Market Resource Alternative Solutions and Results of the NH/VT Pilot Study

Connecticut IRP Stakeholder Meeting
September 20, 2011

Eric Johnson, Senior External Affairs Representative
Marianne Perben, Supervisor, Resource Analysis and Qualification
ISO New England Inc.

About ISO New England

- **Not-for-profit corporation created in 1997 to oversee New England's restructured electric power system**
  - Regulated by the Federal Energy Regulatory Commission (FERC)
- **Regional Transmission Organization**
  - Independent of companies doing business in the market
  - No financial interest in companies participating in the market
- **Major responsibilities:**
  - Reliable operation of the electric grid
  - Administer wholesale electricity markets
  - Plan for future system needs

Presentation Overview

- Background on Regional System Planning and Non-Transmission Alternatives
- Pilot Study: Scope, Assumptions, Results
- Strategic Planning Initiative
- Next Steps

Regional System Planning

- Process:
  - ISO develops scope of work, Needs Assessments and Solution Studies (i.e., transmission alternatives) with input from the Planning Advisory Committee
- Objectives:
  - Provide opportunities for market solutions: generation, demand-side measures, and merchant transmission
  - Provide a transmission plan that can be modified based on market solutions that develop
- Regional System Plan (RSP)
  - Provides annual snapshot of the system for the 10-year planning horizon; project listing provides updates on transmission projects
  - Does not constitute an integrated resource plan

Meeting Reliability Needs

- New England has a robust planning process to develop ***transmission solutions*** to meet reliability needs
  - $4 billion invested since 2002; $5 billion on the horizon
- ISO is working with stakeholders to analyze the ability of ***market resource alternative solutions**** to address identified reliability needs
  - Does not include economic analysis or scenario analysis of least-cost or hybrid solutions; narrowly focused on reliability
  - ISO does not have authority to do integrated resource planning
    - States have that authority and take different approaches

** Also referred to as non-transmission alternatives (NTAs)*

Background on Non-Transmission Alternatives

- New England stakeholders requested additional information on non-transmission alternatives (NTAs) as a supplement to the Needs Assessments and other information presented in the regional planning process
- ISO conducted pilot study of effectiveness of generation and demand resources to meet identified reliability needs in the New Hampshire-Vermont (NH/VT) area, as potential alternatives to regulated transmission solutions
- ISO updates to stakeholders at the Planning Advisory Committee:
  - Introduced a conceptual approach in October 2010
  - Presented preliminary results for the NH/VT pilot study in April
  - Presented final results for the NH/VT pilot study in May
    - Full presentation available on PAC website

Overview of Pilot Study

1. Pilot study starts with the model used for the transmission needs assessment
2. Add just enough generation or demand resources in each sub-area to relieve thermal overloads on the transmission system
3. Each sub-area's potential solution only works if applied simultaneously with potential solutions identified for all other sub-areas

Scope of the Pilot Study

- Limited to a screening type of analysis using a steady-state thermal assessment, which is typical for initial transmission studies
  - Additional information about specific resources would be required to perform more detailed transmission studies
  - Software limitations do not facilitate voltage assessment
- Consideration of two distinct market resource scenarios
  - Reliance on supply-side resources
  - Reliance on demand-side resources
- Incremental usefulness of the added capacity to be analyzed using the Forward Capacity Market (FCM) overlapping interconnection impacts standard
- An economic assessment is not performed
- Based on the New Hampshire/Vermont (NH/VT) Needs Assessment

Geographic Scope of Pilot Study

- Study evaluated market resources in nine sub-areas:
  1. **Northwestern Vermont**
  2. Central Vermont
  3. Connecticut River Corridor
  4. Southern Vermont
  5. Southeastern Vermont and Western New Hampshire
  6. Northern Vermont and Northern New Hampshire
  7. Central New Hampshire
  8. **Southern New Hampshire**
  9. Seacoast New Hampshire

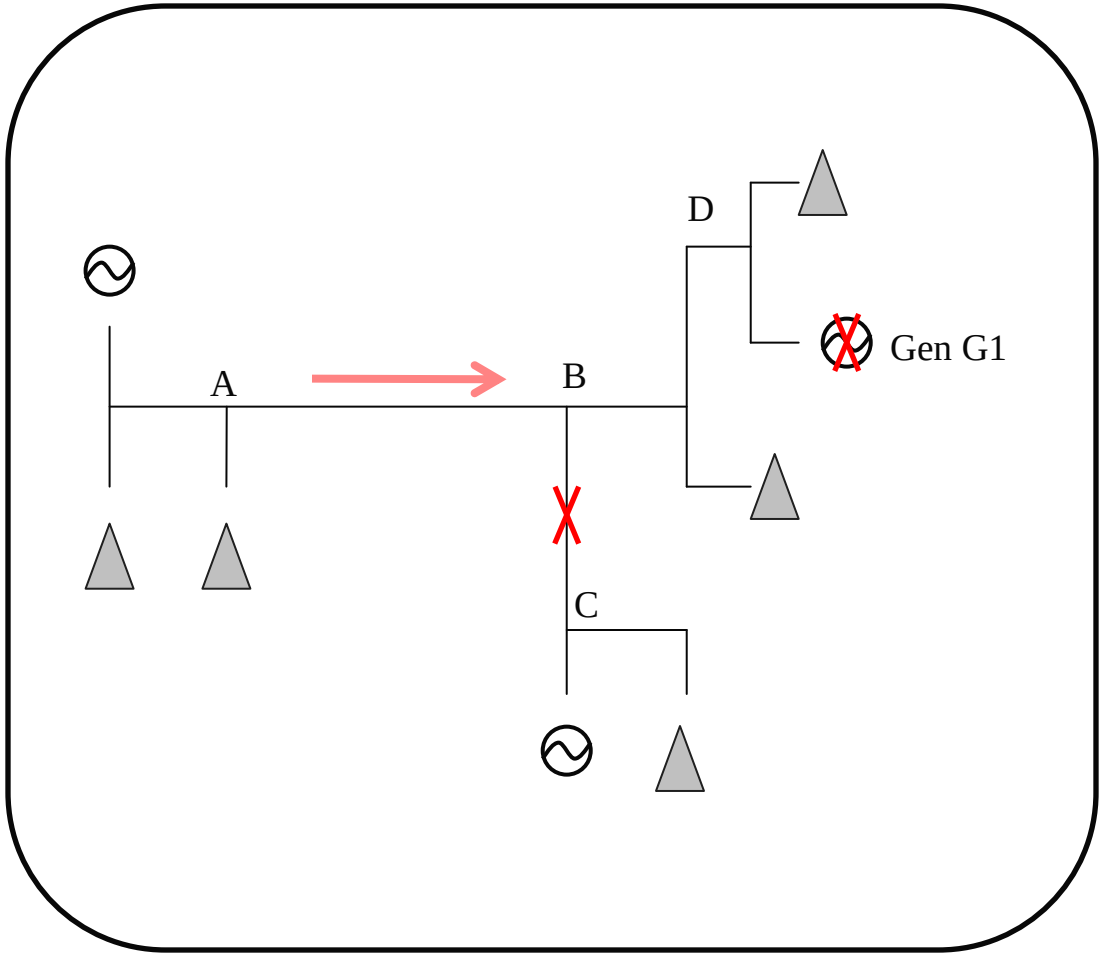
Pilot Study – Assumptions

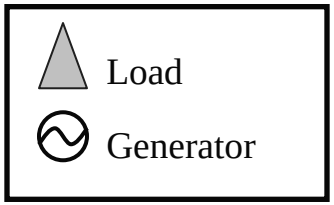
- Use the same system conditions and study criteria used in the NH/VT Transmission System Needs Assessment, such as
  - 2020 90/10 summer peak load based on 2010 ISO load forecast (CELT)
  - Modeled demand resources and generation based on the 4th Forward Capacity Auction (FCA) results
  - Modeled transmission projects based on all Proposed Plan Application (PPA) approvals in the NH/VT study area
  - Considered all N-1 and N-1-1 scenarios used in the transmission assessment
    - Including scenarios with Vermont Yankee assumed in-service and scenarios with Vermont Yankee assumed retired
- Focused on physical system needs
  - All loadings brought at or below 100% of the relevant transmission element rating

Pilot Study – Supply-side Market Resources

- Representative supply-side market resources were added to the study system's model
  - Blocks of 500 MW of *effective* capacity were modeled at all 115kV and 345kV buses in Vermont, New Hampshire and bordering Massachusetts and Maine areas (~350 potential injection points)
    - A minimum of 0 MW and a maximum of 500 MW could be dispatched at each injection point
    - A sensitivity to smaller block sizes was described in the 04/13/2011 PAC presentation and showed that smaller block sizes led to sub-optimal results or infeasible solutions
  - A security constrained dispatch algorithm was used to determine the minimum amount and best location of the MWs needed to relieve all thermal overloads for all system conditions under consideration
    - Security constrained dispatches sought to minimize the amount of MW dispatched
  - Alternative solutions were also developed that sought to reduce the number of injection points required
    - In these alternative solutions, the amount of MWs dispatched may be higher as a trade-off

Example: Pilot Study for Supply-side Market Resources

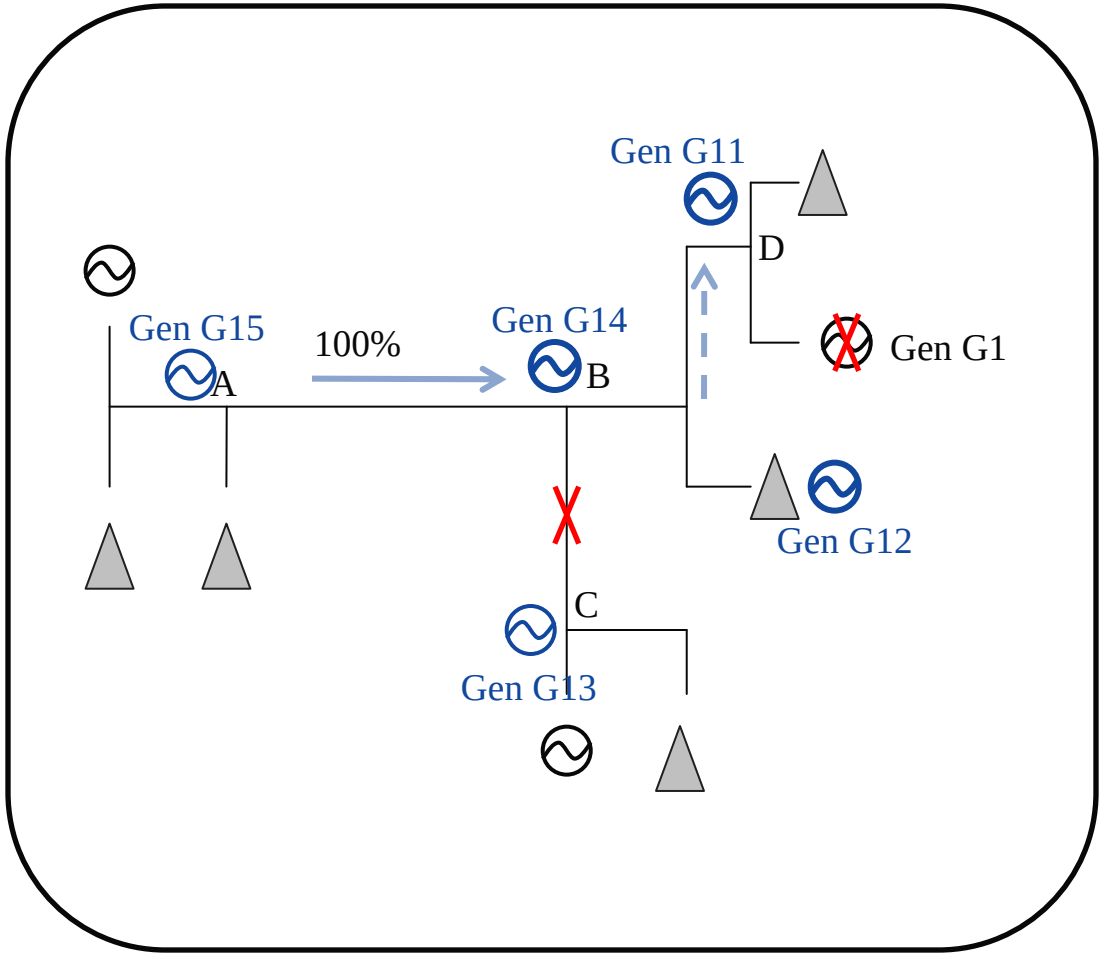




- Assumption:

  Under a scenario considering both the outages of Generator G1 and Line [BC], Line [AB] is overloaded.

Example: Pilot Study for Supply-side Market Resources, *cont.*



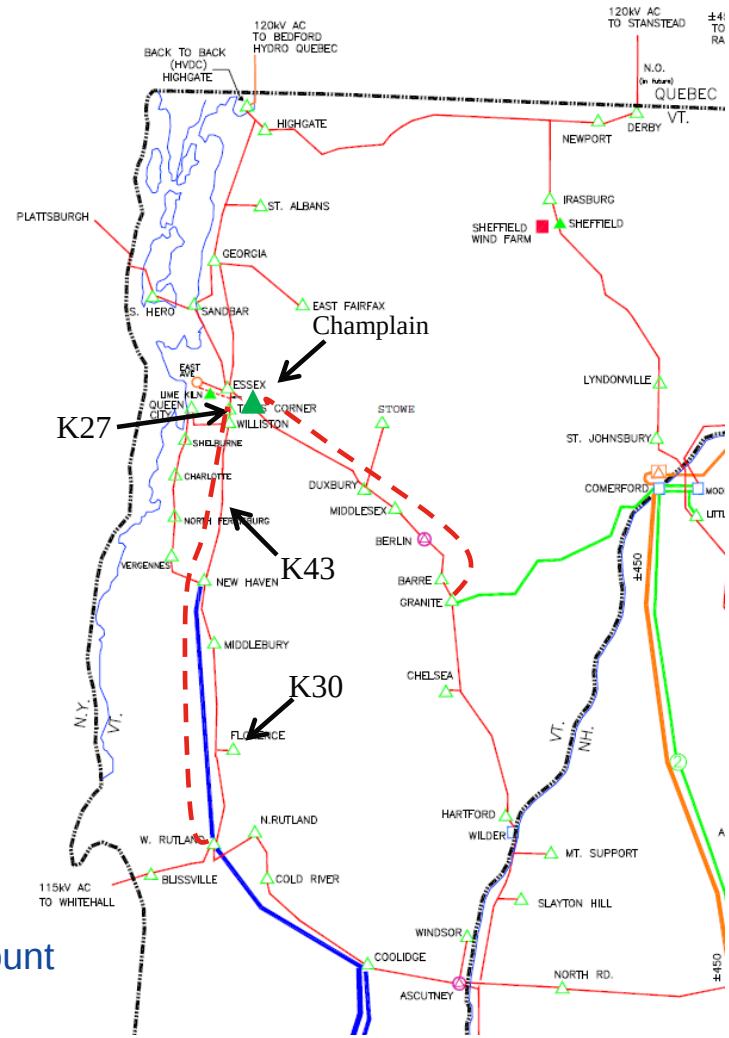
- Supply-side market resources are considered to relieve the overload. They are placed at “key” locations on the system.
- Software simulations show that a minimum of 50 MW dispatched at G14 and 15 MW dispatched at G11 reduces the loading on line [AB] to 100% of its rating while keeping line [BD] from overloading due to the dispatch of G14.
- MW dispatched at G13 and G15 are ineffective at relieving the line [AB] overload.
- By restricting the software into not using G14, an alternative solution shows that a minimum of 75 MW dispatched at G11 provides the same outcome as the prior simultaneous dispatch of G14 and G11.

Example Study Results for Supply-side Market Resources

Northwestern Vermont

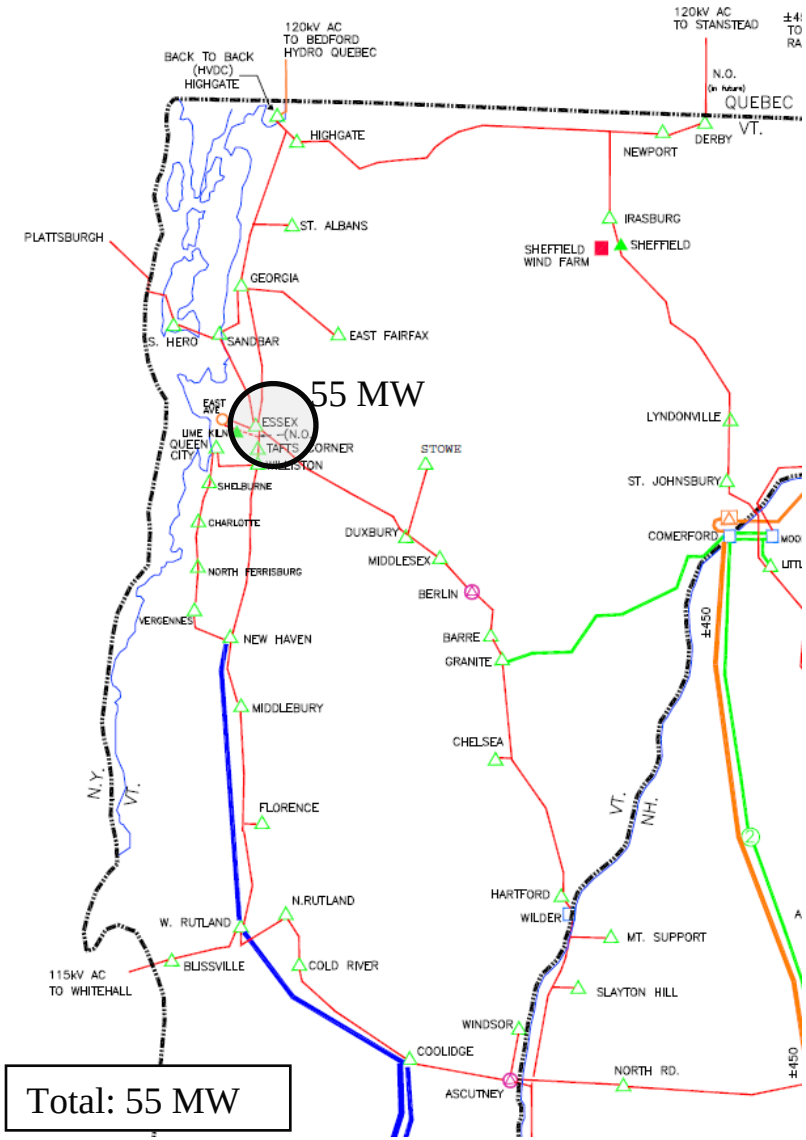
Northwestern VT Transmission Solutions

- Area load: Approximately 600 MW *
- Identified Needs
  - Voltage violations caused by loss of key supplies to the area
  - Thermal violations related to facilities out of service
- Transmission Solution Alternatives
  - #1: Upgrade overloaded 115 kV lines
  - #2: New Granite-Champlain 230 kV line
  - #3: New W. Rutland-Champlain 345 kV line
  - #4: New W. Rutland-Champlain 115 kV line



* Note: This value provides an order of magnitude for the amount of load in this area

Northwestern VT Supply-side Market Resources

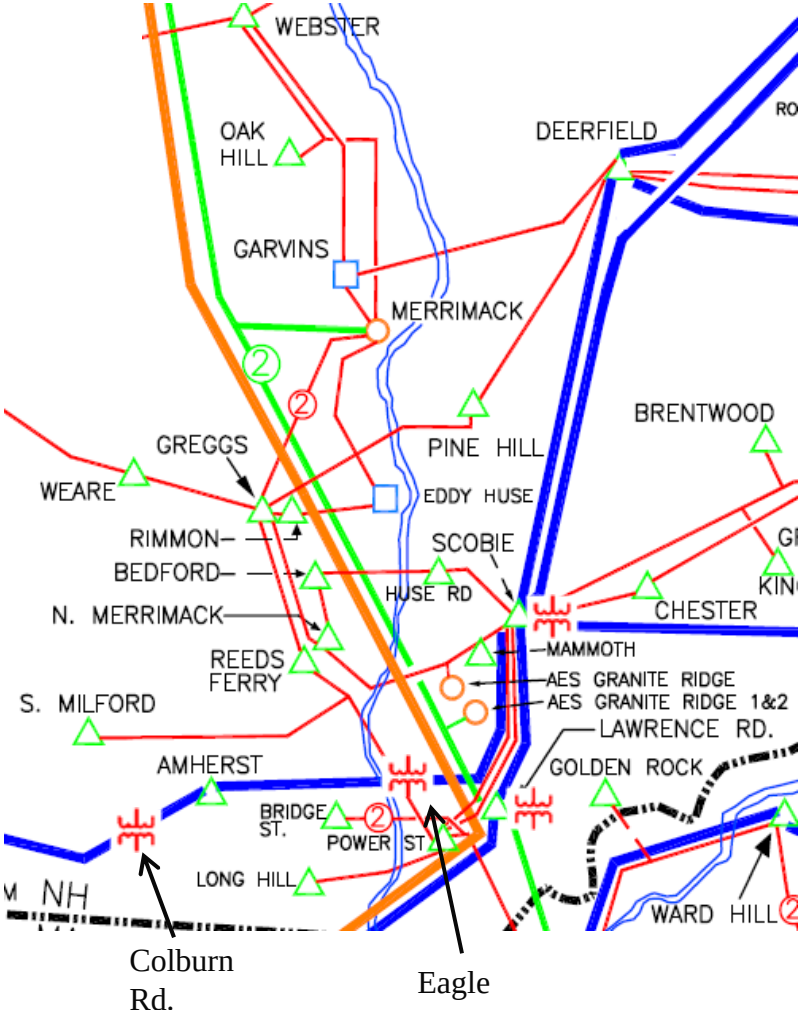


- Software simulations show that a minimum of
  - 55 MW available at Essex

  reduces all sub-area loadings to 100% of the relevant rating or lower
- For all overloads to be resolved, generation has to be well balanced at each location
  - Any deviation from the software solution may result in a greater NTAs MW need
- This sub-area's potential NTA solution works only if applied simultaneously with potential NTAs solutions in other sub-areas

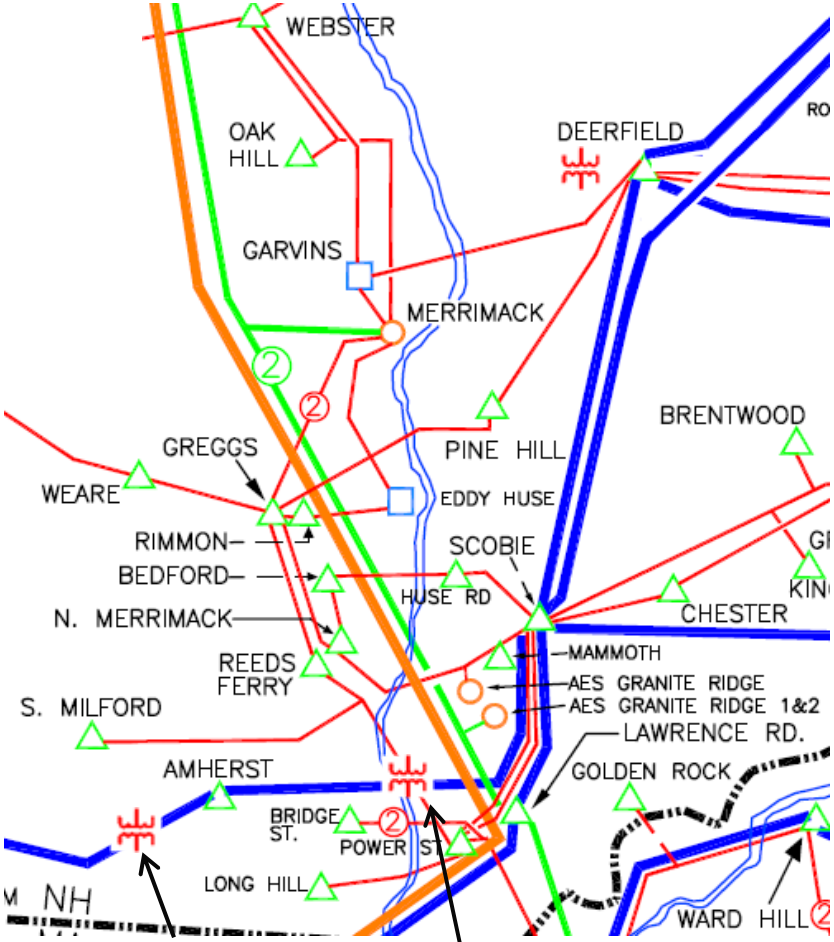
Southern New Hampshire

Southern NH Transmission Solutions



- Area Load: Approximately 1,600 MW
- Identified Needs
  - Thermal and voltage violations stretching from Concord (Webster) to Massachusetts border
- Transmission Solution Alternatives for Scobie auto violations
  - #1: Scobie #4 345/115 kV auto
  - #2: Colburn Road 345/115 kV auto
  - #3: Lawrence Road 345/115 kV auto
  - #4: Eagle 345/115 kV auto

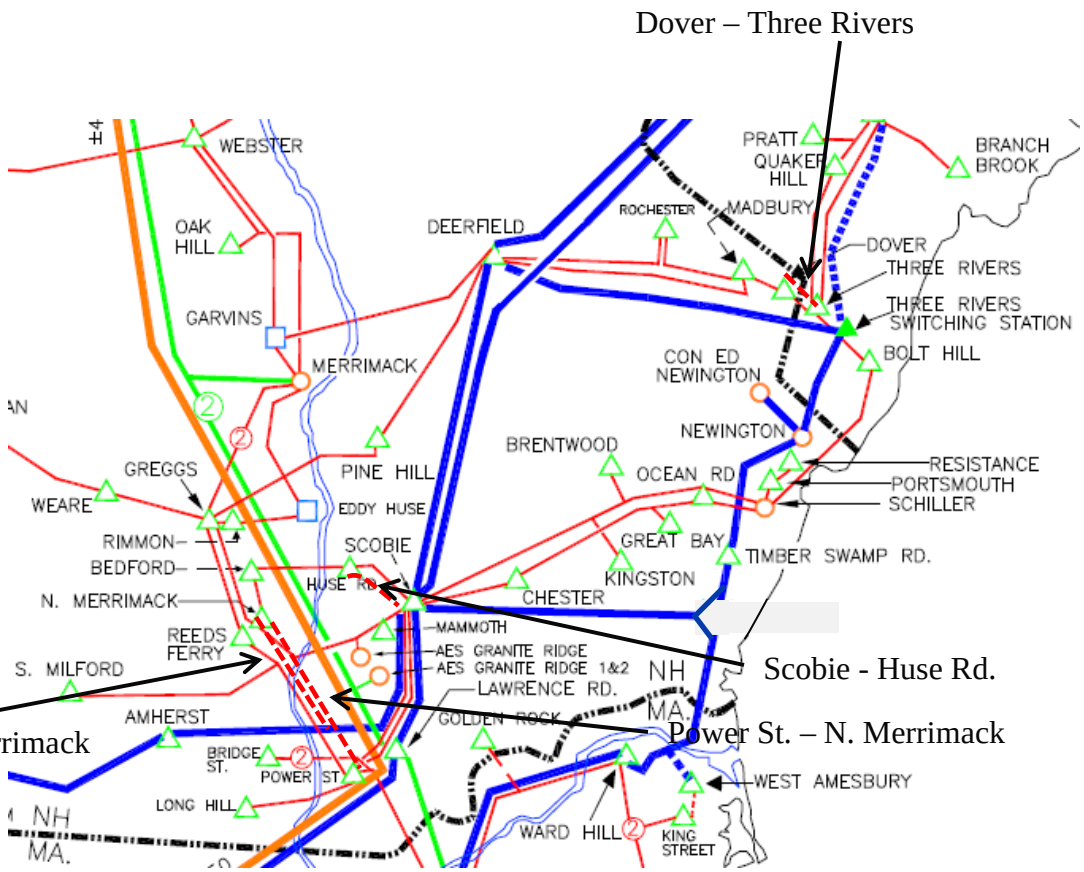
Southern NH Transmission Solutions, *cont.*



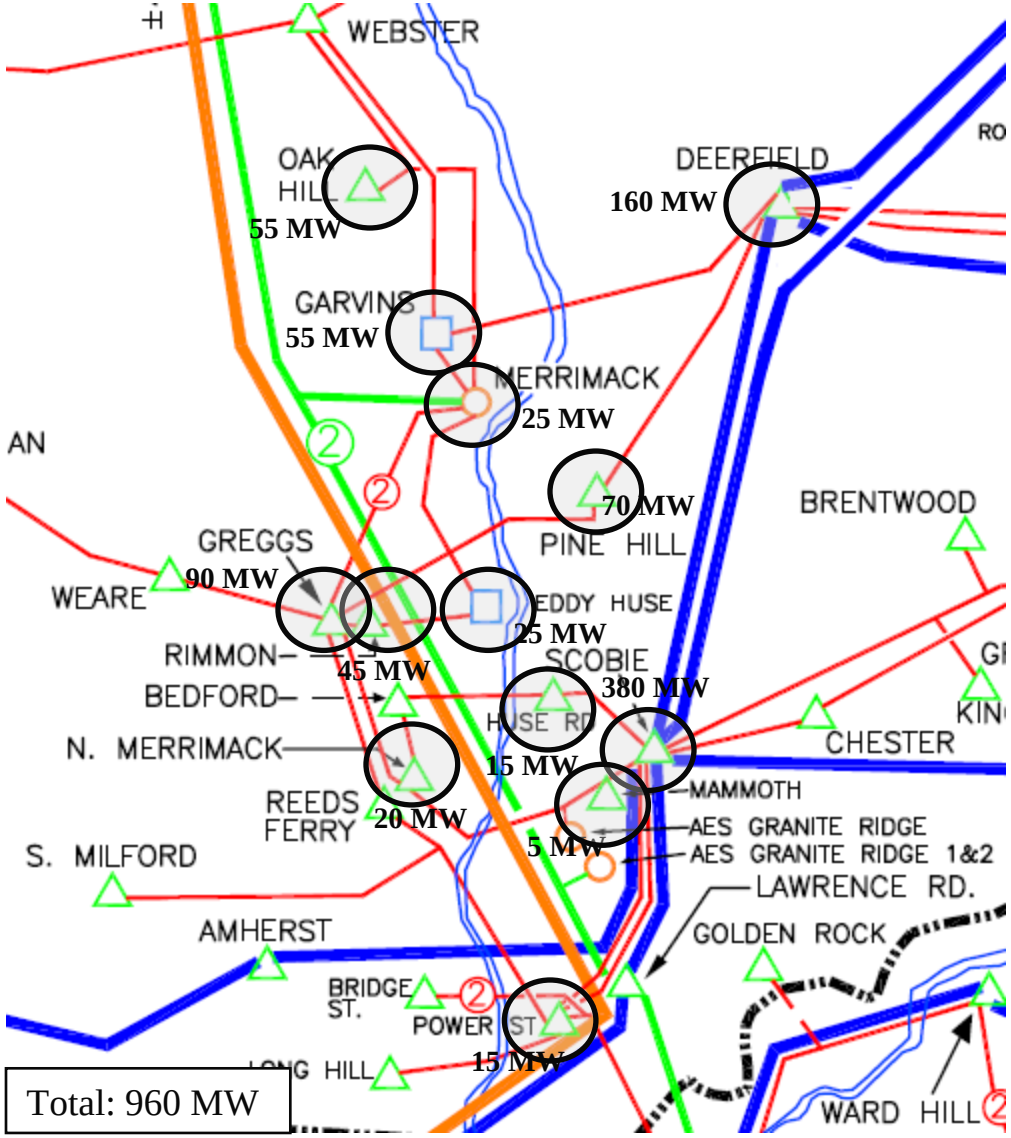
- Transmission Solution Alternatives for Deerfield auto violations
  - #1: Replace existing Deerfield 345/115 kV auto
  - #2: Deerfield #3 345/115 kV auto

Southern NH Transmission Solutions, *cont.*

- Transmission Solution Alternatives for Concord/Manchester Load area
  - Series breakers at Merrimack and Greggs substations
  - Capacitor banks at Rochester, Madbury, Chester
  - New 115 kV transmission lines
    - Scobie - Huse Road
    - Power St. – N. Merrimack
    - Eagle – N. Merrimack
    - Dover – Three Rivers
  - Existing 115 kV line upgrades



Southern NH Supply-side Market Resources



Southern NH Supply-side Market Resources, *cont.*

Software simulations show that a minimum of

- 160 MW available at Deerfield (115 kV bus)
- 70 MW available at Pine Hill
- 90 MW available at Greggs
- 45 MW available at Rimmon
- 25 MW available at Eddy
- 25 MW available at Merrimack
- 55 MW available at Garvins
- 55 MW available at Oak Hill
- 20 MW available at N. Merrimack
- 380 MW available at Scobie (115 kV bus)
- 5 MW available at Mammoth
- 15 MW available at Huse Road
- 15 MW available at Bridge Street

reduces all sub-area loadings to 100% of the relevant rating or lower

- For all overloads to be resolved, generation has to be well balanced at each location
  - Any deviation from the software solution may result in a greater NTAs MW need
- This sub-area's potential NTA solution works only if applied simultaneously with potential NTAs solutions in other sub-areas

Pilot Study – Results Summary

- Some reliability needs may be more suitable to market resource alternative solutions where fewer resources are needed in a single location and generator dispatch is not overly complex
- In other areas, market resource alternative solutions may require resources in multiple locations, generator dispatch may become overly complex, and transmission solutions may be more practical
- Alternatives that pass the initial screening test (i.e., steady-state thermal assessment) may still require transmission upgrades based on additional analysis of the incremental usefulness of an alternative (i.e., FCM overlapping impact test)
- For the New Hampshire/Vermont area, the pilot study showed that the magnitude (MW) of demand-side and supply-side resources required to address the reliability need is approximately the same

Strategic Planning Initiative

- ISO and stakeholders are evaluating a long-term approach to market resource alternative solutions through the regional Strategic Planning Initiative
  - Wholesale markets may not adequately reflect the rapidly-evolving reliability needs identified through reliability planning and system operations
  - Better **alignment of markets and planning** could create more opportunities for market resources to meet reliability needs

Next Steps

- Later this year, ISO will be discussing with stakeholders further geographic areas for study of market resource alternative solutions
  - May include enhancements to the analysis