Scoping the 2021 Vermont Long Range Transmission Plan

vermont electric power company

VELCO

July 15th, 2020

VSPC quarterly meeting

Outline

- Study plan
  - VT planning process
  - Overview of 2021 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

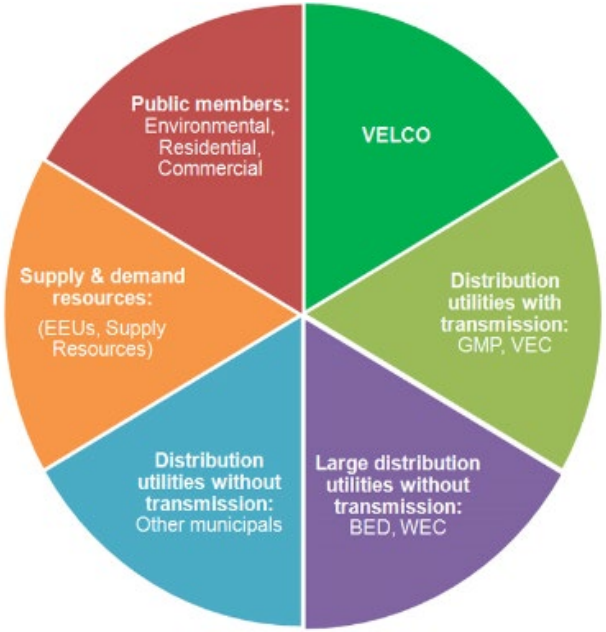
Vermont study history, continued

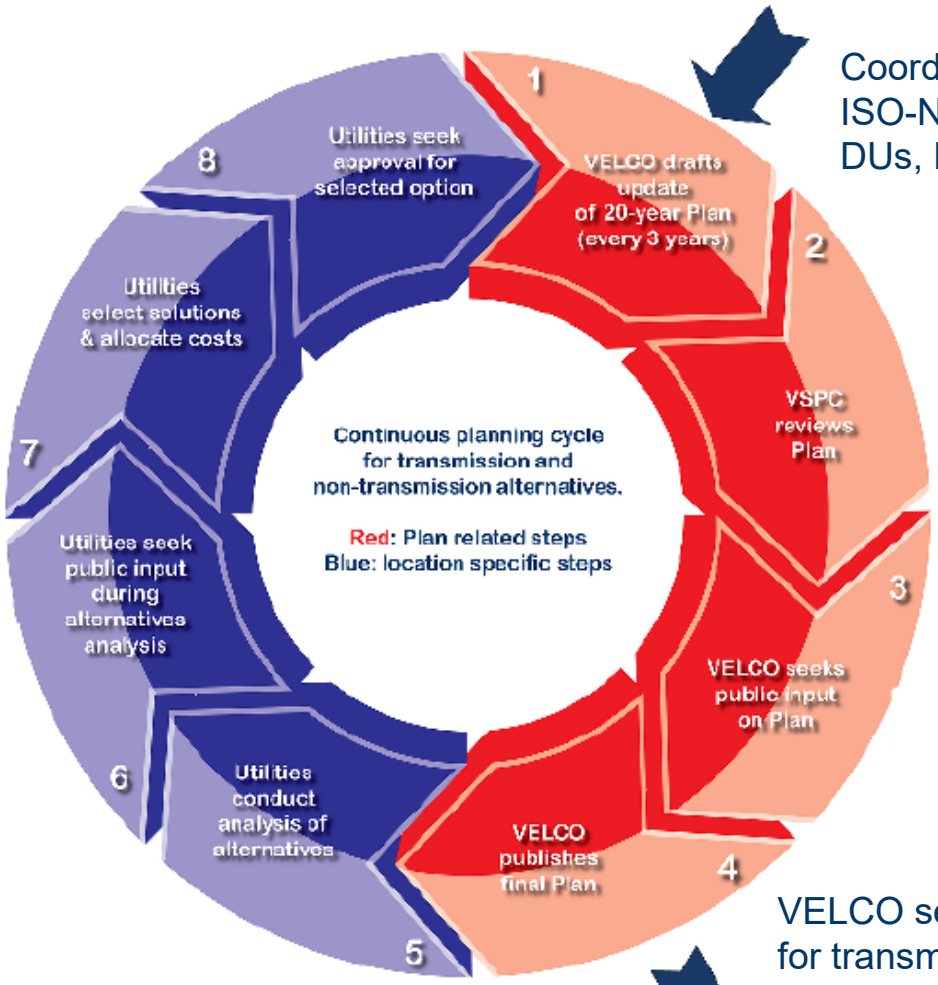
- **2011**—ISO-NE completed the 10-year VT/NH 2010 needs assessment
- **2012**—VELCO published 20-year long-range plan
- **2014**—ISO-NE completed the 10-year VT/NH 2013 needs assessment
- **2015**—VELCO published 20-year long-range plan
- **2016**—VELCO completed the NERC TPL-001-4 assessment
- **2018**—VELCO published 20-year long-range plan
- **June 2020**—VELCO starting the 2021 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

November 2019 to June 2020	Prepare a load/renewable energy forecast
June and July 2020	Prepare load flow cases and auxiliary files
June 2020	Consultation with distribution utilities
July VSPC Quarterly Meeting	Review high level scope with the VSPC
July to November 2020	Perform system analysis
July to October 2020	Identify deficiencies and develop solution options
August 2020	Engineering support (modeling data)
September and October 2020	Project Controls support (cost estimates)
November and December 2020	Prepare draft report for VSPC review
January to March 2021	Obtain formal feedback from VSPC
March 2021	Incorporate VSPC comments
April and May 2021	Conduct public meetings for input to the report
June 2021	Incorporate comments from the public
June 2021 (by 7/1/21)	Publish plan

Docket 7081 MOU steps for VSPC input

- VELCO consults with DUs, DPS 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 2021 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 2021 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 (post-switching) 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

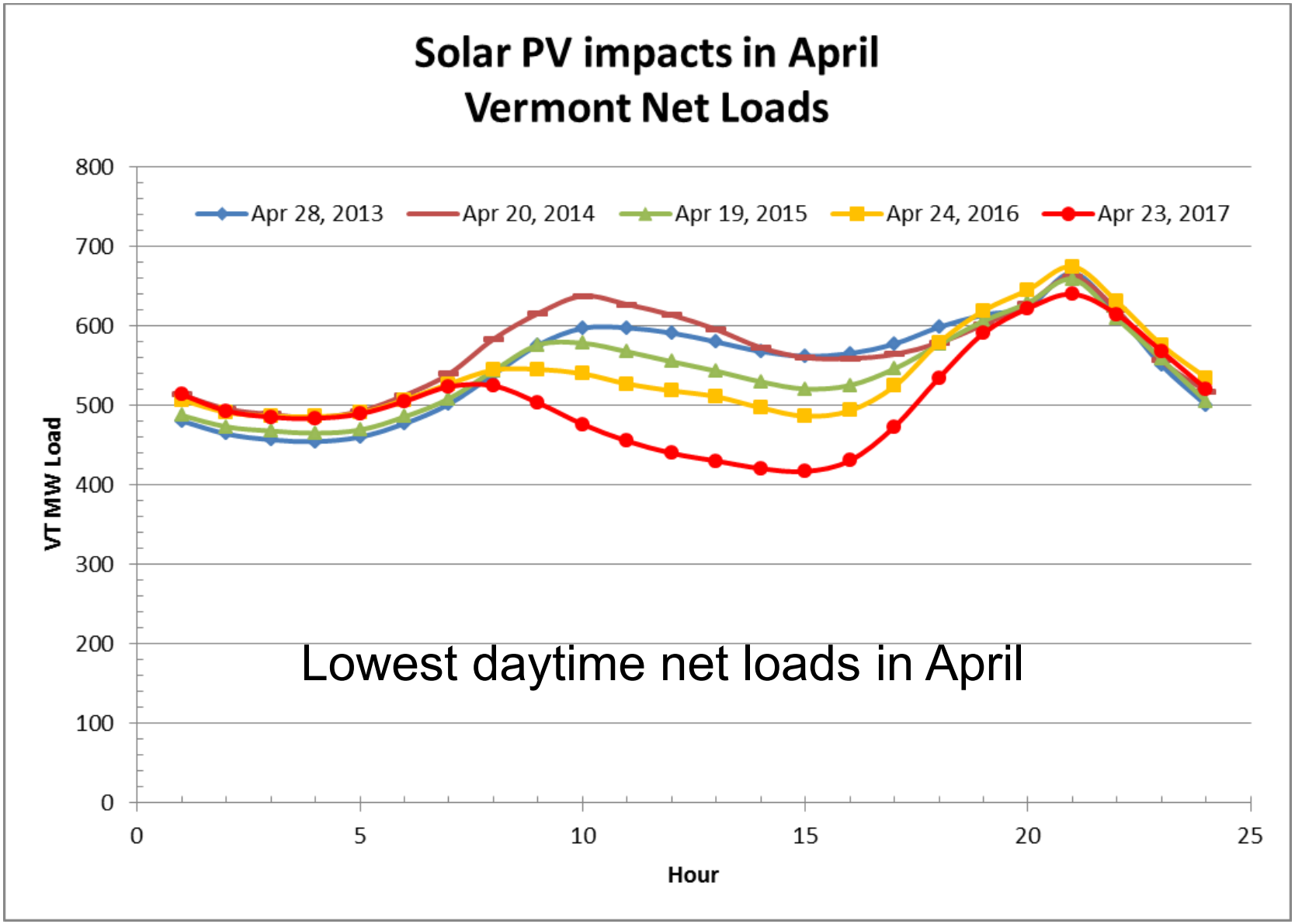
Sub-transmission performance screening approach

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 (LTE rating if applicable)	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 from the 2018 analysis will be used as a starting point
- The load forecast was reviewed at the last forecast subcommittee meeting on June 8th
- 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 issues
  - 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

Potential Scenarios

- High in-state distributed generation
  - Doubling of Tier II or 1000 MW of solar
  - Low daytime spring loads
  - Refine 2018 Optimized Distribution
    - Use more realistic assumptions
    - Consider distribution limits
- High electrification
  - High forecast scenario
    - Significant growth in EVs and heat pumps
    - Some growth in daytime loads, large growth in peak loads
  - Consider load management measures
  - Consider high in-state distributed generation

Next steps

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