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Via US Mail

September 17, 2015

Debra A. Howland
Executive Director
New Hampshire Public Utilities Commission
21 S. Fruit Street, Suite 10
Concord, NH 03301-2429

Re: IR 15-296 Electric Distribution Utilities
Investigation into Grid Modernization

Dear Ms. Howland:

Pursuant to IR 15-296 issued July 30, 2015 by the New Hampshire Public Utilities Commission, Dominion Voltage, Inc. and Dominion Energy Technology, Inc. hereby files Joint Comments addressing the scope of the above mentioned proceeding. Enclosed are an original and six paper copies of the Joint Comments filed.

If you have any questions related to this document, please contact me directly.

Sincerely,

Maria Mercedes Seidler
Director, AES Policy & Grants

cc: Service list

BEFORE THE
STATE OF NEW HAMSHIRE
PUBLIC UTILITIES COMMISSION

ELECTRIC DISTRIBUTION UTILITIES	)	
Investigation into Grid Modernization	)	IR 15-296

JOINT COMMENTS OF DOMINION VOLTAGE, INC. AND DOMINION ENERGY TECHNOLOGIES, INC.

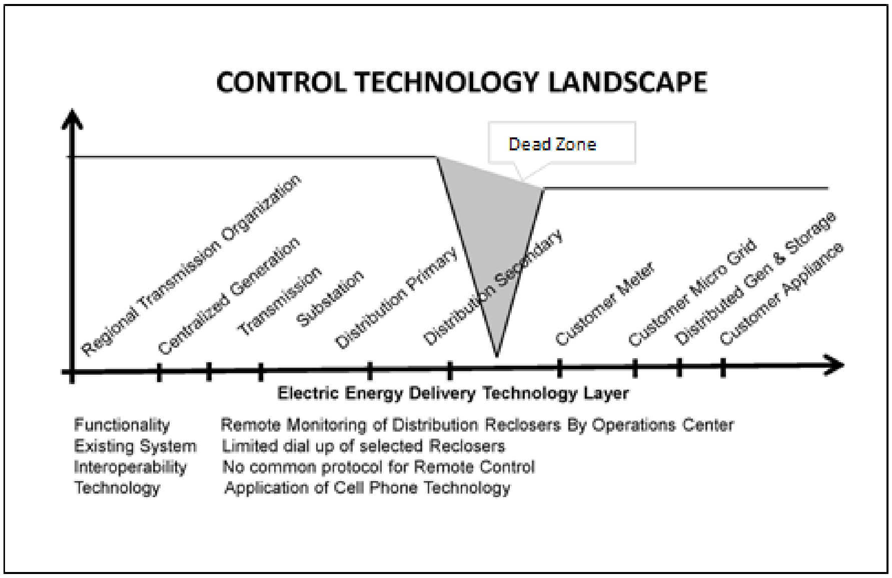
Pursuant to the *Order of Notice* issued by the Public Utilities Commission of the State of New Hampshire (the "Commission") on July 30, 2015 in the above-referenced docket, Dominion Voltage, Inc. ("DVI") and Dominion Energy Technologies, Inc. ("DET"), subsidiaries of Dominion Resources, Inc. ("DRI"), respectfully submit these Joint Comments to contribute to the Commission's investigation on the definition and elements of grid modernization.[1]

The Commission's *Order of Notice* was issued in compliance with New Hampshire House Bill 614, which was enacted to facilitate the State's ten-year energy strategy to increase investment in cost- effective energy efficiency, to prioritize near-term distributed generation ("DG") currently under-developed in New Hampshire, and to enable electric vehicle ("EV") infrastructure. However, the pathway to achieving these goals is through the strategy's grid modernization vision for a more flexible and resilient electric grid that empowers consumer participation in energy management.

Resiliency and consumer empowerment will require correcting the lack of visibility, communication and the information "dead zone" that currently exists on the outer boundaries of most current distribution systems from the substation parameters to customers' meters, as depicted in Diagram 1 below.

[11] *Order of Notice, Electric Distribution Utilities, Investigation into Grid Modernization*, IR 15-296, p. 2.

Diagram 1.



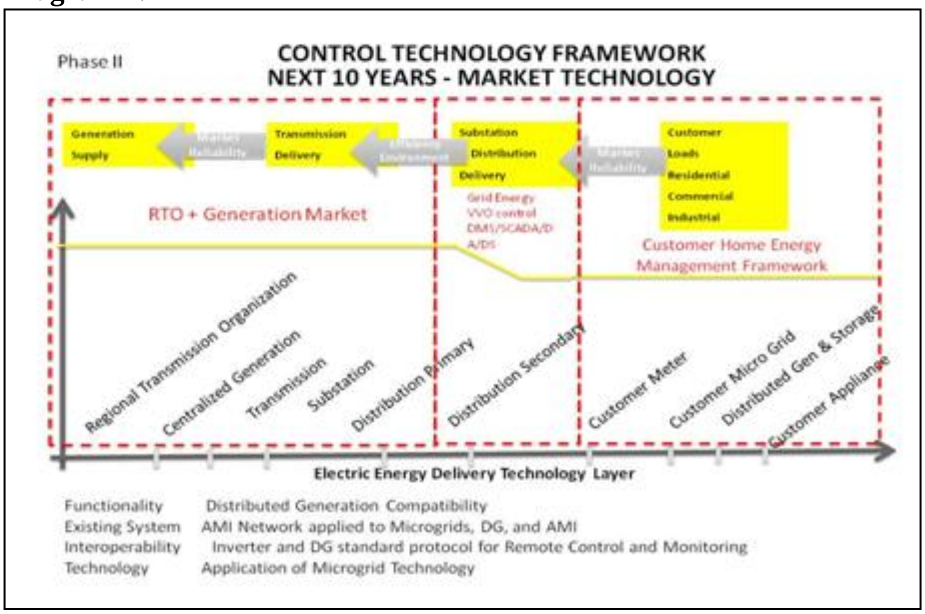
DVI and DET respectfully suggest that the Commission's investigation should include identifying issues within this zone and those technologies that should be prioritized for their cost-effective capabilities to transform this dead zone into a first responder zone expediting resiliency and self-correction that is the hallmark of grid modernization. Technologies that should be included in a first-phase advancement of grid modernization in New Hampshire would be those that extend operational visibility and data communication beyond the substation parameters to the customer meter, enabling faster automated response by the delivery system to real-time operating conditions on all circuits, primary and secondary, benefiting the grid, the operator and distribution customers.

For the reasons discussed in more detail below, there are three technology solutions with which DVI and DET would suggest the Commission should start because they would not only advance a resilient modernized grid, but also advance the strategy's other goals for energy efficiency, DG and EV management. Specifically:

1. A necessary and basic functionality for an integrated grid is enhanced collection and communication of consumer-level data back to the control room. Advanced metering infrastructure ("AMI") provides these essential functionalities. AMI's role in a more integrated grid design and its "e-pad" capability to facilitate other smart grid applications will allow customers to experience direct and more visible benefits, such as the energy efficiency provided by AMI-enabled voltage management and home energy management. Grid modernization should not be slowed by the need for customers' consent to install AMI when customers see those benefits behind their meters that extend beyond lowering line-item expenses in utilities' rates.
2. A second essential functionality is automated voltage control enabled on primary and secondary circuits. Voltage optimization ("VO") technology, when combined with AMI, provides automated voltage control that can manage voltage delivery at the meter within the lower, more efficient range of the voltage standard. As indicated above, voltage optimization can provide 24x7 energy savings, reducing customers' bills while ensuring that voltage is maintained at safe and reliable levels for customers' equipment and appliances. In addition, automated voltage control technology with the dual capability of communicating with smart inverters, in addition to AMI, can provide voltage stabilization, allowing more renewable DG installation on distribution circuits while providing greater reliability for all customers, regardless of their DG ownership.
3. An essential preparatory step, however, before implementing a modernized grid design, should be to update utilities' models depicting the connectivity of their grid, particularly among primary and secondary circuits. Virtual grid mapping technology that utilizes digital signals from power flows can create a virtual map of the distribution system and help track equipment issues affecting operations along secondary circuits in the communication dead zone. Virtual grid mapping can serve many data analytical needs for modernizing the grid, including the identification of locational benefits of DG.

Overall, knowing the connectivity of New Hampshire's distribution systems enhances operational responsiveness and the ability to increase its reliability and interactivity through the integration of compatible technologies. Virtual grid mapping capabilities provide a cost-effective means to monitor and update grid connectivity after storm restorations. Resiliency is also improved by automated controls and by data collection and communication facilitating faster alerts that can help reduce outages or limit them to smaller events. AMI voltage data can be a key indicator of operational issues and automated voltage management is a key component to the grid's safe integration of increasing amounts of intermittent renewable DG. Optimizing voltage delivery can also produce energy savings that could help offset the rate impact from smart grid investments reflected in customers' bills. AMI's data collection capability, its two-way communication and dynamic voltage management across secondary circuits should be included in the first phase in the transition of the grid depicted in Diagram 1 into the integrated electricity delivery system that includes DG and microgrids depicted in Diagram 2 below.

Diagram 2.



I. PARTIES' BACKGROUND

DVI and DET are subsidiaries of DRI, a holding company that is publicly traded and which operates as an integrated energy company and significant producer and transporter of energy. DRI's portfolio of assets includes approximately 23,500 MW of generation; 11,000 miles of natural gas transmission, gathering, and storage pipeline; 56,900 miles of electric distribution lines; and 6,300 miles of electric transmission lines.

DVI holds, licenses, and sells software in the field of VO, and also maintains the intellectual property rights to such software. To this end, DVI has developed an innovative, state-of-the-art software solution for voltage and volt-ampere reactive (var) control and optimization called EDGE® (which stands for Energy Distribution & Grid Efficiency) that can achieve advanced conservation voltage control ("CVR") that is translatable into energy savings for a utility and its customers and provides a foundational platform for further smart grid enhancements of the distribution grid, including DVI's grid voltage stabilization solution for increasing intermittent renewable energy DG.

DET provides a research and development ("R&D") service in emerging energy technologies, including, but not limited to, renewable generation, energy storage, and smart grid sectors and facilitates commercialization of the more developed alternative energy technologies.

II. JOINT COMMENTS

A. The Distribution Efficiency and Enhanced Reliability of AMI-enabled VO:

The National Association of Regulatory Utility Commissioners ("NARUC") expressly identified VO as a critical component of the electric power grid's modernization in its *Resolution Supporting the Rapid Deployment of Voltage Optimization Technologies* ("Resolution"),[2] recognizing the advancement of adaptive VO technologies over conventional conservation voltage reduction ("CVR") practices. The Department of Energy ("DOE") sponsored VO demonstration pilots in twenty-six of its Smart Grid Investment Grant projects and, in a 2012 report, noted demonstrated benefits that included an average 2% reduction in peak load.[3] Finally, the Environmental Protection Agency ("EPA") recognizes the benefit of VO advancements in its *Guide to Action* that includes VO as a best practice for energy efficiency:

[2] National Association of Regulatory Utility Commissioner (NARUC), EL-2/ERE-3 *Resolution Supporting the Rapid Deployment of Voltage Optimization Technologies*, (November 14, 2012); can be found at http://www.naruc.org/Resolutions/Resolution%20Supporting%20the%20Rapid%20Deployment%20of%20Voltage%20Optimization%20Technologies.pdf, p. 6-7. The Resolution is also included in Exhibit 1 of these Comments.

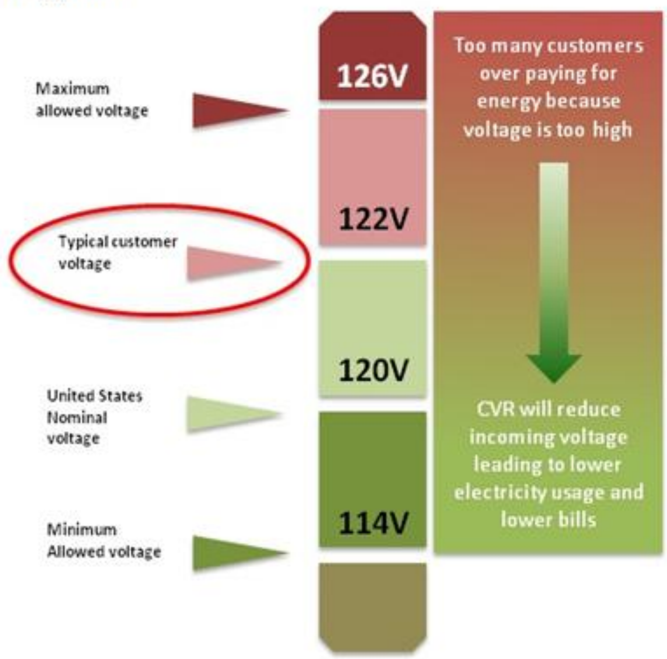
[3] DOE, *Application of Automated Controls for Voltage and Reactive Power Management – Initial Result*, Smart Grid Investment Grant Program (Dec. 2012), at ii; can be found at https://www.smartgrid.gov/files/VVO_Report_-_Final.pdf .

. . . modern grid technologies enable a better understanding of the exact voltage at different points in the transmission and distribution system. Rapid communication with controls, combined with the ability to automatically respond to grid conditions, offers the potential for greater energy savings. The improved information also increases operational confidence among grid managers and regulators. While performance can vary by circuit, many utilities find 1 to 4 percent savings on initial deployment" [4]

The EPA has also included VO as an example of distribution efficiency that states could consider as a compliance measure under its Final Rule for the Clean Power Plan ("CPP").[5]

Energy conservation through voltage reduction has been used for several decades. Higher voltage levels results in higher energy consumption behind the meter. Reducing voltage means less energy consumed. These early CVR programs, however, used a low-tech solution involving physical adjustment of a transformer setting that established voltage at the substation level for delivery of energy within the lower one-half of the 10% voltage band required by American National Standards Institute ("ANSI") equipment standards. However, it was difficult to sustain lower settings without knowing the voltage conditions on the primary circuits and at the meter.

Diagram 3.



Lacking real-time operating information at the meter, utilities generally deliver energy at a conservative 120V to account for distribution line losses that could cause the voltage delivered

[4] EPA, *Guide to Action*, at p. 7-113.
[5] EPA's Final Rule, *Carbon Pollution Emission Guidelines For Existing Stations Sources Electric Utility Generating Units* ("Final Rule"), (issued Aug. 3, 2015)

to customers to drop below regulated levels. However, AMI-enabled VO technology can manage voltage settings at the lower range indicated on the scale in Diagram 3 above safely and reliably without any noticeable change in customers' equipment or appliance performance. Voltage management within the lower range can produce long-term sustainable energy savings – 24 hours a day, 7 days a week– or contribute to a utility's demand response ("DR") capacity by the operator's turning on the VO software during periods of peak load. The relationship between voltage reduction and the amount of energy saved is stated as a system's CVR factor (CVR_f). The Commission might consider, as part of its investigation, conducting a CVR_f study to assist in projecting the potential energy savings that could be realized from prioritizing VO deployment in the Commission's grid modernization process.

Because VO would be a distribution efficiency program that does not require any change in customer behavior or initial investment by customers, it serves the Commission's public policy interest and the State's strategy goal in expanding access to energy efficiency benefits to low-income customers. In its report on the results of its VO pilot project funded by the DOE, Central Lincoln People's Utility District ("Central Lincoln") noted that all socioeconomic groups benefited as the savings occurred without regard to homeowner or renter status. In fact, the utility said that the "results of the pilot project were so impressive that Central Lincoln is undergoing plans for a full system wide implementation."[6] VO as a grid-side energy efficiency program ensures equitable participation of ratepayers in its energy savings and environmental benefits, as well as the operational benefits gained through greater and expanded grid visibility.

VO that integrates AMI data into its software automated response will also directly contribute to increased reliability on the distribution grid. VO provides greater stability through

[6] Central Lincoln, *Voltage Management at Central Lincoln PUD,"* Smart Grid Investment Grant 2014 Report Project ID 09-0269, attached to these Comments as Exhibit 2.

the tightening of the bandwidth of voltage being delivered to the end user. Grid operators have enhanced visibility of what is happening at the customer meter, enabling them to identify significant voltage outliers and act on them prior to their becoming an operational issue or customer complaint. Having an advanced platform for voltage planning and monitoring reduces the occurrence of voltage dips and surges that cause service interruptions for customers. The value of the transparency that AMI provides to grid operations at a granular level is evidenced as the grid operator is alerted to outages much earlier, allowing for faster response times. The customer level data on voltage can be maximized by preventing costly outages and facilitating more effective planning for system upgrades that make the greatest impact.

B. Maintaining Grid Stability for Integration of More Solar DG:

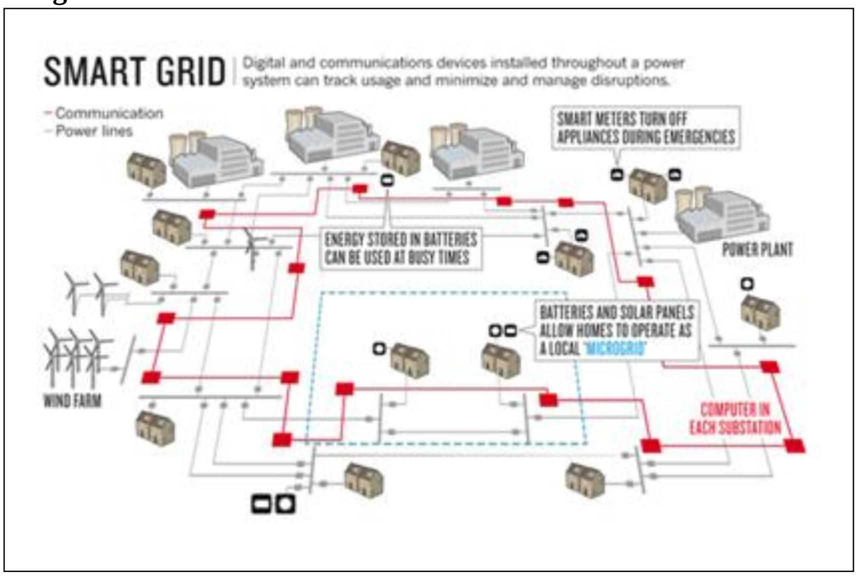
Voltage management is key to addressing grid stability issues associated with increasing penetration of intermittent and non-dispatchable renewable DG. To address the volatility of voltage fluctuations that can occur in solar DG due to cloud transience, for example, DVI is adding a voltage stabilization module to its VO platform that (i) monitors solar DG using AMI voltage data; (ii) creates a voltage profile for solar homes or businesses, and then, (iii) using the same voltage automated control of its VO software, manages the secondary circuit's voltage based on the voltage profile. The stabilization software can safely and reliably mitigate the voltage effects of cloud transience and helps maintain circuit stability. In addition, when a VO platform includes monitoring and planning modules, such as are components of DVI's VO platform, the data it collects can inform the decision-making process for planners and operators in modernizing the distribution system so that it is prepared to accommodate the inevitable upsurge of variable renewable DG penetration.

C. Advancing to a Weather-Resilient Integrated Grid:

Currently, operators can only assume the flow pattern of power on their grids as grid connectivity has changed time and time again as a result of multiple storm restorations and outage responses. Linemen must make decisions in the field when reconnecting down circuits to the grid and reinstituting customer service. Further, as noted earlier, grid communication capabilities generally end at the substation parameters, leaving grid operators blind as to the operating conditions on the secondary circuits of the status quo distribution system. Consequently, they do not have the ability to follow up and update grid connectivity down to the customer's meters. A preparatory step in the transformation of New Hampshire's distribution grids into DG-integrated operational electrical systems would be to update the utilities' model of their grid connectivity. Smart grid digital technology can utilize digital signals from power flows that will create a virtual map of the distribution system. This virtual map will provide a realistic base line to provide information for data analytics that will be used to identify hosting capacity and locational benefits of DG. Whatever technology approach the Commission might ultimately require, this need for a current updated connectivity model should be identified as a preliminary stage to grid modernization.

Virtual grid mapping technology enables data (voltage, power, energy readings, GPS location, phase and circuit connectivity) to be sent from the remote location to the substation over the same path as the power, enabling remote awareness of the grid and enhancing its value. It facilitates control and timing of remote communications with multiple types of standard down line communication networks with very low bandwidth usage. It should be noted that to the extent that there are distribution areas where AMI has not been installed, recognizing per RSA 374:62 that customers must provide written consent to the installation of smart meter devices, non-AMI existing meters can be used with this remote collection and monitoring of power data, enabling it to serve as a preliminary step in grid modernization plans. As for its value for the modernized grid, it is particularly useful for mapping and monitoring of high variation loads such as renewable energy DG across a distribution domain. The result is an integrated physical and electrical mapping of the primary and secondary circuits of the distribution network as depicted in Diagram 4 below.

Diagram 4.



III. CONTACTS AND COMMUNICATION ON BEHALF OF DVI AND DET

Any communications and correspondence related to DVI and DET's Joint Comments and/or its participation in this proceeding should be directed to the following representatives:

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DVI and DET appreciate the opportunity to provide these Joint Comments to the Commission in response to its *Order of Notice.* The Companies would also appreciate the opportunity to participate in any upcoming technical session scheduled by Staff and to be available to answer any questions or provide more information to the Commission regarding any technical or operational aspect regarding the technologies described above.

Respectfully submitted this 17th day of September, 2015.

DOMINION VOLTAGE, INC.
DOMINION ENERGY TECHNOLOGIES, INC.

By: /s/ Maria M. Seidler

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