Scoping the 2018 Vermont Long-Range Transmission Plan

vermont electric power company

VELCO

July 12, 2017

VSPC quarterly meeting

Hantz Présumé

Outline

- Study plan
  - VT planning process
  - Overview of 2018 study plan
- Criteria and assumptions
- Next steps

Vermont study history

- **Before 2005** (pre-Docket 7081)—VELCO performed long-range studies as needed prior to 7081 MOU
  - Northwest Reliability Project (NRP) originated from the 2001 long-range study, which used the Public Service Department load forecast
- **2005**—VT Legislature required VELCO to file a long-range plan looking out at least 10 years and to update every three years [Act 61 amendments to 30 V.S.A §218c(d)]
- **2006**—VELCO published 10-year long-range plan using the PSD load forecast
- **2007**—VT Public Service Board approved Docket 7081 MOU, establishing a 20-year planning horizon
- **2009**—VELCO published the 20-year Vermont Long-Range Transmission Plan
  - VELCO prepared its own forecast with VSPC assistance

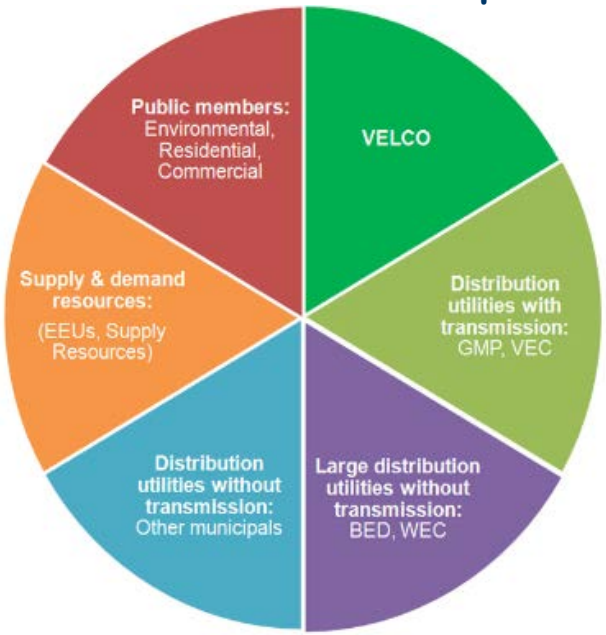
Vermont study history, continued

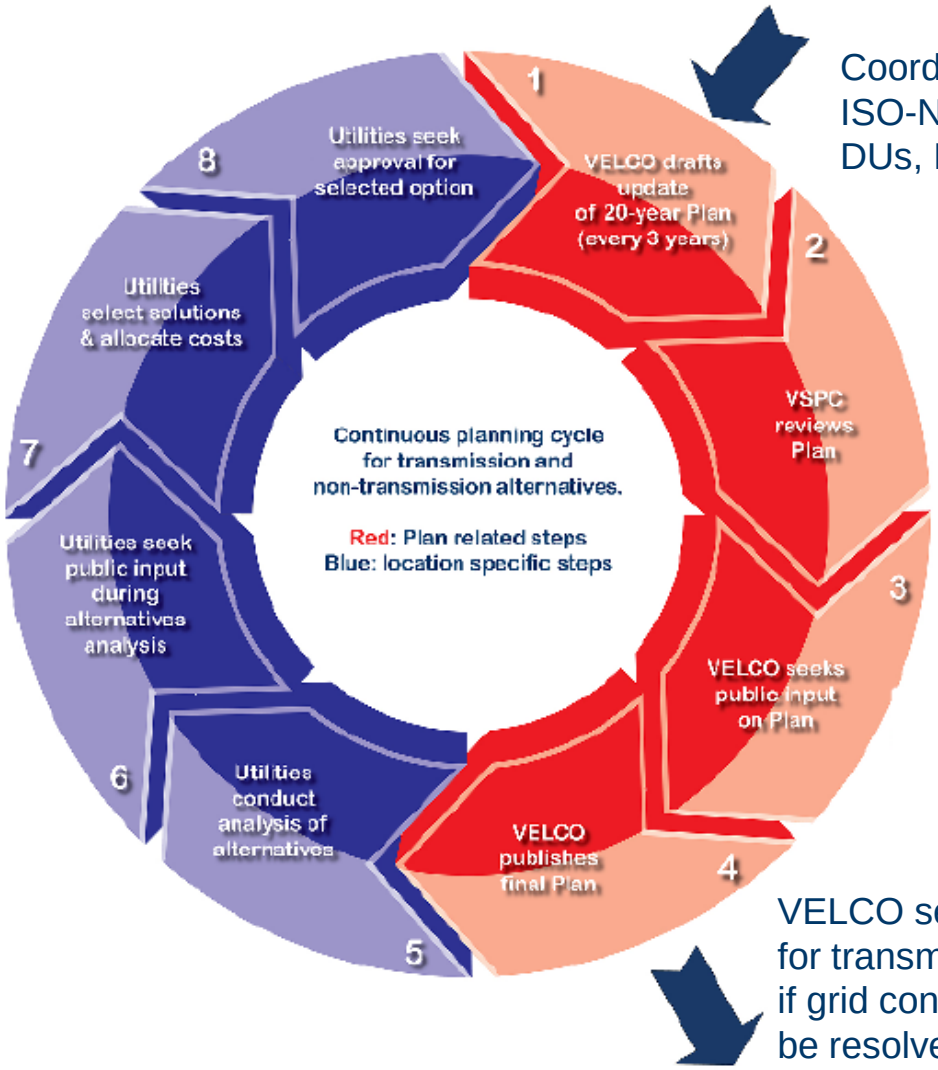
- **2011**—ISO-NE completed the 10-year VT/NH 2010 needs assessment
- **2012**—VELCO published 20-year long-range plan
- **2014**—ISO-NE completed the 10-year VT/NH 2013 needs assessment
- **2015**—VELCO published 20-year long-range plan
- **2016**—VELCO completed the NERC TPL-001-4 assessment
- **July 2017**—VELCO starting the 2018 20-year long-range plan

The Vermont planning process

Process as required by Docket 7081 MOU, which also formed Vermont System Planning Committee (VSPC)

VSPC membership





Coordination with ISO-NE—input from DUs, DPS, VEIC

VELCO seeks permits for transmission projects if grid concerns cannot be resolved by non-transmission solutions

http://www.velco.com/our-work/planning/long-range-plan

Plan development timeline

Jan to Jul 2017	Prepare a load/renewable energy forecast
May to Jul 2017	Prepare load flow cases and auxiliary files
Jun 2017	Consultation with distribution utilities
Jul VSPC quarterly meeting	Review high level scope with the VSPC
Jul to Nov 2017	Perform system analysis
Jul to Oct 2017	Identify deficiencies and develop solution options
Aug 2017	Engineering support (modeling data)
Sep and Oct 2017	Construction Controls support (Cost estimates)
Nov and Dec 2017	Prepare the draft report for VSPC review
Jan to Mar 2018	Obtain formal feedback from VSPC
Mar 2018	Incorporate VSPC comments
Apr to May 2018	Conduct public meetings for input to the report
Jun 2018	Incorporate comments from the public
Jun 2018 (by 7/1/18)	Publish plan

Docket 7081 MOU steps for VSPC input

- VELCO consults with DUs, PSD and ISO-NE during plan development
- VELCO provides draft to VSPC
  - Minimum 60-day review period
  - Input on content
  - Specific review of system level determinations and NTA screenings
  - Formal memo of response to VELCO
- VELCO incorporates VSPC input or provides rationale why not

Overview of public outreach plan

- Identify targeted stakeholders
- Develop plan for public meetings
- Secure media coverage
- Develop website
- Conduct public meetings
  - At least two geographically diverse “open houses”
  - Public hearing in Montpelier
  - Presentation at meetings of groups as invited
- Compile public input
  - Statute requires transcript of public comments

Steps in developing 2018 long-range plan

- ISO-NE's VT/NH assessments and the VELCO TPL-001-4 assessment will be used as bulk system analysis for years 1-10
- VELCO will analyze sub-transmission system for years 1-10
- VELCO proposes to analyze years 11-20 only to examine risks and trends due to long-range forecast uncertainties and the inability to forecast public policy initiatives
- VELCO will requested DU input on subsystem analyses
- Plan will be non-CEII public document based on underlying technical analysis, as in previous plans

CEII: Critical Energy Infrastructure Information

Planning criteria relevant to 2018 plan

- NERC planning standard TPL-001-4
  - No outages (N-0) or Category P0
  - Outage of one element (N-1) or Category P1
  - Outage of two or more elements (N-k, N-1-1) or Categories P2 to P7
- ISO-NE planning standard PP3
  - N-0, N-1, N-k, N-1-1
  - Stressed conditions
    - Extreme weather load (90/10)
    - Two significant resources unavailable (probabilistic considerations currently under review)
    - Maximize regional power transfers

NERC = North American Electric reliability Council
ISO-NE = Independent System Operator of the New England electric system
90/10 = 90% chance that the actual load will be at or lower than the forecast, 10% chance that it will exceed the forecast

Transmission outages examined

- Single-element outages
  - Line, transformer, generator, Essex STATCOM, Highgate HVdc terminal
- Multi-element outages
  - DCT, breaker failure, Sandy Pond HVdc terminal
- First single-element outage, then system adjustment, then another outage is tested
  - Prior studies tested a subset of elements as the first outage
  - In this study, all transmission lines and Highgate HVDC tested as first outage
    - NERC BES definition now in effect
    - NERC TPL-001-4 was approved in 2013

DCT = Double circuit tower outage that disconnects two lines supported by the same poles
Breaker failures = outage that disconnects elements adjacent to a breaker

Transmission performance criteria

	Thermal criteria	Voltage criteria	
System event	For all facilities	For 115 kV facilities	For 230 kV and above
NERC Category P0 (All-lines-in)	At or below normal rating	At or above 0.95 pu and At or below 1.05 pu	At or above 0.98 pu and At or below 1.05 pu
Categories P1 to P7 (single or multi-element outages)	At or below LTE rating	At or above 0.95 pu and At or below 1.05 pu Delta V no greater than 10%	At or above 0.95 pu and At or below 1.05 pu Delta V no greater than 5%

Delta V for shunt switching with all lines in: 2.5% for below 230 kV, 2% for 230 kV and above
Delta V for shunt switching with a line out: 5% for below 230 kV, 4% for 230 kV and above

Thermal = That which is related to current flow
Normal rating = Nearly continuous current capacity of a piece of equipment, such as a line, a transformer
LTE rating = Long-term (4 to 12 hours) emergency current capacity of a piece of equipment
Voltage = That which is needed to allow current to flow. The higher the voltage, the lower the current for the same power level
pu = per unit voltage, which is the ratio of the calculated voltage over the nominal/operating voltage level, such as 115 kV, 46 kV
Delta V = change in voltage before and after an outage

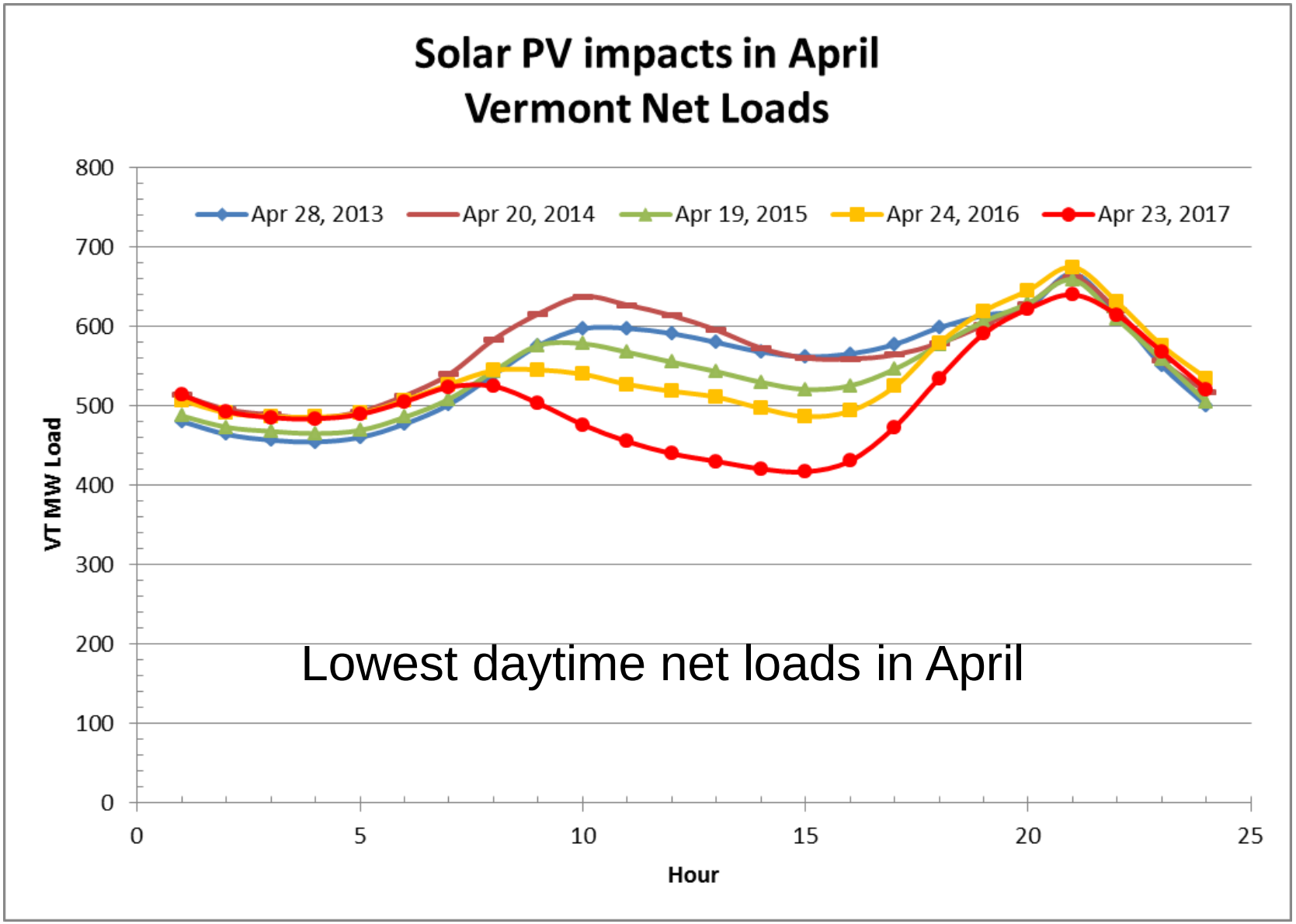
Sub-transmission performance screening approach

System event	Thermal limit	Voltage limit
NERC Category P0 (All-lines-in)	At or below rating	At or above 0.95 pu and At or below 1.05 pu
NERC Category P1 (single-element outages) N-1	At or below rating	At or above 0.90 pu and At or below 1.05 pu Delta V no greater than 10%

- Will record system performance for single loss of:
  - Transmission facility
    - Also with a transmission facility already out of service
  - Step-down transformer (115 kV to a lower voltage)
    - Loss of load for radial transformers will be considered acceptable unless affected DUs state otherwise
  - Sub-transmission facility
    - Breaker to breaker and line-end open scenarios
- DUs will determine whether study results outside the above screening limits need to be resolved

Study assumptions

- Generation dispatch and system stresses will be the same as in the 2015 analysis
- The load forecast will be reviewed at the next forecast subcommittee meeting on August 2nd
- The forecast is enormously uncertain due to the 20-year horizon and unpredictable public policies
- How we may be able to mitigate the risk
  - Examine multiple scenarios in long-range plan
  - Continue to use the geographical targeting subcommittee to identify areas where DG and EE can help mitigate
  - Evaluate how the grid may be negatively affected by a large amount of DG during lower load levels



- Additional DG may cause grid concerns in some regions

Next steps

- Review VSPC comments on scope
- Perform analysis and consult DUs on results
- Present draft report at January meeting