LNG and storage strategy
- follow-up study -

Final Presentation
27 September 2017
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Energy Markets Global Limited
LNG and storage strategy - follow-up study -

LNG: Main Findings
LNG: Main Findings of the Study

- How to improve liquidity, flexibility, transparency
  1. Scenarios
  2. Characteristics of energy trading markets
  3. LNG Industry structure and major players
  4. Case study: liberalisation of pipeline gas
  5. Case study: oil trading markets
  6. Case study: iron ore trading
  7. Results of interviews with LNG industry
  8. Conclusions and recommendations
Three key factors drive trading markets

1. A market crisis or other major driver for change

2. Deliberate government action to create the environment for a market

3. The market then develops by itself
LNG: Drivers for LNG Trading

1. Many sellers or suppliers
2. Many buyers or customers
3. Industry crisis
4. Supportive regulatory and fiscal framework
5. Standard contract
6. Price publication service
7. Storage infrastructure
8. Other infrastructure
9. Diversity of supply
10. Entry of new players
LNG: Indications of Active Trading

11. Increased contract flexibility
12. Shorter-term and smaller contracts
13. Resale and secondary markets
14. Capacity trading
15. Spot and futures price
LNG: Barriers to Liquidity in LNG

- Concentration of players
- LNG trading suitability
- Rigid contractual terms
LNG: State of LNG Trading Markets

1. Market crisis
   ▸ Supply overhang
   ▸ New technology

2. Government actions (EU)
   ▸ Ship fuelling regulations
   ▸ Destination clauses
   ▸ Regulated regasification terminals

3. Market actions
   ▸ New business models
   ▸ Luck
LNG: Recommendations

• What governments can and cannot do
  ▶ Actions which can only be carried out by the market
  ▶ Areas where governments can set the environment within which a market operates
  ▶ Areas where government can take direct action
LNG: Recommendations

1. Essential actions by the market alone
   ▶ Contracts

2. Actions where the EU can set the environment
   ▶ LNG hubs
   ▶ International cooperation

3. Areas where the EU can take direct action
   ▶ Transparency
     • LNG prices
     • Information for new market entrants
     • Terminal pricing
   ▶ Terminal access
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LNG Monthly
(YTD – through May 2017)

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Office of Fossil Energy
Office of Oil & Natural Gas
Office of Regulation and International Engagement
Division of Natural Gas Regulation
Phone: 202-586-7991
Email: ngreports@hq.doe.gov
### VESSEL-BORNE EXPORTS OF DOMESTICALLY-PRODUCED LIQUEFIED NATURAL GAS (LNG)

<table>
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<tr>
<th>Date of Departure</th>
<th>Name of Exporter</th>
<th>Supplier</th>
<th>Docket Number</th>
<th>Docket Term</th>
<th>Country of Destination</th>
<th>Name of Tanker</th>
<th>Departure Terminal</th>
<th>Volume (MMBtu of Natural Gas)</th>
<th>Price at Export Point (cents/MMBtu)</th>
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<td>2,551,103</td>
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LNG: Future Price and Supply Dynamics
LNG: Future Price and Supply Dynamics

- Henry Hub pricing
  - Marginal supplier sets the market price
  - USA largest supplier and marginal supplier
  - LRMC: HH + liquefaction + transport (+ regasification)
  - SRMC: HH + very minimal transport

- Different benchmarks
  - USA – Henry Hub
  - Europe – HH/NBP/TTF + Russia
  - East Asia – JKM / Singapore hub / Shanghai?
LNG: Gas and LNG Prices

Natural Gas and LNG Prices, $/MMbtu

Note: UK NBP = National Balancing Point; US HH = Henry Hub
LNG: EEGM Reference Case

Implications for the EEGM Reference Case:

- Volumes available for Europe:
  - 2020: 87 mt (~1300 TWh);
  - 2025: 113 mt (~1700 TWh);

- Prices, Europe LNG:
  - 2020: $6.50 (~26 €/MWh)
  - 2025: $7-8 (~28-32 €/MWh)
Speculative LNG Projects Since March - Sep 17

Total LNG Speculative Projects: 629 MT

- Some Progress Shown: 287.8 MT (46%)
- No Progress since 2015: 273.5 MT (43%)
- Cancelled LNG Projects: 68 MT (11%)
**LNG: Scenarios**

<table>
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<tr>
<th></th>
<th>Low Supply</th>
<th>High Supply</th>
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<tbody>
<tr>
<td><strong>High Demand</strong></td>
<td><strong>“Emerging Markets”</strong>&lt;br&gt;High emerging market demand&lt;br&gt;LNG price up to $10/mmbtu</td>
<td><strong>“Steady As She Goes”</strong>&lt;br&gt;Existing production as now&lt;br&gt;IEA global demand estimates&lt;br&gt;LNG price around $7-8</td>
</tr>
<tr>
<td><strong>Low Demand</strong></td>
<td><strong>“Boom and Bust”</strong>&lt;br&gt;No new liquefaction built&lt;br&gt;Prices rise in early 2020s&lt;br&gt;new liquefaction capacity built&lt;br&gt;Price falls to around $3-5/mmbtu</td>
<td><strong>“Chinese Shale”</strong>&lt;br&gt;Large supply overhang&lt;br&gt;A period of turmoil&lt;br&gt;LNG price collapse to $3-5/mmbtu</td>
</tr>
</tbody>
</table>
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LNG: Instruments for Flexibility in Global LNG
LNG: Instruments for Flexibility in Global LNG Market

- LNG Industry players
  - Traditional
  - New players
- New business models
- Swaps
- Drivers for flexibility
LNG: Industry Players

Traditional LNG Business

- Large national buyers
- Producers and liquefaction terminals
- Shipping companies
LNG: New industry players and business models

- Traditional producers - IOCs & NOCs
- Liquefaction terminals - JVs of producers and buyers
- Aggregators / portfolio players - Shell/BG, Chevron, Gazprom etc
- Shipping companies
- New US LNG companies
- Project developers - Höegh, Golar
- Traditional buyers - Japan, SK
### LNG: New Business Models bringing flexibility

<table>
<thead>
<tr>
<th>New emerging market buyers</th>
<th>Contracts</th>
</tr>
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<tbody>
<tr>
<td>• FSRUs</td>
<td>• Increasing take or pay flexibility</td>
</tr>
<tr>
<td>• National buyers with surplus supplies to resell</td>
<td>• Buyers renegotiating prices</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure</th>
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</thead>
<tbody>
<tr>
<td>• Buyers buying stakes in liquefaction plants</td>
</tr>
<tr>
<td>• Traders investing into infrastructure</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Government actions</th>
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<tr>
<td>• Hubs + Re-exports</td>
</tr>
<tr>
<td>• Removal of destination clauses + shipping fuels + regulated regas</td>
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</tbody>
</table>

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LNG: Swaps

- A useful tool generally: Location swaps and time swaps
- Not common in LNG
  - Almost all by month or quarter and are seasonal swaps
- Reasons include
  - Scheduling (both time and location swap needed)
  - Vessel differences
  - Terminal specifications
  - Gas quality specifications
  - Limited communications between buyers
  - Contract inflexibility
Thank You
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