Case Study for the New Normal: Transmission Deferral in Vermont

Tom Dunn,
Vermont Electric Power Company

Overview

- Introduction to Vermont Electric Power Company (“VELCO”)
- New Normal: Lower Load Growth (flat or declining in some areas)
  - Weak economy, DSM, Increasingly rigorous standards/codes, DG growth, Fuel Switching
  - Reduces the need for transmission related to load growth
  - Drivers of future transmission investment
    - Integration of renewable generation
    - Aging infrastructure
- Transmission planning in Vermont
- The case for deferral of transmission investment
- Challenges of increased deployment of Distributed Generation

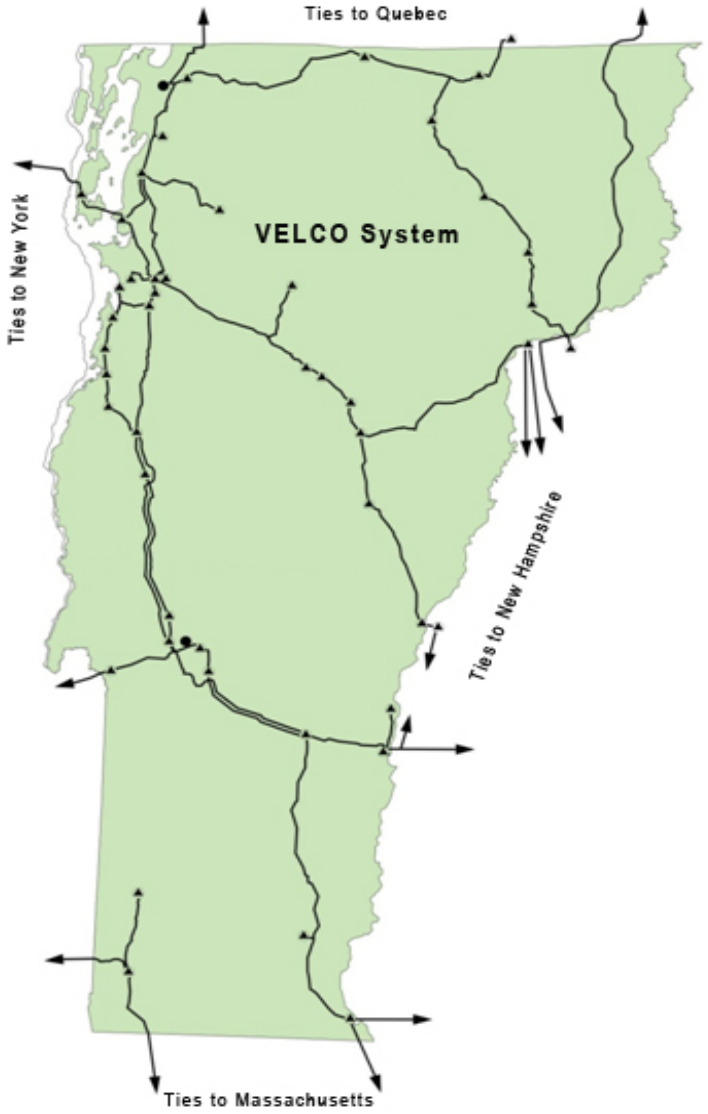
Roles & responsibilities

VELCO, formed in 1956, is Vermont's transmission company responsible for ensuring transmission system reliability by planning, constructing, operating and maintaining the state's high-voltage electric grid.

Related responsibilities

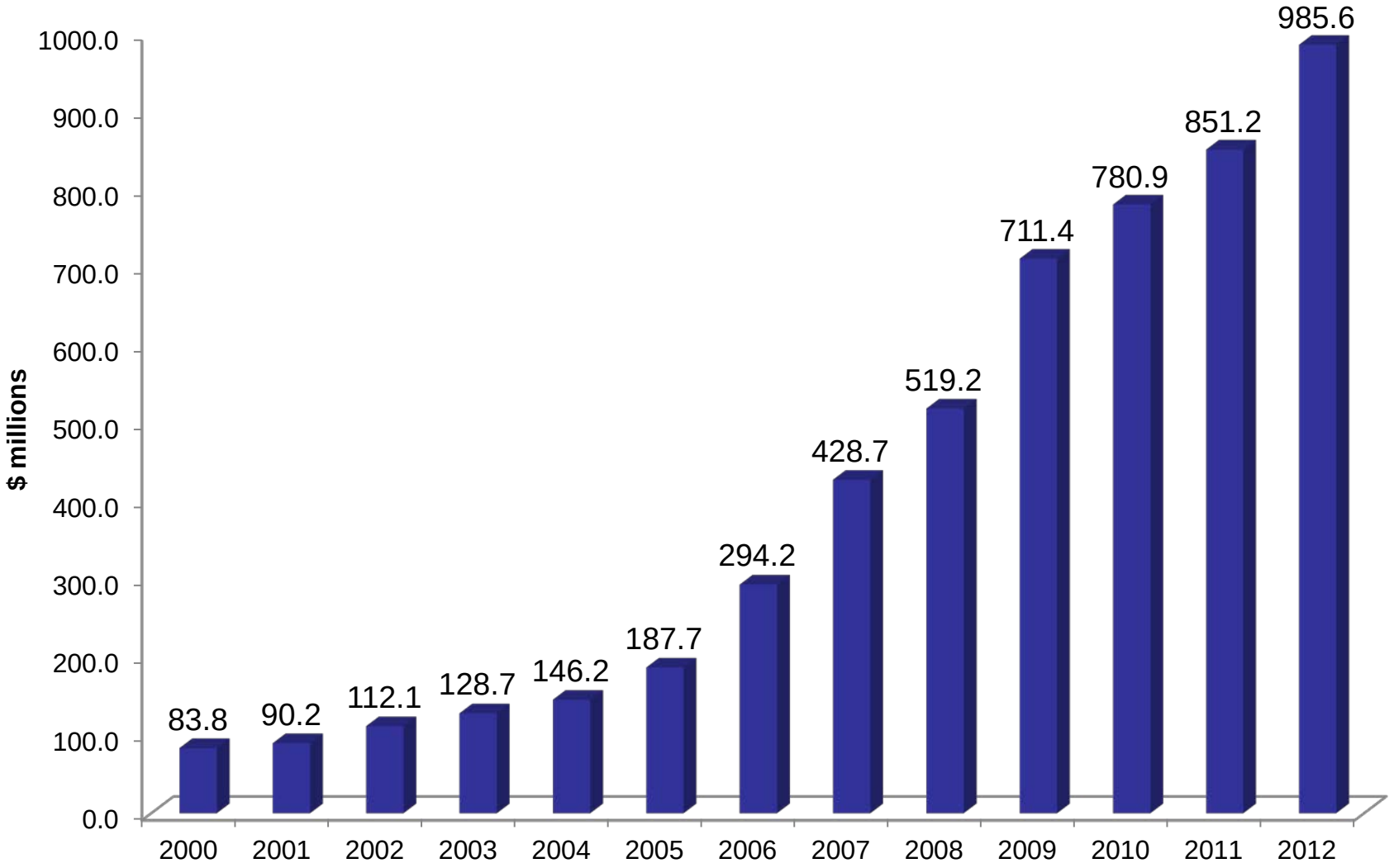
- Serve as Local Control Center for grid operations in Vermont
- Develop and submit Vermont's Long-Range Transmission Plan
- Manage Vermont System Planning Committee
- Coordinate eEnergy Vermont Smart Grid Project
- Advocate owner and state positions at ISO-NE
- Enable utilization of fiber network to advance state telecommunications goals consistent with utility purpose
- Provide metering and billing services for SPEED projects
- Provide GIS mapping data to owners and regulators

Vermont Transco transmission assets managed by VELCO



- 738 miles of transmission lines (115, 230 & 345 kV)
- 13,000 acres of rights-of-way
- 55 substations, switching stations and terminal facilities
- 225 MW back-to-back converter interconnection with Hydro-Quebec
- 1,400 mile fiber optic network to monitor and control the electric system
- 52-mile 450 kV direct current line through the Northeast Kingdom owned by Vermont Electric Transmission Company (VETCO)

VT Transco total asset growth 2000-2012



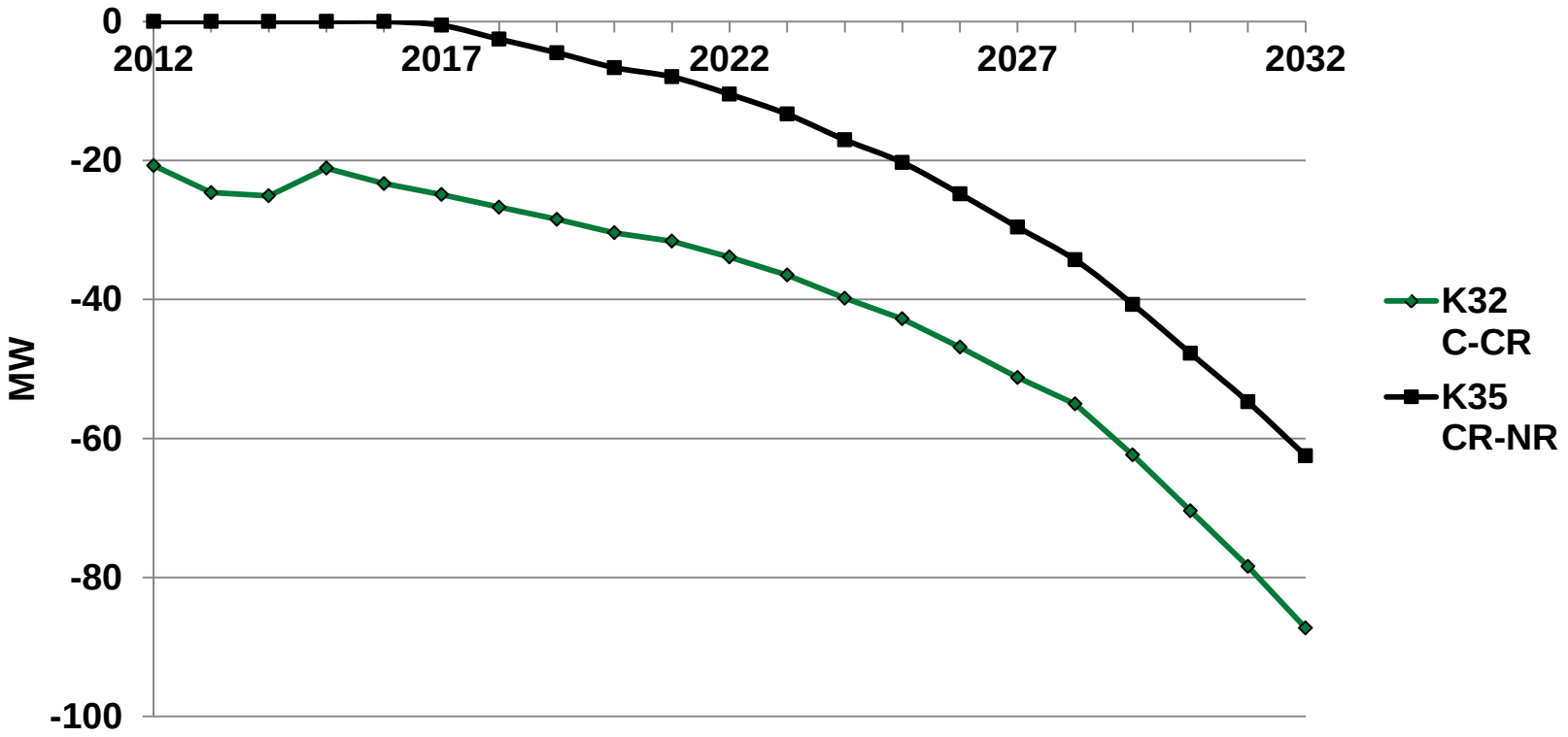
Regulatory Requirements Affecting Transmission Planning

- New England allocates transmission costs across all customers (i.e., all looped 115 kV & above)
  - Non Transmission alternatives (NTA) paid for by Vermont only
  - Cost Allocation mechanism favors transmission solutions over other non-transmission solutions.
- Vermont statute requires VELCO to:
  - Submit 20-year transmission plan at least every three years
  - "Identify potential need for transmission system improvements as early as possible, in order to allow sufficient time to plan and implement more cost-effective non transmission alternatives to meet reliability needs, wherever feasible."
  - Responsible for all utilities and regulators to advocate for regional cost support for the least cost solution with equal consideration and treatment of all available resources, including transmission, strategic distributed generation, targeted energy efficiency, and demand response resources on a total cost basis." *Act 61*
  - Evaluate Non Transmission Alternatives (NTA) as potential solutions to transmission needs
- NTA's include one or more resources implemented over the planning period to eliminate reliability gaps
  - These resources could included energy efficiency, demand response, generation etc.

Transmission Planning in Vermont

- ISO New England responsible for transmission planning in New England
  - Affected Transmission Owners work collaboratively with ISO NE on studies
- In 2011 ISO New England studied VT-NH
  - Identified significant transmission capacity deficiency in central Vermont
  - Best transmission solution: new 345 kV line ($157 M)
    - Vermont shares 4% of costs for transmission: $6.3 M
- Distribution Utilities (DU) & VELCO form study group to assess potential for NTA to resolve Central VT concerns
  - NTA are resources that can be implemented over the planning period to eliminate reliability gaps
- VELCO required to propose the most cost-effective option for resolving reliability deficiencies

Central Vermont Reliability Gap



Overloads	Vermont load (MW)	New England load (MW)
K-32 C-CR: (18.2mi Coolidge-Cold River)	1010	27100
K-35 CR-NR: (5.6mi Cold River-North Rutland)	1045	28000

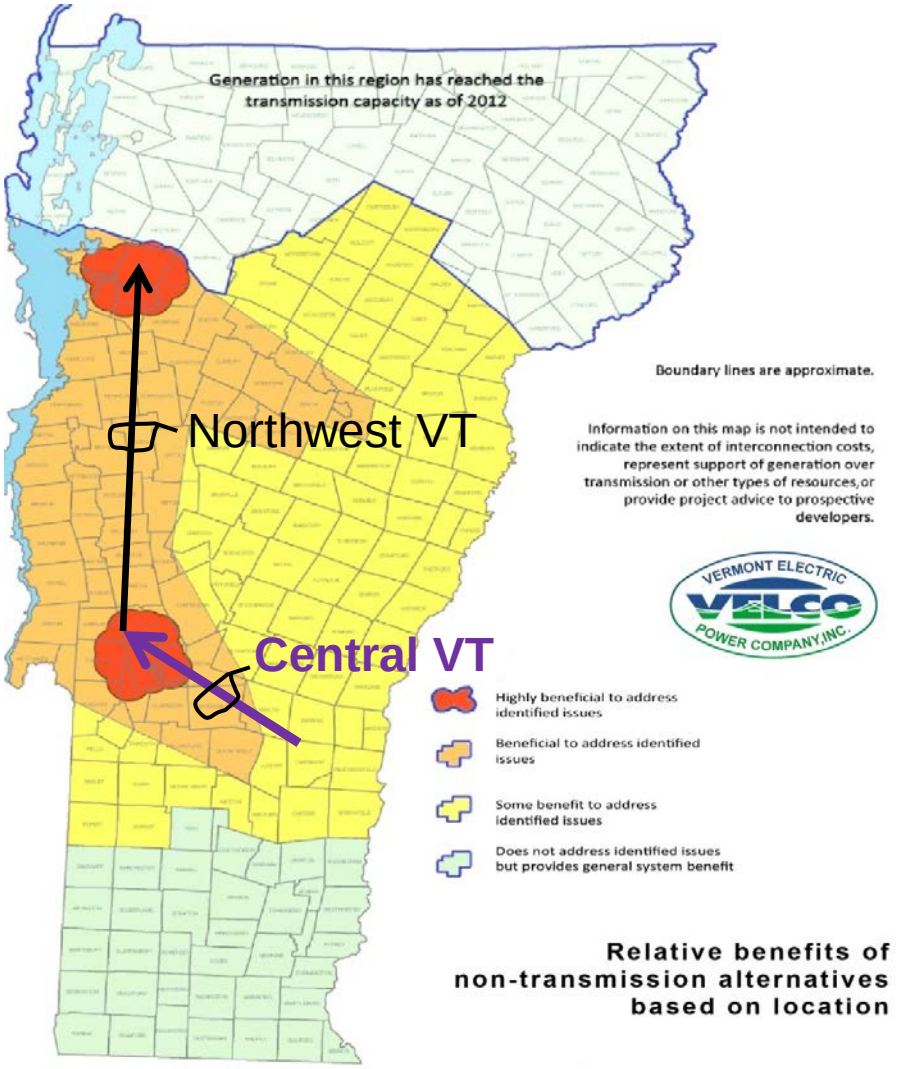
VELCO 2012 Twenty Year Transmission Plan

2012 Plan includes a map depicting the relative benefit to the transmission grid of new generation or load reductions by location.

Zones of benefit are based on ISO-NE 2011 VT/NH analysis.

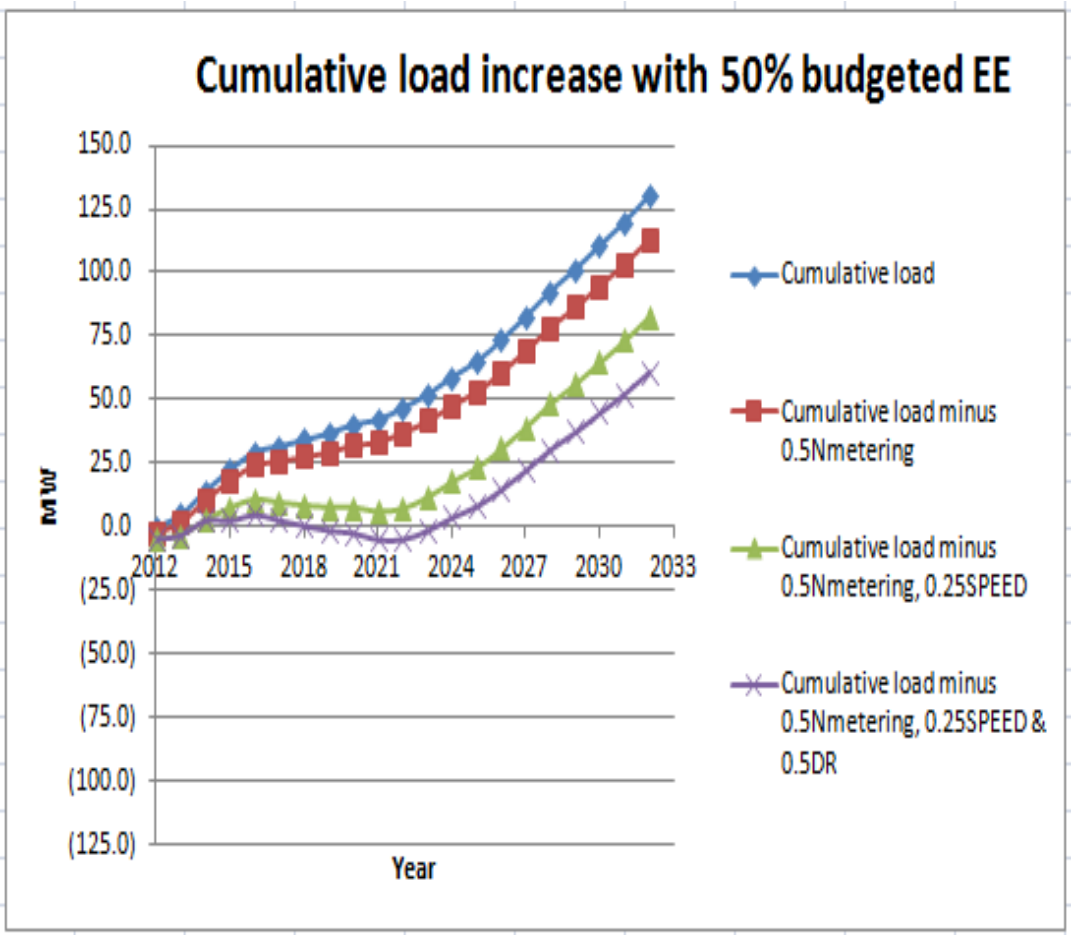
Benefits are being much more precisely analyzed by “NTA Study Group.”

This map also depicts areas where siting generation is NOT beneficial for addressing transmission concerns that have screened in.



Vermont is Actively Supporting Deployment of Distributed Resources

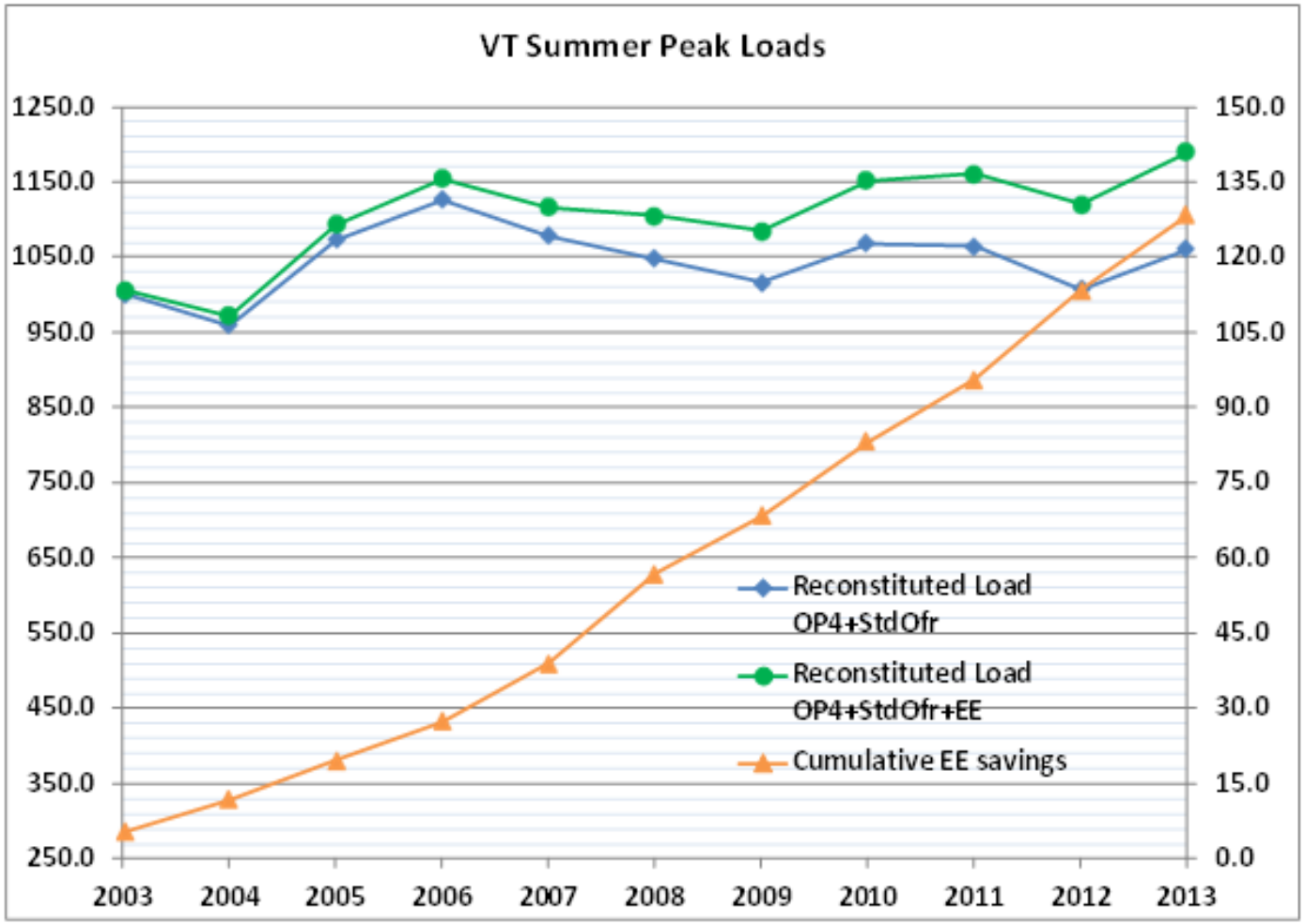
- Vermont is actively promoting deployment of distributed generation (i.e., solar, methane, farm methane, wind, hydro)
  - Feed In Tariff (i.e., SPEED* program)
  - 8 MW 2011, 12 MW in 2012
  - Cumulative goal of 127.5 MW by 2022
  - Net-metering
- Programs modeled as negative load in Vermont's load forecast



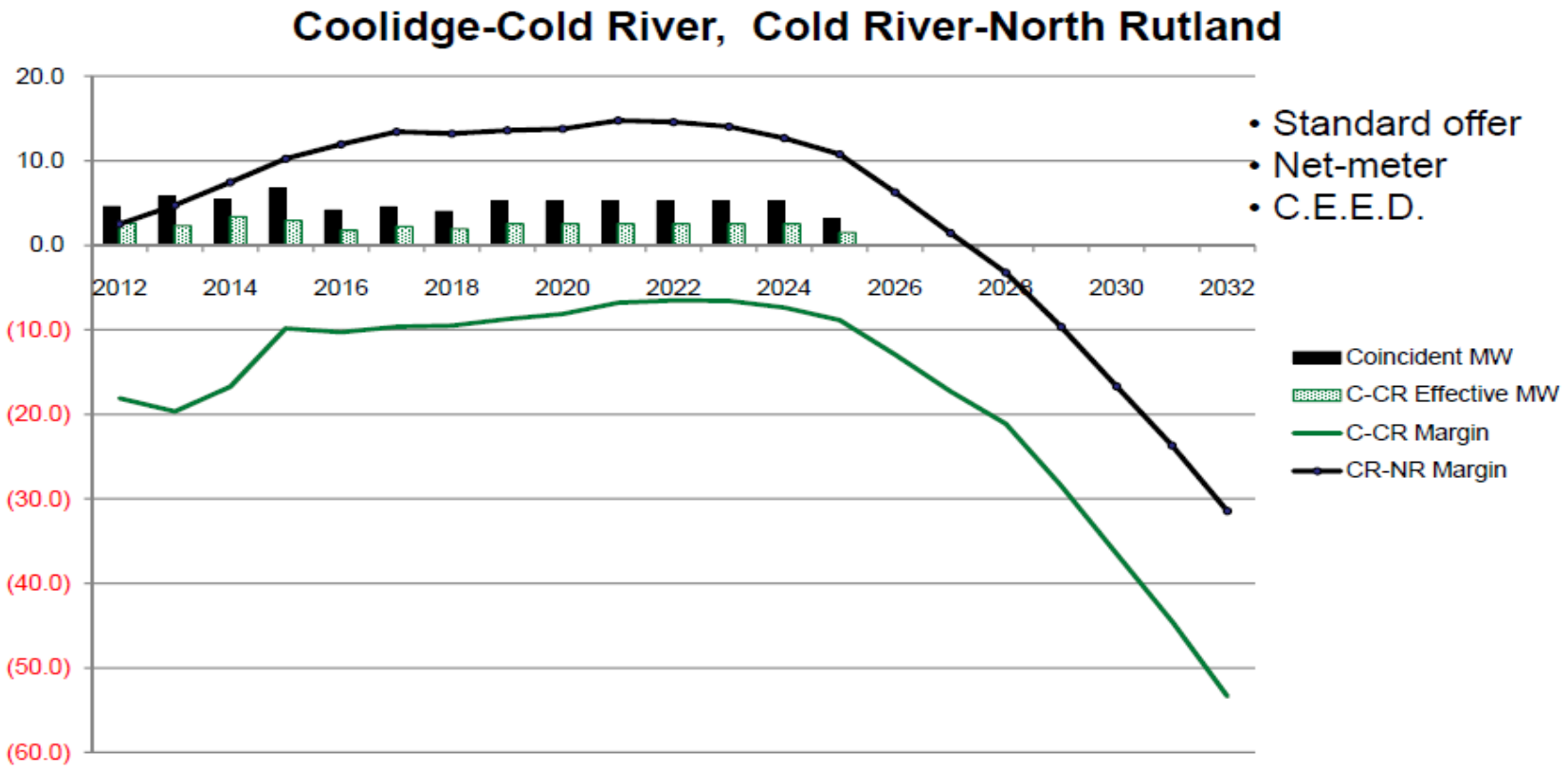
*Sustainably Priced Energy Enterprise Development

Effects of Energy Efficiency on the summer peaks

- Reported EE savings from VEIC annual reports (2013 figure was estimated to be 15 MW by VELCO)



NTA Study Results



- Reliability gap nearly closed by existing state sponsored programs
- Remaining gap is relatively flat and can be managed with a demand response program and operating procedures

Evolution of the planning studies

Late 2011: ISO-NE publishes preliminary study showing system concerns in Central VT

Late 2011: DUs & VELCO form study group per Docket 7081 MOU to assess potential for non-transmission alternatives (NTA) to resolve Central VT concerns

April 2012: ISO-NE Solutions Study proposes transmission upgrades to resolve Central VT concerns

At this point, without VT NTA study requirement, a transmission solution would likely have been implemented.

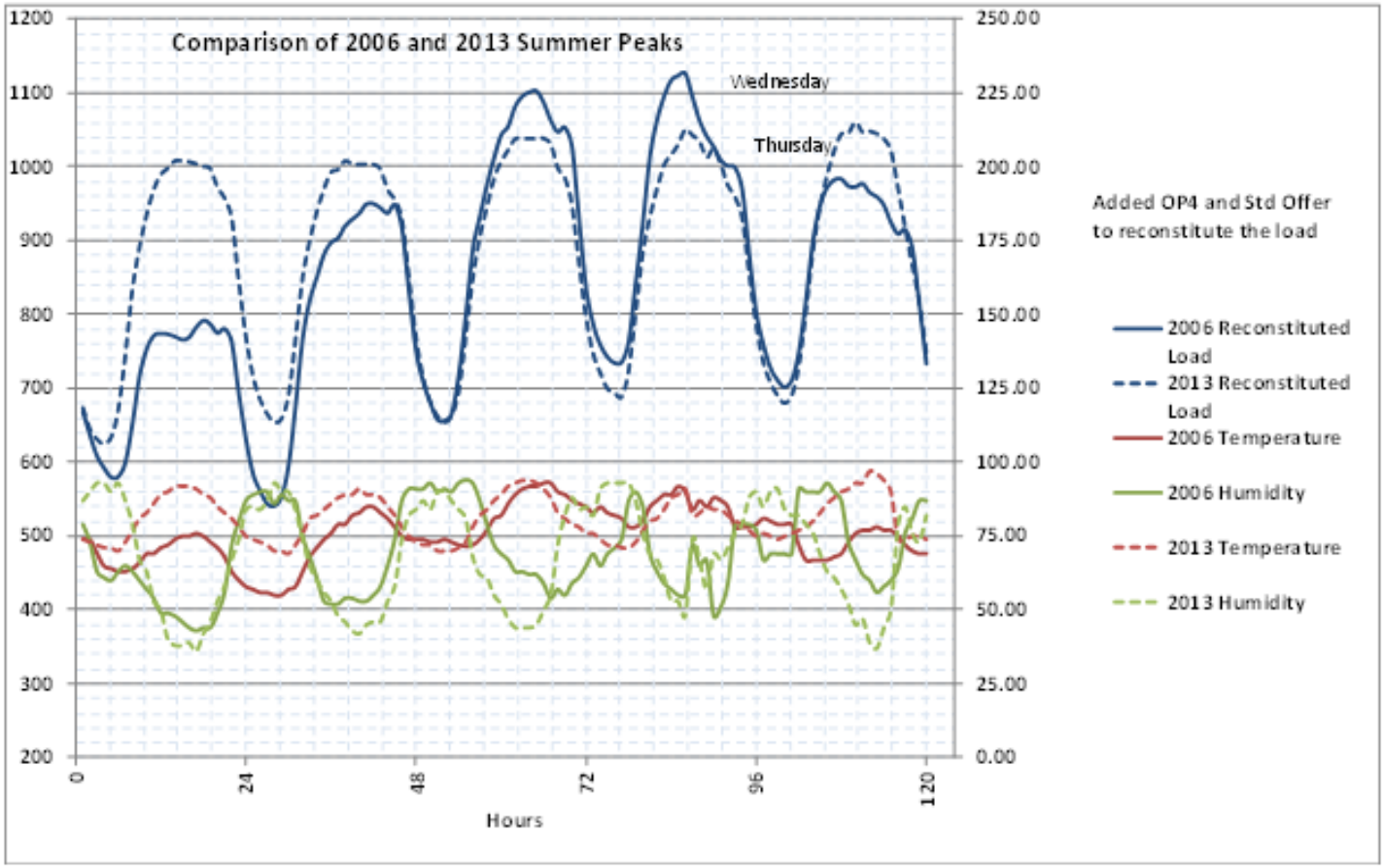
Nov 2012: GMP & VELCO present study group results to ISO-NE showing potential for NTA to postpone Central VT upgrades

Early 2013: ISO-NE reassesses need for Central VT upgrades

Summer 2013: ISO-NE study confirms $157 million Central VT upgrade deferral

Validation: Comparing the 2006 and 2013 summer peaks

- The 2013 peak was about 65 MW lower than in 2006
  - The temperature exceeded 90°F for 5 straight days in 2013 (98°F on the 5th day)
  - The 2013 peak occurred later in the week – the later timing tends to be higher
  - There were more hot days leading up to the peak day in 2013 compared to 2006



Increasing Amounts of Distributed Generation Can Affect

- System reliability
  - Value to the transmission system is location specific
    - Curtailing wind generation in northern Vermont due to transmission constraints
      - Additional DG in this area exacerbates problem
    - Other locations DG mitigates transmission deficiencies
- Accuracy of load forecasts
  - Pace of deployment of DG resources
  - Some estimates DG will make up more than 10% of VT's peak by 2021 (Synapse)
- Need for transmission investment
  - Projects needed at today's or higher future load levels could be deferred if loads remain flat or decline

Challenges for Transmission Operators of Increased DG

- Lack of visibility and controllability of the DG resources
  - Many of these resources do not participate in regional markets
    - Location of resources unknown/uncertain
    - Real Time output of DG unknown/uncertain
- Interconnection standard requirements
  - Uncertainty of performance of DG during system events (e.g., ride-through capability)
- Impact of these resources on reserve requirements
  - Output variability of DG could increase need for generation to provide spinning reserves, AGC
- Reduced use of pumped storage facilities

Ways to improve integration of Distributed Generation

- Enhanced weather forecasting
  - VELCO is evaluating ways to obtain more accurate weather data (e.g., more granular-2 km^2; -up to 48 hours into future)
  - Predict output for DG (e.g., wind, solar, hydro)

- Use enhanced communication network
  - Use extensive fiber optic network and statewide smart meters
  - Collect real time data and deliver it to control center

- Use data to optimize system dispatch and system planning
  - Granular information on DG production
  - Effectively capture the impact of DG on transmission system

- ISO NE forming a DG Working Group
  - Track deployment in New England
  - Forecasting
  - Integration

Conclusions

- NTA study slowed solution for long enough to identify changing DG and EE landscape and avoid $157 M transmission investment
  - Current and planned programs will reduce the need to about 10 MW held constant over the next ten years
  - VT can address remaining gap with demand response program or a similar less costly solution
- ISO-NE reassessed need for Central VT upgrades and consider distributed generation in other regional planning studies
  - ISO-NE's 2013 updated study confirmed deferral of upgrades, but reached its conclusion based on a different analysis, i.e., lower ISO-NE load forecast resulting from full credit of future EE in contrast to VT approach where stakeholders have agreed that 50% of EE is embedded in our forecast
- Increasing deployment of DG is presenting many opportunities and challenges to utilities