

VELCO, Transmission and Integrating Distributed Generation



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Senate Natural Resources & Energy
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Mission

VELCO manages the safe, reliable, cost-effective transmission of electrical energy throughout Vermont. Our goal is to provide an optimal system of electric transmission facilities as part of an integrated regional network designed to meet both current and future energy needs.

Vision

VELCO's vision is to serve as a trusted partner in all we do

Values

VELCO values people, safety, creativity and great work
To live our values we...

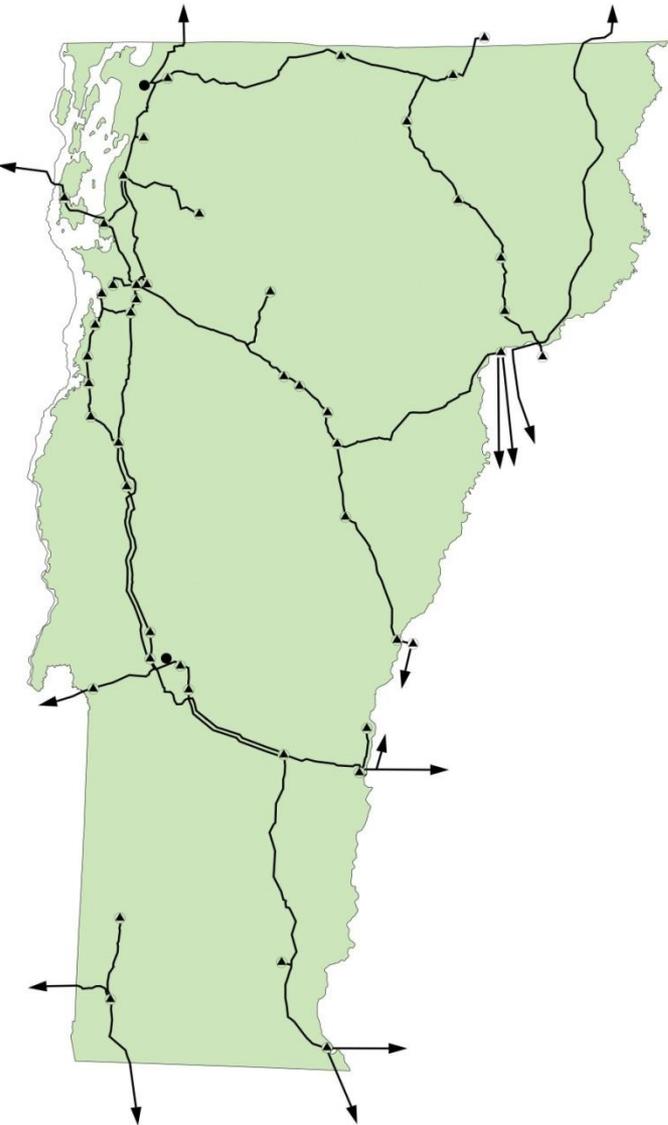
- Treat everyone with respect
- Act with care
- Empower people
- Expect the best from everyone

Motives

- Provide public benefit
- For-profit company structured to achieve cooperative goals



VELCO-managed assets



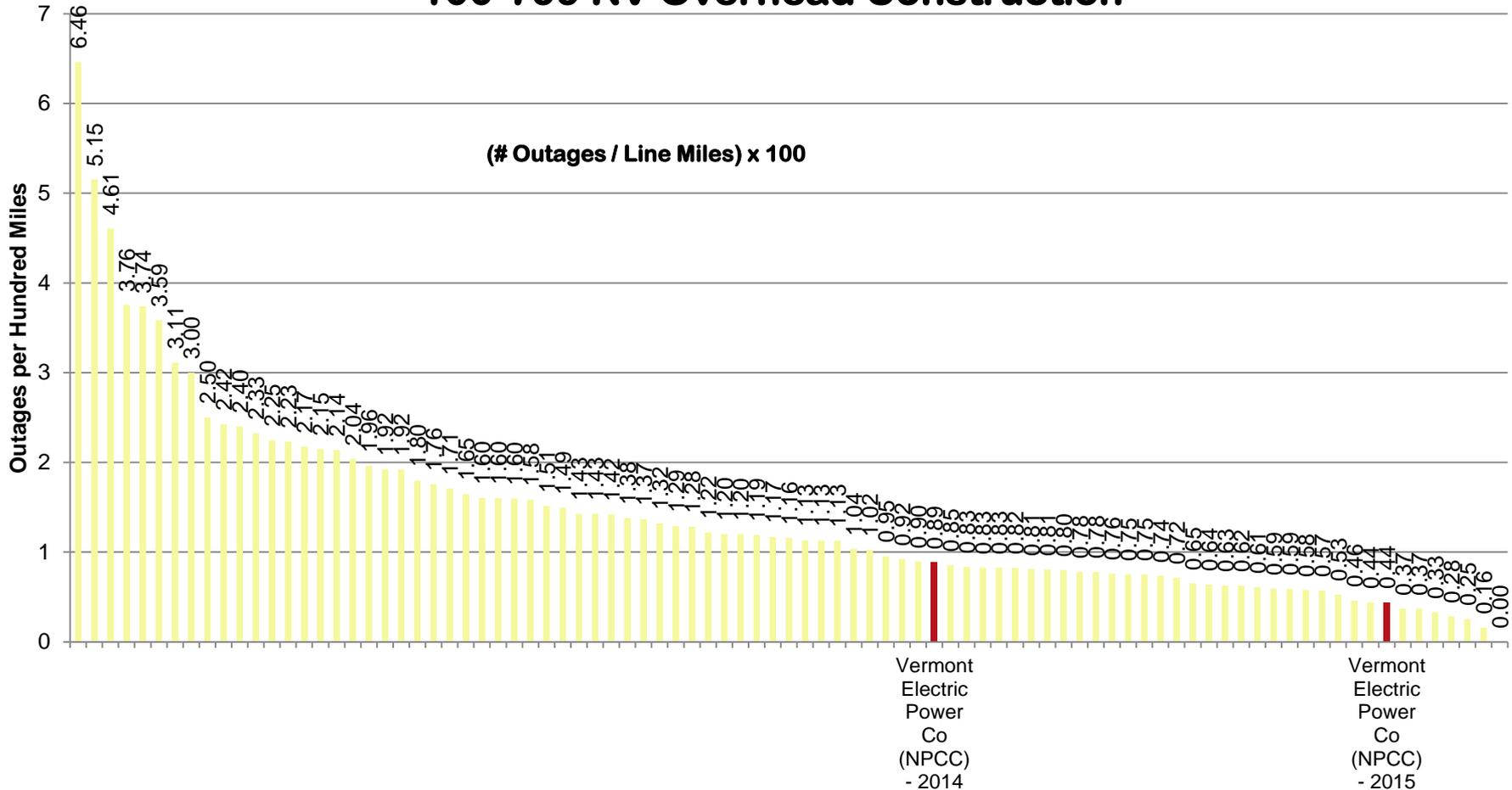
- 738 miles of transmission lines, 115 kV and higher
- 14,000 acres of rights-of-way
- 55 substations, switching stations and terminal facilities
- Equipment that enables interconnected operations with Hydro-Québec
- Fiber optic communication networks that monitor and control the electric system and provide the backbone for most Vermonters' high-speed data internet access
- 52-mile high-voltage direct current line through the Northeast Kingdom owned by Vermont Electric Transmission Company (VETCO)

Background

- Formed in 1956 by local utilities to share access to clean hydro power and maintain the state's transmission grid
- Nation's first statewide, "transmission-only" company
- Owned by Vermont's 17 local electric utilities and VLITE

NATF 2014 Metrics Database

2014 Sustained AC Circuit Outages per Hundred Line Miles 100-799 KV Overhead Construction



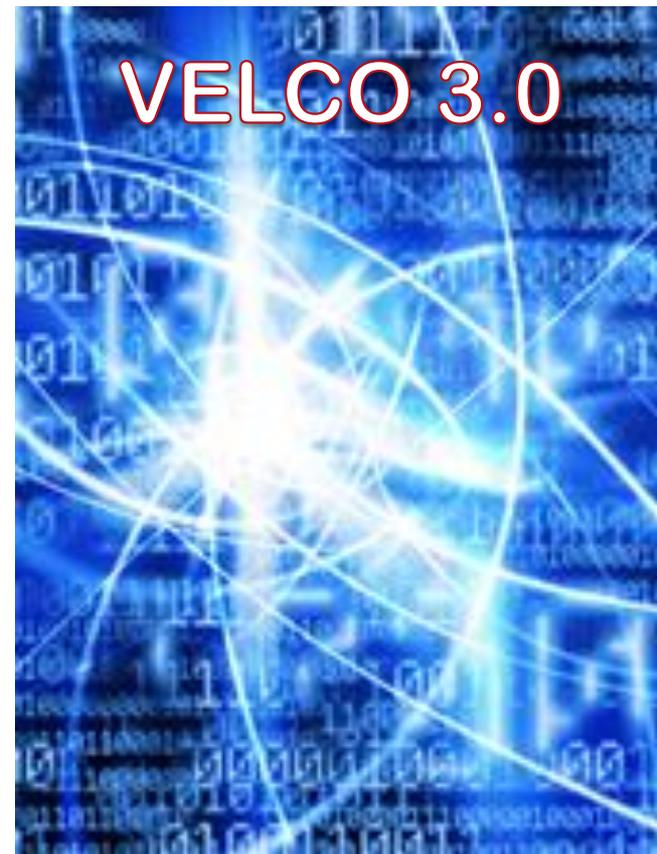
Evolution



Operations



Construction

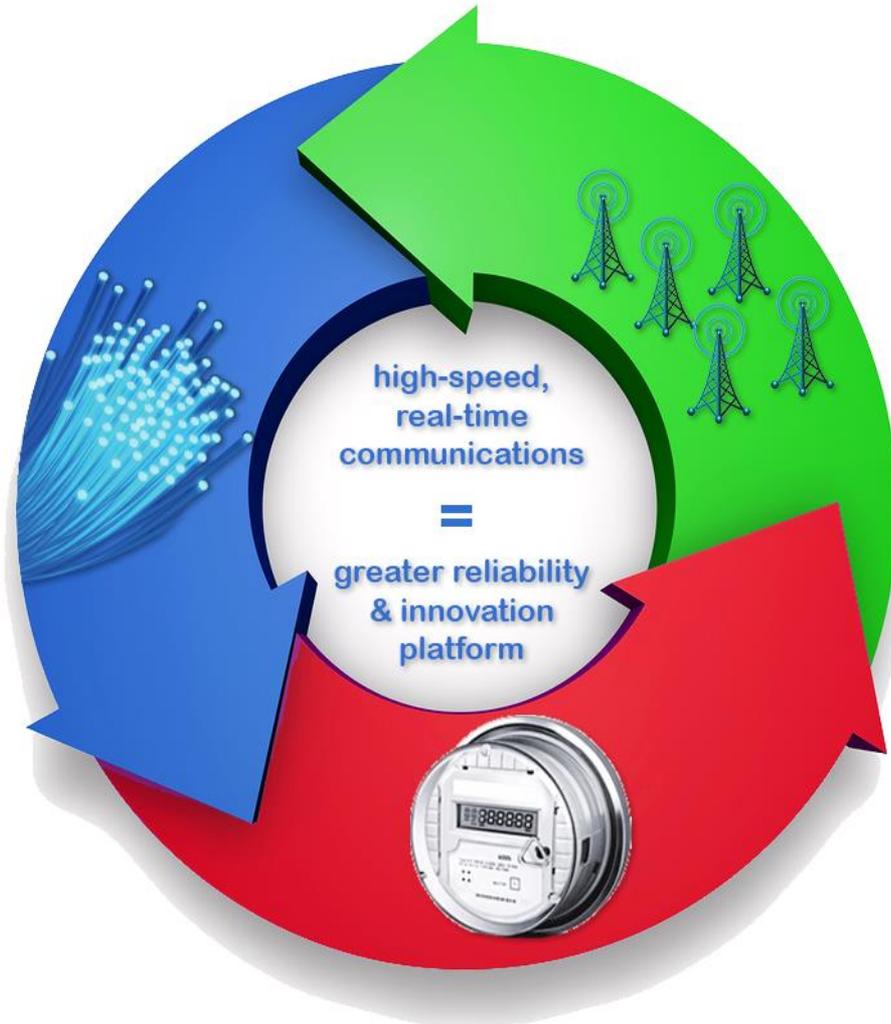


Information

Communications critical; platform in place

Statewide Infrastructure

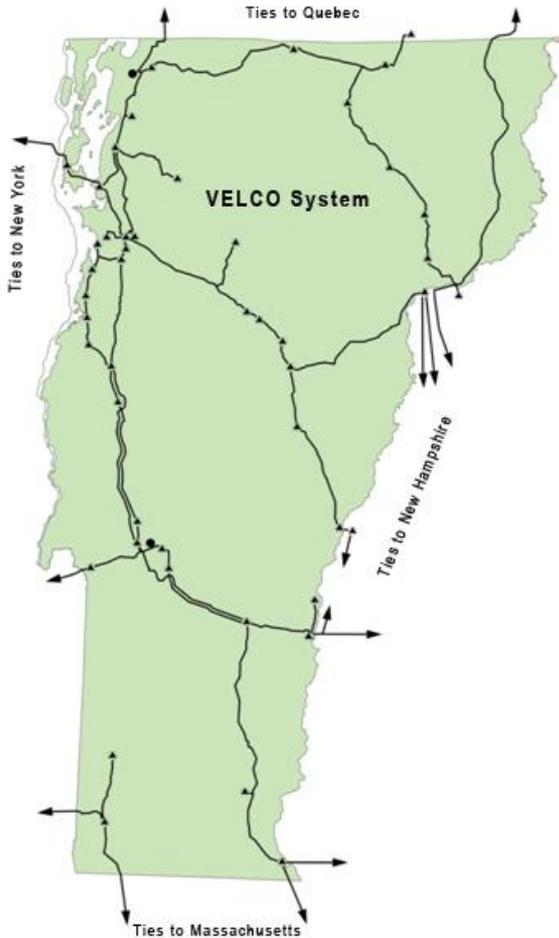
- eEnergy VT smart grid
- Fiber optic network
- Radio system



Transmission planning: why should you care?

- ISO-NE responsibility for grid planning means regional strongly influences local. ISO-NE determines:
 - **How much renewables “count”**
 - Economics of renewables
 - Need for transmission upgrades
 - Merchant projects
 - Cost of our power
- Key issues to understand
 - Vermont influential for our size, but we are only 4% of regional load
 - Vermont dependence on imported power
 - Renewables—particularly solar—are changing the grid
 - **Location of distributed resources determines benefit to grid**
 - Innovation is creating new tools with many uses: local, state, regional

Vermont now imports close to half its power



Type		MW 2014	MW 2015
Fossil (fast start units)	Winter	188	188
	Summer	138	138
Hydro		152	152
Wind		123	123
Trash-to-energy		9	9
Biomass (wood)		72	72
Nuclear		625	0
Solar and other, e.g. methane		~100 and growing	~100 and growing
TOTAL IN-STATE GENERATION		1265	640

73% of 2014 hours VT was exporting power

~84% of 2015 hours VT will import >400 MWs

More Than 4,200 MW of Generation Have Retired or Will Retire in Less Than Five Years

Major Generator Retirements:

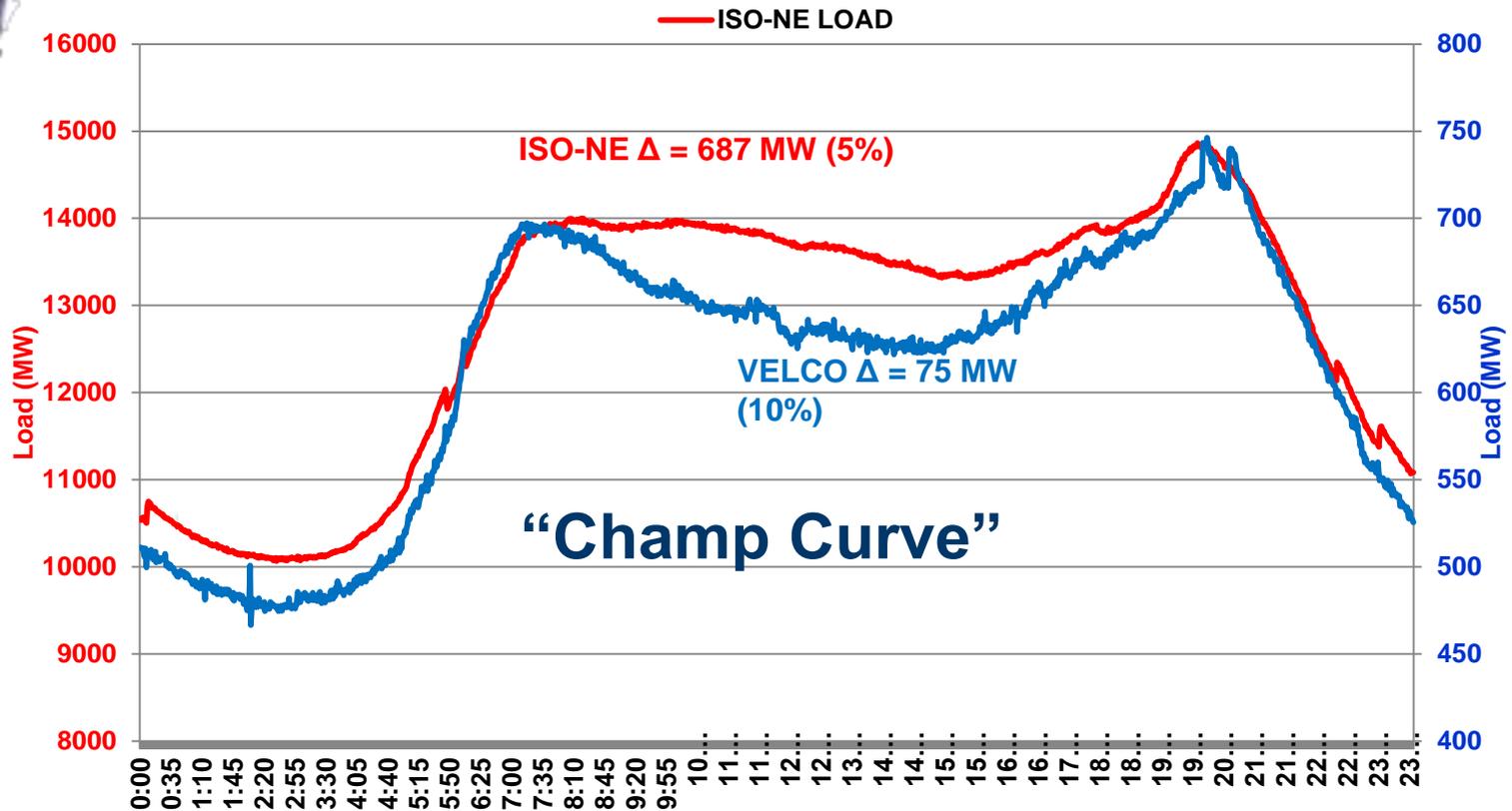
- Salem Harbor Station (749 MW)
 - 4 units (coal & oil)
- Vermont Yankee Station (604 MW)
 - 1 unit (nuclear)
- Norwalk Harbor Station (342 MW)
 - 3 units (oil)
- Brayton Point Station (1,535 MW)
 - 4 units (coal & oil)
- Mount Tom Station (143 MW)
 - 1 unit (coal)
- Pilgrim Nuclear Power Station (677 MW)
 - 1 unit (nuclear)
- *Additional retirements are looming*



Source: ISO-NE

Boom in distributed solar is already changing VT's load shape

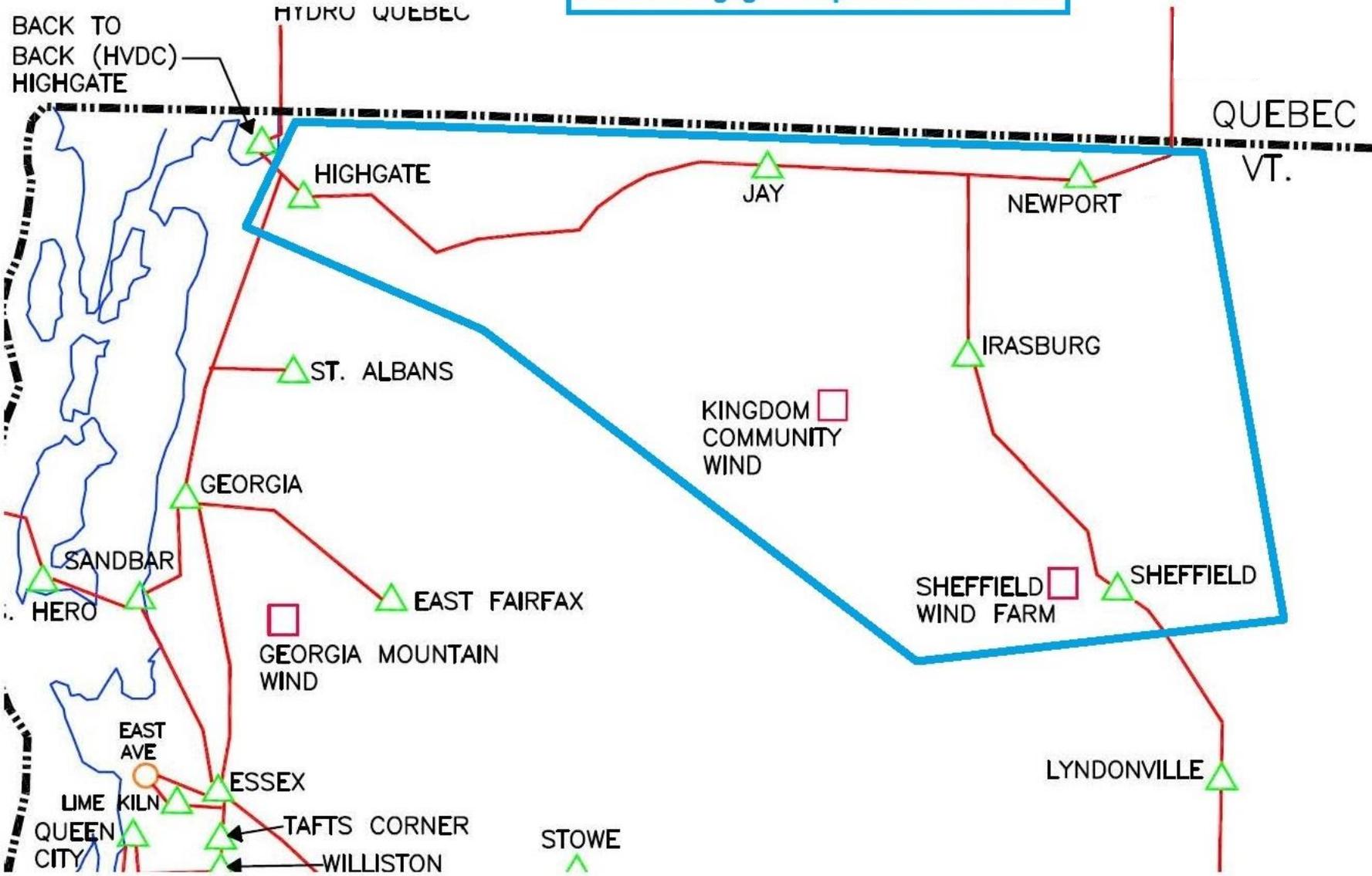
VELCO vs. ISO-NE load curve—illustrative day (Tues 4/13/2015)



Securing benefits of distributed generation: location matters

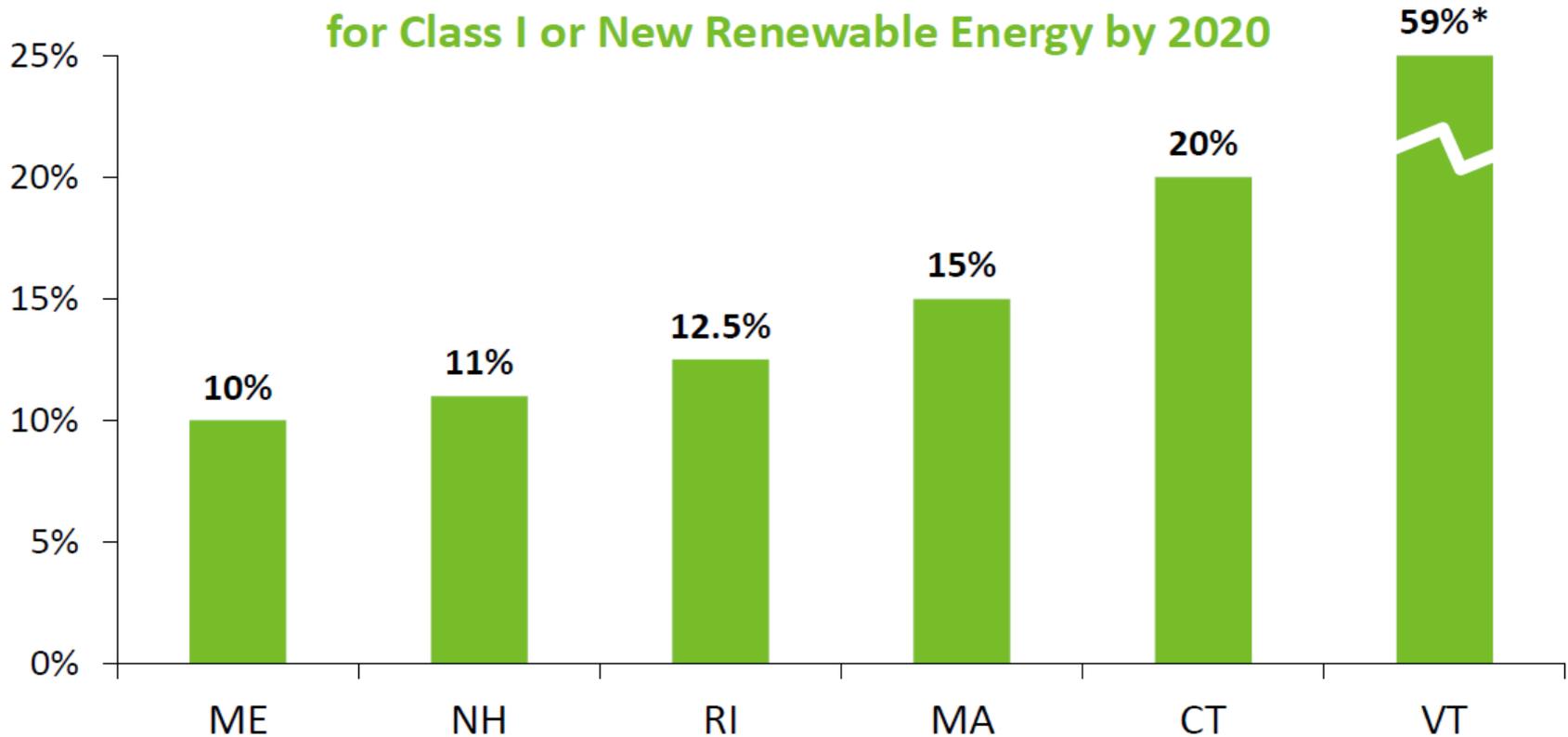
- Northern VT has an operating limit constraining how much generation can be exported from Northern VT
- Even without additional new projects, existing wind and hydro generation is sometimes curtailed in that area
- Constraints on generation NOT a reliability issue at ISO-NE; they will just turn off generation
 - Therefore, costs of needed upgrades must be paid for by developers or locally

Sheffield Highgate Export Interface area



State Policy Requirements Drive Proposals for Renewable Energy

State Renewable Portfolio Standard (RPS)* for Class I or New Renewable Energy by 2020

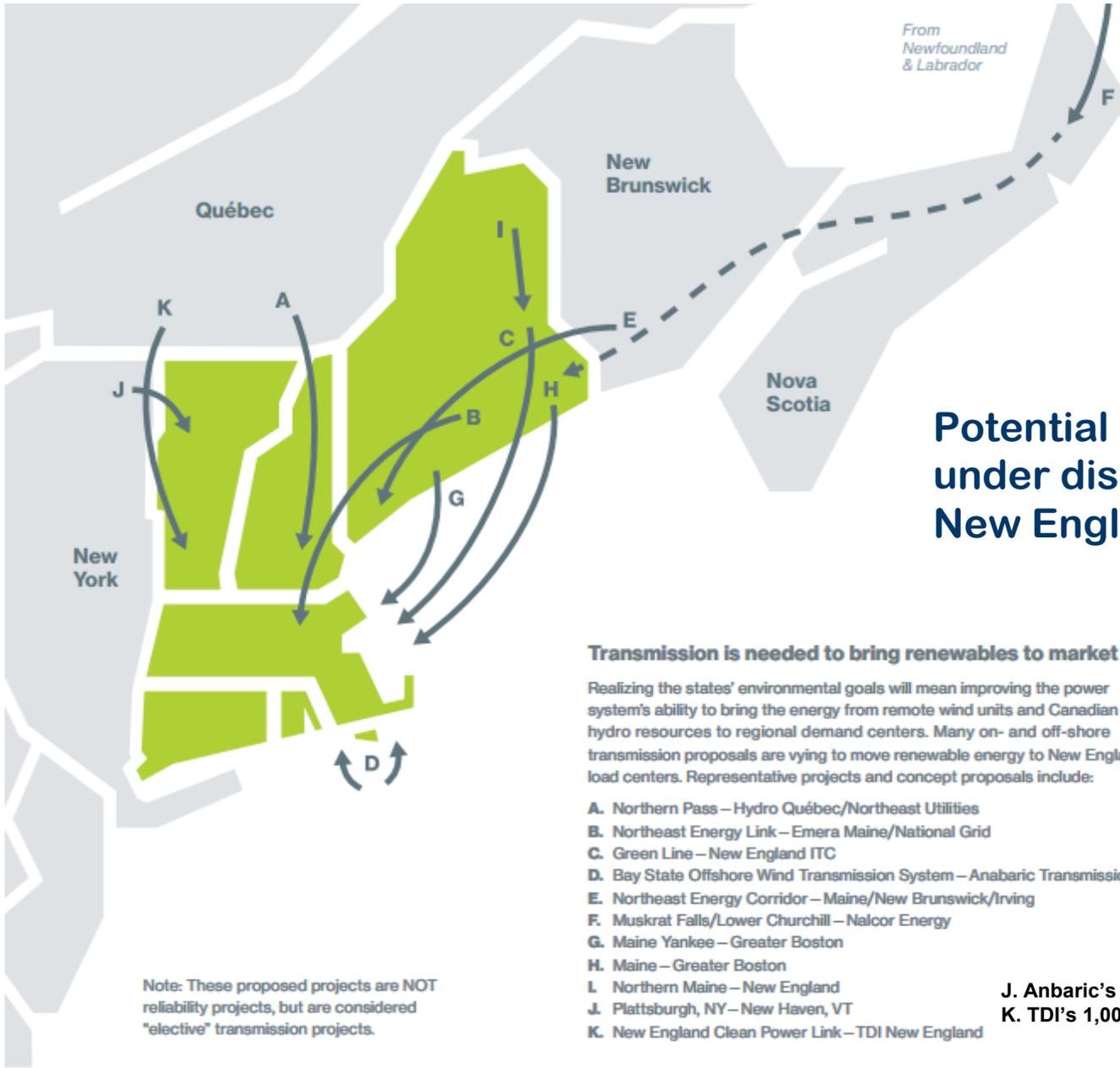


* State Renewable Portfolio Standards (RPS) promote the development of renewable energy resources by requiring electricity providers (electric distribution companies and competitive suppliers) to serve a minimum percentage of their retail load using renewable energy. Vermont's new Renewable Energy Standard has a 'total renewable energy' requirement (reflected above), which recognizes large-scale hydro and all other classes of renewable energy.

Source: ISO-NE

Three-state Clean Energy RFP (MA/CT/RI)

- 24 proposals submitted; decision April – July 2016
- Solicits clean energy (CE) proposals
 - In-state projects (20 MW and larger)
 - CE + transmission
 - Electric Dist. Co. (EDC) required to procure CE (National Grid, Eversource, Unitil and United Illuminating)
 - HQ supply bid as non-carbon resource, not (currently) eligible in MA and RI
- Complex process involving many parties
 - Evaluation by multiple groups in each state
 - Contemplates coordination among states to evaluate and possibly combine proposals
 - PUC approval required for PPAs submitted by EDCs
 - FERC OK needed for transmission tariffs



Potential merchant projects under discussion around New England

Transmission is needed to bring renewables to market

Realizing the states' environmental goals will mean improving the power system's ability to bring the energy from remote wind units and Canadian hydro resources to regional demand centers. Many on- and off-shore transmission proposals are vying to move renewable energy to New England load centers. Representative projects and concept proposals include:

- A. Northern Pass – Hydro Québec/Northeast Utilities
- B. Northeast Energy Link – Emera Maine/National Grid
- C. Green Line – New England ITC
- D. Bay State Offshore Wind Transmission System – Anabarc Transmission
- E. Northeast Energy Corridor – Maine/New Brunswick/Irving
- F. Muskrat Falls/Lower Churchill – Nalcor Energy
- G. Maine Yankee – Greater Boston
- H. Maine – Greater Boston
- I. Northern Maine – New England
- J. Plattsburgh, NY – New Haven, VT
- K. New England Clean Power Link – TDI New England

Note: These proposed projects are NOT reliability projects, but are considered "elective" transmission projects.

Source: ISO-NE
2015 Regional
Energy Outlook

J. Anbaric's 400 MW Vermont Green Line project
K. TDI's 1,000 MW Vermont project

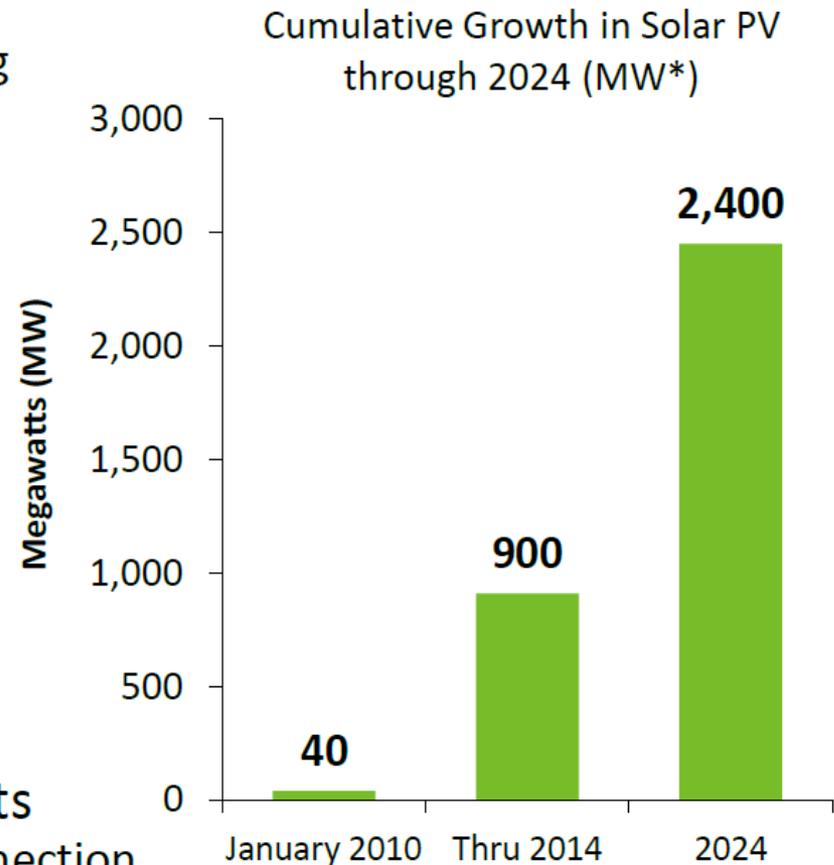


VELCO Participation Terms

- Interconnecting TO: Preserve Reliability
- Preserve Independence
 - Consider multiple projects
- Maximize risk-adjusted value
 - Recover expenses, obtain revenue stream
 - Provide services (e.g., R/W, engineering, O&M)
- Evaluate equity investment
 - Ratebase recovery model (non-merchant) for project that wins regional RFP and
 - Definitive supplier arrangements
 - Investment at financial close
- Only (1) 500-1000 MW project will “fit” into existing Vermont transmission system (studies will confirm)
 - Some upgrades to VELCO’s AC system are likely

The ISO is Leading Efforts to Account for Solar Resources Connected to the Distribution System

- Long-term solar forecast
 - Tracking historical growth; predicting solar development 10 years ahead
 - Used in transmission planning and market needs assessments
 - In 2015, PV forecast used for first time in Installed Capacity Requirement time, reducing 2019/2020 need by 390 MW
- Short-term solar forecast
 - ISO creates daily forecasts of solar PV production to improve daily load forecasts
- Interconnection rules improvements
 - ISO is helping develop new interconnection standards to reduce reliability concerns



Source: ISO-NE



Vermont Weather Analytics Center benefits diverse stakeholders

Safety/reliability— more precise, localized weather prediction

Operations—better preparedness

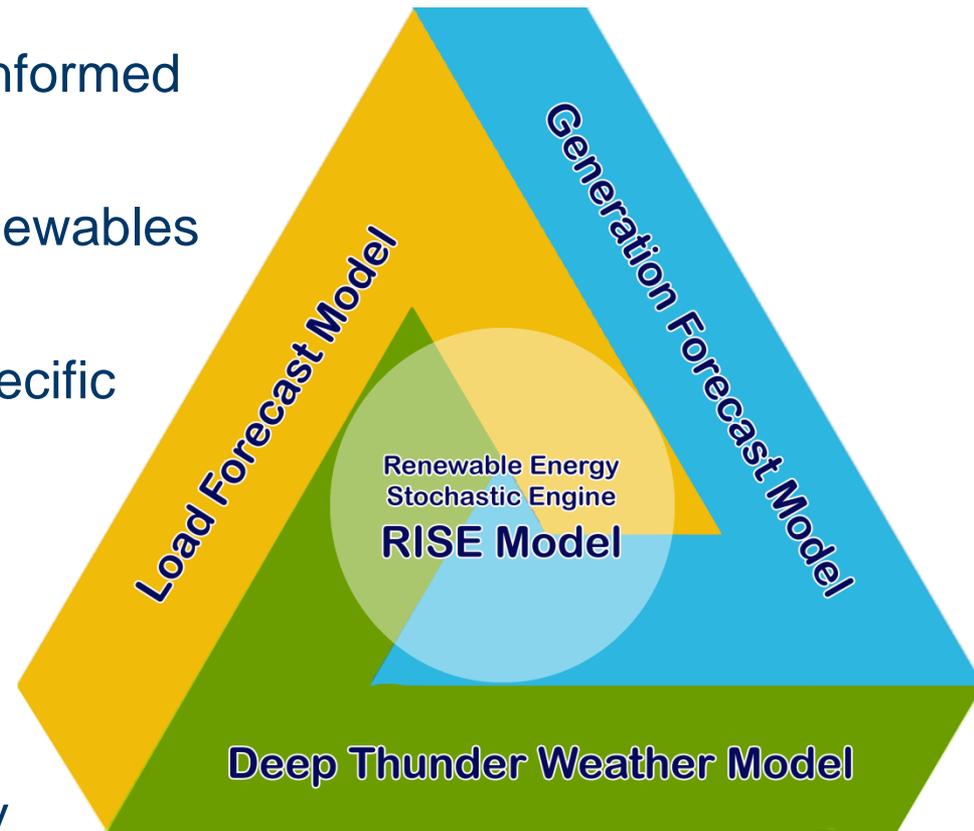
Maintenance/construction—better informed scheduling

Planning—improved prediction of renewables output

Generation siting—more location-specific information

Compliance—Act 56, water quality and other regulations

Demand-side management—better informed demand response and peak management, and efficiency measure validation



VELCO's ongoing work

- Meet transmission needs for reliability, power supply decarbonization and microgrid deployment
- Evolve from construction to data analytics and advanced communication networks
- Create more adaptable, resilient and efficient grid that better serves customer choice
- Advocate appropriate recognition of DG's value at regional level
- Serve as resource/broker, innovation enabler and advocate