2016 Maine Resource Integration Study – Scope of Work

Planning Advisory Committee

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Agenda

- Background on the ability to interconnect new resources in Maine
- Scope of Work for the 2016 Maine Resource Integration Study

BACKGROUND

Previous Analysis of Resource Integration in Maine

- *"New England Wind Integration Study" (the "NEWIS") – to assess the effects of large-scale wind penetration in New England (2009)*
- *Northern Maine System Performance*, Planning Advisory Committee (PAC) presentation (September 21, 2010)
- *Wind Development in Constrained Areas*, PAC presentation (March 21, 2013)
- *Strategic Transmission Analysis: Wind Integration Study*, PAC Presentation (December 18, 2013)
- *Strategic Transmission Analysis: Wind Integration Study – Stage 1- Maine, Regional Constraints*, PAC Presentation (May 21, 2014)
- *Strategic Transmission Analysis: Wind Integration Study – Stage 2- Maine, Interface Constraints*, PAC Presentation (December 18, 2014)

Drivers of the Interconnection Queue Backlog in Maine

1. Issues with Inverter Based Generators

Focus of February 2016 Interconnection Process Filing

2. Characteristics of the Maine system

Focus of these "Phase 2" Discussions

3. Requests far beyond the capability of the existing Maine system

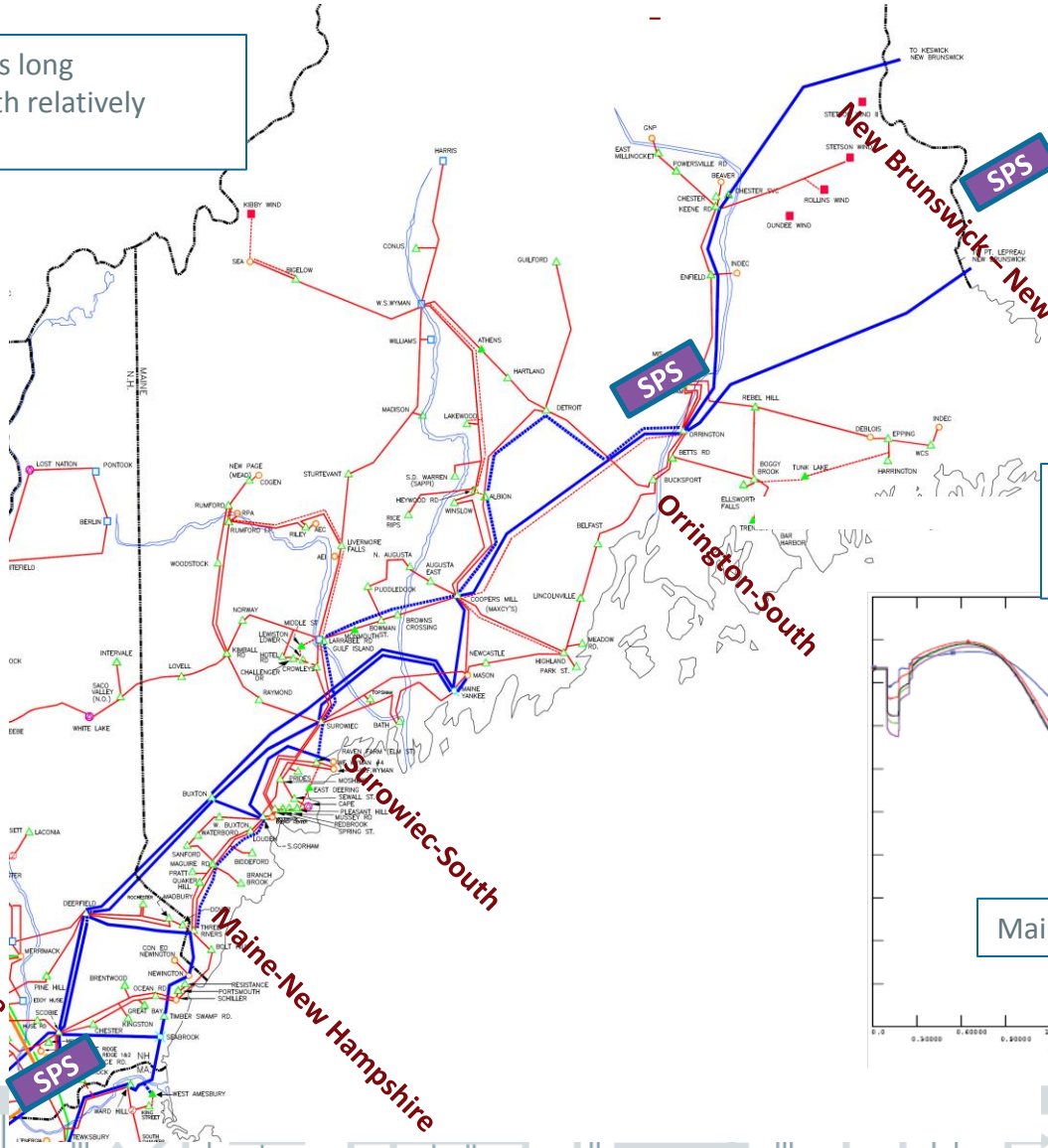
The Existing Maine System

Three existing Special Protection Systems (SPS) associated with actions to reduce flows under contingency conditions

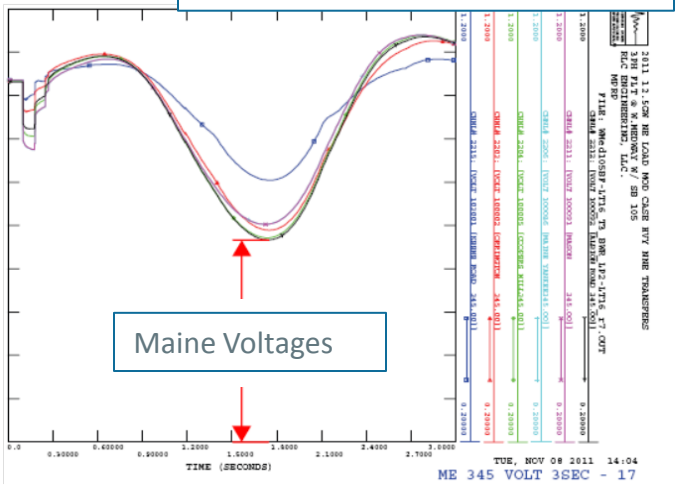
The Maine system has long transmission lines with relatively little load

Multiple Major Interfaces to manage flows

Multiple Local Interfaces to manage local constraints (Not Shown)



Maine corridor experiences severe voltage sags for faults in Southern New England



Requests Far Beyond the Existing Capability of the Maine Transmission System

Maine System	Approximate (MW)
Forecast 2015 Summer Peak Load[1] (net)	2,300
Maine Export Capability	1,900
Load + Export Capability	**4,200**
Existing Generation Capacity (Summer 2015)	3,100
New Brunswick Import Capability	1,000
New Requests (February 2016)[1]	**4,000**
Resource Totals	**7,700**

1. Note that most of the proposals are located north of Orrington – where there is only approximately 300 MW of peak load

Considerations Previously Discussed with Stakeholders

- Interconnection issues in the identified remote areas of the system are not caused by, nor can they be addressed by, queue process changes
  - The existing transmission system was built to serve system load and is at its limit
    - As noted above, studies since 2009 have shown the need for significant transmission system expansion
    - Even if small incremental amounts of resources can be added, it is clear that the existing system cannot support hundreds or thousands of proposed MWs
  - If individual projects are not able or willing to make the scale of system upgrade investments now required: key issue becomes infrastructure
- How to address the infrastructure issues?
  - Additional resource integration analysis to identify the overall upgrades required to interconnect the levels of proposed MW
    - Essentially a clustering analysis
    - Useful only if coupled with cost allocation (study costs and upgrade costs) to queued projects to share costs
      - Interconnection cost allocation alternatives?

2016 MAINE RESOURCE INTEGRATION STUDY

Scope of Work

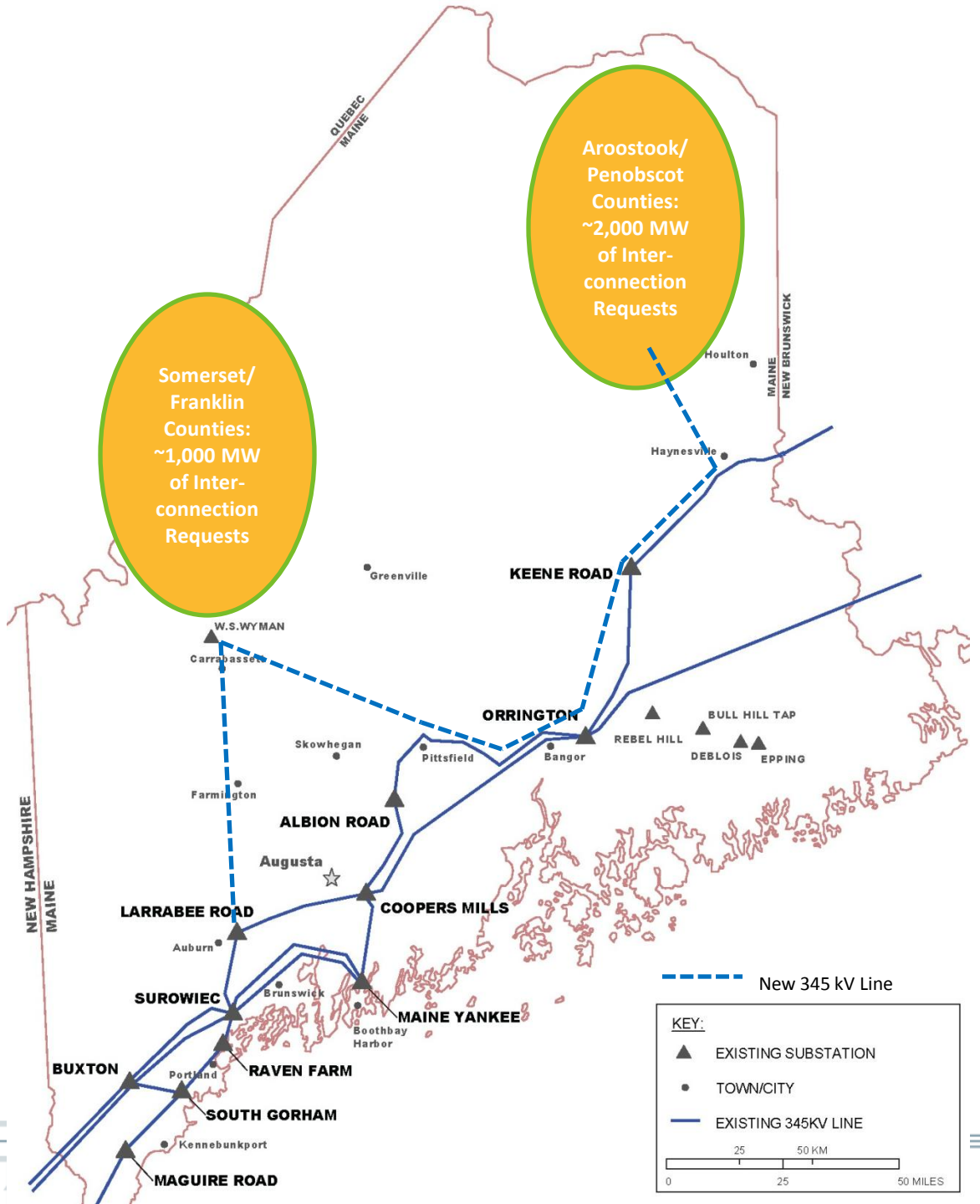
Study Objectives

- Identify transmission infrastructure that can be added to interconnect requested generation in Maine
  - MW quantity of generation that could interconnect
  - Order of magnitude cost of the transmission infrastructure
  - Expected time to construct

New Transmission

- The 2016 Maine Resource Integration study will focus on the addition of new 345 kV AC transmission circuits
  - The study will also attempt to identify whether there is an identifiable point where HVDC becomes an appropriate alternative to continuing to add AC transmission to the existing system
- Connecting to the areas with the largest quantity of requested new generation interconnections

- Analysis of new 345 kV transmission in parallel with the existing network
- Evaluations will include interconnecting with, or bypassing, existing lines and substations



Testing

- Steady State Thermal
  - N-1, N-1-1
- Steady State Voltage
  - N-1, N-1-1
- Stability Testing
  - Local and some remote (BPS impact) testing
  - Will use real queue generation data to the extent possible
- Inverter-Based/Weak Grid Issues
  - Reactive Support
  - Low Short Circuit Ratio

Next Steps

- Present interim results
  - Summer 2016
- Present final results
  - End of 2016

Questions

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