ISO New England’s Strategic Transmission Analysis

New England Electricity Restructuring Roundtable: Generation Retirement Study & 2020 Resource Options

Stephen Rourke

VICE PRESIDENT, SYSTEM PLANNING
Five Regional Challenges Identified

1. Resource performance and flexibility
2. Increased reliance on natural-gas-fired capacity
3. Retirement of generators
4. Integration of a greater level of variable resources
5. Alignment of markets and planning needs improvement
Strategic Transmission Analysis Study Objective

- Evaluate the reliability impacts associated with the retirement of 28, 40+ year-old coal- and oil-fired resources by 2020

- Determine whether these retirements totaling 8.3 GW pose transmission security or resource adequacy issues
## Capacity Resources Assumed to be at Risk of Retirement (from 2010 Economic Study)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Unit Type</th>
<th>MW Maximum Assumed</th>
<th>In-service Date</th>
<th>Age in 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAYTON POINT 1</td>
<td>Coal</td>
<td>261</td>
<td>01-Aug-63</td>
<td>57</td>
</tr>
<tr>
<td>BRAYTON POINT 2</td>
<td>Coal</td>
<td>258</td>
<td>01-Jul-64</td>
<td>56</td>
</tr>
<tr>
<td>BRAYTON POINT 3</td>
<td>Coal</td>
<td>643</td>
<td>01-Jul-69</td>
<td>51</td>
</tr>
<tr>
<td>BRAYTON POINT 4</td>
<td>Oil</td>
<td>458</td>
<td>01-Dec-74</td>
<td>46</td>
</tr>
<tr>
<td>BRIDGEPORT HBR 2</td>
<td>Oil</td>
<td>190</td>
<td>01-Aug-61</td>
<td>59</td>
</tr>
<tr>
<td>BRIDGEPORT HBR 3</td>
<td>Coal</td>
<td>401</td>
<td>01-Aug-68</td>
<td>52</td>
</tr>
<tr>
<td>CANAL 1</td>
<td>Oil</td>
<td>597</td>
<td>01-Jul-68</td>
<td>52</td>
</tr>
<tr>
<td>CANAL 2</td>
<td>Oil</td>
<td>599</td>
<td>01-Feb-76</td>
<td>44</td>
</tr>
<tr>
<td>MERRIMACK 1</td>
<td>Coal</td>
<td>121</td>
<td>01-Dec-60</td>
<td>60</td>
</tr>
<tr>
<td>MERRIMACK 2</td>
<td>Coal</td>
<td>343</td>
<td>30-Apr-68</td>
<td>52</td>
</tr>
<tr>
<td>MIDDLETOWN 2</td>
<td>Oil</td>
<td>123</td>
<td>01-Jan-58</td>
<td>62</td>
</tr>
<tr>
<td>MIDDLETOWN 3</td>
<td>Oil</td>
<td>248</td>
<td>01-Jan-64</td>
<td>56</td>
</tr>
<tr>
<td>MIDDLETOWN 4</td>
<td>Oil</td>
<td>415</td>
<td>01-Jun-73</td>
<td>47</td>
</tr>
<tr>
<td>MONTVILLE 5</td>
<td>Oil</td>
<td>85</td>
<td>01-Jan-54</td>
<td>66</td>
</tr>
<tr>
<td>MONTVILLE 6</td>
<td>Oil</td>
<td>418</td>
<td>01-Jul-71</td>
<td>49</td>
</tr>
<tr>
<td>MOUNT TOM 1</td>
<td>Coal</td>
<td>159</td>
<td>01-Jun-60</td>
<td>60</td>
</tr>
<tr>
<td>MYSTIC 7 GT</td>
<td>Oil</td>
<td>615</td>
<td>01-Jun-75</td>
<td>45</td>
</tr>
<tr>
<td>NEW HAVEN HBR</td>
<td>Oil</td>
<td>483</td>
<td>01-Aug-75</td>
<td>45</td>
</tr>
<tr>
<td>NEWINGTON 1</td>
<td>Oil</td>
<td>424</td>
<td>01-Jun-74</td>
<td>46</td>
</tr>
<tr>
<td>NORWALK HBR 1</td>
<td>Oil</td>
<td>173</td>
<td>01-Jan-60</td>
<td>60</td>
</tr>
<tr>
<td>NORWALK HBR 2</td>
<td>Oil</td>
<td>179</td>
<td>01-Jan-63</td>
<td>57</td>
</tr>
<tr>
<td>SCHILLER 4</td>
<td>Coal</td>
<td>51</td>
<td>01-Apr-52</td>
<td>68</td>
</tr>
<tr>
<td>SCHILLER 6</td>
<td>Coal</td>
<td>51</td>
<td>01-Jul-57</td>
<td>63</td>
</tr>
<tr>
<td>W. SPRINGFIELD 3</td>
<td>Oil</td>
<td>111</td>
<td>01-Jan-57</td>
<td>63</td>
</tr>
<tr>
<td>YARMOUTH 1</td>
<td>Oil</td>
<td>56</td>
<td>01-Jan-57</td>
<td>63</td>
</tr>
<tr>
<td>YARMOUTH 2</td>
<td>Oil</td>
<td>56</td>
<td>01-Jan-58</td>
<td>62</td>
</tr>
<tr>
<td>YARMOUTH 3</td>
<td>Oil</td>
<td>122</td>
<td>01-Jul-65</td>
<td>55</td>
</tr>
<tr>
<td>YARMOUTH 4</td>
<td>Oil</td>
<td>632</td>
<td>01-Dec-78</td>
<td>42</td>
</tr>
</tbody>
</table>

**TOTAL 8,281 MW**
Future Transmission Incorporated into Study

- Regional transmission projects expected to be in service before 2020 were included in study
- These transmission projects facilitate retirements, improve deliverability of existing resources, and provide significant flexibility for locating new replacement resources
Transmission Projects Impact Retirements

**NEEWS**
- Allows higher import capability into CT and RI; improves east-west and west-east transferability; and, at least in part, facilitates retirements in Boston, eastern and western MA, RI and CT

**Greater Boston**
- Upgrades improve import capability into Boston; has a positive impact on facilitating retirements and delivery of NH and ME resources to Boston

**Long-Term Lower SEMA**
- Facilitates improved load serving capability in lower SEMA/Cape Cod area allowing for the retirement of some resources in SEMA

**Maine Power Reliability Program**
- Facilitates deliverability to load in Maine and supports possible retirements of at-risk resources

**Vermont/New Hampshire**
- Affect deliverability in VT/NH areas facilitating reliable retirements of at-risk resources in NH
Retirements Alone Result in Capacity Shortfalls

Region will be challenged to meet 2020 Installed Capacity Requirements absent replacements, repowering or the addition of new resources

<table>
<thead>
<tr>
<th>Description</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualified Capacity Assumed Available in 2020 including EE Forecast</td>
<td>37,000</td>
</tr>
<tr>
<td>Representative Installed Capacity Requirement in 2020 (net of HQICC)</td>
<td>34,600</td>
</tr>
<tr>
<td>Margin Before Potential Retirement of At-Risk Units</td>
<td>2,400</td>
</tr>
<tr>
<td>Amount of At-Risk Generation</td>
<td>8,300</td>
</tr>
<tr>
<td>Shortfall After Retirements</td>
<td>-5,900</td>
</tr>
</tbody>
</table>

Retirement of At-Risk Units without replacements or new resources will result in shortfall of ICR

<table>
<thead>
<tr>
<th>Description</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortfall After Retirements</td>
<td>-5,900</td>
</tr>
<tr>
<td>April 2013 Generator Interconnection Queue*</td>
<td>5,200</td>
</tr>
<tr>
<td>Shortfall plus queue</td>
<td>-700</td>
</tr>
</tbody>
</table>

* Generator Interconnection Queue includes nameplate capacity – note almost 40% of April 2013 queue is wind generation
Three Retirement Scenarios Evaluated

Scenario I

Existing generation with no new replacement resources

Scenario II

At-risk resources are replaced at the hub, and critical resources are retained at existing sites

Scenario III

At-risk resources are replaced at the hub, and critical resources are repowered at existing sites

Each retirement analysis evaluates how much generation can be retired, recognizing:
• Resource needs
• Existing capacity constraints
• Area transmission security
Application of New England Trading “Hub”

- New England Trading Hub (Hub) is a central trading location in energy market where no significant energy congestion is expected
  - 32 electrical buses/nodes in West-Central Massachusetts make up the Hub
  - Interconnection of new proxy generation at the Hub was represented by six 345 kV buses/nodes*

- Replacement resources needed were envisioned to be integrated at the Hub

* W. Medway 345 kV is electrically close to, but not in the defined Trading Hub
Scenario I

With assumed resources and transmission in 2020, no more than 950 MW may be retired without causing reliability problems

• Issues caused by retirements:
  – Resource deficiency
  – Area and local transmission constraints

• Observations:
  – Maximum amount of retirement capacity that can be achieved is 950 MW
  – More resources can retire if replaced by new resources to meet capacity needs
  – Approximately 1,400 MW of existing capacity will be limited in effectiveness due to deliverability constraints
Scenario II

Assumes all units retired, except at critical resource sites; remaining resource needs met by new resources at the Hub

- Issues caused by retirements:
  - Area and local transmission constraints

- Observations
  - SEMA import transmission constraints would require continued operation of assumed at-risk resources in SEMA
  - Local transmission constraints would require continued operation of assumed at-risk resources in Connecticut
  - Some existing resources will need to be retained, repowered or replaced; otherwise transmission upgrades will be necessary
  - Up to 5,100 MW of replacement resources at the Hub needed
  - Integrating resources to the Hub appears to be more deliverable than some existing resource sites

- Total Unable to Retire: 1,350 MW
  - Oil-Fired Capacity: 950 MW
  - Coal-Fired Capacity: 400 MW

- Proxy Resource at the Hub (up to 5,100 MW)

- Retained Capacity

- Central, Southeast and Southwest CT

- SEMA
Scenario III

Assumes all units retired; repowering of critical resource sites; remaining resource needs met by new resources at the Hub

• Issues caused by retirements:
  – Area import and local transmission constraints

• Observations:
  – 900 MW are needed to address SEMA import constraints and CT local constraints
  – SEMA import constraint can be addressed by adding generation at multiple sites
  – Local constraints within CT must be addressed electrically close to existing generation sites
  – Approximately 5,100 MW of replacement capacity at the Hub is required to replace lost capacity due to retirement of all the other at-risk resources
Overall Observations

• If 8,300 MW retire by 2020, resource adequacy needs dictate replacement capacity of at least 5,900 MW plus almost 800 MW of new energy efficiency reflected in EE forecast.

• With the currently planned system configuration at least 900 MW of the 5,900 MW replacement capacity must be in specific locations due to transmission constraints:
  – 500 MW must be in SEMA
  – 400 MW must be in Connecticut

• Approximately 5,000 MW may need to be integrated into Hub:
  – Transmission may be needed to make resources deliverable to the Hub
  – From Hub power can be delivered to the load
Overall Observations, continued

• If substitute resources are not available, only 950 MW of the existing 8,300 MW of older oil and coal resources will be able to retire without causing reliability problems.

• Major transmission projects significantly improve deliverability of most existing resources, and greatly facilitate retirement of assumed at risk resources.

• Repowering all existing sites would likely result in congested capacity, thereby increasing the amount of capacity that needs to be replaced, compared to a scenario where the replacement capacity is deliverable to the Hub.
Overall Observations, continued

- New zonal definitions may need to be considered
  - Zones may not resemble current definitions (i.e., state boundaries)

- Actual retirement requests will be evaluated as submitted based on prevailing system conditions

- This study focused on the year 2020, assuming all major transmission projects were already in service
  - Individual retirements may trigger local transmission reliability issues that were not captured in this study
Questions