

2020 Resource Report

Village of Ludlow Electric Light Department

9 Pond Street
Ludlow, VT 05149
Phone (802) 288-7766

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the Vermont Public Utility Commission
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Submitted by:

Vermont Public Power Supply Authority
on behalf of the Village of Ludlow Electric Light Department
in fulfillment of Vermont Public Utility Commission Rule 5.206(B)



Overview & Introduction

As a member of the Vermont Public Power Supply Authority (VPPSA), Village of Ludlow Electric Light Department (“LED”) relies on VPPSA to plan for and manage its power supply in New England’s wholesale markets. In this role, VPPSA not only manages LED’s power supply in the ISO New England’s (ISO-NE) wholesale power markets, but also plans for and solicits new power supplies for LED and its other municipal utility members.

The information contained in this report describes LED’s power supply needs and acquisition strategy over the next five years. It is divided into four sections.

I. Electricity Demand

This section shows how electricity demand has changed over the past five years, and forecasts the demand for the upcoming five years.

II. Electricity Supply

This section describes each resource in LED’s portfolio of supplies, as well as the new resources that have been acquired over the past year.

III. Electricity Supply & Demand

This section illustrates the balance between the supply and demand for energy, capacity, and renewable energy credits.

IV. Anticipated Transactions & Acquisition Strategy

This section lists the resources that are expected to be acquired over the upcoming five-year period, and outlines the strategy for procuring them.

Electricity Demand

In 2020, LED's energy requirements¹ ("Load") totaled 54,666,204 kWh, and its coincident annual peak with ISO-NE was 6,681 kW on July 27th at hour ending 18. As shown in Table 1, LED's energy requirements have fluctuated up to 13% per year while its peak loads have fluctuated up to 50%. These fluctuations are a function of LED's two largest customers, Okemo and Imerys, whose operations have a large impact on LED's loads.

Table 1: Historical Loads

Year	Load (kWh)	% Change	Peak Load (kW)	% Change
2016	49,603,025	0.2%	6,403	9.6%
2017	50,752,427	2.3%	5,510	-13.9%
2018	57,455,289	13.2%	8,295	50.5%
2019	59,477,242	3.5%	8,269	-0.3%
2020	54,666,204	-8.1%	6,681	-19.2%

LED's peak and energy needs are forecasted annually using a multiple regression model whose inputs include historical loads, weather, and economic variables like employment and income. These forecasts are adjusted for anticipated changes in net metering, heat pump and electric vehicle penetrations. Table 2 shows the results of the most recent 5-year load forecast.

Table 2: Forecast Loads

Year	Load (kWh)	% Change	Peak Load (kW)	% Change
2021	59,288,080		7,032	
2022	59,540,770	0.4%	7,092	0.9%
2023	59,808,000	0.4%	7,152	0.9%
2024	60,248,520	0.7%	7,213	0.9%
2025	60,300,870	0.1%	7,275	0.9%

Assuming normal weather, loads (kWh) are forecast to increase by 0.1-0.7% per year. Peak loads (kW) are expected to increase by 0.9% per year.

¹ LED's energy requirements ("Load") account for behind-the-meter hydro generation, transmission losses, and adjustments for Vermont's Standard Offer Program. Also known as "Total Load - Including Losses, it is not the same as LED's Real-Time Load Obligation (RTLO) with ISO New England.

Electricity Supply

LED's power supply is made up of long-term contracts and short-term contracts. The resources in LED'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 LED's power supply costs against the cost of serving load in ISO New England's energy, capacity and ancillary markets. These power supply resources are summarized in Table 3.

Table 3: 2020 Electricity Supply Resources

Resource	2020 MWH	%	Fuel	Exp. Date
Chester Solar	1,848	3.2%	System	6/30/39
Fitchburg Landfill	6,321	11.0%	Landfill Gas	12/31/31
HQUS Contract	2,544	4.4%	Hydro	10/31/38
Kruger Hydro	4,457	7.8%	System	12/31/37
Market Contracts	8,581	15.0%	System	Varies
McNeil Facility	4,595	8.0%	Wood	Life of Unit
NYPA Niagara Contract	3,742	6.5%	Hydro	9/1/25
NYPA St. Lawrence Contract	80	0.1%	Hydro	4/30/32
Project #10	43	0.1%	Oil	Life of Unit
Ryegate Facility	1,710	3.0%	Wood	10/31/21
Seabrook 2018-22 Purchase	21,401	37.3%	Nuclear	12/31/22
Standard Offer Program	1,259	2.2%	Solar	Varies
Stony Brook Station	502	0.9%	Oil	Life of Unit
VEPPI Program	226	0.4%	Hydro	10/31/20
TOTAL RESOURCES	57,310	100.0%		

Total Load Including Losses	54,666			
ISO Exchange (+ Purchase/- Sale)	-2,644	-4.6%		

Resource Descriptions

The following bullets summarize the essential characteristics of each resource, and in some cases, include notes that describe unique aspects of the resource.

1. Chester Solar

- Size: 4.8 MW
- Fuel: Solar
- Location: Chester, MA
- Entitlement: 26.3% (1.26 MW), PPA
- Products: Energy, capacity
- End Date: 6/30/39
- Notes: The contract does not include the environmental attributes and appears as system mix in the summary table.

2. Fitchburg Landfill

- Size: 4.5 MW
- Fuel: Landfill Gas
- Location: Westminster, MA
- Entitlement: 17.035%, PPA
- Products: Energy, capacity, renewable energy credits (MA I)
- End Date: 12/31/31

3. Hydro Quebec US (HQUS)

- Size: 212 MW
- Fuel: Hydro
- Location: Quebec
- Entitlement: 0.205%, 0.435 MW, PPA
- Products: Energy, renewable energy credits (Quebec system mix)
- End Date: 10/31/38

4. Kruger Hydro

- Size: 6.7 MW
- Fuel: Hydro
- Location: Maine and Rhode Island
- Entitlement: 19.29%, 1.29 MW, 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 and appears as system mix in the summary table.

5. Market Contracts

- Size: Varies
- Fuel: New England System Mix
- Location: New England
- Entitlement: Varies (PPA)
- Products: Energy, 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. McNeil

- Size: 54 MW
- Fuel: Wood
- Location: Burlington, Vermont
- Entitlement: 2%, 1.08 MW, joint-owned through VPPSA
- Products: Energy, capacity, renewable energy credits (CT Class I)
- End Date: Life of Unit
- Notes: As the joint-owner, VPPSA has agreements with the Electric Department to pay for and purchase 1.2% of the unit's output.

7. New York Power Authority (NYPA)

- Size: 2,675 MW (Niagara), 1,957 MW (St. Lawrence)
- Fuel: Hydro
- Location: New York State
- Entitlement: 3.31%, 0.1 MW (Niagara PPA), 0.997%, 0.001 MW (St. Law. PPA)
- Products: Energy, capacity, renewable energy credits (NY System Mix)
- End Date: 9/1/25 (Niagara), 4/30/32 (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: 10% (4 MW) MW, 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 4.7% of the unit's output.

9. Ryegate

- Size: 20.5 MW
- Fuel: Wood
- Location: East Ryegate, VT
- Entitlement: 0.93280% (0.0093 MW), PPA
- Products: Energy, capacity, renewable energy credits (CT Class I)
- End Date: 10/31/2021

10. Seabrook 2018-22

- Size: 1,250 MW
- Fuel: Nuclear
- Location: East Ryegate, VT
- Entitlement: 2.805 MW On-Peak, 2.112 MW Off-Peak (PPA)
- Products: Energy, capacity, environmental attributes (Carbon-free nuclear)
- End Date: 12/31/2022

11. 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: 0.9456% (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 2020, 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.

12. Stony Brook Station

- Size: 352 MW
- Fuel: Natural Gas, Oil
- Location: Ludlow, MA
- Entitlement: 0.5283%, (1.86 MW), PPA
- Products: Energy, capacity, reserves
- End Date: Life of unit

14. VEPPI Program

- Size: Small hydro < 80 MW
- Fuel: Hydro
- Location: Vermont
- Entitlement: 0.8756% (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.

Newly Acquired Resources

In December 2020, LED replaced a portion of the Seabrook 2018-22 resource with a fixed-price, fixed-volume energy plus Renewable Energy Credit (REC) contract. This contract will hedge part of LED's energy and Tier I REC requirements over its term.

1. Brookfield 2023-2027

- Size: 8-10 MW On-Peak, 7-8.5 MW Off-Peak
- Fuel: Hydro
- Location: MA HUB
- Entitlement: 20-25% On Peak, 23.5-28.6% Off Peak
- Products: Energy, Tier I RECs
- Term: 1/1/2023 - 12/31/2027

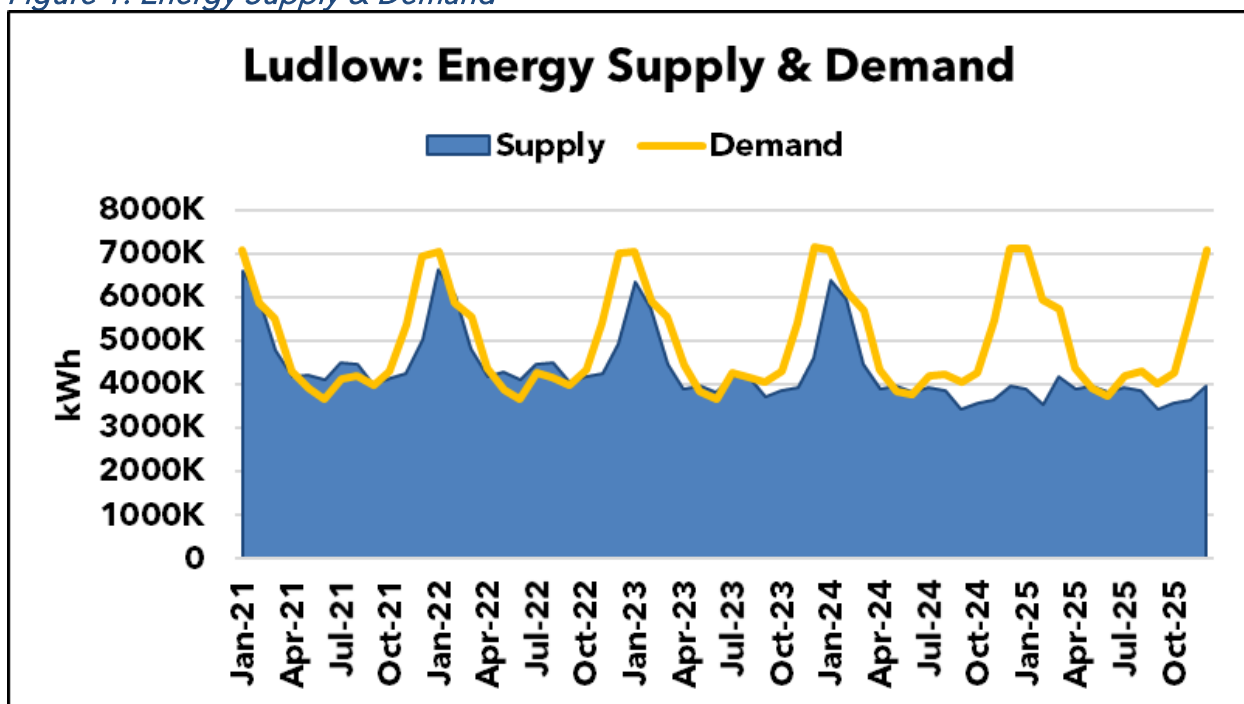
Resource Supply & Demand

Energy, capacity and Renewable Energy Credits (RECs) are the primary products that LED needs to manage, and the following sections illustrate the forecasted balance between their supply and their demand over the next five to twenty years.

Energy

Figure 1 shows the current forecast of energy supply and demand for the next five years. The forecast shows a slight deficit that fluctuates monthly with the operation of Okemo Mountain Resort. There are no significant deficits until 2023 and 2024. This is due to the expiration of the Seabrook 2018-22 PPA on 12/31/22 and a market contract on 6/30/24. We anticipate that these deficits will be hedged in 2021 using the On/Off Peak Energy process that is described in the next section.

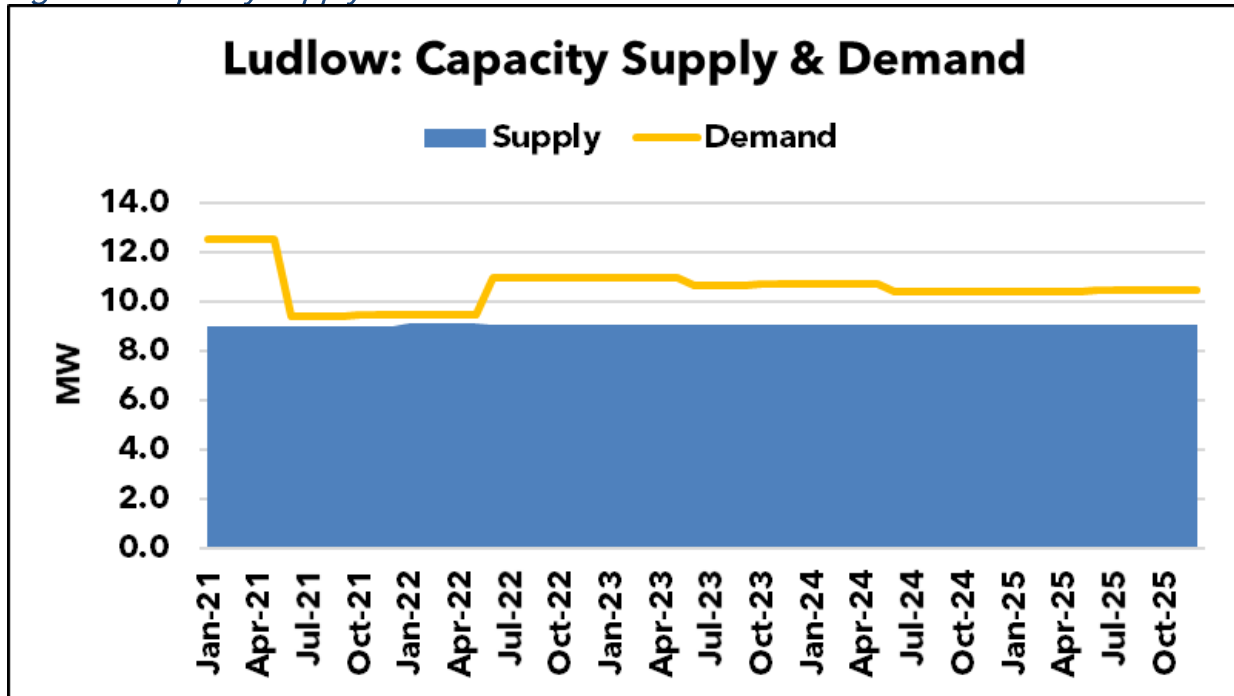
Figure 1: Energy Supply & Demand



Capacity

Figure 2 shows the capacity supply and demand balance for the next five years. The supply is forecasted to be about 10% lower than the demand for the next five years. However, this outcome depends on LED’s coincident peak load with ISO New England. LED’s largest customers can impact this peak significantly, and LED is actively working with them to reduce these peak loads.

Figure 2: Capacity Supply and Demand



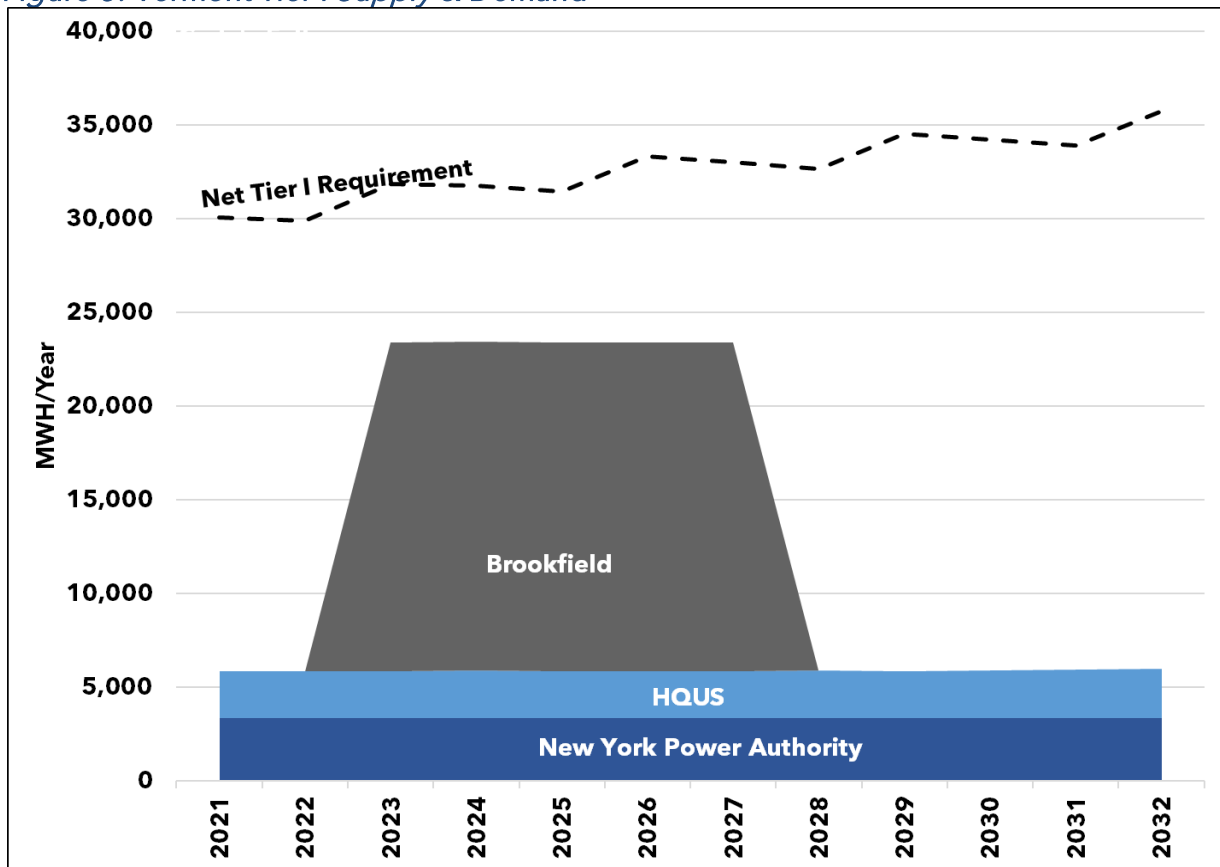
Renewable Energy Credits

Figure 3 and Figure 4 illustrate LED’s need for RECs under Vermont’s Renewable Energy Standard (RES).

Tier I

LED anticipates purchasing about 25,000 MWH/year of Tier I RECs through 2022. When the Brookfield 2023-2027 PPA comes into effect, this will drop to about 8,000 MWH/Year. After 2027, a new Tier I qualified resource will be necessary to meet the RES requirements.

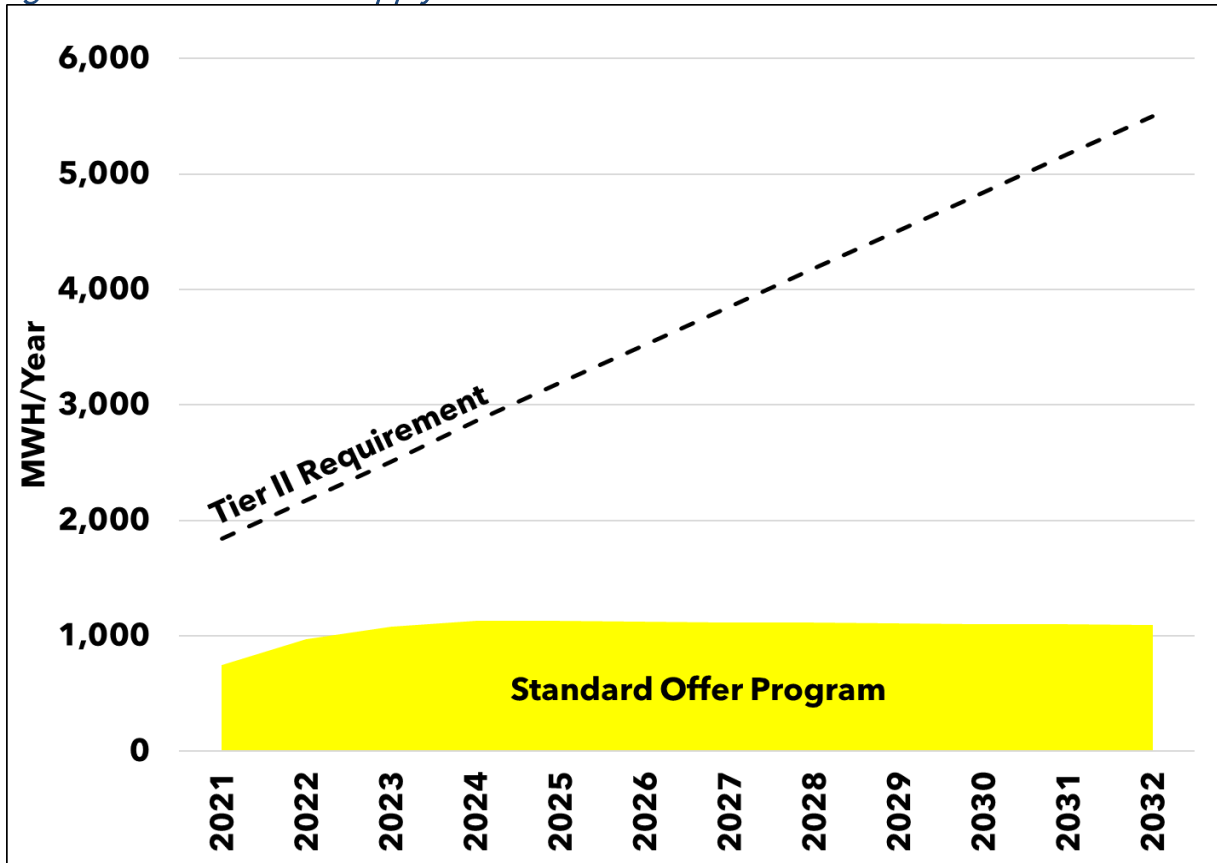
Figure 3: Vermont Tier I Supply & Demand



Tier II

LED anticipated purchasing 1,000 - 2,000 MWH/year of Tier II RECs through 2025. In addition, LED expects to participate in the development of a Tier II qualified resource, mostly likely a solar PPA.

Figure 4: Vermont Tier II Supply & Demand



Anticipated Transactions & Acquisition Strategy

VPPSA anticipates that LED may enter into one or more of the transactions that are listed in Table 4.

Table 4: Anticipated Hedging Transactions

Product	Action	Term	Quantity	Anticipated Price Range	Transaction Anticipated
7x24 Energy	Purchase or Sale	1 month	0-4 MW	\$25-\$75 /MWH	Monthly / Seasonally
On / Off Peak Energy	Purchase	1-60 months	0-4 MW	\$25-\$75 /MWH	Spring 2021
Long-Term Bundled PPAs	Purchase	5+ years	0-4 MW	\$25-\$75 /MWH	None anticipated.
Capacity	Purchase	5+ years	1 MW	\$2-\$5 /kW-month	None anticipated.
VT Tier I RECs	Purchase	1-5 years	8-25,000 MWH/Year	\$0.10 - \$1.50 /MWH	May / June 2021
VT Tier II RECs	Purchase or Sale	1-5 years	1,000-2,000 MWH/Year	\$10 - \$40 /MWH	May / June 2021

Energy Acquisition Strategy

7x24 Energy

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 LED. 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 LED 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.

On / Off Peak Energy

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 Bundled PPAs

VPPSA evaluates long-term Purchased Power Agreements (PPAs) for bundled energy, capacity, renewable energy credits, and/or ancillary products on an ongoing basis. Recently, LED has evaluated a solar PPA in partnership with Encore Renewables, and this year, LED anticipates that it may evaluate 1.) a contract extension with NextEra as the current Seabrook PPA expires at the end of 2022, and 2.) a hydro PPA that includes energy, capacity, and Tier I RECs. Because long-term PPAs are subject to PUC approval, the acquisition strategy is simply to negotiate the best terms and to make contract execution contingent on PUC approval.

Capacity Acquisition Strategy

Capacity is seldom acquired as a stand-alone product, and because market prices are fixed by the Forward Capacity Market three years in advance of the operating year, there is little opportunity to make short-term (< 5 year) capacity purchases. However, there is short-term opportunity on the demand side. For example, VPPSA forecasts monthly and annual coincident peak loads, and communicates the forecast of the peak day and hour to its members. As a result, all available demand-side actions are taken to reduce capacity requirements. This presently includes maximizing behind-the-meter generation such as load-reducing hydro, and demand response using VPPSA's contract with Virtual Peaker².

For long-term (>5 years) capacity purchases, the acquisition strategy is to bundle capacity into negotiations for long-term, bundled PPAs as mentioned in the previous section.

REC Acquisition Strategy

VPPSA acquires RECs on behalf LED and its other members during the quarterly trading periods that are defined in the NEPOOL Generator Information System (GIS)³. The acquisition strategy has three parts.

1. First, VPPSA completes an analysis of Tier I and Tier II requirements at the beginning of each quarter's trading period. Because REC banking is limited to three years, the analysis never calls for purchasing more RECs than can be used during that time frame.
2. Second, broker quotes are compared to historical prices and budgeted REC prices to decide when to purchase RECs.
3. In the event that no purchase opportunities arise during the first three trading periods, then VPPSA acquires the required RECs at prevailing market prices during the fourth quarter's trading period.

² More information on Virtual Peaker can be found on their website at <https://www.virtual-peaker.com/>.

³ <https://www.nepoolgis.com/>

Generation and Transmission Facility Transactions

Generation

VPPSA continues to work with Encore Renewables to develop Tier II qualifying solar projects within its members service territories. Because LED expects to have a deficit of Tier II RECs for the coming five years, LED may choose to develop and/or participate in a solar project in the coming year(s).

Transmission

VPPSA is currently working on a lease of LED's Phase I transmission rights. The terms of the lease have been under negotiation for much of 2020, and are expected to be completed in 2021.

Waiver Request

In accordance with Rule 5.204, LED requests a waiver of the notification for short-term transactions that will be subject to after-the-fact reporting, pursuant to Rule 5.206(A). These transactions could be up to five years in nature and are designed to either hedge LED's short-term exposure or maximize short-term value of existing resources. LED anticipates seeking individual waivers of any longer-term purchases as otherwise required by Rule 5.200, if necessary.