ANNUAL REPORT
TO THE PUBLIC SERVICE BOARD &
PUBLIC SERVICE DEPARTMENT

January 31, 2017

INTRODUCTION

In accordance with the Memorandum of Understanding (MOU) approved by the Public Service Board in Docket 7081 as amended[1], this document comprises the annual report of the Vermont System Planning Committee (VSPC) detailing activities undertaken in 2016.

Among its provisions, the Docket 7081 MOU requires that the VSPC provide a report to the Public Service Board (PSB or Board) and Public Service Department (PSD) by February 15 of each year and post that report on the VSPC website. The report must consist of at least the following:

> 89. A report on each Reliability Deficiency identified to date in the [Long-Range Transmission] Plan or through the process described in Steps 1 through 6, above, including:
>
> i. The status of NTA [Non-Transmission Alternative] Analysis for the Reliability Deficiency.
>
> ii. The status of decision-making on the selection of alternative(s) to address the Reliability Deficiency.
>
> iii. The status of decision-making on the allocation of costs of the alternative to address the Reliability Deficiency.
>
> iv. The strategy chosen for implementing the alternative selected to address the Reliability Deficiency.

[1] Investigation into Least-Cost Integrated Resource Planning for Vermont Electric Power Company, Inc.'s Transmission System. Amended 1/30/2012, 8/1/2012 & 11/6/2013.

v. The status of implementation of the alternative(s) to address the Reliability Deficiency.

vi. All documentation pursuant to paragraph 86, above, relating to advisory votes within the preceding calendar year.[2]

90. A statement of the dates and locations of all VSPC meetings held during the preceding year.[3]

In 2014, the Board approved a recommendation by the VSPC, designed to harmonize reporting procedures, that the VSPC annual report incorporate annual utility updates on areas that have been approved for energy efficiency geographically targeted.[4] At this time, no area of the state is approved for energy efficiency geographic targeting so no such annual utility updates are provided for the current year.

This document comprises the VSPC annual report on the status of transmission and non-transmission analysis, solution selection, cost allocation, and implementation planning of all identified reliability deficiencies as required by the MOU, as well as the meetings and organizational work of the VSPC during 2016.

VSPC ACCOMPLISHMENTS, MEETINGS AND PROCESS

The past year was the ninth full year of VSPC operation. During this year, the major activities and accomplishments of the Committee included:

- Received regular briefings each quarter from lead utilities on all reliability deficiencies identified in the 2015 Vermont Long-Range Transmission Plan.
- Developed, and filed on October 24, 2016, the annual geographic targeting recommendations to the Board. The development of the recommendations followed a full review by the Geographic Targeting Subcommittee of transmission and subtransmission issues, as established in Docket 7081, and distribution issues, as established in Docket 7873/7874.
- Concluded deliberation on changes needed in the Docket 7081/VSPC process to adapt the process to significant changes that have taken place in the planning process, electric grid and energy-related public policy since the process was established in 2007. The outcome of the process was the adoption of a charter updating and articulating the purpose and work of the VSPC in plain language. A copy of the charter as adopted is attached to this annual report.

[2] ¶ 86 requires the VSPC to take advisory votes to resolve disputes regarding determinations of affected utilities and cost allocation.

[3] Docket 7081 MOU at 35-36.

[4] Docket EEU-2013-11, In re: VSPC Geographic Targeting Process Improvement Analysis, 1/24/2014.

- Received regular briefings on a variety of current policy proceedings, such as the net metering rulemaking and interconnection rulemakings, Renewable Energy Standard (RES) implementation process, Act 174 of the 2016 General Assembly (energy siting), regional energy planning and the Comprehensive Energy Plan update.

- Heard presentations on a wide variety of energy-related initiatives, studies and reports. Presenters included the Acadia Center, Energy Action Network, Vermont Energy & Climate Action Network, Vermont Weather Analytics Center, Vermont Energy Investment Corporation (VEIC), Green Mountain Power (GMP) and VELCO. Presentation topics included transmission policy to accommodate distributed resources, the Solar Pathways initiative, benefits of weather analytics, proposed merchant transmission projects, energy storage efforts of GMP and VELCO, and the GMP Solar Mapping Project, .

- With regular participation by an ISO-New England (ISO-NE) representative, and briefings by VELCO, updated participants regularly on significant policy developments at the regional and federal level. Topics of particular focus included: FERC Order 1000 implementation, the Distributed Generation Forecast Working Group, stakeholder input into the Regional System Plan, and FERC Order 745 (demand response) Supreme Court appeal.

The VSPC held the following full committee meetings during 2016:

1/20/2016	Quarterly meeting, South Burlington, VT
4/27/2016	Quarterly meeting, Middlebury, VT
7/20/2016	Quarterly meeting, Middlebury, VT
10/19/2016	Quarterly meeting, Rutland, VT

The subcommittees of the VSPC met throughout the year as follows:

- Public Participation Subcommittee: The Public Participation Subcommittee did not meet in 2016.

- Coordinating Subcommittee: The Coordinating Subcommittee met by phone January 4, April 12, July 7 and September 26 to plan the agendas for regular VSPC meetings.

- Forecasting Subcommittee: The Forecasting Subcommittee met on July 13 and October 5. The subcommittee spent the first half of the year working on the VSPC charter, developed in consultation with the Geographic Targeting Subcommittee, as discussed below. In the latter half of the year, it began developing the work plan for collaboration on the next statewide load forecast.

- Geographic Targeting Subcommittee: The Geographic Targeting Subcommittee met on February 10, May 24 and September 21. The subcommittee met several times jointly with the Forecasting Subcommittee on the VSPC charter, as discussed below. The group also carried out its responsibilities for receiving reports on all

current load growth-related reliability issues from the utilities and drafting the VSPC's geographic targeting recommendations to the Board.

- Joint Geographic Targeting and Forecasting Subcommittee meetings: Joint and ad hoc meetings of the two subcommittees were held to develop the VSPC charter on February 10, April 5, April 6, April 11 and July 7.

The calendar of VSPC meetings is posted on the VSPC website at:
http://www.vermontspc.com/calendar

Agendas and meeting minutes for the full VSPC meetings are posted on the VSPC website at:
http://www.vermontspc.com/vspc-at-work/meetings

Subcommittee agendas and meeting minutes are posted on the VSPC website at:
http://www.vermontspc.com/vspc-at-work/subcommittees

No advisory votes were taken in 2016.

REPORT ON IDENTIFIED RELIABILITY DEFICIENCIES

Paragraph 51 of the Docket 7081 MOU requires that the VSPC, VELCO and the distribution utilities report progress on identified reliability deficiencies at least annually to the Board. The following sections address all identified reliability issues as follows:

1. *Issues that screened in for full NTA analysis in the 2015 Vermont Long-Range Transmission Plan (the Plan)*[5] *and are currently the subject of Project-Specific Action Plans/Reliability Plans.* The Rutland area is the only area identified in the plan that fits into this category. As previously reported to the Board and described below, GMP now projects that this reliability gap will not arise within the 10 to 20 year horizon.

2. *Transmission and subtransmission issues that screened out of full NTA analysis in the 2015 Plan and are the subject of brief updates.* These include: Connecticut River Valley and Central Vermont. VEC has determined that the Northern Area is no longer a concern because reliability concerns arise when a large customer's load that is currently disconnected is re-energized. VEC will continue to monitor the load, and appropriate steps will be taken once the customer requests to be reconnected. A brief update is provided.

3. *Distribution issues that are the focus of reliability plans as required by the Docket 7873/7874 Screening Framework and Guidelines for Implementation of 30 V.S.A. § 8005a(d)(2).* The Hinesburg area is included in this section.

[5] The 2015 Vermont Long-Range Transmission Plan, filed with the Board on 6/25/2015, serves as the basis for the current list of identified bulk system and subsystem reliability issues. The Plan is posted at http://www.velco.com/longrangeplan2015

GROUP 1—ISSUES THAT SCREENED IN FOR FULL NTA ANALYSIS IN THE 2015 PLAN AND ARE CURRENTLY THE SUBJECT OF PROJECT-SPECIFIC ACTION PLANS/RELIABILITY PLANS.

RUTLAND

GMP filed a reliability plan for the Rutland area on April 1, 2015.[6] The plan indicates that various developments that have occurred or are projected have eliminated the projected reliability gap for the Rutland area within the next 10 to 20 years. In effect, the re-analysis has removed the Rutland area from the current list of issues requiring continued tracking through the Docket 7081 process since no reliability gap is now projected within the 10-year time frame. A brief update of status follows.

GMP's analysis of the Rutland area shows that the previously identified reliability gap is no longer likely to emerge as a result of developments in the Rutland area, particularly economic conditions and the influx of solar power. GMP's planned integration of former Vermont Marble Power Division into GMP's system, including its plans to permanently close the normally open 46 kV tie at West Rutland (2018); reconductor the Florence-West Rutland 46 kV line (2017), and permanently close and reconductor the normally-open (second) Rutland-West Rutland 46 kV line (2018), will widen the reliability margin for the area. GMP's plan further includes continued monitoring of area load growth to determine when the reliability margin is within three to four years of exhaustion; monitor load shapes and annual load duration curve; evaluate GMP energy initiatives, including Act 56 implementation, to determine impacts on reliability margins; update studies as needed; and deploy identified resource options if and when a reliability gap is again projected.

[6] The Rutland Reliability Plan may be accessed on the VSPC website at: http://www.vermontspc.com/gmp-rutland-reliability-plan

GROUP 2—TRANSMISSION AND SUBTRANSMISSION ISSUES THAT SCREENED OUT OF FULL NTA ANALYSIS IN THE 2015 PLAN

Status update: Connecticut River Valley	
Lead utility	Green Mountain Power[7]
Description	Bulk system deficiency (see page 24 of the 2015 Plan). Overloads on Coolidge to Ascutney, as well as subsystem overloads. Low and high voltages, as well as voltage collapse in a subarea bordered by the Middlebury, Granite, Bellows Falls, and Webster 115 kV substations. Line overloads and voltage concerns for a single contingency that may remove one or more elements from service (N-1 conditions) and two succeeding contingencies (N-1-1.) The transmission overload is largely affected by power transfers from generation in Massachusetts and Vermont supplying New Hampshire load.
NTA Screening	A detailed NTA screening for the Connecticut River Valley deficiency demonstrates that an NTA would not be a viable solution. See page 25 of the 2015 Plan.
Proposed alternative	Reconductoring and rebuilding the 115 kV line from Coolidge Substation to Ascutney Substation (K31 Line), adding a +50/-25MVAr reactive device adjacent to the Ascutney Substation, adding a new bay at Ascutney Substation to accommodate the reactive device, rebuilding the Chelsea Substation into a 115 kV ring bus configuration, and splitting the 25MVAr capacitor bank at Hartford Substation into two 12.5MVAr capacitor banks.
Status of decision-making on cost allocation	This alternative will be funded per ISO-NE planning procedure 4 regarding pool transmission facilities, where New England utilities fund projects per their load ratio share of the New England load. Upgrades to GMP facilities will be funded by GMP.
Status and timing of implementation	ISO-NE Needs Assessment and Solution Assessment have been completed. VELCO NTA screening analysis has been completed. VELCO applied to the Board for a Certificate of Public Good (CPG) on September 24, 2015, which was granted on June 9, 2016. Construction is underway at the time of publication with an expected in-service date of ranging from 2017 to 2018 for the transmission components of the projects.

[7] The Docket 7081 MOU defines the lead utility as the distribution utility with the responsibility for leading the NTA analysis. Although GMP was designated as the lead, VELCO is the petitioner for the transmission upgrade to resolve this reliability issue.

Status update: Central Vermont Area	
Lead utility	Green Mountain Power[8]
Description	Bulk system deficiency (see page 25-26 of the 2015 Plan). Coolidge to Cold River overload. No voltage concerns assuming the Connecticut River upgrades are completed. Line overloads when more than one element is out of service (N-1-1 condition). However, 1030 MW critical load level is not projected to be reached until 2028, barring the addition of new generation or an increase in imports of power through Vermont, which could hasten the need date for this project.
NTA Screening	Screens out due to a year of need beyond the 10-year horizon.
Preferred alternative	Rebuild 115 kV line.
Status and timing of implementation	This project is on hold and will be re-evaluated in the 2018 Plan update.

Status update: Northern Area (Highgate, Jay, Newport, Irasburg, Burton Hill)	
Lead utility	Vermont Electric Cooperative
Description	Predominantly bulk system deficiency (see page 28 of the 2015 Plan). Low voltages in the northern subarea that occur when one element is out of service (N-1) conditions. This is a predominantly bulk deficiency that affects the sub-transmission system.
NTA Screening	To be determined
Preferred alternative	Addition of 46 kV capacitor banks. Upgrade of Moshers Tap. These upgrades will be completed in stages as load grows.
Status and timing of implementation	The need date of this project is undetermined. The timing of need is highly dependent on the status and amount of a single large customer's load. Load levels elsewhere in the northern area, such as the Jay ski resort, may also affect the timing of need. VEC has determined that system analyses can be placed on hold until such time the large customer requests to be reconnected. VEC will continue to monitor any changes in load predictions and other factors.

[8] The Docket 7081 MOU defines the lead utility as the distribution utility with the responsibility for leading the NTA analysis. GMP is designated as the lead in terms of Docket 7081; however, VELCO would be the petitioner should a transmission solution be required.

GROUP 3—DISTRIBUTION ISSUES THAT ARE THE FOCUS OF RELIABILITY PLANS

HINESBURG

GMP has identified a distribution system constraint in the Hinesburg area for which it filed a reliability plan on October 1, 2016.[9] GMP customers in the Town of Hinesburg are served by an eight-mile-long distribution line which originates at the GMP Charlotte substation. The load concentration in Hinesburg, together with its distance from the Charlotte substation, results in potential thermal overloads, voltage limitations, and challenges to adequately protect the distribution line for contingencies. While GMP has identified a solution to the existing protection issues, there remain a number of unresolved issues including the potential for future load growth, voltage constraints, high solar penetration, and motor start limitations. GMP analyzed a number of possible solutions to address the long-term reliability needs of the Hinesburg area. These solutions were considered in combination with the goal of producing a robust, cost-effective, long term solution for the area. The potential solutions include: a new GMP substation; a new jointly-owned substation with the Vermont Electric Cooperative (VEC); installation of distance relaying; distributed generation; energy efficiency; and battery energy storage.

After analysis and consideration, GMP plans to install a battery energy storage system (BESS) in the Hinesburg area while participating with VEC in a new substation. Installation of a BESS, in conjunction with a substation, provides GMP with a flexible solution that allows for the deferral of certain transmission and distribution infrastructure while providing the potential to be the lowest cost solution to area deficiencies. GMP is committed to constructing additional storage facilities on its electric system to obtain benefit streams including reduced power and transmission expenses, deferral of transmission and distribution projects, reduced power supply risk, and enhanced resiliency. The Hinesburg area provides a particular opportunity for GMP to gain insights into the costs and effectiveness of a BESS solution in addressing an actual reliability deficiency. The Hinesburg area reliability deficiencies include multiple facets of interest, including high solar penetration and a relatively weak distribution system with limited capacity for future growth. GMP has stated that, given the inherent advantages of battery storage modularity, a battery solution in this area will effectively address uncertainties surrounding load growth and solar penetration while providing insights on the ability of storage solutions to address reliability needs.

[9] GMP's Hinesburg Reliability Plan may be viewed on the VSPC site at http://www.vermontspc.com/library/document/download/5518/2016_09_30_GMP_HinesburgReliabilityPlan.pdf

Vermont System Planning Committee
CHARTER

Purpose

The **Vermont System Planning Committee (VSPC)**[1] is a collaborative body comprised of representatives of stakeholder groups with an interest in electric system reliability. Its purpose is to ensure full, fair, and timely consideration of all societally cost-effective solutions to resolve electric grid reliability issues.

In fulfilling its purpose, the VSPC shall undertake the following objectives:

1. Collaborate with and provide formal input to VELCO in the development and review of the **Vermont Long-Range Transmission Plan (LRTP)** as established in the **Docket 7081 Memorandum of Understanding (MOU)** and such other processes as may be adopted.
2. Jointly review known reliability issues (**transmission**, **subtransmission** and **distribution**) at least once annually to encourage shared insight and facilitate collaboration among electric grid stakeholders.
3. Carry out the functions assigned to the VSPC for screening and analysis of **Non-Wires Alternative** potential as established in the MOU and the **Docket 7874 Screening Framework**.
4. Enhance transparency and public engagement in electric system planning.
5. Provide a forum for the discussion and analysis of the impacts of emerging trends on the behavior of Vermont's electric energy load, including electrification of different end-uses, the installation of storage capacity, demand response measures, distributed generators, merchant projects, and others.
6. Seek consensus on the Vermont load forecast to support LRTP development.
7. Monitor the installation and impacts of **Distributed Energy Resources (DER)** to provide broadly shared insight about DER integration and support the development of tools and processes needed to plan for and maintain reliability in an increasingly modernized and intelligent electric grid.
8. Provide a forum for utilities and partners to share plans for managing load and infrastructure, and allow for peer-to-peer learning through discussion of shared experiences.
9. Maintain regular communication with **ISO New England** to increase Vermont stakeholder and ISO New England understanding of mutually relevant issues, such as forecasting and grid management.

In carrying out this charter, the VSPC will recognize the utility-specific obligations in individual utility **Integrated Resource Plans (IRPs)** and statewide energy policy.

[1] Terms in bold can be found in the VSPC glossary at http://www.vermontspc.com/charter-glossary

Deliverables

#	Related purpose	Current task?	Tasks/deliverables (current and potential)
1	1, 4, 6	Yes	Provide formal input to the LRTP as required by the MOU.
2	1 , 4, 6	Yes	Provide input to the Vermont load forecast.
3	2, 3, 4, 7	Yes	Annually review utility NWA screenings and make geographic targeting recommendations for energy efficiency and standard offer above the cap to the Public Service Board.
4	4	Yes	Recommend candidates for PSB appointments to public seats.
5	4	No	Identify and address gaps (if any) in current membership structure and stakeholder representation
6	4	Yes	Maintain transparency of the VSPC through a VSPC website and adherence to VSPC procedures for meeting notice and open meetings.
7	3, 4, 7	Partial	Maintain a regularly updated, easily understood, publicly available tracking tool for the status of all screened reliability issues.
8	4, 5, 8	Yes	Provide information about policy, programmatic and technological developments, such as FERC Orders, Vermont rule and legislative changes, and research projects.
9	4, 5, 7	Yes	Provide a forum for sharing of utility IRPs.
10	4, 5, 7	No	Monitor emerging grid transformations and consider whether the VSPC has a value-added role to play in evaluating impacts and/or adapting to specific changes as they emerge.
11	3, 4, 5, 7	Partial	Modify project screening tools as needed/when necessary to ensure continued consistency with purpose and objectives.

Vermont System Planning Committee

Glossary of terms and abbreviations used in the VSPC charter

DER — Distributed Energy Resources: Distributed energy resources (DER) are smaller power sources and demand control systems that can be aggregated and coordinated to provide power necessary to meet regular demand. (Source: EPRI.)

Distribution: The final stage in the delivery of electric power, distribution carries electricity from the transmission system to individual consumers.

Docket 7874 Screening Framework: An attachment to the PSB Order in Docket 7874 that establishes the procedure for implementation of 30 V.S.A. § 8005a(d)(2), the procedure for the PSB to approve standard offer generation that provides "sufficient benefit" to the grid to warrant permitting outside the program's annual cap.

FERC — Federal Energy Regulatory Commission: An independent federal agency that regulates the interstate transmission of natural gas, oil, and electricity, as well as natural gas and hydropower projects. (Source: FERC.gov.)

FERC Order 1000: A FERC order that reforms planning, cost allocation and interregional planning of transmission facilities, and requires competitive bidding for the construction of new transmission infrastructure. For more information: http://www.ferc.gov/industries/electric/indus-act/trans-plan.asp

Grid transformation: Adaptation of the electric power grid to increasing integration of DER and renewable energy.

ISO-NE — ISO New England: The independent, not-for-profit company authorized by the Federal Energy Regulatory Commission (FERC) to serve as the Regional Transmission Organization for Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and most of Maine. Its responsibilities include operating the power system, administering the electric power markets, and conducting power system planning for the region.

IRP — Integrated Resource Plan: A utility plan for meeting forecasted annual peak and energy demand, plus some established reserve margin, through a combination of supply-side and demand-side resources over a specified future period. Vermont utilities are required to submit an IRP to the PSB and PSD at least once every three years looking out over a 20-year horizon. (See Vermont Statutes Title 30 Section 218c.)

LRTP — Vermont Long-Range Transmission Plan: The least cost integrated plan for the electric transmission system required to be filed by VELCO once every three years. (See Vermont Statutes Title 30 Section 218c.)

MOU — Docket 7081 Memorandum of Understanding: The settlement in PSB Docket 7081, Investigation into Least-Cost Integrated Resource Planning for Vermont Electric Power Company. The settlement establishes the VSPC, procedures related to screening of transmission and subtransmission issues for the potential to be resolved with NWAs and other collaborative planning processes.

NWA — Non-Wires Alternatives: Targeting the use of energy efficiency, and energy resources including distributed energy resources (DERs) in a specific location or geographic boundary to defer or avoid building new transmission or distribution infrastructure to resolve a reliability issue. NWAs may also include hybrid solutions that may combine some traditional capital investment and some DER components.

NWA screening: Preliminary review of an identified reliability issue to determine, at a high level, its potential to be resolved with an NWA.

NWA screening tools: A formally adopted form used to perform NWA screening. The following two screening tools have been approved for use in Vermont.

Docket 7081/VSPC Non-Transmission Alternatives screening tool required for all transmission issues and may be used for sub-transmission issues.

Docket 6290 screening tool required for all distribution issues and may be used for sub-transmission issues.

PSB —Public Service Board: A quasi-judicial board that supervises the rates, quality of service, and overall financial management of Vermont's public utilities: cable television, electric, gas, telecommunications, water and large wastewater companies.

PSD — Public Service Department: An agency within the executive branch of Vermont state government charged with representing the public interest in energy, telecommunications, water and wastewater utility matters.

Reliability: The ability to meet the electricity needs of end-use customers, even when unexpected equipment failures or other conditions reduce the amount of available power supply; the capability of electricity networks to withstand sudden disturbances or unanticipated losses in system components, whether caused by natural or man-made events; maintaining sufficient resources to provide end-use customers with round-the-clock delivery of electricity at the proper voltage and frequency. (Source: North American Electric Reliability Corporation.)

Reliability deficiency: an existing or forecasted violation, pre- or post-contingency, of applicable Bulk Transmission System or Subsystem design or operating criteria, with consideration given to the reliability and availability of individual system elements. (As defined in Docket 7081 MOU.)

Subtransmission: Electric system delivery components that are classified neither as transmission nor distribution.

Transmission: The bulk movement of electrical energy from a generating site, such as a power plant, to an electrical substation.

VELCO — Vermont Electric Power Company: The owner/operator of Vermont's electric transmission system.

VSPC — Vermont System Planning Committee: The stakeholder committee established in Docket 7081 for collaborative transmission planning, public engagement and transparency of the planning process.