Other Distributed Energy Resources

In Order 2222, the Federal Energy Regulatory Commission defined a distributed energy resource (DER) as, "any resource located on the distribution system, any subsystem thereof, or behind a customer meter. These resources may include, but are not limited to, electric storage resources, distributed generation, demand response, energy efficiency, thermal storage, and electric vehicles and their supply equipment." Increasingly, these resources can be controlled to reduce load, and especially peak demand. Reducing peak demand can assist with electric reliability (i.e., energy assurance) by increasing the gap at the transmission level between actual load and the load at which one more contingency would result in an outage. Vermont deploys DERs through many different avenues, including its Energy Efficiency Utility (Efficiency Vermont), distributed generation programs such as net-metering, Tier III of the Renewable Energy Standard, and utility pilots and tariffed offerings.

## Resiliency

The high-voltage transmission network in Vermont is operated by the Vermont Electric Power Company (VELCO) at voltages ranging from 115 kV to 345 kV. This network – as part of the broader regional transmission system – provides access to electric sources beyond VT borders from the rest of New England, New York, or Canada.

GMP, and the other 16 Vermont distribution utilities, connect to VELCO and serve loads at sub-transmission and distribution voltages. Distribution grid reliability is governed by industry rules and standards; distribution utilities are also required to file Service Quality and Reliability Plans with the Vermont Public Utility Commission and Public Service Department, reporting on reliability performance metrics such as the frequency and duration of outages, along with a list of the utility's worst-performing circuits and plans to improve their reliability.

Infrastructure resiliency – differentiated from reliability by virtue of the duration, scale, and scope of the disruptive event – is increasingly a topic of discussion in Vermont. The State's inaugural Climate Action Plan includes recommendations related to energy infrastructure resilience, which encompass the domains of prevention, survivability, and recovery. The overarching strategies – each with its own set of action items – include:

A. Create a policy, planning, and organizational foundation to support effective investments in infrastructure resilience.
B. Public, private, and nonprofit entities should be prepared to respond and recover quickly

to disruptions caused by severe weather and other climate change threats.

C. Increase the resilience of critical infrastructure to severe weather and other climate change threats by reducing vulnerabilities of specific facilities.
D. Increase the resilience of critical infrastructure to severe weather and other climate change threats by improving system efficiency, reliability, and redundancies.

Part of the ongoing work under the Climate Action Plan is the development of a Municipal Vulnerability Index, which is currently under development. In part, the Index is expected to build upon mapping done by Green Mountain Power to identify so-called resiliency zones, where areas with a confluence of poor reliability, electric-dependent telecommunications, and social vulnerability factors are being identified to target resiliency interventions such as microgrids. In future iterations of this Plan, the Department will provide an update of that work and how it is being used to enhance energy reliability.

The Climate Action Plan also recommends that federal funds be sought to defray the cost of utility resilience upgrades that exceed benefits to ratepayers, such as:

- Ubiquitous communications networks that enable full utilization and participation of distributed energy resources in an interactive grid.
- Resilience Zones: batteries installed at or near critical facilities, potentially paired with solar (and/or small wind) and with a microgrid /islanding where possible, to allow them to continue to operate in the event of extended disruptions to electric service.
- Strategic upgrades to substations, distribution, and transmission capacity across the Vermont grid needed to enable the state's renewable and electrification goals, after first exploring feasibility of any lower-cost options, e.g. flexible load management, curtailment, and storage.
- Emerging non-wires technologies that address major challenges system resilience (e.g., long-duration outages).

The Department has applied for both formula and competitive federal funds in 2023 to bolster grid resilience. The next State Energy Security Plan will include a summary of funding received and planned uses.

## Winter Energy Adequacy

Increasingly, the New England electric system has become reliant on natural gas for power generation year-round. Available pipeline capacity limits the amount of natural gas that it is possible to procure from our neighboring regions and, during a cold snap, some natural gas plants would find their fuel supply restricted by the competing demand of residential heating.

While it is possible for some generating stations to utilize liquid natural gas (LNG) in place of the gas piped in from neighboring regions, it may still be difficult for these plants to obtain fuel given supply chain challenges and competing demand from foreign markets.

The growth of renewable, intermittent resources in Vermont and elsewhere in the region has begun to decrease the demand for electricity from fossil fuel generators, and indications are that this essential process will continue. However, the efficacy and availability of these resources can be severely hampered by extreme weather conditions. It is expected that, in a winter weather event, wind turbines may be shut down due to blade icing or high wind, solar panels may be covered by snow or ice, and that small-scale hydro turbines could suffer from deficient water flow. Reduction of this risk will require the diversification of renewable resources with regard to technology type and geographical location across Vermont and, expressly, across New England.

Other types of resources for generating electricity that are already connected to Vermont's grid, such as biomass and large-scale hydro, can operate efficiently even during periods of extreme cold. It is possible to store biomass fuel like wood chips at quantities that allow several consecutive days of operation, and large hydro facilities do not incur the same fuel transport concerns of other resource types. It is important to recognize that these resources provide unique reliability advantages.

## Threats/Vulnerabilities

The Vermont Public Utility Commission Rule 4.900 (Electric Outage Reporting) requires all electric utilities to annually report the number and duration of outages in the following categories:

Trees — Outages caused by the interaction of trees and tree branches (regardless of whether the tree originated inside or outside of the right-of-way) with the electric system, including Outages resulting from trees interacting with the electric system during severe weather. Tree-related Outages which result from operator error, accidents, or animals (e.g., beavers) should be listed under the respective cause-related category.

Weather — Outages caused by wind, snow, lightning, ice, and flooding. Outages from weather events which cause trees to interact with the electrical system should be listed in the trees category. Other weather events such as wind, heavy wet snow or ice build-up on power and communication lines can lead to lines being forced out-of-service or damaged. The only way to

avoid weather events doing damage would be to bury the lines. Some outages can be caused by weather events such as lightning strikes.

Equipment Failure — Outages caused by specific equipment failures such as transformer or arrester failures. Operator Error — Outages caused by utility or utility contractor error, including contract tree trimmer error.

Accidents — Outages caused by accidents by other than utility employees or contractors, including the felling of trees into utility lines, as well as outages resulting from emergencies such as police or fire department requests for shutdowns.

Animals — Outages caused by the interaction of animals such as birds, squirrels, and raccoons with the electric system. Outages also caused by trees, in which the root cause is the action of an animal, should also be placed in this category.

Power Supplier — Outages caused by the loss of power supply from another utility or non-utility provider.

Vandals or Terrorists - vandals and terrorists can cause disruptions to the electric power systems by sabotage, or equipment destruction.

Contractors – many interruptions of service to customers are caused by contractors performing excavations and damaging buried electric, communication and gas lines.

**Mitigation**

Energy Conservation
When the power system appears to be headed for a shortage of capacity to handle the load, distribution utilities may, in coordination with VELCO and at the ultimate direction of ISO-NE, send a message to the public asking for reduction in the use of electricity.

Load Management (Demand Response)
There are commercial customers who can manage their loads by shutting down a portion of their load or starting another source of power to perform the work that was previously done from the power supplied from the electric grid. This could be their own electric generation or in Vermont in the winter it might be diesels to operate snow-making in the ski resorts. There are also customers who can manage their loads by rotating what processes are on at any given time and