Potential Markets for Alaskan LNG

Anchorage, AK
August 5-9, 2013
North Slope Gas & LNG Symposium
Markets for Alaskan LNG

- Strong Growth From Most Regions
  - LNG driver different by market

- LNG Gaining in Popularity
  - Higher demand from existing markets
  - Numerous proposed markets
  - Floating Storage and Regasification Unit (FSRU) offers lower-cost solution

- Asia Will Be Target Market for Alaska
  - Geography
  - Market Size and Growth

- Opportunities Available Elsewhere, But More Limited
  - South America
  - Europe
  - Middle East and Africa
Why LNG? Three Examples

Brazil: Incremental Power Generation by Source

Singapore: Diversify Gas Supply

United Kingdom: Declining Production
Demand Pull Greatest from Asia

LNG Demand by Region, 2012

- Asia: 70%
- Europe: 20%
- North America: 4%
- South America: 4%
- Middle East: 2%

LNG Demand by Region, 2030

- Asia: 69%
- Europe: 19%
- North America: 6%
- South America: 4%
- Middle East: 2%
Proximity Matters

Asia main destination for Asia-Pacific supply
Asia Drives LNG Demand Growth

LNG Demand by Region

- **Middle East and Africa**
- **Americas**
- **Europe**
- **Asia**

**CAGR (2012-30)**
- Middle East: 10.6%
- Americas: 4.5%
- Europe: 3.8%
- Asia: 4.1%

**LNG Demand by Region**

- Global-2030: 505 mmt
- Middle East: 17 mmt
- Americas: 23 mmt
- Europe: 47 mmt
- Asia: 179 mmt
- Global-2012: 238 mmt
- Middle East: 3 mmt
- Americas: 18 mmt
- Europe: 38 mmt
- Asia: 129 mmt
- Global-1990: 50 mmt

**mmt**

North Slope Gas & LNG Symposium | © PFC Energy 2013 | Page 7 | August 2013
- Growth of 4.5% p.a. from 2012-2030
- Mexico
  - LNG offsets falling production
  - But competes with imports from US
- Brazil
  - Diversification from Bolivia
  - Important during droughts
- Argentina:
  - Declining production & reserves
  - Insufficient gas to meet seasonal peak
- Chile
  - Replace pipeline imports from Argentina
- Puerto Rico & Dominican Republic
  - Gas-fired power generation
- Proposed New Importers
  - Jamaica, Uruguay, and Colombia
Lower growth region for LNG at 3.8% from 2012-2030
- Large share of this is recovery: LNG peaked at ~66 mmt in 2011
- Moderating energy intensity per GDP (Energy efficiency and demographics)

Sharp LNG decline from 2011-13
- LNG diverted to higher-priced markets
- Lower demand due to economy, coal, renewables, hydro
- Pipeline gas replaced LNG

LNG Growth Driven by
- Declining production (UK, Netherlands)
- Energy security (supply diversification)
- New Importers: Poland, Lithuania
- Proposed Importers: Sweden, Croatia, Estonia, Ukraine, Finland, and Ireland
Fastest growth region: 10.8% p.a. from 2012-2030, but smallest market

Power Biggest Driver for Existing Markets: UAE, Kuwait
- Fuel switching away from oil
- Need to meet rising power demand during peak months (summer)
- Both have proposed expansions to import capacity

New Importer: South Africa

Proposed New Importers:
- Benin, Ghana, Kenya
LNG Outlook: Asia

LNG Demand Outlook: Asia

LNG Demand Growth by Country

2012 Asia
- Philippines: 167
- Japan: 28
- China: 77

2030 Asia
- Philippines: 336
- Japan: 1
- Korea: 16
- China: 77
- India: 7
- Singapore: 7
- Thailand: 6
- Malaysia: 6
- Bangladesh: 6
- Vietnam: 4
- Taiwan: 3
- Indonesia: 1

mmt LNG Demand Growth by Country
How To Assess Markets for LNG Projects: Supply-Demand Gap

- Finalized Contracts (15-20 years)
  - SPA: Sales and Purchase Agreement
  - Equity Offtake (small portion of total)

- Preliminary Contracts
  - MOU: Memorandum of Understanding
  - HOA: Heads of Agreement

- Markets have different preferences for the share of demand not tied to long-term supply contracts
  - Short-term contracts
  - Spot volumes

Growing Supply-Demand Imbalance in Asia

Asia LNG Demand and Supply

<table>
<thead>
<tr>
<th>Year</th>
<th>Gap</th>
<th>Preliminary Contracts</th>
<th>Finalized Contracts</th>
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<tbody>
<tr>
<td>2012</td>
<td>167</td>
<td>6</td>
<td>161</td>
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<tr>
<td>2015</td>
<td>156</td>
<td>23</td>
<td>133</td>
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<tr>
<td>2020</td>
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<td>38</td>
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<td>2025</td>
<td>166</td>
<td>97</td>
<td>79</td>
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<tr>
<td>2030</td>
<td>134</td>
<td>35</td>
<td>99</td>
</tr>
</tbody>
</table>
LNG Important Supply Source for Asia

Asian Markets: Gas Supply by Source

- Taiwan
- South Korea
- Japan
- Philippines
- Vietnam
- Singapore
- Malaysia
- Indonesia
- India
- China

LNG Share of Gas in Asia

- 2000: 35%
- 2005: 35%
- 2010: 35%
- 2015: 38%
- 2020: 38%
- 2025: 38%
- 2030: 38%

Legend:
- LNG
- Production
- Pipeline
Japan: Gas Demand Drivers

**Japan: Gas Demand by Sector**

- **2000** to **2030**
  - Residential
  - Commercial
  - Industrial
  - Transport
  - Other

**Japan: Electricity Generation by Fuel**

- **2000** to **2030**
  - Hydro
  - Coal
  - Gas
  - Oil
  - Nuclear
  - Renewables
Japan: LNG SD Outlook

- Japan is the largest destination for LNG (88 mmtons in 2012)
- LNG Buyers:
  - Gas Utilities (e.g. Tokyo Gas, Osaka Gas)
  - Electric Utilities (e.g. Tokyo Electric)
  - Other marketers/traders (Mitsubishi, Mitsui)
- Uncertainties in Outlook:
  - Choice of fuel in power generation:
    - Nuclear
    - Coal
    - Renewables
South Korea: Gas Demand Drivers

Power and industry largest drivers

Steady role in fuel mix for gas
Larger relative S-D gap than Japan
- Korea heavily reliant on the spot market to meet demand

Seasonal demand swings and storage

LNG Buyers:
- Korea Gas Corp (KOGAS)
- Companies importing LNG for own-use:
  - Posco (Steel producer)
  - K-Power
  - KEPCO-owned Korea Midland Power Company (KOMIPO)
  - GS (proposed)

Uncertainties in outlook:
- Liberalization of gas market
- Commitment to nuclear power targets

South Korea: LNG SD Outlook
Taiwan: Gas Demand Drivers

Gas prioritized for power generation

Growing role for gas in power
Taiwan: LNG SD Outlook

- Relatively large SD gap
- LNG Importers:
  - CPC
- Uncertainties in Outlook:
  - Power generation from gas
  - Development of new LNG import capacity

Taiwan: Supply-Demand Balance

- Gap
- Indonesia
- Papua New Guinea
- Malaysia
- Australia
- Other
- Qatar
- Demand

Taiwan: LNG SD Outlook
China: Gas Demand Drivers

**High demand upside from gas penetration potential**

**LNG competes with pipeline gas & production**

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**China: Gas Share of Energy by Sector**

- **Power**
- **Industry**
- **Transport**
- **Residential**
- **Commercial**
- **Petchems**

**China: Gas Supply-Demand Balance**

- **Exploration**
- **Finalized LNG**
- **Pipeline Production**
- **Gas Demand**

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- **Share of Gas (%)**
- **bcf/d**

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- **2000**
- **2005**
- **2011**
- **2015**
- **2020**
- **2025**
- **2030**

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- **2012**
- **2015**
- **2020**
- **2025**
- **2030**

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- **0%**
- **2%**
- **4%**
- **6%**
- **8%**
- **10%**
- **12%**
- **14%**
- **16%**
- **18%**

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- **0**
- **10**
- **20**
- **30**
- **40**
- **50**
- **60**
China: LNG SD Outlook

- Well-supplied through 2020
- Chinese NOCs moving up the LNG value chain
- LNG Importers:
  - CNOOC
  - PetroChina
  - Sinopec
  - Others
- Uncertainties in Outlook:
  - Availability of other supply sources
  - Gas pricing

![China: LNG Supply-Demand Balance](chart)

- Gap
- Papua New Guinea
- Malaysia
- Indonesia
- Other
- Qatar
- Australia
- Demand

<table>
<thead>
<tr>
<th>Year</th>
<th>Supply (mmt)</th>
<th>Demand (mmt)</th>
<th>Gap (mmt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>2015</td>
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<td>2025</td>
<td>29</td>
<td>56</td>
<td>27</td>
</tr>
<tr>
<td>2030</td>
<td>56</td>
<td>80</td>
<td>24</td>
</tr>
</tbody>
</table>
India: LNG Demand Drivers

LNG offsetting declines in production

Can India deliver on its exploration potential?
India: LNG SD Outlook

- LNG Importers:
  - GAIL
  - Petronet LNG
  - Reliance
  - Gujarat State Petroleum Corporation (GSPC)

- Uncertainties in Outlook:
  - Availability of other sources of supply
  - Gas pricing

![India: LNG Supply-Demand Balance](chart)

- Qatar
- Australia
- Preliminary
- US
- Other
- Demand
- Gap

<table>
<thead>
<tr>
<th>Year</th>
<th>Supply mmtpa</th>
<th>Demand mmtpa</th>
<th>Gap mmtpa</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>8</td>
<td></td>
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</tr>
<tr>
<td>2020</td>
<td>9</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>2030</td>
<td>29</td>
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</tbody>
</table>
Demand From New LNG Importers in Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>LNG Demand Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>Pipeline gas supply, Fuel substitution, Government Incentives</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Coal use in power, Government promotion of domestic LNG, Infrastructure development</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Power sector, Gas pricing reform, Industrial development</td>
</tr>
<tr>
<td>Thailand</td>
<td>Ability to pay, Domestic gas production, Pipeline gas imports (Myanmar)</td>
</tr>
</tbody>
</table>

Source: PFC Energy Global LNG Service
## LNG Potential of Proposed Importers in Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>LNG Demand Drivers</th>
<th>Constraints</th>
</tr>
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<tbody>
<tr>
<td>Philippines</td>
<td>Power/gas shortages</td>
<td>Gas pricing</td>
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<tr>
<td>Vietnam</td>
<td>Delays in domestic production</td>
<td>Gas pricing</td>
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<td>Gas and power pricing</td>
<td>Regulated Electricity Market</td>
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<td>Coal</td>
<td>Government Capacity</td>
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<td>Gas pricing</td>
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<td>Pakistan</td>
<td>Gas Supply Shortages</td>
<td>Government Capacity</td>
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<td>LNG Financing</td>
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<td>Bangladesh</td>
<td>Gas Supply Shortages</td>
<td>Government Capacity</td>
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<td></td>
<td>Power, Transport, Industrial, Distribution</td>
<td>LNG Financing</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Power</td>
<td>Market Size</td>
</tr>
</tbody>
</table>
Concluding Remarks

- Markets opportunities exist globally
- LNG becoming increasingly popular for existing and new markets
- Many uncertainties will shape outlook:
  - Nuclear
  - Coal
  - Oil Price
  - Domestic production
  - Gas Pricing