Developing New U.S. Natural Gas Supply Sources
February 13, 2001
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Overview

Any comprehensive U.S. energy solution will require innovative thinking
- U.S. will need significant additional gas supplies in the near future, especially near the coasts
- There are few viable alternatives

LNG should be an integral part of any U.S. energy solution

Floating LNG terminals offer many unique advantages

To promote growth of LNG, terminals need to be unregulated

El Paso plans to aggressively expand LNG capacity
U.S. Natural Gas Market is Growing Rapidly

- U.S. natural gas demand is growing over 2% per year or approximately 1.5 Bcf/d per year
- Growth is led by the power generation market
- NG consumption rate of growth for this market is almost 7% per year
- Industry sources list 316,000 MW under some stage of development

At 100% utilization, a new 500 MW CCGT plant uses almost 100 MMcf/d
Source: El Paso estimates

U.S. Lower 48 Demand Bcf/d

1998 1995
54
63

1998 2005
Residential
Industrial
Commercial
Electricity Gen.
Primary Growth in Coastal Areas

Demand Growth from 1998-2005

Over 50% of the growth is on the U.S. coasts

Source: El Paso estimates

Obtained and made public by the Natural Resources Defense Council, March/April 2002
Gas Growth is Likely to Continue

- Electric generation will continue to be gas-fired
  - Gas-fired plants require lower capital costs and shorter construction lead times
  - 95% of all current electric generation development is designed to use natural gas
- New homes will increasingly choose natural gas as a source for heating
  - Natural gas costs less to heat a home than electricity, heating oil, propane, or kerosene
  - Heating an average home in a moderate climate costs 5% less to heat with gas than with heating oil and 33% less than with an electric heat pump
- Over 40% of U.S. factories use natural gas as their primary fuel source
- Natural gas is the cleanest and most efficient fossil fuel
U.S. Lower-48/Canada Unable to Meet Increased Demand

- U.S. production has been essentially flat for the last 5 years.
- Canadian imports have been essential to meet growing demand, but are now under considerable production pressure.

Source: EIA; National Energy Board (NEB)
Gulf of Mexico Unable to Meet Increased Demand

- Gulf of Mexico production has been in decline the last 2 years
- Deepwater production to date has not been able to offset shelf declines

Source: Minerals Management Services
There are No Cheap Alternatives

Note: Transport rate includes full tariff and fuel
Source: El Paso estimates

Obtained and made public by the Natural Resources Defense Council, March/April 2002
Longhaul Pipelines are Also Expensive

- Representative tariff rate examples
  - Arctic Gas to Calgary: $1.50–2.00/Dth
  - Alliance: $0.77/Dth
  - Buccaneer: $0.81/Dth
  - Southern Trails: $0.67/Dth
  - M&NE: $1.13/Dth

  LNG Regasification: $0.25–0.50/Dth

Source: Literature search; Filed tariffs
Any comprehensive U.S. energy solution will require innovative thinking.

LNG should be an integral part of any U.S. energy solution.
- LNG is most attractive solution.
- Existing terminals and new land-based terminals are only part of the answer.

Floating LNG terminals offer many unique advantages.

To promote growth of LNG, terminals need to be unregulated.

El Paso plans to aggressively expand LNG capacity.
LNG is Most Attractive Solution

- LNG terminals currently exist in major demand growth regions on the East Coast
- Cost reductions have significantly reduced the landed cost of LNG
  - Liquefaction costs down 33% over the last 10 years
  - Shipping costs have decreased by 40%
  - Excess supply has led to reasonably priced spot market
- Facilities allow for baseload and peaking services at end of telescoping pipelines

Obtained and made public by the Natural Resources Defense Council, March/April 2002
LNG Costs Have Been Steadily Falling

$/MMBtu - 2,500 mile voyage

1980's LNG costs: $1.54
Current LNG costs: $0.40

Liquefaction: $0.59
Transportation: $1.00
Regasification: $0.10
Total: $2.53

30% decline of into pipeline costs

Note: Does not include feedstock prices
Source: McKinsey & Company analysis

Lower costs can improve networks or open additional markets, especially with higher opportunities.
Currently Only Four U.S. LNG Facilities

- Everett: Operating since 1988 with long-term supply contracts
- Lake Charles: Operating since 1989 on a short-term, spot cargo basis
- Elba Island: To reopen October 2001
- Cove Point: To reopen mid-2002
## U.S. Needs Additional Terminal Capacity

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Send-out Capacity Bcf/d</th>
<th>Storage Capacity Bcf</th>
<th>Annual Capacity Bcf/yr</th>
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</thead>
<tbody>
<tr>
<td>Lake Charles</td>
<td>0.70</td>
<td>6.3</td>
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<tr>
<td>Elba Island</td>
<td>0.44</td>
<td>4.0</td>
<td>160</td>
</tr>
<tr>
<td>Cove Point</td>
<td>0.75</td>
<td>6.7</td>
<td>245</td>
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<tr>
<td>Everett</td>
<td>0.54</td>
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<tr>
<td><strong>Totals</strong></td>
<td><strong>2.43</strong></td>
<td><strong>20.6</strong></td>
<td><strong>752</strong></td>
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</tbody>
</table>

Source: Filed tariffs

Obtained and made public by the Natural Resources Defense Council, March/April 2002
Land Based Terminals Only
Part of the Answer

Advantages:
- Proven
- Scalable
- Reliable in harsh environment
- Creates optionality on pipeline system

Disadvantages:
- Few "ideal" sites
- Longer development time
- Permitting issues
Any comprehensive U.S. energy solution will require innovative thinking

LNG should be an integral part of any U.S. energy solution

Floating LNG terminals offer many unique advantages
- El Paso developed stringent design requirements
- Technology is proven
- High availability is expected

To promote growth of LNG, terminals need to be unregulated

El Paso plans to aggressively expand LNG capacity
Floating Terminals Have Unique Advantages

An FSRU (Floating Storage and Regasification Unit) is a specially designed ship that has both storage and regasification facilities.

Advantages:
- Environmentally friendly
- Mobile
- Can be delivered by 2005
- Proven tank design

Disadvantages:
- First-of-a-kind for LNG
El Paso HasOutlined Stringent Design Requirements

- Offload ships in up to 3 meter seas
- Offload ships in 12 hours or less
- Continue vaporization in up to 10 meter seas
- Operating availability of 95–100%
- Stay on station during "100 year storm"
- 40 year life with no dry dock requirements
- Able to unload all existing ships > 70,000 CBM
- 24 hour/365 day operation
- Mobile (can be relocated seasonally)

Potential design is an FSRU, which is very similar to an FPSO (floating, production, storage and offloading) and a modified LNG tanker

Key element is liquids transfer between floating tanker and moored, floating storage vessel.
Floating Terminals Have Unique Advantages

LNG Tanker with Regasification on board

Advantages:
- Environmentally friendly
- Extremely Mobile
- Can be delivered by 2004
- Scalable
- Proven tank design

Disadvantages:
- Not as much storage capability
- Only modified ships may connect to the buoy
- Longer send-out time (several days)
El Paso Has Outlined Stringent Design Requirements

- Connect to buoy in up to 6 meter seas
- Volume send out tailored to market demand
- Continue vaporization in up to 10 meter seas
- Operating availability of 98–100%
- Stay on station during "100 year storm" with propulsion option available to evade storm if desired
- 40 year life
- 24 hour/365 day operation
- Extremely mobile (each cargo can be relocated seasonally)
FSRU and Modified LNG Tanker Employ Proven Technology

- Tanks: Will use 1 of 3 tank types that have been used in virtually all LNG Cargo Ships (Moss Dome, IHI SPB or CTT Membrane) for 25 years
- Mooring: Single Point Mooring System (SPM) allows the barge to weathervane and find the position of least resistance. Technology has been well proven in FSO's and FPSO's
- Unloading: Will unload in "side by side" configuration using unloading arms. Very similar to the operation at Elba Island terminal. Tandem unloading or the use of a flexible LNG hose may be developed if side by side actual or model results prove unreliable (FSRU only)
- Vaporization: Very similar to land-based terminals

ABS and DNV ready to certify design and construction of FRSU

DNV has concluded FRSU concept is feasible after review of design proposals
FPSOs Have Proven Track Record

- FPSO's/FSO's have been in operation worldwide for 20+ years, including offshore U.S. (oil, LPG, etc.)
- Approximately 80 FPSO's currently operable
- Certified by all international maritime classification agencies (ABS, DNV, etc.) for oil, LPG, etc.
- Uninterrupted, safe operations through Force 12 ocean storms
- MMS has completed Draft Environmental Impact Statement for FPSOs in Gulf of Mexico

FSRU and modified LNG tanker have less environmental risk than oil-spilled LNG would vaporize

Cryogenic liquids transfer between two floating vessels successfully done under "emergency" conditions
High Availability Expected

Florida East Coast Weather Conditions (28.5N, 80.2W)

<table>
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<th>Significant Wave Heights</th>
<th>%</th>
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<tr>
<td>Exceedance</td>
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<tr>
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<tr>
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<td>2</td>
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<tr>
<td>6.0 meters</td>
<td>1</td>
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- FSRU cargo transfer limits
- Modified LNG tanker connection limits

Bechtel indicates approximately 97% availability

<table>
<thead>
<tr>
<th>Wind Speed</th>
<th>%</th>
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<td>Exceedance</td>
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<tr>
<td>30 km/hour</td>
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<td>40 km/hour</td>
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<tr>
<td>50 km/hour</td>
<td>1</td>
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