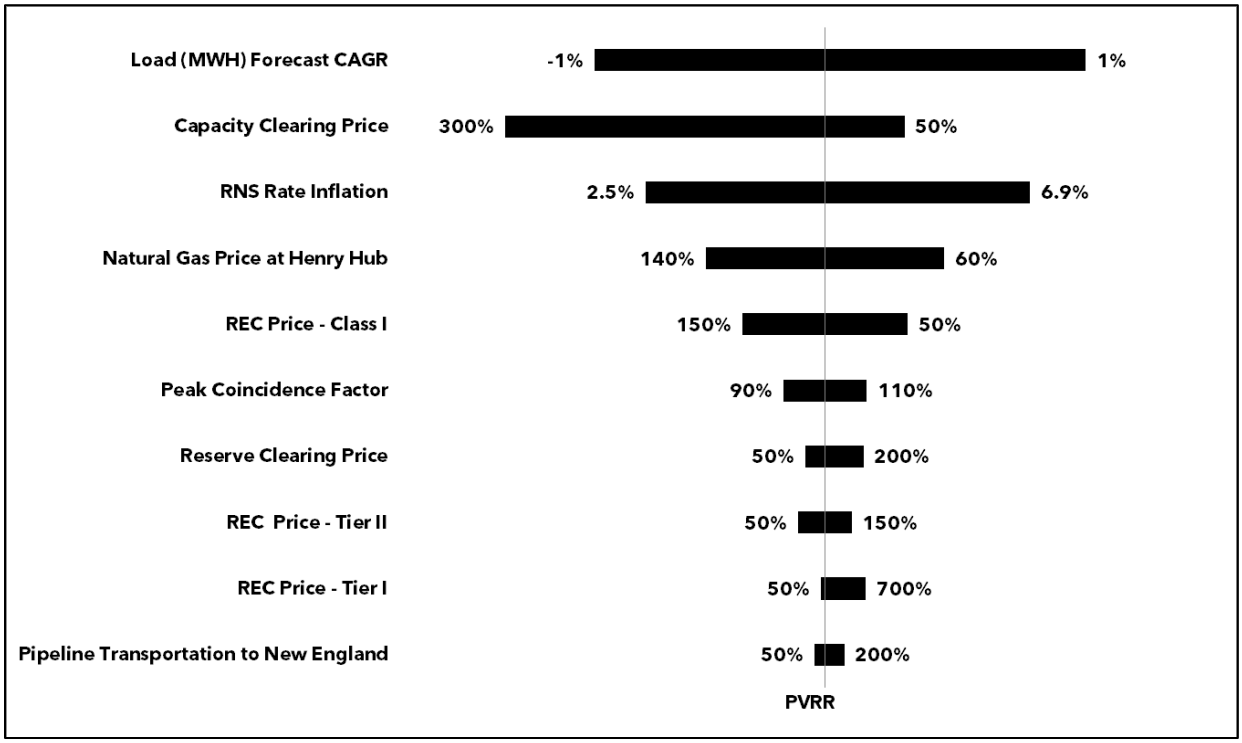
Returning to the discussion of Pathway 10, its risk is best understood in the context of Pathway 11. Recall that Pathway 10 and 11 are identical except that the loss of NVU is assumed in Pathway 11. In this event, two primary things happen.

1. Retail rates increase by 27%, and

2. *Higher* natural gas prices *lower* the PVRR.
    a. This is due to the surplus energy that JW&L would have after making all three resource decisions then losing the NVU load.

This outcome would not be an adverse one, necessarily. It would simply change JW&L's relationship to the energy market for as long as its supply exceeded its demand. However, it would be a substantial change to the status quo, and a counterintuitive one for many stakeholders. As a result, we conclude from this comparison that JW&L exclude NVU's load from the volume of multi-year energy supplies it considers, thus guaranteeing that JW&L is not overcommitted to resource supplies in the event that NVU closes.

Figure 25: Sensitivity Analysis of Key Variables – Pathway 11



Conclusions

Several conclusions can be drawn from the results in the various pathways.

1. First, the loss of NVU is the largest risk that JW&L faces and would likely cause a rate increase of approximately 26%.

2. Second, natural gas prices are the second largest risk that JW&L faces, regardless of whether NVU continues to operate, and hedging this risk is necessary.

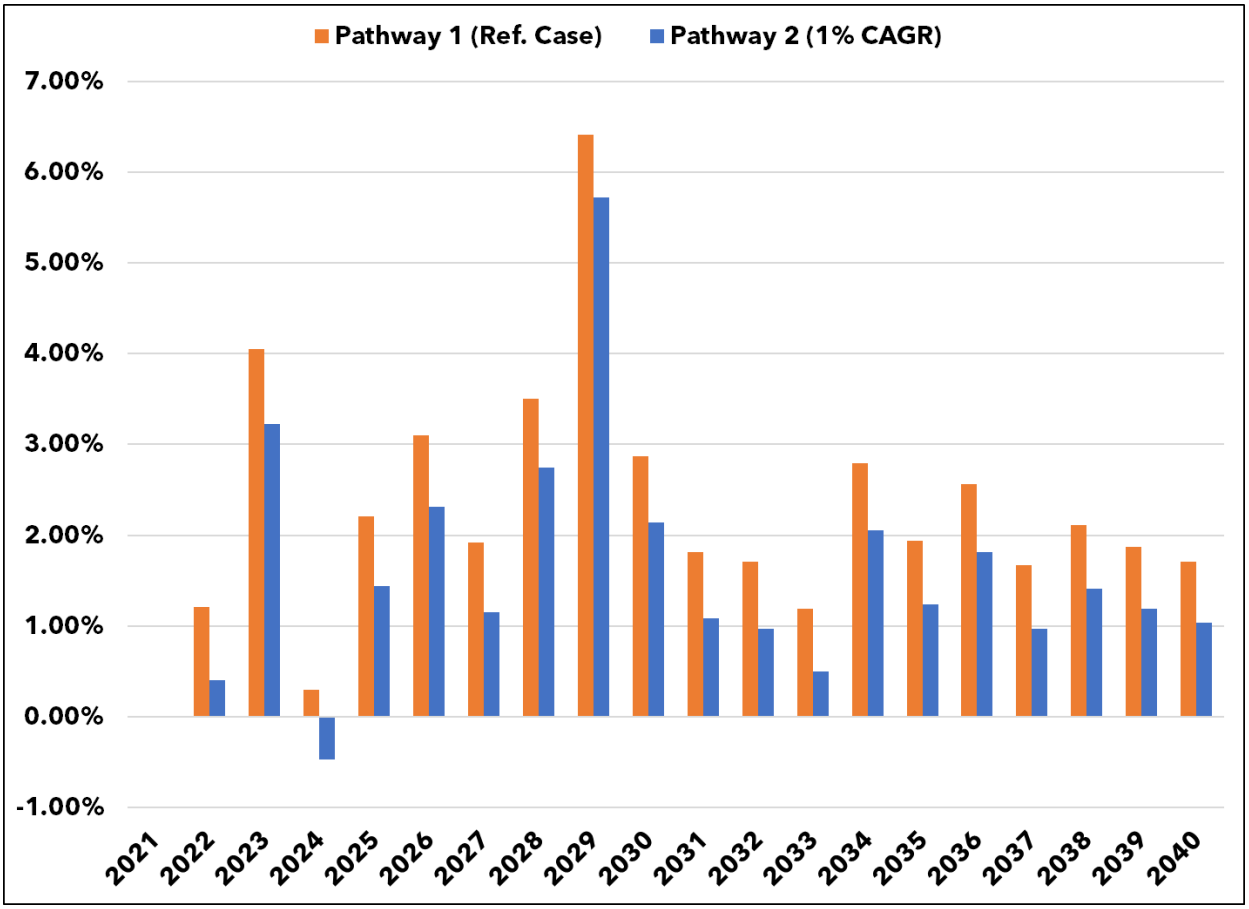
3. Finally, if JW&L commits to multi-year energy supplies, the volume should be chosen assuming that NVU closes at some point. This would prevent JW&L from having a multi-year surplus of energy, and the energy price risk that would accompany it.

    a. Alternatively, this conclusion could be implemented by purchasing energy more frequently (as often as annually), and for smaller terms (for as little as one year). Taking this approach would minimize the risk of having a surplus of energy until the uncertainty surrounding NVU's closure is resolved.

Impact of 1% Compound Annual Load Growth (CAGR)

Promoting energy-efficient load growth is an implied goal of the RES's Energy Transformation (Tier III) requirements. This section quantifies the impact that a 1% increase in annual load growth would have on retail rates. As Figure 26 shows, the impact is uniformly to lower rates. This is intuitive but is an important outcome to quantify. If this level of load growth were to occur between 2020 and 2032, for example, the 1% compound annual load growth could reduce rates by about 8% in 2032 as compared to the reference case.

Figure 26: Rate Impact of 1% CAGR Load Growth



Summary and Conclusions

The answers to the questions that were posed at the beginning of this chapter are now evident.

Resource Decisions

1. 2023–2027 Energy Only PPA

   Q1: What are the costs and benefits of signing a 5-year energy-only PPA in the context of potentially losing NVU's load?

   A1: This PPA would have no discernable impact on JW&L costs, but the benefit is that it would reduce energy price risk during this time period. As a result, it is a decision that should be considered, but only in quantities that would not cause a surplus if NVU were to close. JW&L could also choose to hedge its energy requirements annually using one-year PPAs until the uncertainty surrounding NVU's closure is resolved.

2. 2028-2040 Hydro Energy + Tier I RECs PPA

   Q2: What are the costs and benefits of signing a long-term energy plus Tier I REC PPA in the context of potentially losing NVU's load?

   A2: This PPA would increase JW&L's costs marginally, but the benefit would be that it would reduce energy and Tier I REC price risk during this time period. As a result, it is a decision that should be considered, but only in quantities that would not cause a surplus if NVU were to close. JW&L could also choose to hedge its energy and Tier I requirements annually using one-year PPAs until the uncertainty surrounding NVU's closure is resolved.

3. 25-Year Solar PPA

   Q3: What are the costs and benefits of a 25-year solar PPA?

   A3: The solar PPA increases costs marginally over 20 years but would reduce the price risk in the Tier II REC market. As a result, it is a decision that should be considered, but only in quantities that would not cause a surplus if NVU were to close. JW&L could also choose to enter a 250 kW PPA until the uncertainty surrounding NVU's closure is resolved.

Load-Related Questions

4. 1% CAGR

   Q5: What is the rate impact of adding 1% compound annual load growth to the load forecast?

   A4: Rates could be 8% lower in 2032 if 1% per year load growth were to occur between now and then.

5. NVU Shuts Down - 30% Reduction in Load

   Q5: What is the rate impact of NVU shutting down?

A5: A 26% rate increase can be expected in the event that NVU shuts down.

These and other conclusions are carried into the Action Plan in the following section.

Action Plan

VI. Action Plan

Based on the foregoing analysis, we envision taking the following actions.

- **NVU**
  - Mitigate the threat of NVU closure
    i. JW&L should investigate rate incentives that may contribute to NVU economic stability
    ii. JW&L should investigate the potential to intercede or provide input to the State College System budget process, either directly or through the services of a lobbyist.
    iii. Emphasize impacts closure would have on local community;
      1. 26% rate increase due to loss of load
      2. Local economic impact
      3. Local Employment levels
      4. Education enhances economic opportunity

- **Automated Metering Infrastructure (AMI)**
  - JW&L will participate in an evaluation of AMI readiness which, if results are positive, will lead to preparation of an RFP leading to vendor and equipment selection and ultimately to implementation of an AMI system. Upon completion of the RFP phase of the project, JW&L will have the information needed to examine the business case and make a decision to commit to implementation of an AMI system, or not. JW&L recognizes that cost reduction, while desirable, is but one of many factors that must be weighed in making the decision to go forward with AMI JW&L sees the potential for a number of future benefits that, while difficult to quantify in cost/benefit terms, will clearly be desirable to various stakeholders. These benefits include (but may not be limited to) improved system control/optimization, ability to deliver/administer more creative customer and load management initiatives, and ability to accommodate emerging initiatives such as EV charging. JW&L also notes that unanticipated initiatives may emerge over time that positively impact the perceived value of having an AMI system in place. JW&L is considering the potential benefit of a staged implementation that would initially focus on limited areas of high load or customer concentration.

- **Energy Resource Actions**
  - Manage year to year energy market requirements using fixed-price, market contracts that are less than five-years in duration.
  - Seek a firm, hydro PPA that includes energy and Tier I RECs, but only energy in quantities that would not cause a surplus if NVU were to close.
  - Consider purchasing energy (and RECs) annually and for one-year terms until the uncertainty surrounding NVU's closure is resolved.

- **Capacity Resource Actions**
  - Manage and monitor the reliability of Project 10 to minimize Pay-for-Performance (PFP) risk and maximize capacity, reserves, and PFP benefits.

- **Tier I Requirements**
  - Make forward purchases of qualifying RECs on the regional market to manage REC price and ACP risk, but purchase them in quantities that would not cause a surplus if NVU were to close.
  - Seek a firm, hydro PPA that includes energy and Tier I RECs, but only energy in quantities that would not cause a surplus if NVU were to close.
  - Consider purchasing RECs (and energy) annually and for one-year terms until the uncertainty surrounding NVU's closure is resolved.
- **Tier II Requirements**
  - Consider a 250-500 kW solar PPA, and stage/size it to anticipate NVU's potential closure.
  - Bank surplus RECs for future compliance years to the extent allowed.
  - Make forward purchases of qualifying RECs on the Vermont market to manage REC price and ACP risk.
- **Tier III Requirements**
  - Identify and deliver prescriptive and/or custom Energy Transformation programs, and/or
  - Commission a solar project and retire surplus RECs to fulfill Tier III to the extent allowable.
  - Purchase a surplus of Tier II qualifying renewable energy credits.
- **Active Load Control Pilot Program**
  - Investigate options for engaging customers in active load control programs and tariffs, including end-uses such as electric thermal storage, CCHPs, and HPWHs.
- **Peak Load Management Pilot Program**
  - Explore ways to align reductions in customer demand charges with utility coincident peak costs through use of a pilot tariff.
- **Net Metering**
  - Monitor the penetration rate and cost of solar net metering for future grid parity, and advocate for appropriate policies to mitigate potential upward rate pressure.
- **Storage**
  - Complete Round 2 of the VPPSA Storage RFP.
  - Develop potential storage projects in partnership with the selected company.

Appendix

Appendix A: Lamoille County Regional Plan

Due to its large size, this appendix is made available through the following link:

https://www.lcpcvt.org/vertical/Sites/%7B3C01460C-7F49-40F5-B243-0CA7924F23AF%7D/uploads/2015-2023_Regional_Plan_as_amended_on_May_22_2018.pdf

Appendix B: 2020 Tier 3 Annual Plan

This appendix is provided separately in a file named:

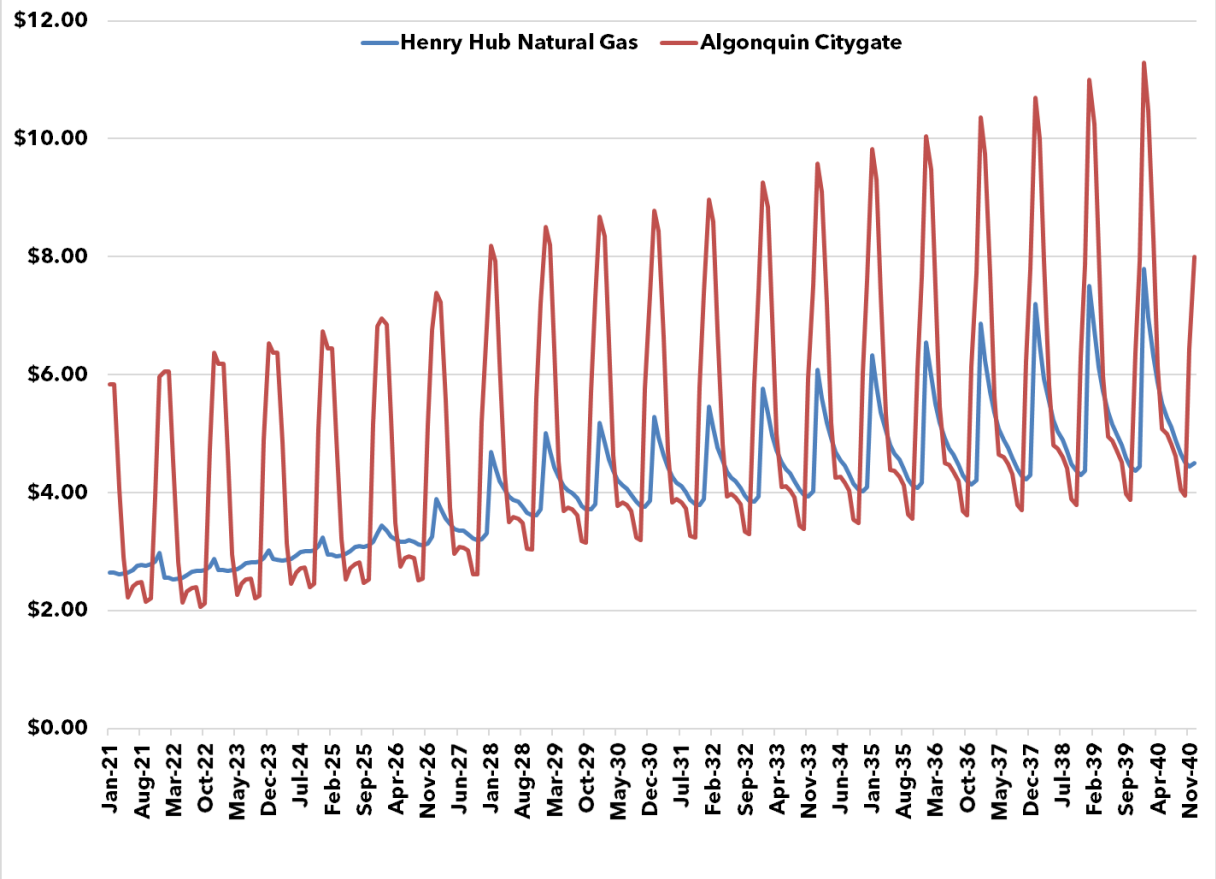
Appendix B – VPPSA Revised 2020 Tier 3 Annual Plan.pdf

Appendix C: Pricing Methodology

Energy Pricing

Energy prices are forecast using a three-step method. First, a natural gas price forecast is formed by combining 5 years (2021-2025) of NYMEX Henry Hub futures prices with 15 years (2026-2040) of Energy Information Administration (EIA) Annual Energy Outlook (AEO) Henry Hub forecast for the period 2022 to 2040. The forecast of Henry Hub Natural Gas prices can be seen in Figure 27.

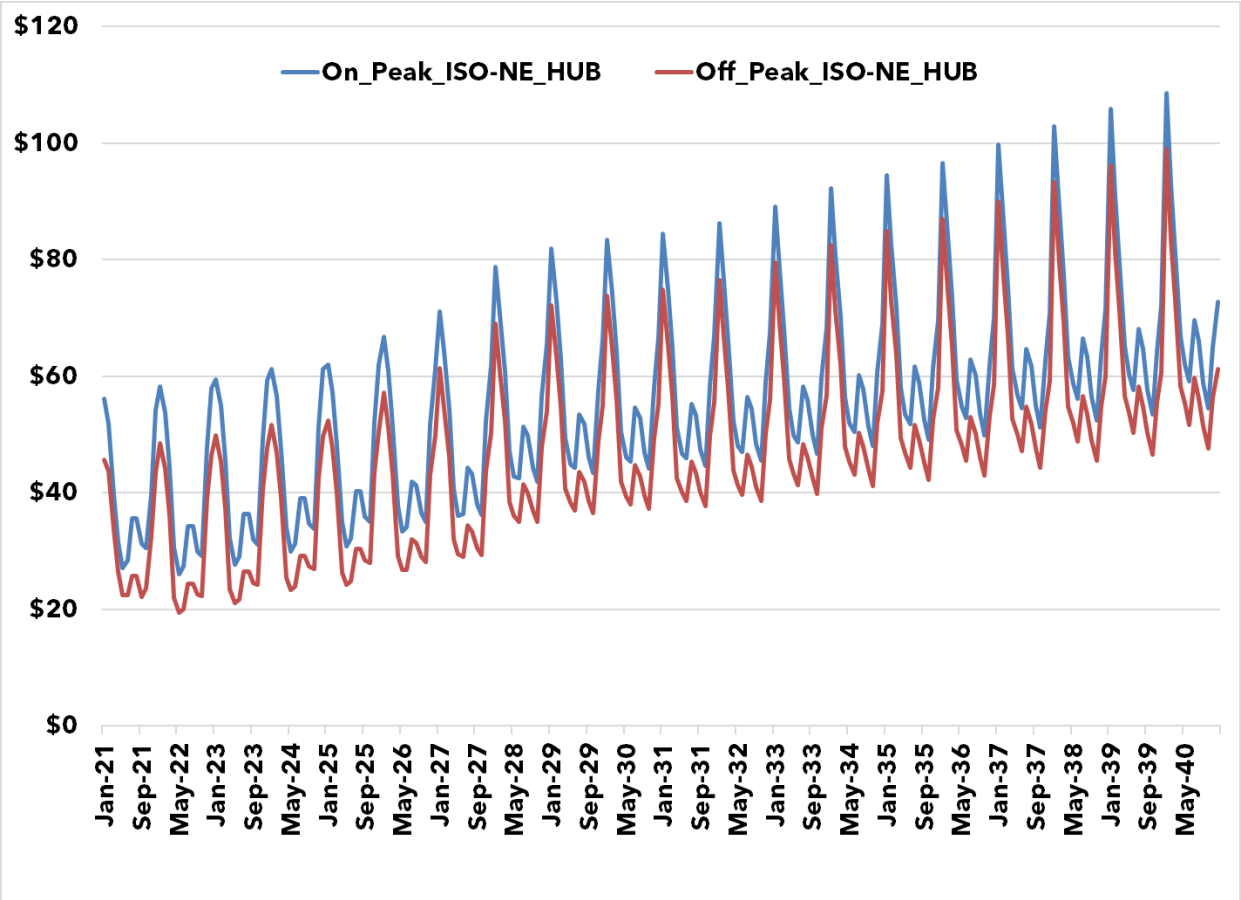
Figure 27: Henry Hub Natural Gas Price Forecast (Nominal $/MMBtu)



Second, we use NYMEX futures prices (between 2020-2021) to find 1.) the cost of transportation (basis) to the Algonquin Hub and 2.) the cost of on and off-peak energy at the Massachusetts Hub (MA Hub). These prices are used to calculate an implied heat rate (MMBtu/MWH) and a spread between on and off-peak electricity prices. These values (sometimes called shapes) are used for the remainder of the forecast period.

Third and finally, we multiply the natural gas price forecast by the implied heat rate to get the on-peak electricity price. From this value, we subtract the spread between the on and off-peak prices to get the off-peak price. The results can be seen in Figure 28.

Figure 28: Electricity Price Forecast (Nominal $/MWH)

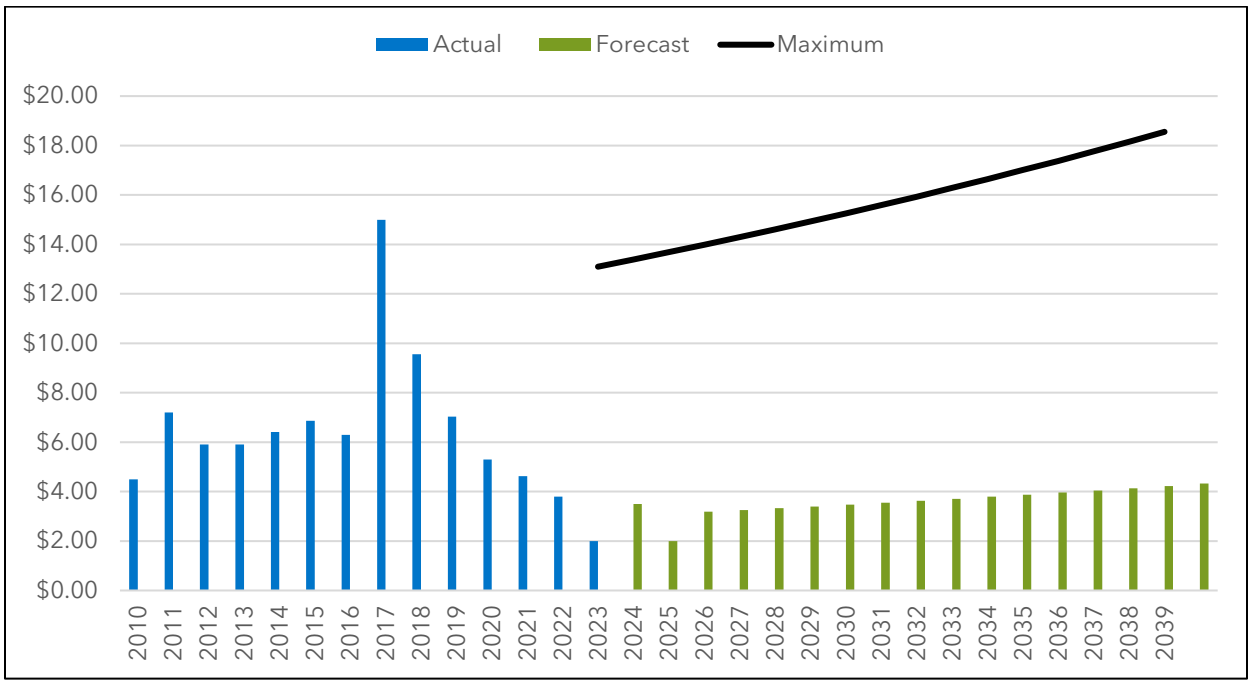


Finally, and in keeping with the function of ISO-NE's Standard Market Design, we use a five-year average basis between LMP nodes to adjust the price forecast at the MA Hub to the location of JW&L's load and resources.

Capacity Pricing

The capacity price forecast is an average of the last three years of actual auction results plus a forecast of the next two years of auction clearing prices. It grows from $2.00 per kW-month in 2023 to $4.32 per kW-month in 2040. Significant upside price risk does exist, as shown by the Maximum line in Figure 29. This line represents the Forward Capacity Auction Starting Price plus inflation.

Figure 29: Capacity Price Forecast (Nominal $/kW-Month)



Appendix D: PUC Rule 4.900 Outage Reports

Village of Johnson ALL OUTAGES

This report is pursuant to PSB Rule 4.903B. It is to be submitted to the Public Service Board and the Department of Public Service no later than 30 days after the end of the calendar year.

Electricity Outage Report -- PSB Rule 4.900

Name of company	Village of Johnson
Calendar year report covers	2014
Contact person	Duncan Hastings
Phone number	802-635-2611
Number of customers	947

System average interruption frequency index (SAIFI) = Customers Out / Customers Served	**1.4**
Customer average interruption duration index (CAIDI) = Customer Hours Out / Customers Out	**2.6**

	Outage cause	Number of Outages	Total customer hours out
1	**Trees**	2	63
2	**Weather**	0	0
3	**Company initiated outage**	6	843
4	**Equipment failure**	6	2,569
5	**Operator error**	0	0
6	**Accidents**	0	0
7	**Animals**	0	0
8	**Power supplier**	0	0
9	**Non-utility power supplier**	0	0
10	**Other**	0	0
11	**Unknown**	0	0
	Total	14	3,475

All outages

Village of Johnson

This report is pursuant to PSB Rule 4.903B. It is to be submitted to the Public Service Board and the Department of Public Service no later than 30 days after the end of the calendar year.

Electricity Outage Report -- PSB Rule 4.900

Name of company	Village of Johnson
Calendar year report covers	2015
Contact person	Sandy Miller
Phone number	802-635-2611
Number of customers	942

System average interruption frequency index (SAIFI) =	**1.2**
Customers Out / Customers Served	
Customer average interruption duration index (CAIDI) =	**0.7**
Customer Hours Out / Customers Out	

	Outage cause	Number of Outages	Total customer hours out
1	**Trees**	1	62
2	**Weather**	0	0
3	**Company initiated outage**	4	10
4	**Equipment failure**	3	110
5	**Operator error**	0	0
6	**Accidents**	0	0
7	**Animals**	0	0
8	**Power supplier**	1	471
9	**Non-utility power supplier**	0	0
10	**Other**	4	119
11	**Unknown**	0	0
	Total	13	772

Village of Johnson

This report is pursuant to PSB Rule 4.903B. It is to be submitted to the Public Service Board and the Department of Public Service no later than 30 days after the end of the calendar year.

Electricity Outage Report -- PSB Rule 4.900

Name of company	Village of Johnson
Calendar year report covers	2016
Contact person	Meredith Birkett
Phone number	802-635-2611
Number of customers	948

System average interruption frequency index (SAIFI) = Customers Out / Customers Served	**2.6**
Customer average interruption duration index (CAIDI) = Customer Hours Out / Customers Out	**3.2**

	Outage cause	Number of Outages	Total customer hours out
1	**Trees**	3	45
2	**Weather**	2	74
3	**Company initiated outage**	0	0
4	**Equipment failure**	1	66
5	**Operator error**	0	0
6	**Accidents**	2	2,016
7	**Animals**	0	0
8	**Power supplier**	2	5,573
9	**Non-utility power supplier**	0	0
10	**Other**	1	16
11	**Unknown**	1	15
	Total	12	7,806

Village of Johnson

This report is pursuant to PSB Rule 4.903B. It is to be submitted to the Public Service Board and the Department of Public Service no later than 30 days after the end of the calendar year.

Electricity Outage Report -- PSB Rule 4.900

Name of company	Village of Johnson
Calendar year report covers	2017
Contact person	Meredith Birkett
Phone number	802-635-2611
Number of customers	961

System average interruption frequency index (SAIFI) = 0.8
Customers Out / Customers Served

Customer average interruption duration index (CAIDI) = 5.4
Customer Hours Out / Customers Out

	Outage cause	Number of Outages	Total customer hours out
1	**Trees**	3	327
2	**Weather**	1	10
3	**Company initiated outage**	8	669
4	**Equipment failure**	1	4
5	**Operator error**	0	0
6	**Accidents**	1	3,154
7	**Animals**	0	0
8	**Power supplier**	0	0
9	**Non-utility power supplier**	0	0
10	**Other**	0	0
11	**Unknown**	0	0
	Total	14	4,164

Village of Johnson

This report is pursuant to PSB Rule 4.903B. It is to be submitted to the Public Service Board and the Department of Public Service no later than 30 days after the end of the calendar year.

Electricity Outage Report -- PSB Rule 4.900

Name of company	Village of Johnson
Calendar year report covers	2018
Contact person	Meredith Birkett
Phone number	802-635-2611
Number of customers	978

System average interruption frequency index (SAIFI) =	**0.2**
Customers Out / Customers Served	
Customer average interruption duration index (CAIDI) =	**3.5**
Customer Hours Out / Customers Out	

	Outage cause	Number of Outages	Total customer hours out
1	**Trees**	0	0
2	**Weather**	11	147
3	**Company initiated outage**	1	169
4	**Equipment failure**	0	0
5	**Operator error**	0	0
6	**Accidents**	1	265
7	**Animals**	0	0
8	**Power supplier**	0	0
9	**Non-utility power supplier**	0	0
10	**Other**	0	0
11	**Unknown**	0	0
	Total	13	580

Appendix E: Inverter Source Requirements

Inverter Source Requirement Document of ISO New England (ISO-NE)

This Source Requirement Document applies to inverters associated with specific types of generation for projects that have applied for interconnection after specific dates. These details will be described in separate document(s). This document was developed with the help of the Massachusetts Technical Standards Review Group and is consistent with the pending revision of the IEEE 1547 Standard for Interconnection and Interoperability of Distributed Resources with Associated Electrical Power Systems Interfaces. All applicable inverter-based applications shall:

- be certified per the requirements of UL 1741 SA as a grid support utility interactive inverter
- have the voltage and frequency trip settings
- have the abnormal performance capabilities (ride-through)
- comply with other grid support utility interactive inverter functions statuses

These specifications are detailed below and are consistent with the amended IEEE Std 1547a-2014.

1. **Certification per UL 1741 SA as grid support utility interactive inverters**

   In the interim period while IEEE P1547.1 is not yet revised and published, certification of all inverter- based applications:

   a. shall be compliant with only those parts of Clause 6 (Response to Area EPS abnormal conditions) of IEEE Std 1547-2018 (2nd ed.)1 that can be certified per the type test requirements of
   UL 1741 SA (September 2016). IEEE Std 1547-2018 (2nd ed.) in combination with this document

   replaces other Source Requirements Documents (SRDs), as applicable;

   b. may be sufficiently achieved by certifying inverters as grid support utility interactive inverters per the requirements of UL 1741 SA (September 2016) with either CA Rule 21 or Hawai'ian Rule 14H as the SRD. Such inverters are deemed capable of meeting the requirements of this document.

2. **Voltage and frequency trip settings for inverter based applications**

   Applications shall have the voltage and frequency trip points specified in Tables I and II below.

3. Abnormal performance capability (ride-through) requirements for inverter based applications

The inverters shall have the ride-through capability per abnormal performance category II of IEEE Std 1547-2018 (2nd ed.) as quoted in Tables III and IV.

The following additional performance requirements shall apply for all inverters:

a. In the Permissive Operation region above 0.5 p.u., inverters shall ride-through in Mandatory Operation mode, and
b. In the Permissive Operation region below 0.5 p.u., inverters shall ride-through in Momentary Cessation mode.

1

7.3 as a proxy, subject to minor

editorial changes.

Consistent with IEEE Std 1547-2018 (2nd ed.) the following shall apply:

a. DER tripping requirements specified in this SRD shall take precedence over the abnormal performance capability (ride-through) requirements in this section, subject to the following:
    1. Where the prescribed trip duration settings for the respective voltage or frequency magnitude are set at least 160 ms or 1% of the prescribed tripping time, whichever is greater, beyond the prescribed ride-through duration, the DER shall comply with the ride-through requirements specified in this section prior to tripping.
    2. In all other cases, the ride-through requirements shall apply until 160 ms or 1% of the prescribed tripping time, whichever is greater, prior to the prescribed tripping time.
b. DER ride-through requirements specified in this section shall take precedence over all other requirements within this SRD with the exception of tripping requirements listed in item a. above. Ride-through may be terminated by the detection of an unintentional island. However, false detection of an unintentional island that does not actually exist shall not justify non- compliance with ride-through requirements. Conversely, ride-through requirements specified in this section shall not inhibit the islanding detection performance where a valid unintentional islanding condition exists.

4. Other grid support utility interactive inverter functions statuses

Other functions required by UL 1741 SA shall comply with the requirements specified in Table V. For functions not activated by default, the inverter is compliant if tested to the manufacturers stated capability.

5. Definitions

The following definitions which are consistent with IEEE Std 1547-2018 (2nd ed.) and UL 1741 SA shall apply:

cease to energize: Cessation of active power delivery under steady state and transient conditions and limitation of reactive power exchange. This may lead to momentary cessation or trip.

clearing time: The time between the start of an abnormal condition and the DER ceasing to energize the utility's distribution circuit(s) to which it is connected. It is the sum of the detection time, any adjustable time delay, the operating time plus arcing time for any interposing devices (if used), and the operating time plus arcing time for the interrupting device (used to interconnect the DER with the utility's distribution circuit).

continuous operation: Exchange of current between the DER and an EPS within prescribed behavior while connected to the utility's distribution system and while the applicable voltage and the system frequency is within specified parameters.

mandatory operation: Required continuance of active current and reactive current exchange of DER with utility's distribution system as prescribed, notwithstanding disturbances of the utility's distribution system voltage or frequency having magnitude and duration severity within defined limits.

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momentary cessation: Temporarily cease to energize the utility's distribution system while connected to the utility's distribution system, in response to a disturbance of the applicable voltages or the system frequency, with the capability of immediate restore

output of operation when the applicable voltages and the system frequency return to within defined ranges.

permissive operation: operating mode where the DER performs ride-through either in mandatory operation or in momentary cessation, in response to a disturbance of the applicable voltages or the system frequency.

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ISO-NE PUBLIC **Table I: Inverters' Voltage Trip Settings**

Shall Trip – IEEE Std 1547-2018 (2nd ed.) Category II					
Shall Trip Function	**Required Settings**		**Comparison to IEEE Std 1547-2018 (2nd ed.) default settings and ranges of allowable settings for Category II**		
	Voltage (p.u. of nominal voltage)	**Clearing Time(s)**	**Voltage**	**Clearing Time(s)**	**Within ranges of allowable settings?**
OV2	1.20	0.16	Identical	Identical	Yes
OV1	1.10	2.0	Identical	Identical	Yes
UV1	0.88	2.0	Higher (default is 0.70 p.u.)	Much shorter (default is 10 s)	Yes
UV2	0.50	1.1	Slightly higher (default is 0.45 p.u.)	Much longer (default is 0.16 s)	Yes

Table II: Inverters' Frequency Trip Settings

Shall Trip Function	Required Settings		Comparison to IEEE Std 1547-2018 (2nd ed.) default settings and ranges of allowable		
	Frequency (Hz)	Clearing Time(s)	Frequency	Clearing Time(s)	Within ranges of allowable settings?
OF2	62.0	0.16	Identical	Identical	Yes
OF1	61.2	300.0	Identical	Identical	Yes
UF1	58.5	300.0	Identical	Identical	Yes
UF2	56.5	0.16	Identical	Identical	Yes

Table III: Inverters' Voltage Ride-through Capability and Operational Requirements

Voltage Range (p.u.)	Operating Mode/ Response	Minimum Ride-through Time(s) (design criteria)	Maximum Response Time(s) (design criteria)	Comparison to IEEE Std 1547-2018
V > 1.20	Cease to Energize	N/A	0.16	Identical
1.175 < V ≤ 1.20	Permissive Operation	0.2	N/A	Identical
1.15 < V ≤ 1.175	Permissive Operation	0.5	N/A	Identical
1.10 < V ≤ 1.15	Permissive Operation	1	N/A	Identical
0.88 ≤ V ≤ 1.10	Continuous Operation	infinite	N/A	Identical
0.65 ≤ V < 0.88	Mandatory Operation	Linear slope of 8.7 s/1 p.u. voltage starting at 3 s @ 0.65 p.u.: T = 3 s + 8.7 s (V − 0.65	N/A	Identical
0.45 ≤ V < 0.65	Permissive Operation [a,b]	0.32	N/A	See footnotes a & b
0.30 ≤ V < 0.45	Permissive Operation [b]	0.16	N/A	See footnote b
V < 0.30	Cease to Energize	N/A	0.16	Identical

The following additional operational requirements shall apply for all inverters:

a. In the Permissive Operation region above 0.5 p.u., inverters shall ride-through in Mandatory Operation mode, and
b. In the Permissive Operation region below 0.5 p.u., inverters shall ride-through in Momentary Cessation mode with a maximum response time of 0.083 seconds.

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Table IV: Inverters' Frequency Ride-through Capability

Frequency Range (Hz)	Operating Mode	Minimum Time(s) (design criteria)	Comparison to IEEE Std 1547-2018 (2nd ed.)
f > 62.0	No ride-through requirements apply to this range		Identical
61.2 < f ≤ 61.8	Mandatory Operation	299	Identical
58.8 ≤ f ≤ 61.2	Continuous Operation	Infinite	Identical
57.0 ≤ f < 58.8	Mandatory Operation	299	Identical
f < 57.0	No ride-through requirements apply to this range		Identical

Table V: Grid Support Utility Interactive Inverter Functions Status

Function	Default Activation State
SPF, Specified Power Factor	**OFF[2]**
Q(V), Volt-Var Function with Watt	**OFF**
SS, Soft-Start Ramp Rate	**ON** **Default value: 2% of maximum current**
FW, Freq-Watt Function OFF	**OFF**

2

with unity PF.

Appendix F: One-Line Diagrams

JW&L does not currently have a one-line diagram but is investigating the process to develop one.

Appendix G: VPPSA Storage RFP

This appendix is provided separately in a file named:

Appendix G-VPPSA_2020_Storage_RFP_Final.pdf

Glossary

Glossary

ACP	Alternative Compliance Payment
ACSR	Aluminum conductor steel-reinforced
APPA	American Public Power Association
CAGR	Compound Annual Growth Rate
CAIDI	Customer Average Interruption Duration Index
CC	Combined Cycle (Power Plant)
CCHP	Cold Climate Heat Pump
CEDF	Clean Energy Development Fund
CEP	Comprehensive Energy Plan
CRC	Cooperative Response Center
DPP	Damage Prevention Plan
DPS	Department of Public Service or "Department"
EIA	Energy Information Administration
ET	Energy Transformation (Tier III)
EV	Electric Vehicle
EVT	Efficiency Vermont
FERC	Federal Energy Regulatory Commission
GMP	Green Mountain Power
HPWH	Heat Pump Water Heater
IRP	Integrated Resource Plan
ISO-NE	ISO New England (New England's Independent System Operator)
JW&L	Village of Johnson Water & Light Department
JSC	Johnson State College
kV	Kilovolt
kVA	Kilovolt Amperes
kW	Kilowatt
kWh	Kilowatt-hour
LCPC	Lamoille County Planning Commission
LIHI	Low Impact Hydro Institute
MAPE	Mean Absolute Percent Error
ME II	Maine Class II (RECs)
MEAV	Municipal Association of Vermont
MSA	Master Supply Agreement
MVA	Megavolt Ampere
MW	Megawatt
MWH	Megawatt-hour
NEPPA	Northeast Public Power Association
NVU	Northern Vermont University (formerly Johnson State College)
NYPA	New York Power Authority
PFP	Pay for Performance
PUC	Public Utility Commission
PPA	Power Purchase Agreement
PVRR	Present Value of Revenue Requirement
R^2	R-squared
RES	Renewable Energy Standard
ROW	Right-of-way
RTLO	Real-Time Load Obligation

SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control and Data Acquisition
TIER I	Total Renewable Energy (Tier I)
TIER II	Distributed Renewable Energy (Tier II)
TIER III	Energy Transformation (Tier III)
TOU	Time-Of-Use (Rate)
VEC	Vermont Electric Cooperative
VELCO	Vermont Electric Power Company
VEPPI	Vermont Electric Power Producers, Inc.
VFD	Variable Frequency Drive
VSPC	Vermont System Planning Committee
VT ANR	Vermont Agency of Natural Resources
VTel	Vermont Telephone Company, Inc.
WQC	Water Quality Certificate

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Vermont Public Power Supply Authority
Putting the Public in Power.
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Vermont Public Power Supply Authority
2020 Tier 3 Annual Plan

In accordance with the Public Utility Commission's ("PUC") *Final Order in Docket 8550*, Vermont Public Power Supply Authority ("VPPSA") is filing this Annual Plan describing its proposed 2020 Energy Transformation programs. Vermont's Renewable Energy Standard ("RES"), enacted through Act 56 in 2015, requires electric distribution utilities to either generate fossil fuel savings by encouraging Energy Transformation ("Tier 3") projects or purchase additional Renewable Energy Credits ("RECs") from small, distributed renewable generators ("Tier 2").

VPPSA's Requirement

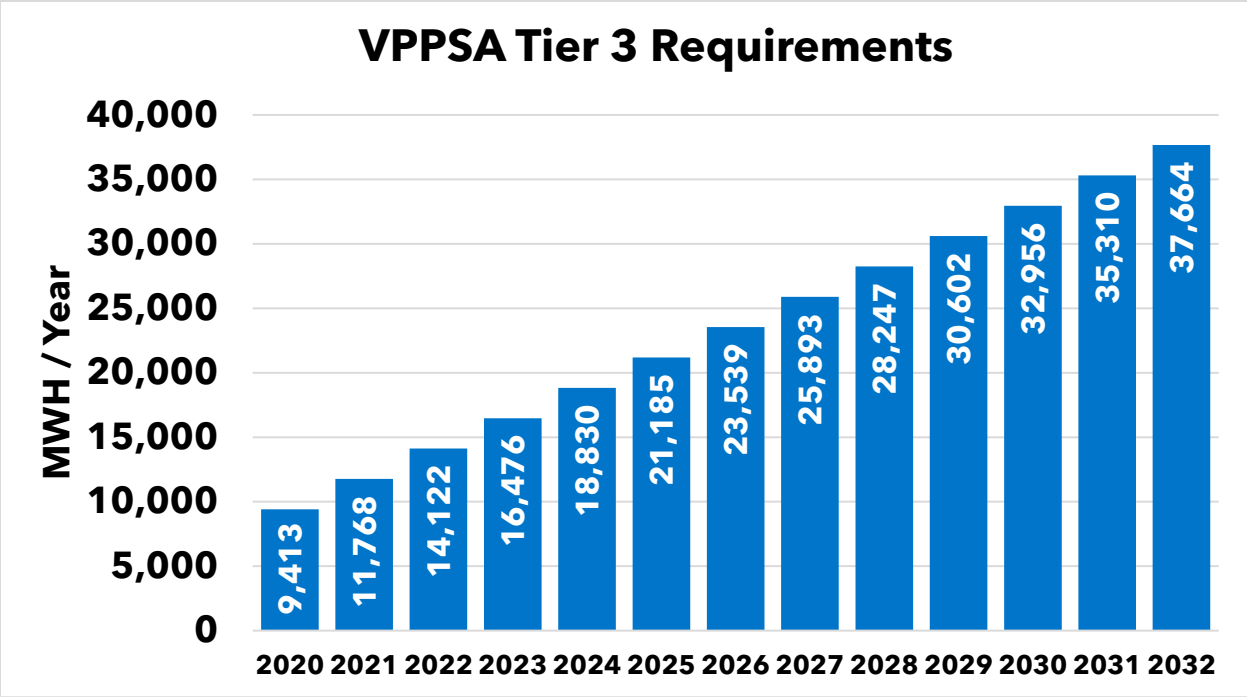
Utilities' Tier 3 requirements are established by 30 V.S.A. § 8005(a)(3)(B), which states that "in the case of a provider that is a municipal electric utility serving not more than 6,000 customers, the required amount shall be two percent of the provider's annual retail sales beginning on January 1, 2019.[1]"

Under 30 V.S.A. § 8004 (e) "[i]n the case of members of the Vermont Public Power Supply Authority, the requirements of this chapter may be met in the aggregate." The 11 VPPSA member utilities plan to meet Tier 3 requirements in aggregate. In 2020, VPPSA's aggregate requirement is estimated to be 9,413 MWh equivalent in savings, representing 2.67% of annual retail sales.

VPPSA Members:
- **Barton Village**
- **The Village of Enosburg Falls**
- **Hardwick Electric Department**
- **Village of Jacksonville**
- **Village of Johnson**
- **Ludlow Electric Light Department**
- **Lyndonville Electric Department**
- **Morrisville Water & Light**
- **Northfield Electric Department**
- **Village of Orleans**
- **Swanton Village**

[1] 30 V.S.A. § 8005(a)(3)(B)

Tier 3 requirements increase by .67% annually. The below chart represents VPPSA's projected annual MWh equivalent in savings through 2032.



Summary of 2019 Projects

VPPSA expects to meet its 2019 Tier 3 requirements of 7,059 MWh through a combination of prescriptive and custom measures and through employing excess Tier 2 RECs as needed.

Prescriptive measures included post-purchase rebates for:

1. Cold Climate Heat Pumps
2. Heat Pump Water Heaters
3. Electric and Plug-In Hybrid Vehicles

Of the three prescriptive measures, we found cold climate heat pumps to be the most successful. We additionally found that custom measures, while providing a greater return in MWh savings at a lower cost, tend to have a longer ramp-up time. We identified and began working on multiple custom measures in 2019, but completion will likely not take place until a later date. Because the pricing of Tier 2 RECs was lower than the cost of implementing Tier 3 programs, purchasing excess Tier 2 was an effective strategy for keeping the Tier 3 compliance cost low. However, to accommodate the changing REC market prices, we have preemptively employed a Tier 3 marketing strategy to raise customer awareness around Energy Transformation Projects and increase uptake in the coming years.

2020 Program Overview

VPPSA proposes employing a similar strategy to meet the 2020 Tier 3 requirements while mitigating costs that could put upward pressure on rates. This includes a combination of prescriptive and custom measures and use of excess Tier 2 RECs.

Prescriptive Measures

VPPSA intends to expand its prescriptive measures offerings. Savings are estimated using measure characterizations created by the Tier 3 TAG. VPPSA's budget and estimated savings for prescriptive Tier 3 Programs is summarized below.

Cold Climate Heat Pumps

VPPSA will continue to offer customer rebates for the purchase of cold climate heat pumps ("CCHP".) In 2020 the rebate amount will be increased to $400. For customers that can demonstrate a defined level of building performance, the CCHP rebate will be increased to $500. The additional incentive serves to highlight the importance of overall building performance. In order to be eligible for the higher incentive amount, customers will need to demonstrate that their homes were weatherized according to a list of standards developed and circulated by the Department of Public Service ("DPS") during the CCHP measure characterization by the TAG.

Heat Pump Water Heaters

VPPSA will provide rebates to customers that install heat pump water heaters ("HPWH") to replace fossil-fuel fired water heaters. In 2019, VPPSA's post-purchase incentives were provided in conjunction with Efficiency Vermont's ("EVT") upstream rebates, which are paid to the equipment distributor. Because EVT and VPPSA were both claiming fossil fuel savings in 2019 for HPWH that replaced fossil-fuel water heaters, it was necessary to split savings and costs between the two entities. VPPSA continues to urge EVT to avoid using Thermal Energy and Process Fuels ("TEPF") funds for incentives on electrification measures. For 2020, VPPSA and EVT have agreed that VPPSA will fund 100% of the upstream rebate for HPWH that replace fossil fuel systems and thus will claim 100% of the fossil fuel savings in the form of Tier 3 credits. Efficiency Vermont will fund the upstream rebate and claim the associated savings for HPWH that are installed to replace *electric* water heaters.

Electric Vehicles and Plug-In Hybrids

Despite lower operating and maintenance costs associated with electric vehicles ("EVs") and plug-in hybrid electric vehicles ("PHEVs"), the upfront cost continues to be a major barrier to greater EV penetration in the state. EVs and PHEVs remain a relatively low percentage of overall vehicle sales in the state. According to Drive Electric Vermont, the number of plug-in vehicles (EVs and PHEVs) in the state increased by 676 vehicles, or 26%, over the past year. These vehicles comprised 4.1% of new passenger vehicle registrations over the past quarter. Nonetheless, there were only 3,288 plug-in vehicles registered in Vermont as of July 2019.

VPPSA is working to raise awareness of the benefits of plug-in vehicles and help alleviate the financial barriers to EV and PHEV adoption. VPPSA will continue to offer customer rebates for the purchase or lease of EVs and PHEVs and raise the rebate levels in 2020. The customer incentive for purchasing or leasing a new electric vehicle will be $1000 and the customer incentive for purchasing or leasing a new plug-in hybrid electric vehicle will be $500. Low-income customers[2] will receive an additional $400 towards the purchase or lease of an EV or PHEV.

To further expand on this program, VPPSA is adding incentives for purchasing used EVs and PHEVs. The customer incentive will be $500 for the purchase of a used EV and $250 for the purchase of a used PHEV. We are also adding a $500 incentive for the purchase of a Level 2 Charger.

Forklifts

Several industrial customers in VPPSA Members' territories utilize forklifts in their operations. Because the potential fossil fuel savings from converting diesel forklifts to those powered by electricity is significant VPPSA will actively work with these customers to determine whether a conversion is feasible. We are adding a rebate incentive of $3000.

Golf Carts

VPPSA has identified opportunities to switch golf carts from fossil fuel to battery powered. We are adding a rebate incentive of $50.

Lawn Mowers

VPPSA will be adding both commercial and residential lawn mower incentives. A rebate of $25 for a residential lawn mower and $1,000 for a commercial lawn mower will be available in 2020.

E-Bikes

Utility customers have expressed interest in e-bikes, which has led VPPSA to add a rebate incentive of $100 for the purchase of a new e-bike or e-bike conversion kit.

[2] According to the PUC's *Order Implementing the Renewable Energy Standard* dated 6/28/2016, "A low-income customer shall be defined as a customer whose household income is at or below 80% of Vermont statewide median income.

Measure	Savings/Unit (MWh)	Incentive Amount	Admin Cost	Total Cost	Volume	Cost/MWh	Credit (MWh)	Budget
EV	31.88	$1,000	$403	$1,403	16	**$44.00**	510	$22,443
PHEV	24.55	$500	$310	$810	18	**$33.00**	442	$14,582
EV (Low Income)	31.88	$1,400	$403	$1,803	5	**$56.55**	159	$9,013
PHEV (Low Income)	24.55	$900	$310	$1,210	5	**$49.29**	123	$6,050
EV (Used)	15.94	$500	$201	$701	4	**$44.00**	64	$2,805
PHEV (Used)	12.27	$250	$155	$405	4	**$33.01**	49	$1,620
CCHP	21.74	$400	$275	$675	42	**$ 31.03**	913	$28,333
CCHP (Weatherized)	26.84	$500	$339	$ 839	8	**$31.26**	215	$6,712
HPWH	14.23	$650	$180	$830	10	**$58.31**	142	$8,297
Level 2 Charger	16.75	$500	$212	$ 712	4	**$42.48**	67	$2,805
Forklift	89.64	$3,000	$1,132	$4,132	3	**$46.10**	269	$12,397
Golf Cart	3.24	$50	$41	$91	25	**$28.06**	81	$2,273
Lawn Mower (Residential)	1.51	$25	$19	$44	20	**$29.19**	30	$881
Lawn Mower (Commercial)	52.35	$1,000	$814	$1,814	2	**$28.15**	129	$3,628
E-Bike	5.3	$100	$67	$167	10	**$31.57**	53	$1,667
TOTAL					**176**	**$38.06**	**3,246**	**$123,549**

Custom Measures

Commercial and industrial ("C&I") customers will be served on an individual, custom basis in 2020. VPPSA continues to explore cost-effective Tier 3 custom projects, including converting utility customers from diesel generators to electric service. In addition, C&I customers that have potential Tier 3 projects are being identified by Efficiency Vermont through a joint arrangement with VPPSA to ensure that these customers receive comprehensive efficiency services. To date, opportunities have been identified at ski resorts, a furniture maker, a quarry, and a candy manufacturer. Due to the long ramp-up time expected for these projects, completion will likely take place after 2020. The Tier 3 savings would be claimed in the year the project is completed. VPPSA will continue to work with the DPS on custom projects to ensure savings claims are valid and able to be evaluated.

Tier 2 RECs

To the extent that there is a shortfall in savings from the prescriptive and custom measures, VPPSA will purchase Tier 2 RECs when prices are low as a hedge against a shortfall in savings from Tier 3 programs. To the extent that Tier 2 RECs are less expensive than implementing Tier 3 programs, VPPSA will exercise this strategy to benefit its members. For VPPSA members that own Tier 2 eligible generating resources, Tier 2 RECs may be the primary strategy for Tier 3 compliance.

Should REC prices increase, VPPSA will reevaluate its incentive levels and potentially increase the rebate value. In that situation, VPPSA would re-file its annual Tier 3 planning document.

Demand Management

Over the long-term, Tier 3 programs have the potential to significantly increase loads for Vermont utilities. Through ongoing distribution planning efforts, the VPPSA members have identified that their systems remain robust, and the expected growth in annual and local peak demand associated with proposed measures can generally be sustained if monitored and deployed carefully.

VPPSA has established a partnership with Virtual Peaker, allowing us to assist our members in demand-response programming. In 2020, VPPSA will be piloting the following demand-response programs to keep peak load and the cost of electricity at a minimum:

1. Internal utility behavioral demand-response program to strategically maximize load-reducing generation
2. Active demand-response programs to control electric devices including CCHPs, HPWHs, and Level 2 chargers

VPPSA is also exploring partnerships outside of Virtual Peaker to best deploy demand-response programming.

Equitable Opportunity

The Tier 3 incentives described above will be available to all VPPSA member utility customers. The ability to bring financial benefits to all customers, rather than just participating customers, makes electrification an attractive Tier 3 option from an equity perspective. If additional kWh can be procured at costs at or below the costs embedded in a utility's rates, increasing the number of kWh delivered through the utility's system allows the fixed costs of operating the utility to be recovered over a larger number of units, driving the per kWh rate down.

VPPSA's analysis shows that the incentive dollars paid to customers in rebates for electrification measures are expected to be recovered through increased sales over the life of the measures, making these programs revenue neutral or, more likely, economically beneficial for non-participating ratepayers.

Partnership, Collaboration, and Marketing

VPPSA plans to continue actively working with both public and private partners to best execute our Tier 3 plan in the most cost-effective way.

VPPSA is participating in administering the VTrans electric vehicle incentive. The VTrans incentive is offered on the sale of any vehicle registered in Vermont. The value of the VTrans incentive is dependent upon the owner's household income level. Participating car dealers will sell the vehicle at a price reduced by the statewide incentive. The dealer will then submit the customer's information and vehicle details to VPPSA. VPPSA will batch the incentives on a monthly basis and send the information to VTrans with a summary report and invoice. VTrans will pay VPPSA for the state incentive, which VPPSA will then remit to the dealer. We anticipate that stacked incentives and collaboration with car dealers will help to increase participation in VPPSA's electric vehicle rebate program.

VPPSA and EVT are working together to define how the two entities can provide holistic efficiency services to residential, commercial, and industrial customers. In many cases, this partnership involves VPPSA providing incentives for electrification measures, which can provide benefits to all VPPSA utility customers, while EVT provides incentives for thermal and electric efficiency measures.

VPPSA and EVT are also working closely on the Energy Savings Account pilot, which involves Ethan Allen and the Village of Orleans. This pilot allows Ethan Allen to engage in

electrical efficiency measures and helps to identify opportunities for strategic energy transformation projects.

Two VPPSA member utility areas have been selected for EVT's 2020 Targeted Communities. The Village of Johnson and the Village of Orleans will both receive enhanced services from EVT for efficiency. This is yet another opportunity to explore strategic electrification for customers while reducing overall energy burden. The 2020 Targeted Communities effort is designed to have the greatest impact on low-income households.

VPPSA is taking on a greater role in utility customer interaction. Historically, the individual VPPSA member utilities were responsible for customer outreach. With the addition of Tier 3 projects, VPPSA will educate utility customers on the available incentives through use of the following:

- VPPSA website
- VPPSA member utility websites
- Social media
- Front Porch Forum
- Collaborative events and workshops
- Car dealer outreach
- EVT contractor and distributor outreach

REQUEST FOR PROPOSALS

FOR

ELECTRICITY STORAGE FACILITIES

Issue Date:	October 23, 2020
Response Deadline:	December 4, 2020

TABLE OF CONTENTS

1. Overview & Structure

Vermont Public Power Supply Authority (VPPSA) is a joint action agency and instrumentality of the State of Vermont with broad authority to buy and sell electricity for its eleven non-profit, public power electric utilities ("Members") in Vermont.

By this Request for Proposals (RFP), VPPSA is seeking potential development partners for electric storage facilities in its Member service territories.

VPPSA and its Members are open to a wide variety of proposals as described herein, and have identified potential sites in their service territories that may be suitable for locating storage facilities. These sites are discussed in Section 4.1, and VPPSA is requesting initial proposals for the feasibility and development cost of these "Existing Sites".

- VPPSA is seeking potential development partners for electric storage facilities.
- VPPSA is requesting initial proposals for the feasibility and development cost of Existing Sites.

As described in Section 4.2, "New Sites" may also be identified by potential partners in response to this proposal. Such proposals are encouraged. Finally, VPPSA's Members are open to a variety of ownership structures, including Purchase Power Agreements (PPAs), direct ownership, and other structures.

1.1 RFP Structure

This Request for Proposals (RFP) is divided into eight sections.

1. Overview & Structure
2. Operational Requirements
3. Facility and Site Requirements
4. RFP Structure and Schedule
5. Proposal Components
6. Evaluation and Selection Process
7. Proposal Submittal Requirements
8. Other Terms

2. Operational Requirements

The primary purpose of the storage facilities is to reduce coincident monthly and annual peaks with ISO New England. Reducing these peak loads reduces transmission and capacity costs in ISO New England's markets. Other applications for the storage facilities may include renewables integration, microgrid mode for emergency resilience, and other value-added modes of operation.

Table 2-1: Operational Requirements

APPLICATION	DESCRIPTION
Peak Load Reduction	*Required*. The primary purpose of the storage facility is to reduce coincident monthly and annual peaks.
Renewables Integration	*Desired*. The secondary purpose of the storage system is to manage the distribution system in the presence of increasing levels of behind-the-meter renewable generation (primarily hydro and solar).
Microgrid for Resiliency	*Desired*. This mode of operation is desired if the location of the facility is near critical facilities that can be cost-effectively incorporated into a microgrid for use during emergencies.
Other Applications	*Optional*. Other value-added applications or modes of operation will be considered.

The timing of the coincident peaks is summarized in Table 2-1, and corresponds well with the timing of the annual peaks, which have occurred in July at hour ending (HE) 18 for the past two years. With some exceptions, the storage facility would need to be fully charged by HE 17 and be discharging between HE 18 and 21.

Table 2-2: Timing of Monthly Peaks (Hour Ending)

	MONTH											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
2015	18	19	19	21	16	19	18	21	20	19	18	18
2016	18	19	19	21	21	21	19	21	20	19	18	19
2017	18	19	19	20	20	15	21	18	20	19	18	18
2018	18	19	8	12	21	21	20	20	20	19	18	18
2019	18	18	19	20	19	21	21	19	19	19	18	8

- *The decision to operate the storage facility for peak load reduction may rest with either the Respondent or VPPSA, and Respondents should express their preference for holding this responsibility and the associated performance risk.*

3. Facility and Site Requirements

3.1 General Requirements

1. The Facility or Facilities must be an electric energy storage facility.

2. The Facility or Facilities must be less than or equal to 4.9 MW (AC) in size at any one location, and Facilities less than 1 MW in size may be given preference.

3. The Storage Facility must interconnect with a VPPSA Member utility:

    - Barton Village Inc. Electric Department
    - Northfield Electric Department
    - Swanton Village, Inc. Electric Department
    - Town of Hardwick Electric Department
    - Village of Enosburg Falls Water & Light Department
    - Village of Jacksonville Electric Company
    - Village of Johnson Water and Light Department
    - Village of Ludlow Electric Light Department
    - Village of Lyndonville Electric Department
    - Village of Morrisville Water & Light Department
    - Village of Orleans Electric Department

4. The Delivery Point for the Facility shall be the point where the VPPSA Member distribution system connects with the Seller's Facility, specifically the load side connection of existing Member facilities, to allow Respondent's facility to operate interconnected and in parallel with the Member's electric system.

3.2 Products Requirements

Responses should assume that VPPSA or its Member utility will retain the peak-reducing benefits of the Facility, and may propose to retain any or all of the other products associated with the Facility.

3.3 Physical Requirements

The preferred location, capabilities and ISO market participation of the Facility are listed in Table 3-1. The preferred location is on the distribution system, but colocation with new or existing generation will be considered as will large customer sites. The capacity of the Facility should be less than 5 MW, and longer durations are preferred. Finally, unless greater value can be captured by participating in ISO-NE markets, the storage system is expected to operate independent of ISO-NE energy, capacity and ancillary markets.

Table 3-1: Physical Requirements

TERM	DESCRIPTION
LOCATION	1. Distribution systems of VPPSA municipal utilities, and/or 2. Renewable generators on municipal distribution systems, or 3. Large customers of VPPSA municipal utilities.
CAPACITY	100 – 4,900 kW.
DURATION	4+ hours
ENERGY	TBD based on the optimal capacity and duration of the system.
ISO-NE	Unless greater value can be captured by participating in ISO-NE markets, the storage system will operate independent of ISO-NE energy, capacity and ancillary markets.

3.4 Financial Requirements

Table 3-2 summarizes the high-level financial terms that are being sought. The preferred ownership option is a 10+ year PPA with a purchase option where O&M costs are the responsibility of the Seller. However, direct ownership by VPPSA or one of its individual Members will be considered. Respondents are encouraged to offer their preferred ownership structure. In terms of pricing, a fixed $/kW-month charge is preferred, but other pricing structures will be considered.

Table 3-2: Financial Requirements

TERM	DESCRIPTION
BUYER	Vermont Public Power Supply Authority and/or VPPSA Member
SELLER	To be determined (TBD)
TERM	10 years. Longer terms will be considered.
OWNERSHIP	A PPA is preferred where O&M is the responsibility of the Seller. Other structures, including direct ownership, may be considered.
PRICE	A fixed $/kW-month charge is preferred. Other price structures will be considered.

3.5 Existing Sites

Table 3-3 lists Existing Sites that have been identified as having potential for storage development. Respondents may focus their proposals on these sites or propose a New Site as described in the next section. These sites have established or can readily establish site control and are located close to the indicated substation.

Table 3-3: Existing Sites

UTILITY	SITE NAME	ADDRESS	SUBSTATION	VOLTAGE
Enosburg Falls	Waste Water Pumping Station	387 St. Albans St.	Enosburg Substation	46 kV
Enosburg Falls	Public Works Building	210 Dickenson Ave.	Enosburg Substation	46 kV
Lyndonville	National Guard Garage	Hill St., Lyndonville	VELCO's Lyndonville Substation	115 – 34.5 kV
Northfield	King St. Substation	150 King St., Northfield	King St. Substation	12.47 kV
Barton & Orleans	Heath Substation	Baird Road, Orleans	Heath Substation	46 kV
Morrisville	Trombley Hill	Trombley Hill, Morrisville	Morrisville's Substation #5	34.5 – 12.5 kV

Neither VPPSA nor any of its Members have conducted any analysis of the sites identified in Table 3-3, nor has VPPSA or any Member evaluated any interconnection constraints at these locations. Interconnection cost estimates and any feasibility analyses will need to be completed before a proposals is chosen.

In preparing responses to this RFP, respondents will not be allowed to perform detailed site visits of any identified sites. Such detailed site visits will be limited to respondents that reach the second round of screening. However, municipal sites are open to the public, and many sites can be viewed from various nearby locations, or via desktop methods. Any observed unique features of a site relevant to development should be clearly described.

3.6 New Sites

In addition to sites identified Section 3.5, Respondents are encouraged to offer New Sites for development of storage facilities. If a Respondent offers a New Site, a description of the site including physical address (and/or GPS coordinates), level of Respondent site control, unique features of the site, and any other relevant information should be included in the RFP response. To the extent that these features require additional cost, this should be clearly described in the response.

4. RFP Structure and Schedule

VPPSA intends to hold a two (2) round process.

4.1 Round One

This RFP represents the first round, and its purpose is two-fold.

i. The primary purpose is to identify a short list of qualified development partners.

ii. The secondary purpose is to identify a short list of potential sites, and to prioritize them by their feasibility, cost, and other characteristics.

- Round 1 requires an initial *non-binding* cost estimate and site feasibility assessment. Through these estimates and assessments, Respondents have the opportunity to make a show of interest in the RFP and to illustrate their qualifications.

4.2 Round Two

The second round will consist of a Requests for Proposals that is issued only to selected Respondents.

i. The goal of this round is to select a partner or partners to develop site(s) in 2021.

ii. Responses to this round will be binding, and may include site visits.

4.3 Schedule

The schedule is illustrated in the table below. VPPSA reserves the right to modify this schedule at its sole discretion.

Table 4-1: RFP Schedule

DATE	EVENT
October 23, 2020	Round One begins. VPPSA issues the RFP.
November 13, 2020	Pre-bid conference call at 2:00 PM
December 4, 2020	Round One ends. Deadline to respond to RFP.
January 15, 2021	VPPSA issues second round RFP to selected respondents.
February 26, 2021	Round Two ends. Deadline to respond to RFP.
March 26, 2021	Project awards are announced. (Tentative)

5. Proposal Components

5.1 Statement of Qualifications

Respondents shall provide a statement of qualifications containing the following elements (maximum of 5 pages):

(a) Experience: Respondents must include a description of similar projects, including experience with public entities and experience in Vermont.

(b) Project Team/Partner Resources: Respondents must include a proposed project team, including known financial partners. Include a brief summary of the project team's professional background and experience.

(c) References: Respondents must include at least three client or partner references. Public partner references are preferred.

5.2 Site by Site Proposal(s)

Each site identified as viable for a storage facility should be developed as a standalone proposal that can be evaluated individually. For each location that is proposed for development, the Response should include the following.

(a) Project Proposal: Respondents must include a detailed description of the existing sites for which the Respondent believes a storage facility is feasible and/or any New Sites. Proposals should include the type of storage technology, manufacturer, description of all anticipated equipment, and an explanation of any modifications of the property that might be required, required permitting, and any other relevant conditions.

(b) Operating & Dispatch Plan: Respondents must includes a detailed operating and dispatch plan that illustrates what time of day and how often each month the facility would be operating in a particular mode. In addition, the plan must address which entity holds the power to make dispatch decisions and how the operating risk(s) (peak forecasting risk, primarily) is borne by the parties.

(c) Finance and Ownership Structure: Respondents must include the type of ownership structure proposed and the estimated cost associated with that structure. Multiple ownership structures for the same site may be proposed. Any financing vehicles expected to be utilized should be clearly described. The information submitted must be sufficient for VPPSA to determine the total estimated project cost. Interconnection cost estimates should be made and included in the overall cost; interconnection agreements and interconnection applications are not required for this RFP.

(d) Operations and Maintenance Costs: Respondents must include estimated operations and maintenance costs, and if the Respondent has the capability to provide O&M Services.

(e) Development Risk: Respondents must identify the risks to the project's development and provide a plan for managing them.

(f) Estimated Timeframe: Respondents should include an anticipated timeline for development of the project.

5.3 Required Agreements

Respondents should identify any contracts and agreements that need to be in place with VPPSA and/or its Member to facilitate project development.

6. Proposal Submittal

6.1 Submission of Responses

(a) Name and Address of the Respondent's primary contact should be clearly identified on the first page of the proposal.

(b) Proposals for more than one site and/or ownership structure should be included in a single package response to the RFP.

(c) Respondents shall submit one digital, e-mailed copy of the proposal. Paper copies will not be accepted.

(d) All proposals must be received by VPPSA no later than **December 4st, 2020, as indicated on the timestamp on the submitting e-mail.** Proposals and/or modifications received after this time will not be accepted or reviewed.

(e) Proposals and Questions should be directed to:

Shawn Enterline
Senior Power Supply Analyst
Vermont Public Power Supply Authority
5195 Waterbury Stowe Road
Waterbury Center, VT 05677
senterline@vppsa.com

6.2 Question Submittal and Pre-Bid conference

Entities considering responding to this RFP who provide a notice of interest via email to the contact listed in Section 6.1 not later than **November 10th, 2020** will be invited to the pre-bid conference call on **November 13th at 2:00 PM.**

Such notice will enable the Respondent to receive any additional communications from VPPSA related to this RFP, including, but not limited to answers to questions raised by other potential Respondents.

Questions may be submitted in advance of any pre-bid conference call to senterline@vppsa.com. Responses to questions, to the extent provided, will be provided to all who have provided notice of interest.

7. Evaluation Process

Proposals will be opened and reviewed for completeness immediately following the submittal deadline. VPPSA will review the proposals for economic viability and intends to select multiple Respondents for each viable location for Round Two.

VPPSA reserves the right to reject proposals or eliminate sites from further consideration at its own discretion. VPPSA reserves the right, where it serves its interest, to request additional information or clarification from Respondents. VPPSA understands that the initial round of RFP is very broad in scope, and further clarity may be required as options are explored. Respondents are urged to make their proposals as detailed as possible, while identifying areas where further detail is required or risks are apparent.

The RFP process may result in multiple Respondents being chosen for one or more sites and ownership structures.

There will not be a public bid opening.

7.1 Evaluation Criteria

Proposals will be evaluated on the following criteria.

(a) Total Project Cost,
(b) Net cost, including risk, to VPPSA and/or Members,
(c) Location – Member Existing Sites or desirable New Sites,
(d) Qualifications of Respondents and Personnel assigned to project,
(e) Ownership Structure,
(f) Community Support.

In addition, the overall fit of the proposal will be considered, including combinations of siting, experience, ownership structure(s) and cost.

The lowest cost may not necessarily be chosen.

8. Other Terms

8.1 Conflicts of Interest

Respondents must certify that no elected official from a VPPSA Member system will benefit financially or materially from acceptance for this procurement.

Any alleged oral agreement or arrangement by a Respondent with any employee of VPPSA or VPPSA Member will be considered grounds to reject a proposal.

8.2 Confidentiality

Due regard will be given for the protection of proprietary information contained in all proposals received. However, Respondents should be aware that all materials associated with their submittals are subject to the terms of the Vermont Access to Public Records Act (1 V.S.A. Chapter 5, Subchapter 3) and all rules, regulations and interpretations resulting from, and any other applicable rules, regulations or judicial decisions regarding access to the records of government.

If confidential treatment is requested as part of the proposal, it will not be sufficient for Respondents to merely state generally that the proposal is proprietary in nature and not therefore subject to release to third parties. The pages or sections which a Respondent believes to be proprietary must be specifically identified as such and must be separated from other sections or pages of their proposal. Convincing explanation and rationale sufficient to justify each exemption from release consistent with Section 316 of Title 1 of the Vermont Statutes Annotated must accompany the proposal.

The rationale and explanation must be stated in terms of the prospective harm to the competitive position of the Respondent that would result if the material were to be released and the reasons why the materials are legally exempt from release pursuant to the above cited statute. The final administrative authority to release or exempt any or all material so identified, rests with VPPSA.

8.3 Collusion

By responding to this RFP, the Respondent implicitly states that the proposal is not made in conjunction with any competing Respondent submitting a separate response to this RFP and that it is in all respects fair and without collusion or fraud.

8.4 VPPSA's Rights

Neither VPPSA nor VPPSA Members shall be liable for any costs incurred by Respondents in the preparation of proposals or for any work performed prior to the approval of any executed contract.

All proposals upon submission become the property of VPPSA. VPPSA reserves the right to request additional information to assess and evaluate proposals.

VPPSA reserves the right to reject any or all responses to the RFP, to partner with Respondent(s) best suited to VPPSA or VPPSA Member interests, or re-issue the RFP.

This RFP in no way obligates VPPSA to contract with or otherwise partner with any Respondent.