Appendix D: Summary of Recent Planning Studies

Planning Studies

We conduct studies to determine the feasibility, necessity, costs, and benefits of certain transmission and distribution projects. Here is a summary of recent study recommendations and project status.

Barre Area Study

The Study. Our Barre area study had a number of performance, reliability, and safety goals. One performance goal was to rebuild the area's substations, upgrading all existing 2.4-kV, 4.16-kV, and 12.47-kV circuit voltages to 12.47 kV, enabling several benefits: loading flexibility among the circuits, lowering line losses, enhancing feeder voltage profiles, permitting feeder backup throughout the area, enabling more load growth, allowing increased penetration of DERs, and lowering maintenance and equipment stocking costs. Rebuilding each substation to enable feeder backup throughout the area ensures that any one substation can be out of service while allowing all of that substation's load to be served by the other substations, thus substantially increasing reliability.

Outcomes. As a result, we rebuilt the Barre North End substation, the Barre South End substation, and the Websterville substation. All three substations have a new 15/28-MVA transformer and three 12.47-kV feeders. In addition, the Barre North End substation can support full feeder backup to the Barre South End substation and partial feeder backup to the Berlin substation; the Barre South End substation supports full feeder backup to the Barre North End substation and partial feeder backup to the Graniteville and Websterville substations; and the Websterville substation supports full feeder backup to the Graniteville substation and partial feeder backup to the Barre South End substation.

For more details on the construction of all three substations, see Appendix D: Transmission and Distribution Projects.

Rutland Area Study

The Configuration. The greater Rutland area includes the 46-kV subtransmission system with associated distribution systems. VELCO's North Rutland, Cold River, and Blissville substations' three 115-kV-to-46-kV transformers are the area's primary supply points. In addition, the recently acquired VMPD 46-kV subtransmission system, distribution system and loads, primarily supplied by the VELCO Florence 115-kV-to-46-kV transformer, is effectively islanded from the Rutland area 46-kV system.

The Study. In 2015, we completed our Rutland Area Study (required by Docket Nos. 7873 and 7874 Attachment II Screening Framework and Guidelines), which identified solutions to potential transformer overloads accompanied by line overloads and system under-voltages.

Outcomes. The study presented several solutions that are being addressed. As a result, we:

- Reconductored the 46-kV line from West Rutland to Florence.
- Permanently closed the 46-kV West Rutland B7 tie to the former VMPD system.
- Permanently closed the presently normally open second 46-kV line between Rutland and West Rutland and reconductored this line to enhance reliability. This closing resulted in two new 46-kV breakers at West Rutland, transfer-trip protection to the Glen and Patch generators, and approximately one mile of reconductoring on the 46-kV Rutland to West Rutland tap line.
- We continue to monitor area load growth to assure adequate reliability margins.
- Monitor the shapes of the daily peak load curve and annual load duration curve.
- Evaluate the impact of new company initiatives on Rutland area reliability margins.
- When the reliability margin is within three to four years of being exhausted, begin implementing the necessary resource options to reestablish adequate reliability margins.

Results from the Rutland Study listed seven resource options to close this three-to-four-year reliability gap. This hierarchical list of options is based on a cost-benefit analysis; in other words, the option with the lowest cost and most benefit is first. Also, these options are the ones recommended to be implemented today. As such, these options might change as technology advances and new opportunities arise. Nonetheless, here are the seven recommended resource options.

1. **Dispatch the new Stafford Hill energy storage facility following a contingency.** The facility already exists and its operating cost to regulate frequency is minimal. Because of its location, its effectiveness on a per MW basis would be high.

2. **Use smart meters to control hot water heating.** The cost of this option is minimal, since all capital costs have already been expended and operating costs are minimal. Targeted implementation of this water control program would have a profound effect on reducing load, especially in the North Rutland area.

3. **Island our operations headquarters following a contingency.** The cost of this option is minimal as capital costs have been expended, and its implementation would be the cost of fuel minus the wholesale cost of the avoided energy purchase. Since this option entails a backup diesel classified as "emergency use", its implementation

might include penalties. Its effectiveness on a per MW basis, however, would be high.

4. **Implement broad-based energy efficiency measures.** The cost of this option rises in conjunction with its use. As such, the cost-to-benefit ratio of its implementation would be higher than the first three options. The first three options, however, are shorter-term solutions (essentially constituting kilowatts of efficacy) whereas this option would have a greater effect (in MWs). This option, then, would keep the reliability gap from re-emerging for a longer period of time than would the combined impact of the first three options.

5. **Implement future initiatives (including E-Co).** This option's cost cannot be determined, while its impact would be similar to that of the first four options.

6. **Dispatch other new energy storage facilities following a contingency.** The cost for this option is substantial, while its impact would be similar to that of the first four options.

7. **Employ other renewable sources (such as biomass and bio-gasification).** This option's cost would be substantial (higher than option 6), while its impact would be similar to that of the first four options.

Legacy VMPD Subtransmission Lines Study

The Configuration. A 14-mile, 46-kV subtransmission line from the Huntington Falls hydro to our Salisbury switching station (formerly owned and operated by the Vermont Marble Power Division (VMPD) of Omya) connects both this hydro and the Beldens hydro (about 1.5 miles apart on Otter Creek in Addison County) to our distribution system.

The Problem. The proximity of this line to other 46 kV subtransmission lines uncovers the possibility of multiple system improvements: reduced reliability exposure, reduced maintenance expenses, enhanced aesthetics, improved system connectivity, and lower system losses.

The Study. We first studied these configurations in 2004, revisited in 2016 and finalized in 2021, to consider the feasibility, costs, and benefits of different options to improve system performance. One possibility connects the Huntington and Beldens hydro units directly to the VELCO Middlebury substation by constructing a 0.7-mile, 46-kV subtransmission line. The line would begin where the Huntington to Salisbury line crosses our Middlebury Lower to VELCO Middlebury 46-kV line, and end at VELCO Middlebury substation. This new line would allow us to decommission a nine-mile section of the 46-kV Huntington to Salisbury line.

Another possibility would be to build a four-mile, 46-kV subtransmission line to connect Huntington directly to the VELCO New Haven substation. This would transform the

radial line connecting the Huntington and Beldens hydro units to a networked line and allow us to return the 46-kV, 5.4-MVAR capacitor at the Hewitt Road substation to inventory.

Field review identified another option in 2021. This option would network the 46 kV by connecting GMP Line 60 Pole 113 to Line 77 Pole 17. Motor Operators would be installed at the junction of the two lines. This option would be lower cost and allow the decommissioning of a nine-mile section between 46-kV Belden to Salisbury line.

Outcomes. The project option identified in 2021 and is planned for construction in 2023.

Berlin to Mountain View Subtransmission Line Analysis

The Configuration. A three-mile, 34.5-kV subtransmission line, the 3325 line, extends from our Berlin #5 substation to our Montpelier substation. At the Dog River switch (a half-mile east of the Berlin #5 substation), a 0.7-mile radial tap line extends to the Mountain View substation. This substation not only supplies 12.47 kV loads to the Montpelier area, but also provides feeder backup to Montpelier substation distribution circuits and Berlin #40 substation distribution circuits.

The Problem. Preliminary analysis indicates that the one-half-mile line section between the Berlin #5 substation and the Dog River switch may thermally overload following the loss of the 115-kV-to-34.5-kV source at the VELCO Barre substation. In addition, the 0.7-mile radial tap line may thermally overload under certain feeder backup configurations.

The Study. Our study, completed in 2015, examined the thermal and voltage parameters of the 3325 line and the 0.7-mile radial tap line to the Mountain View substation. The study considered normal peak loads, post-contingency scenarios, the impact of increased distributed generation, and various feeder backup configurations. Three potential solutions emerged: reconductoring both the 3325 line and the 0.7-mile radial tap line; retiring the Dog River switch and upgrading the radial tap with a two-line, in-and-out configuration; and upgrading the Mountain View substation with a high-side circuit breaker and 34.5-kV switching capability.

Outcomes. Continuing the study and implementing a solution, while valuable, has been postponed to at least 2027 while we pursue other higher-priority projects.

Sheffield Highgate Export Interface (SHEI) Initiative

The Configuration. SHEI is a region in northern Vermont, bounded by the 115-kV loop spanning from the Sheffield to Lyndonville line (K39 line) to the Highgate to St. Albans line (K42 line). The 34.5 kV Johnson to Lowell line (B20 line) is a critical

subtransmission asset within the interface because it creates a parallel path back to the 115kV system creating a closed loop system.

The Problem. Power generated in northern Vermont exceeds local demand. Excess power is then transmitted to points south in the state. Under certain contingencies, this north to south transfer puts a tremendous strain on the existing aging electrical infrastructure, which could lead to voltage collapse or overloading of the transmission system. To handle these contingencies, ISO-New England created the SHEI to control power flow in the region by calculating a set of power export limits for different system configurations. When the system is in a specific configuration, ISO-New England institutes a limit of power that can be transferred across the interface. In many cases this results in the issuance of do-not-exceed (DNE) orders to generators in the region to mitigate contingencies before they happen. These DNE orders, however, lead to lost revenue for these generators—an untenable situation.

A Partial Solution. We implemented an automatic voltage regulator (AVR) upgrade at Sheldon Springs Hydro. This upgrade will help enhance the 46-kV voltage in the Highgate area, thus having a positive impact on the transmission SHEI voltage-based limit.

The Study. GMP and other Vermont utilities formed a working group to address the current problem in this region which adversely affects the generator stakeholders in the SHEI. Collectively, with the assistance of VELCO, we considered a number of alternatives identified in the Northern Vermont Export Study. That study work involved power flow simulation studies on the northern Vermont transmission system that assess the ability to reduce curtailment of wind generation by increasing the ability to transfer power across the SHEI for all lines in conditions and facility-out conditions. Power flow simulation analysis was performed for the existing system and for 45 alternative combinations containing one or more of the following upgrade elements: reactive support, 115 kV transmission, 34.5 kV and 46 kV subtransmission, and battery storage.[1]

The chosen Project represents a unique opportunity among those alternatives to reduce SHEI congestion with modest incremental costs to existing reliability-based projects. Accordingly, this Project represents the least-cost alternative among the SHEI mitigation strategies considered. The Project consists of three components:

1. Rebuild of the GMP Lowell 46/34.5 kV Substation

[1] See Northern Vermont Export Study, available at https://www.vermontspc.com/library/document/download/5995/VELCO_SHEI_Study_FinalReport.pdf.

2. Reconductoring upgrade of the 34.5 kV line between the GMP Lowell Substation and the GMP Johnson Substation ("B20 Line")

3. Reconductoring upgrade of a portion of the 34.5 kV line between the GMP Johnson Substation and the Morrisville #3 Substation ("B22 Line")

Outcomes. The GMP Lowell 46/34.5 kV work and B20 reconductoring has been completed. The B22 line work is in progress with expectation for completion in fiscal year 2022.

Killington Area Study

The Configuration. The existing GMP system that feeds the Killington Area includes: Two radial Taps off from different portions of the 46kV networked subtransmission system.

- One radial 46kV feed taps off from the networked 46kV line between the North Rutland Substation and the Walnut Street Substation. This tap is known as the Mendon Tap and is a radial 46 kV tap feeding the Mendon 46/12.47 kV, Mendon 46/34.5 kV and Snowshed 34.5/12.47 kV distribution substations.
- The second radial 46kV feed taps off from the networked 46kV line between the Bethel Substation and the Smead Road Substation. This tap is known as the Sherburne Tap and is a radial tap feeding the Sherburne 46/12.47kV distribution substation.

The Problem. GMP wants to improve the reliability performance of both the 46 kV subtransmission and 12.47 kV and 34.5 kV distribution systems feeding the Killington Area. In addition there is limited capacity available for load growth.

The Study. Our study, completed in 2020, examined twelve solution alternatives including traditional transmission infrastructure upgrades as well as a reactive dynamic device and Battery Energy Storage System.

Outcomes. Least cost solution includes following components:

- Snowshed to Sherburne 34.5 kV line (2.3 miles)
- Sherburne 46/34.5 kV transformer (28 MVA)
- Breakers at Sherburne Tap, Snowshed, Mendon and North Rutland Substations
- 2nd 46/34.5 kV transformer at Mendon Substation (28 MVA)
- North Rutland to Mendon 46 kV line (5.1 miles)
- Mendon to Sherburne 46 kV line (9.8 miles)

GMP needs to decide on the bus configurations for the Mendon, Snowshed and Sherburne Tap substations. We must pursue acquisition of land for the proposed substation work as well as rights of way for the new 34.5 kV and new 46 kV lines. This

project will not be budgeted prior to 2027 due to higher-priority projects, as well as upfront work needed to be completed prior to filing for this project.

Danby Area Study

The Configuration. GMP has a 46 kV radial system that is sourced from the VELCO Blissville 115/46 kV Substation. The H29 breaker protects the 25.94 mile 46 kV line (Lines 47, 48 and 50) that feeds four distribution substations including Poultney, South Poultney, Pawlet and Dorset. The GMP system also has a 46 kV radial system that is sourced from the GMP Marble Street substation. The B3 breaker protects the 20.59 mile feeder (Line 36) that currently serves one customer owned substation, in Danby.

The Problem. GMP wants to improve the reliability performance of 46 kV radial system fed from the VELCO Blissville H29. GMP also plans to construct a 46/12.47 kV substation in the Danby area, extending off the Line 36 that feeds the customer owned substation. This new substation will have the ability to back up the GMP Wallingford G23 circuit, which currently has no feeder backup. Therefore, GMP would like to strengthen and improve the reliability performance of the Marble Street B3 radial line as well. The scope of this Study is to identify the best alternatives to improve system reliability for these two radial systems.

The Study. Our study, completed in 2021, examined three alternatives:

1. New Danby Substation to Dorset Substation,
2. New Danby Substation to Pawlet Substation or
3. New Danby Substation to point where the new tie-line can intersect the existing Pawlet to Dorset 46 kV transmission line.

Outcomes. Alternative 1, a new 46 kV line connecting a new Danby Substation to the Dorset Substation, was the least cost. GMP needs to decide on the bus configuration for the Danby Substation and pursue acquisition of land for the new substation and rights of way for the new 46 kV line. This project will not be budgeted prior to 2027 due to higher-priority projects.

Ryegate Area Study

The Configuration. Green Mountain Power's (GMP) 34.5kV and 46kV networks are connected through a 34.5/46 kV autotransformer at GMP's Ryegate substation in Ryegate, VT. The substation's 34.5 kV bus is connected to two significant generation sources, (Dodge Falls Hydro, Ryegate Wood Energy) and is electrically near the McIndoes Falls. Currently the network is operated normally open on the 46kV side by the Bradford B-2 breaker.

The Problem. GMP wants to improve the reliability performance of both the 34.5 kV and 46 kV systems feeding the Ryegate area. We want to evaluate the potential for permanently closing the 46-kV subtransmission line at Bradford and creating a network from the VELCO Hartford substation instead. The scope of this Study is to identify the options to network these systems.

In addition this area of GMP's infrastructure has asset management concerns that need to be addressed. GMP wants to understand upgrades to improve reliability for this area and combine these upgrades with those for asset management.

The Study. This study has been deferred. Results from analysis completed in 2019 were under evaluation. NGRID was determined to be an affected utility and they would need to complete additional analysis on their system. Given GMP did not foresee completion of this project within the next five years, and the likelihood that study analysis would need to be redone, by both utilities, to capture system changes with respect to load, generation and general system and configuration changes, the study was put on hold.

Outcomes. Continue the study and implementing a solution within the next five years.

Studies to be Completed

Vergennes, Ferrisburgh, Weybridge and Hewitt Road Area. An influx of DER projects has saturated the 12.47-kV distribution systems in this area. These substations have virtually no feeder backup capability. We plan to study this area for how best to provide feeder backup at least-cost with the potential ancillary benefit of allowing for additional DER interconnections.

Legacy Studies

In April 2014, we developed a reliability plan for the St. Albans area, and provided it to the PUC and interested parties. Our analysis showed that the need date, even under a very aggressive growth scenario, was not until 2021. We continue to monitor this area for increases in peak demand and include our new toolset of DERs when reviewing future solutions.

In 2015, we filed the Rutland Area Reliability Plan, which proposed upgrades to improve reliability. These upgrades included eliminating a radial transmission line and recommended NTA options to address area load growth. With these measures, a large transmission build-out would not be needed for 10 to 20 years. We continue to monitor this area.

In 2016, we filed the Hinesburg Area Reliability Plan. This study supported deferring a proposed new Hinesburg substation with a battery energy storage system (BESS) to address load growth when it occurs. The actual timing of the BESS has not been determined. GMP has been monitoring area load growth and loads have not grown in recent years, with 2021 peak being 5.81 MVA (August 26, 2021 7:45PM) compared to 2015 peak at 5.91 MVA (January 7, 2015 6PM). Due to higher priority projects, GMP will defer the BESS, including purchasing property, until area load growth materializes.

In 2017 through 2020, GMP and the VSPC have not found any new areas where geographically targeted energy efficiency or DERs would have the potential to cost-effectively avoid or defer a transmission or distribution project. As such, no new reliability plans have been required or are currently under review.

Distribution Balancing and Optimization Projects

Completed Reconfiguration and Balancing Projects

We have reconfigured and balanced a number of circuits over the previous four years.

Barre City Circuits. We converted most of the remaining 2.4-kV and 4.16-kV circuits in the Barre area to 12.47 kV mainly to maximize their feeder backup capabilities.

Barre Town Circuits. We balanced the load and upgraded the circuit ties on the Websterville 61G1 circuit as part of the voltage conversion of the Graniteville substation and its circuits to 12.47 kV.

Mill Street to Silk Road. In 2021, the 2/0 Copper and 1/0 ACSR along Line 12 in Bennington was upgraded to 336ACSR to enhance feederbackup capability between the Mill Street G51 and the Silk Road G59 circuits.

Pownal to Bennington Circuit. In 2018, we rebuilt the Pownal to Bennington circuit with three-phase construction to enable feeder backup between the circuit's terminal Pownal and South Bennington substations.

South Brattleboro Substation. In 2018, the South Brattleboro substation, reducing its transformers from two to one, and its distribution circuits from four to three. By reconfiguring these circuits, we eliminated some cross-country lines and enhanced feeder backup.

Planned Reconfiguration and Balancing Projects

We constantly assess our transmission and distribution system. As such, we anticipate completing a number of circuit reconfiguration and phase-balancing projects over the next several years.

Castleton. In 2021, we are planning to balance the Castleton G37 circuit to allow for full feeder backup capability of the Hydeville G24 circuit.

Londonderry. We plan to balance the Londonderry G27 circuit to improve voltage performance and potentially increase hosting capacity for DG.

Milton Circuits. In 2019, we extended a circuit south from the Milton substation to provide feeder backup to the Catamount Industrial Park. We are also in the process of extending a circuit north from the Mallets Bay substation into this area. Together, these two projects promise to improve the balance among existing feeders and enhance feeder backup.

North Brattleboro to South Brattleboro. We plan to reconductor 1,700 feet of 1/0 Copper on Canal Street Poles 12 to 28 and 850 feet of 1/0 Copper on Walnut Street Poles 1 to 8, fed off the South Brattleboro G31 circuit. This project will improve feeder backup flexibility between North Brattleboro and South Brattleboro. This work is expected to be complete by spring 2022.

North Springfield. We have been converting the two-phase step-down area on Line 7 and Line 73 from 4.16 kV to 12.47 kV. This upgrade will relieve step-down transformer loading, improve voltage and lower losses. This work is expected to be complete in 2022.

Salisbury. In 2021, we are planning to reconfigure the Salisbury G23 circuit to pick up some load normally fed from Silver Lake G1 circuit. The Silver Lake 500 KVA transformer has had loading in excess of its nameplate. We have proposed a reconfiguration to move approximately 200 KW of load onto Salisbury G23, once we complete necessary line protection changes.

Sharon Circuit. We plan to balance the SHG35 circuit phase that is supplied by the Sharon substation to improve the DER hosting capability.

Sheldon Substation. The 12.47 kV circuit that originates at the Sheldon substation is long, carries high loads, and experiences low fault current. Over the past three years, we have rebuilt sections of this circuit with larger conductor, moved cross-country sections roadside, balanced the phasing, and installed voltage regulators. These improvements balance this circuit to reduce losses, improve its voltage profile, increase the fault currents, and improve system protection.

South Burlington Area. In 2020, We completed construction of the new Airport substation, in part, to upgrade the existing 4.16 kV circuits to 12.47 kV. In addition, we are presently reconfiguring the area's circuits among this new substation and the adjacent Essex, Gorge, Dorset Street, and Town Line substations. These reconfigurations lower losses, enhance feeder backup, and position the system for possible load growth.

Vernon Road to National Grid Huntington. We are looking into the possibility of upgrading approximately 2,500 feet of 2/0 Copper from Line 8 Pole 10 to 25, approximately 3,500 feet from Line 8 Pole 48 to 66 and upgrading from 1 phase and constructing new 3 phase line approximately 12,000' on the Vernon Road G57 to Vernon for possible feeder backup for the National Grid Huntington Substation that serves GMP customers. This will require approximately two miles of new spacer cable, a set of regulators, and new Viper recloser. There is no budgeted date for this given it is in the planning phase.

Winooski Step-Down Area. In conjunction with a possible Tier III electrification project, we plan to upgrade a three-conductor, two-phase step-down area to a three-phase step-down area, and convert this area from 2.4 kV to 12.47 kV. This upgrade will relieve step-down transformer overloading, improve the balance among phases, improve voltage profile, and lower losses.

Winooski City. In 2015, we built a new 34.5-kV distribution feeder from the Gorge substation into downtown Winooski. To leverage further this project, we plan to reconfigure the 34.5-kV feeders from the Winooski and Ethan Allen substations. This will be done in coordination with the Winooski Main Street redevelopment project to better balance the loads among these three feeders, optimize reliability, and enhance feeder backup capability.

Projects with Other Utilities

The electric grid is interconnected, and so are we with other area electric utilities. We continually interact with these utilities to exchange information and upgrade the grid for our shared benefit, but especially for the benefit of our customers. Our interactions with other utilities have increased since the adoption of Rule 5.500, which governs the interconnection of DERs.

Whenever GMP makes upgrades to our system or implements a system reconfiguration change that could affect VELCO or another utility, GMP communicates this information with the affected utilities. This information could include a change in the status of an open point, impedance of a transmission line, transformer tap or transformer impedance and MVA. This communication protocol assures that the system

models for ASPEN and PSSE are kept up to date, providing accurate data for planning and operations.

The following are some of GMP interactions with other utilities:

Burlington Electric Collaboration. In 2017, we transferred ownership of a recently disconnected subtransmission line to the Burlington Electric Department (BED) to our mutual benefit. As a result, we avoided the expense of retiring and removing the line; BED developed a low-cost express feeder from its Queen City substation into the downtown Burlington area.

Collaboration with Vermont Municipal Electric Companies. We are committed to being an advocate for all electric service customers in Vermont. Toward that end, we provide bulk power, operational services, and engineering services to two of Vermont's municipal electric companies:

- Jacksonville Electric Department, serving 719 residential, commercial, and industrial customers in Jacksonville and Whitingham with about 4,966 MWh of energy per year.
- Northfield Electric Department, serving 1,861 residential, commercial, and industrial customers in Northfield with about 26,929 MWh of energy per year.

For example, we collaborated with Northfield Electric regarding three solar interconnection feasibility studies in 2019. In October 2020, Northfield picked up some GMP customers that were fed off our Pleasant Street G43 circuit (i.e. 480 kW peak) for improved reliability.

National Grid Collaboration. National Grid provides service to its New York customers adjacent the western portion of our service area, and to its Massachusetts customers adjacent the southern portion of our service area in Vermont. Because of this geographic positioning, National Grid's subtransmission system supplies our lines at several interconnection points. In reciprocity, we annually develop load forecasts and summarize power factor data that helps National Grid meet certain planning and reporting requirements for ISONew England.

Some recent collaborations included:

- In August 2018, together we updated the G33 contract, in relation to the 69-kV line feeding from Putney to Brattleboro.
- Discussions in 2018 and 2021 regarding the National Grid Vernon (GMP#57) substation and its capacity about serving load for the decommissioning of the Vermont Yankee nuclear power plant.
- Working with National Grid on the replacement and relocation of the existing National Grid substation (to be called Huntington sub) in Vernon. GMP collaborated on the transformer size and getaway facilities at the substation location including

GMP access. GMP is extending high capacity distribution line to the new substation location. The distribution line work is in progress and the substation work is scheduled for 2022.

- Discussions regarding the ownership of the 6,900-volt delta line served from Harriman station in Readsboro, Vermont. The line is old and in bad shape, and only serves our customers. GMP has taken ownership and reconstructed the 6,900 volt delta line that was in poor shape and served the Village of Readsboro which are GMP customers. This was completed in the summer/fall of 2019.
- Our supplying a small section of single-phase National Grid load from our North Bennington #72 circuit (via single-phase primary metering) at the state line on Route 67A in Shaftsbury, Vermont. As part of the project, National Grid must remove an existing railroad crossing. This work was completed in fall/winter of 2019.
- Discussions regarding a planning study for the Ryegate Area.
- Discussions regarding solar facilities proposed on the the subtransmission within the ISO study process.
- Discussions regarding distributed generation interconnection guidelines.

Our collaboration with National Grid is ongoing.

Eversource Collaboration. Eversource provides service to customers in Connecticut, Massachusetts and New Hampshire. Many of their New Hampshire customers are supplied by GMP subtransmission lines or distribution substations.

Some recent collaborations included:

In 2018, GMP reconfigured its distribution feeds between Wells River and Ryegate substations, putting more load on the Wells River substation to accommodate proposed solar. Given Wells River feeds Eversource customers, GMP coordinated the installation of a new Viper recloser at the ownership demarcation.

- We are coordinating with Eversource in the upgrade to our Lafayette Street Substation. Eversource has distribution substations fed from the Lafayette Street Substation. System reconfigurations are necessary while we take this substation out of service to assure proper system performance. This project will address asset management concerns including the replacement of two 46 kV breakers. Reliability will be improved with the addition of another 46 kV breaker. This project is budgeted for completion in 2022.

Discussions regarding solar facilities proposed on the the subtransmission within the ISO study process.

Discussions regarding distributed generation interconnection guidelines.

- Our collaboration with Eversource is ongoing.

Village of Ludlow Electric Primary-Metered Delivery Point. In 2015, after collaboration with the Village of Ludlow Electric Department, we constructed a primary-metered delivery point originating on the Ludlow distribution system to supply an expanding load in our service territory (specifically for a local ski area expansion). This short-term project allows three-phase load to be fed to the area, avoids our upgrading several miles of single-phase distribution lines, helps the ski area meet short-term deadlines, and lowers the overall cost to our customers. We plan to feed this load from our Smithville 62G circuit when load exceeds 673 kW.

In addition, we are working with Ludlow to configure their system to supply their expanding loads, lowering both our services costs and making the best use of existing distribution facilities.

Vermont Electric Cooperative (VEC) Collaboration.

We worked with VEC to construct a new, jointly owned 34.5/12.47 kV substation in Cambridge. Together, we designed the concept of us retaining sole ownership of the in and out transmission line breakers. This substation was energized in November 2018.

We are working with VEC to upgrade the jointly owned 34.5/12.47 kV substation at Richmond. This project will install three circuit breakers, one feeding VEC 34.5 kV subtransmission and two on either side of the Richmond tap, to enhance the reliability of the 18.1 miles of 34.5 kV transmission supply to this area. At present, a permanent fault on the 3334 line opens the breakers at Sand Road and Bolton Falls, which results in outages to customers supplied by the Bolton, Richmond, and VEC Hinesburg substations. Adding breakers to the 3334 line on either side of the Richmond tap sectionalizes the line preventing the loss of supply to the Richmond and VEC Hinesburg customers for any permanent fault on the 3334 line. These breakers would also prevent the loss of supply to GMP Bolton customers for a fault between Sand Road and Richmond. The Project will also replace aged assets. This substation upgrade is proposed for completion prior to October 2023.

We are presently working with VEC to establish three new distribution metering points in the St. Albans district. These metering points will let VEC supply portions of its service territory directly from GMP distribution lines. These projects will allow VEC to avoid longer distribution line rebuilds, move cross-country lines to the roadside, improve reliability, and lower overall system losses. Construction of these projects is scheduled for 2021 and 2022.

The VEC 10-3A distribution circuit is supplied directly from the GMP UH-G23 distribution line. In 2020 and 2021, GMP provided VEC with engineering planning and

support, and constructed line upgrades on the UH-G23, to allow for the safe interconnection of the 1,500 kW ER Jericho Gravel Solar project to the 10-3A circuit.

The GMP Belvidere distribution area is supplied directly at distribution voltage by the VEC Cambridge 1A distribution circuit. In 2021, GMP collaborated with VEC to install protection upgrades for the purpose of improving the reliability and operability of the Belvidere distribution area.

VEC and VELCO Collaboration.

- In 2018 and 2019, GMP collaborated with VELCO and VEC to install protection upgrades on the 34.5 kV X39 subtransmission line. These protection upgrades mitigate the potential for ground fault over voltages on the X39 thereby allowing for the increased interconnection of distributed energy resources on the GMP Underhill and VEC Underhill substations that are supplied by this line.

  In 2019, GMP collaborated with VELCO and VEC to install protection upgrades on the 34.5 kV X29 subtransmission line. These protection upgrades mitigate the potential for ground fault over voltages on the X29 thereby allowing for the increased interconnection of distributed energy resources on the GMP Jeffersonville substation.

  VELCO Collaboration.

  GMP worked with VELCO to ensure a robust distribution supply to its new operations facility in New Haven. Construction of the required distribution upgrades on the GMP system began in 2021.

  We have collaborated on the VELCO proposed Substation Condition Assessment Projects (SCAP), where GMP facilities are involved, for Florence, Blissville and North Rutland.

  GMP provided input on the 2021 VELCO Vermont Long Range Transmission Plan.

  We coordinate our budgeting processes to assure spending fits into the GMP budget without impacting other priority projects as well as transparency on construction timing which can impact system operations and other project construction.