A New Englander’s Perspective:

Shale Gas-Quantities, Price and What’s to be Done

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LEVITAN & ASSOCIATES, INC.
MARKET DESIGN, ECONOMICS AND POWER SYSTEMS
Marcellus production

Sources: Platts, Barclays Capital
Marcellus production forecast

Source: Penn State University
Wet and dry shale gas production

Sources: EIA, Pennsylvania State University Marcellus Center, Dominion Resources, Pennsylvania Department of Conservation and Natural Resources
Marcellus-related planned projects

- National Fuel, "West to East"
- Iroquois, "NYMarc"
- NiSource & UGI, "PENNSTAR"
- Tennessee, "Northeast Supply Diversification"
- Spectra, "AIM"
- Spectra, "NJ / NY Expansion"
- Williams, "Rockaway Lateral/Northeast Connector"
- Spectra/Texas Eastern, "TEAM 2012"
- Millennium, "Minisink Compression Project"
- Williams, "Northeast Supply Link"
- Empire, "Tioga County II"
- Inergy, "Marc I"
- Dominion, "Ellisburg to Craig"
- National Fuel, "Northern Access Project"
- Tennessee, "Northeast Upgrade"
- Williams & Cabot, "Constitution Pipeline"

Source: NGA
New England remains at the “end of the line”

Source: EIA
Soft prices reduce dry gas rig count

Source: RigData
### Marcellus production economics

<table>
<thead>
<tr>
<th></th>
<th>Dry Gas</th>
<th>Wet Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>$/mcf</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Revenues</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>2.60</td>
<td>2.61</td>
</tr>
<tr>
<td>Liquids</td>
<td>--</td>
<td>3.90</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2.60</td>
<td>6.51</td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Production</td>
<td>(3.36)</td>
<td>(3.36)</td>
</tr>
<tr>
<td>Liquids Processing</td>
<td>--</td>
<td>(0.32)</td>
</tr>
<tr>
<td><strong>Net</strong></td>
<td>(0.76)</td>
<td>2.83</td>
</tr>
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</table>

Assume: HH $2.50/MMBtu, WTI $100/Bbl, Dry Gas 1,040 Btu/scf, Wet Gas into Plant 1,266 Btu/scf, NGLs recovery 2.285 gals/mcf, NGLs priced at 52% of WTI, ethane left in processed gas stream.

*Sources: Range Resources, MarkWest Energy Partners*
Inexpensive Gas is the New Conventional Wisdom, but…
LMPs in New England Driven by Delivered Gas Costs

Source: ISO-NE
Generation by Fuel Type (2011)

Source: ISO-NE
Increased Gas Market Share?

- Environmental Regulations

- Weakest Commodity prices in over a decade

- Vermont Yankee’s anticipated retirement
  - ~4,500 GWh (2011)

- Expected decline in imports
  - 10,142 GWh (2011)

- Coal (dark spread) under seige
  - 7,080 GWh (2011)
Impacts on Line pack effects

- Wind forecast errors will result in unscheduled draws on linepack

- Forecast deviations often persist for significant fraction of day and can persist

- P/L additions can improve system tolerance to linepack variations

Source: ISO-NE
Issues & Concerns (Next 3-5 Years)

- PJM / NYISO / MISO are benefited by large new gas gathering and P/L additions → not so N.E.

- Slack deliverability during non-heating season, but increased demand may strain infrastructure in N.E.

- Anticipated retirement of many RFO / dual fuel steamers

- Gas basis benefits will be indirect and are unlikely to materialize during peak heating season

- Growth of intermittent resources requires quick-start resources → line pack part of the solution

Who pays?