New England Pipeline and Transmission Infrastructure: Recent Studies

Energyzt Advisors, LLC

NE Electricity Restructuring Roundtable

20 November 2015
Objectives

- Review the findings of the Energyzt research and reports on winter reliability in New England in the context of a need for a new natural gas pipeline funded by electricity ratepayers
Summary of Reports

ENERGYZT issued two separate reports on winter reliability in New England:


   Question: Is there enough existing energy infrastructure to meet winter reliability requirements?

   Answer: Yes. The only scenario that indicates potential issues is one where LNG import capacity is constrained


   Question: What caused the winter price spikes and what are the most economic solutions to address potential reliability concerns?

   Answer: Failure to utilize existing energy infrastructure caused winter issues. Engage in market-based approaches to contract with existing energy infrastructure (e.g., dual-fuel and LNG)

“An expert knows all the answers – if you ask the right questions” - Anonymous
Analysis | The past three winters, prices were abnormally high

Average Daily Natural Gas Prices for Algonquin Citygate, Massachusetts

Sources: Energyzt analysis of Ventyx Energy Velocity Suite

Assumption: High prices during periods of high demand = inadequate supply

Initial response by the industry: Build more natural gas pipelines
Analysis | Higher basis differentials compared to Henry Hub

Natural Gas Basis Differentials in New England vs. Henry Hub

Source: Energyzt analysis of IEA AEO 2015, Ventyx

Basis differentials to Henry Hub started diverging in 2012 for summer and winter
Analysis | Basis differentials compared to PJM also higher

Basis Differential Algonquin Citygates to TETCO M3
(2010 – 2015)

Number of days basis differentials have been larger than $5/mmBtu before additions and expansions

Basis Differential = 5 /mmBtu

Sources: Interconnect Exchange data via Ventyx

PJM basis differential more than $5/mmBtu occur less than 60 days of the year
Analysis | Pipeline deliveries were lower than 2010 and 2011

Pipeline capacity would appear to be adequate to meet peak days

Source: Energyzt analysis of IEA AEO 2015, Ventyx
Analysis | Peak natural gas demand has been spiky, but flat

Daily New England Natural Gas Demand by End Use
(1/1/2010 - 7/26/2015)

Source: Energyzt analysis of EIA Natural Gas Monthly Report

Plenty of excess pipeline capacity outside of the winter months
Analysis | New capacity more than meets average demand

Source: Energyzt analysis of IEA AEO 2015, Ventyx

Projections also indicate that the underlying issue is a not baseload problem
Analysis | LNG inflows declined in 2012 as contracts expired

Monthly Scheduled Quantities by LNG Terminal

Source: Energyzt analysis of GDF Suez data underlying semi-annual reports to FERC

What would you do if you discovered 85% of a pipeline’s capacity was unused?
Analysis | Dual-fuel units also provide peaking resources

Total Generating Plants with Dual fuel Capability and Natural Gas as Primary Fuel

<table>
<thead>
<tr>
<th>Location</th>
<th># of Plants</th>
<th>MW Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecticut</td>
<td>11</td>
<td>1,258</td>
</tr>
<tr>
<td>Maine</td>
<td>4</td>
<td>469</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>26</td>
<td>4,192</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>2</td>
<td>609</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>3</td>
<td>594</td>
</tr>
<tr>
<td>New England</td>
<td>46</td>
<td>7,121</td>
</tr>
</tbody>
</table>

Secondary Fuel Type For NE States by Capacity (MW)

<table>
<thead>
<tr>
<th>State</th>
<th>Distillate Fuel Oil</th>
<th>Other Fuel Oil</th>
<th>BIT Coal</th>
<th>Kerosene</th>
<th>Wood Waste</th>
</tr>
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<tbody>
<tr>
<td>CT</td>
<td>990</td>
<td>268</td>
<td></td>
<td></td>
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<tr>
<td>ME</td>
<td>187</td>
<td>31</td>
<td></td>
<td>164</td>
<td>88</td>
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<tr>
<td>MA</td>
<td>2,218</td>
<td>1,968</td>
<td>6</td>
<td></td>
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<tr>
<td>NH</td>
<td>3</td>
<td>606</td>
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<tr>
<td>RI</td>
<td>584</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>3,981</td>
<td>2,883</td>
<td>6</td>
<td>164</td>
<td>88</td>
</tr>
</tbody>
</table>

Sources: EIA Form 816 via Ventyx, 2014 NERC Report on Polar Vortex

New England has around 7,000 MW of dual-fuel capability
Analysis | Existing infrastructure was adequate

There is adequate energy infrastructure to meet winter requirements
Analysis

Existing infrastructure was not deployed

Illustration of Winter 2013/2014 Reliability Supply Curve

- 2013/14 Winter Peak Firm Capacity 3.4 bcfd
- Winter 2013/2014
  - Polar Vortex price spikes increased cost of non-firm gas that did become available
  - Power imports fell
  - LNG contracts expired and were not renewed
  - Limited dual-fuel units available at $100/barrel
  - Reduced pipeline capacity due to equipment failure

Existing infrastructure was not appropriately deployed
Analysis | Proposed pipelines would oversupply New England

Illustration of Winter Reliability Supply Curve with All Proposed Pipeline Projects

- Winter Reliability Supply Curve with Expansions
- Contracted Gas Pipeline
- 2013/14 Winter Peak Firm Capacity 3.4 bcf/d
- Peak Demand 1/3/2014 ~4.0 bcf/d
- Expansion
- Supply Curve with New Projects (2018)

Proposed pipelines would substantially oversupply the market
Analysis | Oversupply into New England would find demand

**LNG development**

Proposed LNG export facilities in eastern Canada

1. **Bear Head LNG** (Liquified Natural Gas Ltd. of Australia)
   Richmond County, Nova Scotia
   Requesting permit from Canada to import as much as 503 billion cubic feet of natural gas per year from the U.S. for conversion to LNG and subsequent export.

2. **H-Energy** (Hiranandani Group)
   Melford, Guysborough County, Nova Scotia
   Company proposing for project to export as much as 657 billion cubic feet of natural gas per year to Canada.

3. **Goldboro LNG** (Pieridae Energy Ltd.)
   Goldboro, Guysborough County, Nova Scotia
   Requesting permit from Canada to import 365 billion cubic feet of natural gas per year from the U.S. via "existing pipeline infrastructure" for conversion to LNG and subsequent export.

4. **Canaport LNG** (Repsol)
   Saint John, New Brunswick
   Filed a preliminary project description with Canadian authorities. Sources have told Reuters the project would seek to export 243.5 billion cubic feet of natural gas per year.

Sources: Energy Information Administration (EIA); Spectra Energy/Maritimes & Northeast Pipeline, Reuters.


**Most likely candidates for pipeline capacity resales = Canadian exports**
Analysis | Peaking solutions (dual-fuel and LNG) are least cost

Sources: Energyzt analysis of average cost of incremental supply (variable and capital costs) and does not include price suppression due to excess natural gas supply into the market. Assumptions reflect current market conditions during winter peak periods.

Key assumptions:
- Pipeline cost = $2.4 billion
- Cost Recovery Factor = 12.5%
- Variable Costs = $5 / mmBtu gas supplies and $1 / mmBtu other
- Cost of Fuel Oil = $15 / mmBtu
- Cost of LNG = $10 / mmBtu

In addition, dual-fuel and LNG are more focused, flexible and impose less risk.
Analysis | The electricity sector is not adding to demand

Historic and Forecasted Annual Natural Gas Demand
By New England Electric Generators (1997 - 2030)

Source: Energyzt analysis; Annual Energy Outlook 2015

Flat electricity demand and efficiency improvements limit electric demand
Conclusions | New England needs contracts, not construction

- Winter price spikes reflected a transient peaking problem
- Existing infrastructure is more than adequate
- The market is responding by accessing existing infrastructure
  - Dual-fuel capability
  - LNG contracts
  - Energy efficiency
  - ISO-NE performance programs
  Such peaking solutions are the least cost and least risk to ratepayers
- New pipeline capacity already is being built under traditional financing mechanisms which will expand capacity
- A new natural gas pipeline funded by electricity ratepayers is not needed or justified

The issue is not lack of infrastructure, but inadequate use of that infrastructure
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