Potential Role of Singapore as an LNG Hub

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Content

1. Overview of Asian gas
2. Potential impact of N. American LNG exports
3. Development of LNG trade in South-east Asia
4. Asian LNG pricing
Global Gas Trade Flows 2011 (bcm)  
(with price ranges for regional markets)

Source: BP Statistical Review of World Energy 2012

A: SEA => NEA 96.1  
B: ME => NEA 59.0  
C: CAN => US 88.0  
D: AF => EUR 72.0  
E: ME => EUR 53.7  
F: FSU => EUR 203.7  
G: N EUR => EUR 145.7

ME = Middle East  
NEA = North-East Asia  
SEA = ASEAN + Australia  
AF = North and West Africa  
CAN = Canada  
EUR = Europe  
FSU = Former Soviet Union (Asia)  
N EUR = Norway and Netherlands

Oil-linked & Hub Prices
$11 – $13 & $8 - $10

Oil-linked
$4 - $18

Source: BP (2012)
Asia and the Middle East see some slowdown with the 2008 crisis, then resume. Europe sees another slowdown in 2011, after some bounce-back in 2010.

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2011 share of total</th>
<th>% change, 2008-2009</th>
<th>% change, 2009-2010</th>
<th>% change, 2010-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>690.1</td>
<td>21.5%</td>
<td>-1.6%</td>
<td>3.8%</td>
<td>2.5%</td>
</tr>
<tr>
<td>European Union</td>
<td>447.9</td>
<td>13.9%</td>
<td>-6.3%</td>
<td>8.0%</td>
<td>-9.9%</td>
</tr>
<tr>
<td>S. &amp; Cent. America</td>
<td>154.5</td>
<td>4.8%</td>
<td>-4.4%</td>
<td>11.1%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Middle East</td>
<td>403.1</td>
<td>12.5%</td>
<td>3.7%</td>
<td>9.6%</td>
<td>6.9%</td>
</tr>
<tr>
<td>Africa</td>
<td>109.8</td>
<td>3.4%</td>
<td>-1.3%</td>
<td>8.1%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>590.6</td>
<td>18.3%</td>
<td>3.6%</td>
<td>12.2%</td>
<td>5.9%</td>
</tr>
<tr>
<td>China</td>
<td>130.7</td>
<td>4.0%</td>
<td>10.1%</td>
<td>20.2%</td>
<td>21.5%</td>
</tr>
<tr>
<td>Japan</td>
<td>105.5</td>
<td>3.3%</td>
<td>-6.7%</td>
<td>8.1%</td>
<td>11.6%</td>
</tr>
<tr>
<td>Total World</td>
<td>3222.9</td>
<td>100.0%</td>
<td>-2.5%</td>
<td>7.6%</td>
<td>2.2%</td>
</tr>
</tbody>
</table>

World Liquefaction and Regasification Capacities

- Growth in liquefaction capacities moderate between 2010 and 2015, significant between 2015 and 2020
- Significant growth in regasification capacities between 2010 and 2015, moderate between 2015 and 2020

Source: Nexant, Gas Market Outlook December 2011
Asia: Demand shocks and constrained supplies

- Post-Fukushima Japan: shutdown of total nuclear capacity by April, uncertain how many will re-open
  - Increase in Japan’s short-term LNG (and oil) demand
  - If nuclear shutdown persists, increase in Japan’s long-term LNG demand
- Decreasing natural gas supply from aging fields in Indonesia and Malaysia
  - Indonesia and Malaysia set to begin importing LNG this year
  - Thailand, Singapore, Vietnam and the Philippines among the emerging new importers
- Australia set to emerge as the new Pacific Basin LNG mega-exporter, rivaling Qatar
  - Plants in operation & construction capacity set to reach 81 mn tons by 2017/18
  - But massive cost blow-outs for upcoming large projects
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• Current differentials between Japan import price and HH > $12/MMBtu
• For North American LNG exports to Asia, differentials of around $4.75 (Alberta) to $5.90 (Henry Hub) needed, according to industry sources

Source: ESI estimates
N. American LNG exports outlook

- Expected start date and volume of LNG exports is uncertain, with relatively wide ranges among expert outlooks

<table>
<thead>
<tr>
<th>Expert Estimates</th>
<th>Exporting countries</th>
<th>Start year of LNG exports</th>
<th>Projected volumes</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nexant</td>
<td>US and Canada</td>
<td>2016</td>
<td>10 mtpa (by 2020), of which 7 mtpa goes to Asia</td>
<td>Mostly Asia</td>
</tr>
<tr>
<td>EIA</td>
<td>US</td>
<td>2016</td>
<td>8 mtpa (by 2016) 16 mtpa (by 2019)</td>
<td>Mostly Asia</td>
</tr>
<tr>
<td>IEA</td>
<td>US and Canada</td>
<td>2020</td>
<td>26 mtpa (by 2020)</td>
<td>Mostly Asia</td>
</tr>
<tr>
<td>Gazprom</td>
<td>US</td>
<td>In next 10 years</td>
<td>7-15 mtpa</td>
<td>Mostly Asia</td>
</tr>
<tr>
<td>BG</td>
<td>US</td>
<td></td>
<td>45 mtpa (by 2020)</td>
<td>Mostly Asia</td>
</tr>
<tr>
<td>Woodside</td>
<td>US</td>
<td></td>
<td>50 mtpa (by 2020)</td>
<td>Mostly Asia</td>
</tr>
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</table>
Purchase of US LNG by Asian buyers

- Growing interest in purchasing N. American LNG among Asian buyers
- Japan, India and South Korea have already signed contracts to purchase US LNG on HH-basis
  - GAIL and KOGAS have signed 20-year, 3.5 mtpa contracts with Cheniere
  - Mitsubishi and Mitsui to each import 4 mtpa from Cameron LNG (2016)
  - Tokyo Gas and Sumitomo Corp have reached initial deal to buy 2.3 mtpa of LNG from Cove Point LNG (2017)
  - GAIL in talks to purchase 2 mtpa of LNG from Freeport LNG
  - Indonesia’s Nusantara Regas in talks with a U.S. supplier to import 2 mtpa of LNG (from 2017); Indonesian state utility PLN interested in US LNG imports as well
  - Japan’s Osaka Gas in talks to import LNG from Cove Point LNG, Cameron LNG, Freeport LNG and (via BG and Spain’s GAS) Sabine Pass LNG
Competition for the Asian LNG market

• N. American producers at a cost disadvantage to existing supply from Qatar, Malaysia, Indonesia and Russia
  – But Qatar at production plateau
  – Malaysia and Indonesia increasingly constrained
  – Excess Asian demand will have to be met by upcoming LNG projects

• But N. American producers are competitive against Australia’s upcoming high-cost LNG projects
  – Newer Australian projects incurring massive cost over-runs (labour, regulations, Australian $)
  – Breakeven price of $8-10/MMBtu for Australian exports comparable to or exceeding Canadian and US LNG export breakeven prices (assuming Henry Hub/Alberta prices remain at or below $4/MMBtu level)
Impact on Asia-US gas price differentials

- Panama Canal expansion in 2014 will make US Gulf and East coasts LNG exports (as well as T&T, West Africa) versatile between Atlantic and Pacific basins
- If significant (not necessarily “large”) volumes of trans-Pacific gas trade develop, price differentials will narrow
- Price differentials could diminish if existing suppliers lower Asian gas prices to deter entry of North American producers
- Even if actual volumes of N. American LNG exports to Asia are constrained, HH-pricing basis without destination clauses could significantly reduce gas price differentials
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LNG regional trade in Southeast Asia

• *Floating re-gasification* terminals increasingly the choice of new LNG importers looking for quick start-ups
  – Smaller volume imports will encourage small-scale LNG transport carriers and regional trading of cargoes

• Given the impending decline in LNG output from the region’s producers, there is a role for *floating liquefaction vessels* and regional aggregation of LNG cargoes
  – Declining output from regional gas fields and few new discoveries make large, new long-term contracts less common
  – The growth of floating liquefaction enables smaller and more remote gas fields to become viable
  – The smaller volumes of available gas could be aggregated and distributed within the region
“Short Haul” LNG

- Demand and supply of LNG in region increasingly focused on small-scale production and consumption.

- Increased potential for “short haul” LNG trade, or trade within 1500 nautical miles and short sailing times of 3-4 days.
LNG Regional Trade: Singapore as Hub

- Singapore LNG re-gasification and storage terminal on-line by 2Q2013
- The Government announced the construction of a 3rd tank for use by third parties for trading purposes (bringing its capacity to 6Mtpa by 2014); the terminal has the flexibility to increase from 6 to 22 Mtpa
- It also introduced a concessionary tax rate of 5% on LNG trading income
- Any boil off arising from trader’s cargoes will be absorbed for domestic consumption (traders suffer zero boil-off losses)
- SLNG plans tank segregation (to avoid commingling) and blending capabilities
- Jetties able to handle range of LNG carriers including Q-Max and Q-Flex ships as well as smaller cargoes of 10,000 – 40,000 cu. metres.
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World Price Formation (2009)

- Gas-on-gas competition primarily in North America is the largest category
- Oil price escalation is 2nd most important category in price formation, primarily for pipeline and LNG imports in Asia and Europe
- Regulated prices refer largely to indigenous production outside of the US

Source: IGU 2009; Nexant

Gas-on-gas
Oil price escalation
No price
Regulated Prices
Netback price
Bilateral monopoly price
Natural Gas Prices ($/MMBTU)
Feb 2009 – May 2012

JKM – NBP
Feb 09 – Mar 11:
Std Dev = $0.95; Ave = $1.04
Apr 11 – May 12:
Std Dev = $2.00; Ave = $6.39

JCC crude
JCC 6-mth rolling average
Platts JKM Japan contract
China import
NBP
HH

Sources: Platts (JKM), PAJ, Bloomberg, WGI, FRED Economic Data
Europe: shift towards hub-based pricing?

- Growing shift from oil indexation to hub-based pricing in downstream markets in Europe
  - Rise in share of gas-on-gas competition from 15% in 2005 to >35% in 2010
  - Increasing reliance on one-year contracts with spot-based pricing
  - Shift towards spot pricing particularly pronounced in northwest Europe (France, Germany, Italy, Netherlands)

- Oil-indexed pricing under pressure in Europe
  - Gazprom forced to offer price concessions to Eni, GDF Suez and OMV
  - Hybrid pricing model proposed by Gazprom: majority of gas pricing to be based on oil-indexation, with the spot market smoothing fluctuations in supply and demand

- Shift towards spot-based pricing: permanent or a function of a slump in demand?
Alternatives to oil-indexed pricing in Asia

• Conditions for a shift away from oil-indexed pricing less prevalent in Asia, compared to Europe
  – Robust demand for gas projected in the next 5 years
  – New liquefaction capacity in Australia and North America only to come online after 2015
  – Spot prices in Northeast Asia have neared oil parity in recent months

• Impact of LNG imports based Henry Hub spot prices?
  – GAIL and KOGAS’s contracts with Cheniere are HH-based
  – HH price link provides a natural hedge for gas buyers: diversification benefits

• Spot market price assessments for Japan and Korea
  – Northeast Asia accounts for the vast majority of spot cargoes into Asia
  – Key indicator of a major pool of diverted or spot cargoes into Asia (e.g. Platts JKM assessments)
LNG Regional Trade: Price Discovery?

- Companies with a focus on LNG trading and shipping are beginning to set up operations in Singapore (15 LNG trading desks established in last 4 years)
- Singapore possesses well-developed financial, shipping and bunkering industries that enhance its potential as a hub
- A regional hub for traded LNG in Singapore might spur the development of gas-price assessments focused on Singapore’s LNG terminal
- However, for wider Far East gas price discovery, liquid spot markets of North East Asia (Japan, South Korea, China and Taiwan) play a critical role
- Spot gas price assessments for Japan and Korea (e.g. Platt’s JKM) have been used as the basis for spot tenders and for financial settlements for swaps
Conclusions

- Arbitrage trades between Atlantic and Pacific Basins becoming a key aspect of global gas markets (based on diversions and re-loads)
- North American LNG exports to Asia a new reality: trade volumes may not be as important as pricing formulas at the margin
- Europe is in transition to gas hub-based pricing
- Asian oil-indexed pricing however may remain dominant if spot markets remain tight
- But increasing role of cargo diversions and re-loads will force newer Asian contracts to have greater flexibility (e.g. allowing diversions and greater lee-way on quantity tolerances)
- Post-2015, likely that spurt of new liquefaction capacity will lead Asian contract LNG pricing to reflect prices in Europe more closely (NBP plus freight)
- Role of Singapore as an LNG Hub in a transitioning market could be significant in price discovery for Asian LNG trade
Thank You