LNG Facts – A Primer

Presentation before US Department of Energy, Office of Fossil Energy, LNG Forums

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• What is Natural Gas?
• Background on LNG
• Why LNG?
• LNG Importers and Facilities
What is Natural Gas?
The Natural Gas Industry

Natural Gas Wells → Gas Processing Plant → Main Line Sales → Natural Gas Company → Consumers

Production → Transmission → Distribution

Source: Energy Information Administration, Department of Energy
Natural gas important for all consumers

- Residential
- Commercial
- Industrial
  - Furnace/Heat
  - Boiler/Steam
  - Feedstock
  - Power Generation
- Power Generation
Natural gas is the basic building block of many household goods.

- Ethylene
- Propylene
- Butylene
- Xylene
- Toulene

- Paints
- Dry Cleaning
- Detergents
- Textiles
- Cosmetics
- Tires
- Toys
- Dry Cleaning
- Pharmaceuticals
Background on LNG
19th century - British chemist and physicist Michael Faraday experimented with liquefying different types of gases.

1873 - German engineer Karl van Linde built the first practical compressor refrigerator machine.

1912 - First LNG plant built in West Virginia.

1941 - First commercial liquefaction plant is built in Cleveland, Ohio.

1964 - British Gas Council imports from Algeria, making the UK the world’s first LNG importer and Algeria the first exporter.

January 1959 - The world's first LNG tanker, the Methane Pioneer carries LNG from Lake Charles, LA, to Canvey Island, UK.

1971 – Everett, MA import facility is built.

1974 – Cove Point, MD import facility is built.

1978 – Elba Island, GA import facility is built.

1969 - LNG exported from Kenai plant, AK to Japan.

1981 – Lake Charles, LA import facility is built.
Liquefied natural gas (LNG) is natural gas that has been turned into a liquid by cooling it to a temperature of -256°F at atmospheric pressure.

- It consists of primarily methane (typically, at least 90 percent).
- LNG is odorless, colorless, non-corrosive and non-toxic.
- Liquefying natural gas reduces its volume by a factor of approximately 610.
- LNG’s flammability range limits are 5 to 15 percent in air.
Considerable reserves around the world – just not in the areas where the gas is needed

Total World Reserves of 6,079 Tcf

- Russia: 28%
- Iran: 15%
- Qatar: 15%
- Rest of World: 22%
- Saudi Arabia: 4%
- United Arab Emirates: 3%
- United States: 3%
- Nigeria: 3%
- Algeria: 3%
- Venezuela: 2%
- Iraq: 2%
- Nigeria: 3%

Source: Energy Information Administration, Department of Energy
Economic Sharing in the LNG Chain

Regasification terminals are one small portion of the development of an overall LNG project.

- **Gas Producer**
  - Cost: $0.5 to $1.0 billion
  - Price per MMBtu: $0.50 - $1.00
  - 23% of total cost

- **Liquefaction**
  - Cost: $0.8 to $1.0 billion
  - Price per MMBtu: $0.80 - $1.00
  - 28% of total cost

- **Shipping**
  - Cost: $0.6 to $1.2 billion
  - Price per MMBtu: $0.65 - $1.60
  - 35% of total cost

- **Receiving Terminal**
  - Cost: $300-$400 million
  - Price per MMBtu: $0.40 - $0.50
  - 14% of total cost

**Cost out of Plant**
- Total Investment: $2.2 to $3.6 billion
- Price per MMBtu: $2.50 – $3.50

Note: *depends upon the distance shipped

to fuel over 20 percent of Massachusetts's natural gas fueled electric power plants for 1 month

OR

to fuel almost 2.5 percent of Massachusetts’s residential customers for 1 year (over 31,000 customers)

OR

to fuel 75 percent of Massachusetts's industrial plants for 1 month

Assumptions:
- One LNG tanker carries approximately 125,000 to 138,000 cubic meters of LNG, which will provide about 2.6 to 2.8 bcf of natural gas
- Average monthly power usage of 13.1 bcf;
- Average monthly industrial usage of 3.98 MMcf

Source: Energy Information Administration; Federal Energy Regulatory Commission; Center for Energy Economics, BEG, UT-Austin; and Statoil.com.
As LNG boils off, the gas is withdrawn from the tanks and compressed.

As gas is required, pumps inside the tanks transfer LNG to the plant vaporizers.

The plant vaporizers warm the LNG until it vaporizes.
Types of Offshore LNG Receiving Terminals

Gravity Based Structure

Onboard Vessel Regasification System (with submerged buoy)

Floating Storage and Regasification Unit
Why LNG?
Prices have changed dramatically since winter 2000-01 when markets for gas became exceptionally tight.

Average through 2000: $2.89 (standard deviation: 1.46)

Average for period since 2000-2001 heating season: $5.55 (standard deviation: 2.44)

Source: Intercontinental Exchange
Producers are at the limits of production capabilities

Note: This is an approximation.
Source: EnergySeer.com
Despite increased drilling efforts, production is falling; The US is seeing decreasing drilling productivity.

- 3 percent increase in production (Aug-99 to Dec-01)
- 158 percent increase in rigs (Apr-99 to Jul-01)
- 3 percent decrease in production (Sep-04 to Nov-05)
- 72 percent increase in rigs (Jan-03 to Nov-05)

Source: Energy Information Administration, Department of Energy; and Baker-Hughes Inc.
Producers are drilling over the same areas despite several new areas being technically available.

Source: Independent Petroleum Association of America
US Natural Gas Market Status

In addition, the U.S. has limitations on importing natural gas from other parts of North America and it can’t be shipped in its natural form.
### LNG Worldwide Statistics

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<th>Region</th>
<th>Number of Storage Tanks</th>
<th>Storage Capacity (thousand m³)</th>
<th>Number of Trains</th>
<th>Capacity (million tons/year)</th>
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<td>South America</td>
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As of 2003, 151 LNG tankers were in operation worldwide. 55 ships are currently under construction. The addition of new ships will raise total fleet capacity 44 percent from 17.4 million cubic meters, to 25.1 million cubic meters in 2006.

Source: Energy Information Administration, Department of Energy
LNG Importers and Facilities
Source: Energy Information Administration, Department of Energy
A number of small LNG facilities throughout the US are used for peak shaving or to meet the needs of areas isolated from storage and/or pipeline infrastructure.

Source: Energy Information Administration, Department of Energy.
Current US LNG Import Terminals

Source: Energy Information Administration, Department of Energy

Elba Island, Georgia
- 7.3 Bcf Storage Capacity
- Regasification Capacity:
  - Peak: 1.2 Bcf per day
  - Baseload: 1 Bcf per day

Cove Point, Maryland
- 7.8 Bcf Storage Capacity
- Regasification Capacity:
  - Peak: 1 Bcf per day
  - Baseload: 750 MMcf per day

Everett, Massachusetts
- 3.5 Bcf Storage Capacity
- Regasification Capacity:
  - Peak: 885 MMcf per day
  - Baseload: 710 MMcf per day

Lake Charles, Louisiana
- 6.3 Bcf Storage Capacity
- Regasification Capacity:
  - Peak: 1.2 Bcf per day
  - Baseload: 1 Bcf per day

Gulf Gateway Energy Bridge
- No Storage Capacity
- Regasification Capacity:
  - Peak & Baseload: 500 MMcf per day
Thank You

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