LNG and CNG

Presentation to:

The Energy Council

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Northeast Gas Association
Topics

- LNG exports
- CNG & LNG as transport fuel options
- CNG & LNG as non-pipeline supply alternatives
What is NGA?

- Non-profit trade association
- Local gas utilities (LDCs) serving New England, New York, and New Jersey
- Several interstate pipeline companies
- LNG importers (Distrigas, Repsol) and LNG trucking companies
- About 250 “associate member” companies, from industry suppliers and contractors to electric grid operators
- www.northeastgas.org
NGA’S ANTITRUST COMPLIANCE PROCEDURES

Adopted by the NGA Board of Directors on June 4, 2003

Objective

The Northeast Gas Association (NGA) and its member companies are committed to full compliance with all laws and regulations, and to maintaining the highest ethical standards in the way we conduct our operations and activities. Our commitment includes strict compliance with federal and state antitrust laws, which are designed to protect this country’s free competitive economy.

Responsibility for Antitrust Compliance

Compliance with the antitrust laws is a serious business. Antitrust violations may result in heavy fines for corporations, and in fines and even imprisonment for individuals. While NGA’s attorneys provide guidance on antitrust matters, you bear the ultimate responsibility for assuring that your actions and the actions of any of those under your direction comply with the antitrust laws.

Antitrust Guidelines

In all NGA operations and activities, you must avoid any discussions or conduct that might violate the antitrust laws or even raise an appearance of impropriety. The following guidelines will help you do that:

- Do consult counsel about any documents that touch on sensitive antitrust subjects such as pricing, market allocations, refusals to deal with any company, and the like.

Continued on NGA web site...

http://www.northeastgas.org/about-nga/antitrust-guidelines
Key Points

- Strong North American supply base leading to call for exports – outlet for supplies

- Industry consensus: 4-6 Bcf/d of exports in next several years; most likely export facilities in Gulf, Maryland, British Columbia

- Price advantage leading fleets to seek CNG & LNG for transportation modes

- CNG & LNG providing options for industries and communities not on the pipeline
North American Shale Gas Basins

Map: National Energy Board
U.S. and Canada Projected as Leading Future Producers

Source: IEA, May 2012
BENTEK: “Northeast Production Can Grow by 8.0 Bcf/d by 2017”


Charts: U.S. EIA
LNG Prices, U.S. and Globally

World LNG Estimated June 2012 Landed Prices

Source: FERC
FERC: Proposed Export Terminals

**North American LNG Import/Export Terminals**

**Proposed/Potential**

**Import Terminal**

**PROPOSED TO FERC**
1. Robbinson, ME: 0.5 Bcf/d (Kestrel Energy - Downeast LNG)
2. Astoria, OR: 1.5 Bcf/d (Oregon LNG)
3. Corpus Christi, TX: 0.4 Bcf/d (Cheniere - Corpus Christi LNG)

**Export Terminal**

**PROPOSED TO FERC**
4. Freeport, TX: 1.8 Bcf/d (Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction)
5. Corpus Christi, TX: 1.8 Bcf/d (Cheniere - Corpus Christi LNG)
6. Coos Bay, OR: 0.9 Bcf/d (Jordan Cove Energy Project)
7. Lake Charles, LA: 2.4 Bcf/d (Southern Union - Trunkline LNG)
8. Hackberry, LA: 1.7 Bcf/d (Sempra - Cameron LNG)

**PROPOSED CANADIAN SITES IDENTIFIED BY PROJECT SPONSORS**
9. Kitimat, BC: 0.7 Bcf/d (Apache Canada Ltd.)
10. Douglas Island, BC: 0.25 Bcf/d (BC LNG Export Cooperative)

**POTENTIAL U.S. SITES IDENTIFIED BY PROJECT SPONSORS**
11. Cove Point, MD: 1.0 Bcf/d (Dominion - Cove Point LNG)
12. Brownsville, TX: 2.8 Bcf/d (Gulf Coast LNG Export)
13. Astoria, OR: 1.25 Bcf/d (Oregon LNG)
14. Pascagoula, MS: 1.5 Bcf/d (Gulf LNG Liquefaction)
15. Lavaca Bay, TX: 0.4 Bcf/d (Excelerate Energy)
16. Elba Island, GA: 0.5 Bcf/d (Southern LNG Company)

**POTENTIAL CANADIAN SITES IDENTIFIED BY PROJECT SPONSORS**
17. Prince Rupert Island, BC: 1.0 Bcf/d (Shell Canada)

As of May 24, 2012

Office of Energy Projects
LNG Global Trade Has Been Rising

Figure 2.6  Global Cross-Border Gas Trade

Tcf of Gas

1993  2008

<table>
<thead>
<tr>
<th>Year</th>
<th>LNG</th>
<th>Pipeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>3.0</td>
<td>14.8</td>
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<tr>
<td>2008</td>
<td>8.0</td>
<td>26.4</td>
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</table>

Source: MIT; U.S. Energy Information Administration

Source: MIT Energy Initiative, June 2011
World LNG Capacity Growing

Source: IEA, June 2011
The Case for Exports

- Outlet for rising production
- Underutilized U.S. import facilities
- Opportunity for balance of trade / geopolitical advantages
- Economic benefits

- Two approved facilities to date:
  - Sabine Pass, LA
  - BC LNG, Kitimat, BC
The Case against Exports

- Concern about impact on consumer prices
  EIA report, Jan. 2012: “Larger export levels lead to larger domestic price increases, while rapid increases in export levels lead to large initial price increases that moderate somewhat in a few years. Slower increases in export levels lead to more gradual price increases but eventually produce higher average prices during the decade between 2025 and 2035.”

- Political concern about domestic impacts

- High facility costs

- Competition for export market from other world regions
4 LNG Import Facilities Serve New England

Locations approximate. Not all pipeline systems shown. Original map outline by FERC.

1. Distigas, Everett, MA: 0.7 Bcf/d, 3.4 Bcf storage (GDF SUEZ)
2. Northeast Gateway Project, Off Cape Ann, MA: 0.4 to 0.8 Bcf/d; no storage (Excelerate Energy) [in operation as of May 2008]
3. Neptune LNG, Off Cape Ann, MA: 0.4 Bcf/d; no storage (GDF SUEZ) [in service as of summer 2010]
4. Canaport LNG, Saint John, NB: 0.75 to 1 Bcf/d, 9.9 Bcf of storage (Repsol, Irving Oil) [in operation as of 6-09]

Prepared by Northeast Gas Association (NGA)
Importance of LNG to New England Gas System

Source: U.S. EIA
Storage

LNG Value to LDCs in New England

- Supply Resource
- Reliability Asset
- Balancing Resource
- Distribution System Resource

Source:
U.S. EIA
"If we start making cars and trucks that run on natural gas, there’s the potential to create over a half a million American jobs...With rising gas prices and growing instability in oil regions around the world, the time to act is now."

- Rep. John Larson, CT, lead co-sponsor of NAT GAS Act, U.S. Congress
# U.S. and International NGV Markets

<table>
<thead>
<tr>
<th>Country</th>
<th>Natural Gas Vehicles</th>
<th>GGE/ Year</th>
<th>BCF/year</th>
<th>GGE/ Vehicle/ Year</th>
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<tbody>
<tr>
<td>Iran</td>
<td>2,859,386</td>
<td>1,608,972,185</td>
<td>198</td>
<td>563</td>
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<tr>
<td>Pakistan</td>
<td>2,850,500</td>
<td>1,374,930,471*</td>
<td>169</td>
<td>482*</td>
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<td>Argentina</td>
<td>2,044,131</td>
<td>827,655,981</td>
<td>102</td>
<td>405</td>
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<td>Brazil</td>
<td>1,702,790</td>
<td>569,204,057</td>
<td>70</td>
<td>334</td>
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<tr>
<td>India</td>
<td>1,100,000</td>
<td>530,581,834*</td>
<td>65</td>
<td>482*</td>
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<tr>
<td><strong>United States</strong></td>
<td><strong>112,000</strong></td>
<td><strong>361,760,341</strong></td>
<td><strong>44</strong></td>
<td><strong>3,230</strong></td>
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<td>Ukraine</td>
<td>200,019</td>
<td>285,962,937</td>
<td>35</td>
<td>1,430</td>
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<td>China</td>
<td>600,000</td>
<td>289,408,273*</td>
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<td>482*</td>
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<td>Italy</td>
<td>761,340</td>
<td>213,714,228</td>
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<td>281</td>
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<td>Bangladesh</td>
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<td>204,894,167</td>
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<td>Colombia</td>
<td>348,747</td>
<td>155,040,146</td>
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<td>445</td>
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<td>Uzbekistan</td>
<td>310,000</td>
<td>149,527,608*</td>
<td>18</td>
<td>482*</td>
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<tr>
<td>Egypt</td>
<td>162,000</td>
<td>130,922,790</td>
<td>16</td>
<td>808</td>
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<tr>
<td>Thailand</td>
<td>267,735</td>
<td>129,141,207*</td>
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<td>482*</td>
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<td>Russia</td>
<td>100,053</td>
<td>99,053,427</td>
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<td>Armenia</td>
<td>244,000</td>
<td>91,370,326</td>
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<td>374</td>
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<td>Bolivia</td>
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<td>Peru</td>
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<td>Germany</td>
<td>94,890</td>
<td>50,301,914</td>
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<td>530</td>
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<td>Venezuela</td>
<td>90,000</td>
<td>28,086,570</td>
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<td>312</td>
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Source: N. Sirosh, Quantum Technologies

* Estimated values

Source: GTI
Transportation Sector and Natural Gas Vectors

Direct use in NGVs

✓ CNG and LNG vehicles
  ✓ About 40-45 bcf now (0.045 Quads)
  ✓ Large upside, particularly for medium/heavy duty fleets
  ✓ Latest DOE forecast: 84 bcf (2020)
    ✓ Likely a low estimate given current market conditions

Product availability & price definitely going in right direction

Source: GTI
NGV Heavy-Duty Sector Market Outlook

Attractive payback potential
150 bcf+ market feasible by 2020
Continued progress in bus, refuse markets

Freight truck adoption & infrastructure investment are key determinants

Significant upside exists but requires product and investment for this segment

<table>
<thead>
<tr>
<th>Vehicle Class</th>
<th>Natural Gas Demand Scenario (bcf)</th>
<th>Estimated Current/2011 Use (bcf)</th>
<th>% of Goal in 2011</th>
<th>Estimated 2020 Use (bcf)</th>
<th>% of Goal in 2020</th>
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<tbody>
<tr>
<td>Transit Buses</td>
<td>68</td>
<td>23</td>
<td>34%</td>
<td>54</td>
<td>79%</td>
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<tr>
<td>Refuse Trucks</td>
<td>71</td>
<td>5</td>
<td>7%</td>
<td>40</td>
<td>56%</td>
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<tr>
<td>Freight Trucks</td>
<td>1,096</td>
<td>5*</td>
<td>&lt;1%</td>
<td>50*</td>
<td>5%</td>
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<td>School Buses</td>
<td>53</td>
<td>0.5*</td>
<td>1%</td>
<td>5*</td>
<td>9%</td>
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<tr>
<td>Goal: 1,288</td>
<td>33.5</td>
<td>3%</td>
<td>~150+</td>
<td>12%+</td>
<td></td>
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* SWAG
Some Examples

- **Gaz Métro, fall 2011:**
  - “Blue Road” announced last fall, joint project with Robert Transport to create network of LNG fueling stations, Quebec City to Toronto

- **Chesapeake and Clean Energy, July 2011:**
  - Announced partnership to develop approximately 150 LNG truck fueling stations at strategic truck-stop locations along major trucking corridors to form the backbone of "America's Natural Gas Highway."

- **Shell, June 2012:**
  - “Shell will construct more than 200 LNG fuel lanes at about 100 TA sites and Petro Stopping Centers throughout the interstate highway system.”
  - Last year, Shell “announced it would sell LNG to heavy-duty fleet customers at select Flying J truck stops in Alberta.”
Portable CNG (and LNG)

**Portable natural gas:**

- CNG can be used as a testing gas for newly installed or repaired piping.
- CNG can be used as supplemental or emergency natural gas while the permanent natural gas service is being replaced or repaired.
- Small or mini-tube trailer applications can supply residences and small commercial businesses (approximately 10,000 scf).
- Jumbo tube trailer applications can supply large commercial and industrial businesses (approximately 250,000 scf).

Source: AVSG
Some Examples

- **Backyard Farms, Maine:**
  - Served by LNG, trucked from Boston

- **Cavendish Farms, PEI:**
  - Served by CNG, trucked from New Brunswick, off M&NE Pipeline

Photo: The Guardian newspaper of Prince Edward Island
Thank you...