RENEWABLE ENERGY TECHNOLOGY AND GRID INTEGRATION POLICIES IN RHODE ISLAND

NARUC Energy Regulatory Partnership With Georgian National Energy and Water Supply Regulatory Commission

Tbilisi, Georgia
January 27-31, 2014

Paul J. Roberti
Commissioner, Rhode Island Public Utilities Commission
Siting Jurisdiction – it depends

- State level – most facilities are reviewed at state or local level
  - State-wide body (siting council or public utility commission)
  - Local jurisdictions (county or municipal)
    - All facilities or only facilities under a certain capacity

- Federal level
  - Most hydroelectric facilities – exclusive jurisdiction
  - Facilities on federally owned land (concurrent with state process)
Criteria for Review

- Varies by jurisdiction
- General requirements:
  - No adverse impact on stability and reliability of the grid
  - No undue adverse impact on environmental resources
  - Socio-economic impacts
  - Demonstration of the need for the facility
    - For conventional generation – a regional perspective
    - For renewables, focus is primarily on environmental impacts and consistency with state public policy (i.e., renewable energy mandates and carbon reduction technologies)
Rhode Island’s Energy Facility Siting Process

• The Energy Facility Siting Board (“EFSB”) has jurisdiction over alterations to “major energy facilit(ies)” that “will result in a significant impact on the environment, or the public health, safety, and welfare.”

• Serves as “the licensing and permitting authority for all licenses, permits, assents, or variances which, under any statute of the state or ordinance of any political subdivision of the state, would be required for siting, construction or alteration of a major energy facility in the state.”
Statutory Framework for Siting of Generation Facilities

• “Major energy facility(ies)” are defined as:
  – facilities for the extraction, production, conversion, and processing of coal;
  – facilities for the generation of electricity designed or capable of operating at a gross capacity of forty (40) megawatts or more;
  – transmission lines of sixty-nine (69) Kv or over;
  – facilities for the conversion, gasification, treatment, transfer, or storage of liquefied natural and liquefied petroleum gases;
Statutory Framework for Siting of Generation Facilities continued . . .

• “Major energy facility(ies)”
  – facilities for the processing, enrichment, storage, or disposal of nuclear fuels or nuclear byproducts;
  – facilities for the refining of oil, gas, or other petroleum products;
  – facilities of ten (10) megawatts or greater capacity for the generation of electricity by water power;
  – facilities associated with the transfer of oil, gas, and coal via pipeline; and
  – any energy facility project of the Rhode Island economic development corporation.
Licensing Procedures for Facilities Not Subject to State Energy Facility Siting Board Jurisdiction

- **Facilities Fall Under Local Jurisdiction**
  - County or Municipal Zoning Procedures
  - Local Planning Commission Review
  - Consistency with Comprehensive Plan
  - Noise, height, aesthetics, construction impacts, etc.

- **Potential Residual State Jurisdiction**
  - Highway Crossings
  - Coastal and wetlands Impacts

- **Federal Jurisdiction May Still Be Triggered**
  - Aviation and structure heights
  - Endangered Species
  - Interconnection with regional electric grid
Interconnecting Generation Sources to the High Voltage Electric Grid
Operation of the High Voltage Electric Grid in New England

- Independent System Operator of New England (ISO-NE)
- Responsible for:
  - Ensuring regional reliability of the bulk power system
  - Administering wholesale electricity markets
- Regulated by Federal Energy Regulatory Commission
- Typically Facilities Greater than 69kV
Interconnection Queue

- All significant generation projects must complete necessary studies
  - ISO-NE establishes guidelines for studies
  - Studies conducted by independent contractors
- Entrance into the queue is first-come, first served
- ISO-NE determines who pays for necessary system upgrades
Interconnection Process

- Participant submits interconnection request to the ISO
- ISO-NE reviews interconnection request to validate and assigns the project a queue position based upon the date and time of the interconnection request
- A scoping meeting is scheduled to discuss project details
- Interconnection feasibility study to preliminarily evaluate the feasibility of the proposed interconnection to the Administered Transmission System with available data and information. The customer can opt to do the feasibility study as the first step of the system impact study to expedite the process.
Interconnection Process (cont.)

- Interconnection system impact study is done to evaluate the impact of the proposed interconnection on the reliability and operation of the New England Transmission System.
- Interconnection facility study is done to refine the design and costs to implement the conclusions in the system impact study. The customer may waive this study if they wish to expedite their Interconnection Agreement.
- Development of Interconnection Agreement between the customer, transmission owner, and ISO.
- Small generators (20 MW) or less have a somewhat different process. The electric distribution company has a separate process for the interconnection of Distributed Generation projects.
Interconnection Studies

• New Generation Proponents are responsible for conducting
  – Feasibility Study
  – System Impact Study
  – Facilities Study
Feasibility Study

• High level review of:
  – Existing Peak load and generation sources, including those with higher position in the queue
  – Steady state analysis (voltage and thermal issues)
  – Short circuit analysis
  – Performance under normal operating conditions and contingencies
  – Expected protective equipment and system upgrades required
  – Approximate cost to interconnect
System Impact Study

- More in-depth study than feasibility study
- Examines conditions under a range of loads
- If appropriate, may include additional contingencies
- May include transient stability analysis in addition to steady state analysis
- Wind facilities must conduct one additional study (low voltage ride through capability)
- Provides further detail regarding protective equipment and costs
Facilities Study

- Provides the final determination of the protective equipment needed
- Provides a refined cost estimate of upgrades
- Sets forth any operating protocols that may be necessary
Generator Proposals in the ISO Queue

Approximately 5,000 MW looking to connect to the New England system – Greater than 50 Percent are Renewable Energy Resources
Projected RPS Regional Requirements as % of Net Energy Load 2013-2022**

** Does not include passive demand resources (energy efficiency)
Renewable Resources in the ISO Queue

Total = 2,765 MW

- **Wind**, 2,453 MW (88.7%)
  - Onshore, 1,950 MW (70.5%)
  - Offshore, 503 MW (18.2%)
- **Biomass**, 176 MW (6.4%)
- **Hydro**, 68 MW (2.5%)
- **LFG/fuel cells**, 52 MW (1.9%)
- **Solar PV**, 16 MW (0.6%)

As of April 1, 2013. Totals include non-FERC-jurisdictional projects, including those that are located in northern Maine, which are outside the area administered by ISO-NE.
Renewable Resources in the ISO Queue by State

- **ME, 1571 MW**
- **MA, 610 MW**
- **VT, 175 MW**
- **NH, 290 MW**
- **RI, 57 MW**
- **CT, 62 MW**
- **LFG, 28 MW**
- **Offshore Wind, 29 MW**
Renewable Projects in the ISO Queue

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Nameplate Capacity (MW)(^{(a)})</th>
<th>Capacity Factor (%)(^{(b)})</th>
<th>Maximum Annual Energy (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>68</td>
<td>25%</td>
<td>149</td>
</tr>
<tr>
<td>Landfill gas</td>
<td>28</td>
<td>90%</td>
<td>221</td>
</tr>
<tr>
<td>Biomass</td>
<td>176</td>
<td>90%</td>
<td>1,388</td>
</tr>
<tr>
<td>Wind - onshore</td>
<td>1,950</td>
<td>32%</td>
<td>5,466</td>
</tr>
<tr>
<td>Wind - offshore</td>
<td>503</td>
<td>41%</td>
<td>1,807</td>
</tr>
<tr>
<td>Fuel cells</td>
<td>24</td>
<td>95%</td>
<td>200</td>
</tr>
<tr>
<td>Solar PV</td>
<td>16</td>
<td>13%</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,765</strong></td>
<td><strong>38%</strong></td>
<td><strong>9,248</strong></td>
</tr>
</tbody>
</table>

\(^{(a)}\) A facility's total nameplate capacity is its megawatt value listed in the ISO queue.

Proposed Wind Projects in New England

- More than 2,400 MW of proposed wind projects
  - Includes non-FERC jurisdictional projects
- Majority of wind proposals are in northern New England
- Offshore projects proposed in Massachusetts, Maine, and Rhode Island

Based on April 1, 2013 Interconnection Queue
Note: FERC-jurisdictional wind project totals are bold-faced; non-FERC-jurisdictional totals are non-boldfaced.
Challenges Posed by Greater Levels of Variable Resources

• The region’s aging generation fleet and uncertain performance of demand response resources has increased the need for system operations flexibility – both system wide and locationally
• As traditional units retire or are too expensive to run, and variable resources increase on the system, the system operator will need more resources that have quick-start capability, fast ramp rates, and are dispatchable across seasons
• Wide spectrum of solutions available, some already underway, each with unique costs and complexities. For example:
  • Increase system reserves
  • Enhance performance incentives and penalties in wholesale markets
  • Negative pricing for energy market offers
  • Integrate wind forecasting into commitment and dispatch
Challenges for Wind Development

- Population and electricity demand concentrated in southern New England
- No overlap between wind resources and high energy demand areas
- Transmission investment would be required for large-scale wind integration
New England Wind Integration Study (NEWIS) -- New England-focused wind integration analysis

- Large-scale wind integration in New England is technically feasible
- Regional requirements:
  - Maintaining flexible resources to manage variability
  - Transmission upgrades
  - Increasing regulation service and operating reserves
  - Developing wind forecasting tools
Wind Integration Challenges -- Current Situation

- Wind resources and other Intermittent resources are “non-dispatchable”
  - Unit Dispatch Software (UDS) is unable to manage congestion by sending dispatch instructions
  - Wind resources not eligible to set price in LMP calculator
  - System operators must manually curtail resources if necessary to ensure reliable operation of the grid
- Anticipated wind production generally not reflected in unit commitment for real-time
- Manually curtailing non-dispatchable resources when required to manage congestion does not result in price separation
  - Non-dispatchable resources are effectively zero-priced
  - Resulting LMPs are inconsistent with “dispatch” decisions to curtail zero-price resources
Existing RT Curtailment Procedure

• When economic dispatch is insufficient to manage congestion, priority goes to resources that cleared or self-scheduled in Day-Ahead.

• As a practical matter, this leads to economically inefficient outcomes
  – Renewable energy credits and production tax credits result in wind plants having a negative energy price
  – Interconnections on weaker portions of the grid, and fast ramp rates mean wind plants are typically curtailed more frequently than other resource types
Existing Manual Procedure Will Not Be Adequate Going Forward

- Lack of real-time telemetry and uncertainty about anticipated wind output lead to:
  - More conservative operating practices and limits
  - Less optimal resource commitment
- Suboptimal dispatch and inappropriate pricing
  - Low cost resources may be curtailed before higher cost resources
  - Manual curtailments to manage congestion don’t result in price separation
- With higher wind penetration, system operators with only manual dispatch & curtailment procedures will be overloaded during dynamic weather conditions
Addressing the Challenges of Wind Integration

• The ISO is developing market and infrastructure improvements:
  • Allow negative energy offers
  • Make wind resources dispatchable and eligible to set price
  • Calculate and send out a do-not-exceed (DNE) limit to each wind plant on dispatch
• The DNE limits will reflect several characteristics of each plant:
  • Economic offer curve
  • Maximum output under ideal weather conditions
  • Short-term wind output forecast
  • Transmission constraints
  • Telemetered physical status for the next dispatch interval
• A wind plant will be free to operate anywhere between 0 MW and the DNE limit
Addressing the Challenges of Wind Integration cont.

• A centralized, regional wind power forecasting system is scheduled to be in service in early 2013.
• All wind resources will be required to provide real-time telemetry indicating current output and weather conditions.
  • Improves system operator’s situational awareness
  • Enable ISO’s real-time automated communication of dispatch instructions
  • Enhances the quality of the centralized forecast
• More flexible structure for hourly day-ahead energy offers and intraday reoffers is being developed.
  • Reduces the desire to self-schedule, giving system operators more flexibility to integrate renewable energy resources
  • Increases the percentage of resources dispatched economically
  • Better for efficient system operation as a whole
Addressing the Challenges of Wind Integration cont.

• Potential increase in regulation requirements as more wind resources interconnect to the grid
  – Current hourly requirement averages ~60 MW
  – Could increase to ~300 MW if wind penetration increases to 20% of annual energy
  – New England currently has 800+ MW of regulation capable resources

• Forward Capacity Market issues under consideration
  – Pay-for-performance incentives
  – Identification of operational needs of resources to be acquired in the capacity auction
THANK YOU!

Paul Roberti, Commissioner
Rhode Island Public Utilities Commission
89 Jefferson Blvd.
Warwick, RI 02888
Tel: (401) 780-2101
Email: paul.roberti@puc.ri.gov