Liquefied Natural Gas (LNG)

Sector Overview
March 2017
LNG Industry

Global Industry
- Life Cycle
- Industry Dynamics
- Trade | Regional Mix
- Exporting & Importing Countries
- Pricing

Local Industry
- Dynamics | Production & Consumption
- Government Initiatives
- Upcoming Developments
**LNG - Lifecycle**

*Liquefied Natural Gas (LNG)* is a form of natural gas converted to liquid form ease of storage or transport. It is odourless, colourless, non-toxic, and non-corrosive.

*LNG achieves a higher reduction in volume than (CNG) so that the (volumetric) energy density of LNG is 2.4 times greater than that of CNG or 60 percent that of diesel fuel. This makes LNG cost efficient to transport over long distances where pipelines do not exist.*
Global LNG supply, 4% in 1990, now accounts for ~10% with a CAGR of 6% since 2000

Low growth rate of LNG trade volume in initial years has picked up pace in recent years
Global LNG trade, with a growth of 13.2 MT over CY15, reached a record high 258 MT in CY16.

China, India, and Egypt collectively provided 15.7 MT in new import demand.

Pakistan, importing 1.1 MT in CY15 (first year), saw an increase of 1.6 MT to 2.7 MT (1% share) to meet growing domestic demand.

**Leading Exporter:** Asia-Pacific (39% share), surpassing Middle East; additional 15 MT from Australia.

**Leading Importer:** Asia Pacific (53% share).

<table>
<thead>
<tr>
<th>Exporting Region</th>
<th>Importing Region</th>
<th>Africa</th>
<th>Asia-Pacific</th>
<th>Europe</th>
<th>Russia</th>
<th>Latin America</th>
<th>Middle East</th>
<th>North America</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>Africa</td>
<td>1.2</td>
<td>0.3</td>
<td>0.2</td>
<td>0.4</td>
<td>4.4</td>
<td></td>
<td></td>
<td>6.5</td>
</tr>
<tr>
<td>Asia</td>
<td>Asia</td>
<td>5.5</td>
<td>21.5</td>
<td>0.2</td>
<td>0.3</td>
<td>1.1</td>
<td>18.9</td>
<td>0.5</td>
<td>48.0</td>
</tr>
<tr>
<td>Asia-Pacific</td>
<td>Asia-Pacific</td>
<td>4.4</td>
<td>76.5</td>
<td>0.1</td>
<td>10.6</td>
<td>0.3</td>
<td>45.7</td>
<td></td>
<td>137.6</td>
</tr>
<tr>
<td>Europe</td>
<td>Europe</td>
<td>18.2</td>
<td>2.8</td>
<td>2.5</td>
<td>17.4</td>
<td>0.3</td>
<td></td>
<td></td>
<td>41.2</td>
</tr>
<tr>
<td>Latin America</td>
<td>Latin America</td>
<td>1.7</td>
<td>0.1</td>
<td>0.7</td>
<td>5.2</td>
<td>1.0</td>
<td>1.2</td>
<td></td>
<td>9.9</td>
</tr>
<tr>
<td>Middle East</td>
<td>Middle East</td>
<td>3.2</td>
<td>0.7</td>
<td>0.1</td>
<td>0.8</td>
<td>3.6</td>
<td>0.4</td>
<td></td>
<td>8.8</td>
</tr>
<tr>
<td>North America</td>
<td>North America</td>
<td>0.7</td>
<td>0.5</td>
<td>0.1</td>
<td>4.3</td>
<td>0.5</td>
<td>6.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>34.9</td>
<td>99.6</td>
<td>4.2</td>
<td>10.9</td>
<td>14.6</td>
<td>91.0</td>
<td>2.9</td>
<td>258.1</td>
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## Global Trade | Countries

<table>
<thead>
<tr>
<th>Exporting Countries</th>
<th>Importing Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong></td>
<td><strong>Qty (MTPA)</strong></td>
</tr>
<tr>
<td>1. Qatar</td>
<td>77</td>
</tr>
<tr>
<td>2. Malaysia</td>
<td>25</td>
</tr>
<tr>
<td>3. Australia</td>
<td>44</td>
</tr>
<tr>
<td>4. Nigeria</td>
<td>19</td>
</tr>
<tr>
<td>5. Indonesia</td>
<td>17</td>
</tr>
<tr>
<td><strong>Top 5 share</strong></td>
<td><strong>70%</strong></td>
</tr>
</tbody>
</table>

- Total number of exporting countries increased from 17 in CY15 to 18 in CY16 as:
  i) Angola and Egypt both returned to producing LNG following a halt in CY15 due to repair work,
  ii) and Yemen, which exported LNG during 1H CY15, did not export a single cargo in CY16 due to ongoing instability in the country.

- Total number of importing countries increased from 33 in 2015 to 35 in CY16, with Jamaica and Columbia entering the industry.
Global Pricing Mechanism

Pricing in world gas markets is driven more by local and regional factors. Following are the details pertaining to pricing contracts and mechanism more widely available in the International Market:

**Pricing Contracts:**
- Long-term contracts
- Medium-term
- Spot & Short-term contracts

**Pricing Mechanism:**

1. **Hub-Based:** Prices are largely set at liquid trading hubs, the largest and most important of which is Henry Hub in Louisiana.

2. **Oil-Linked:** Without established and liquid gas trading markets, the price of LNG for majority of Asia and emerging markets is set via oil-linkages.
Global Pricing Dynamics

US Entry as an Exporter

- The technological advancements during the last decade in US Shale gas boom led to a 79% increase in reserves and a 50% increase in production of natural gas.

- Increased shale production reduced natural gas prices in the US in comparison to Europe and Asia, creating a commercial logic to import from US. This led to increase in the projected export facilities from US.

- Lower prices in US as compared to Europe and Asia since 2009 have increased the appetite for short-term supply contracts and spot trade of LNG. These contracts offer buyers the flexibility to arbitrage prices between alternate LNG markets.

Declining Oil Prices

- The decline in oil prices in the last 3 years impacted the economics of LNG import from the US. Due to a large share of long-term contracts and oil-linked pricing, US LNG exports were not able to compete with Russian Pipeline supplies and Qatar’s LNG exports. With a sharp decline in prices in 2014-15 resulting in lower spread between the two contracts, US LNG exports slowed down.

- However, with crude prices increasing from $29 in Jan16 to $54 in Dec16, last year saw a return to preference for US LNG contracts.

- European market: Europe would not have a direct advantage of US LNG exports but would reap indirect benefits due to increased total supply.

- Asian market: The higher shipping cost due to longer distances would make the export commercially unviable in most regions at current oil prices.
Domestic Industry | Gas Production & Consumption

Demand - ~6000mmcfd

Production - ~4000mmcfd

Shortfall – ~2000mmcfd

### Domestic Production Data*

<table>
<thead>
<tr>
<th>Company Name</th>
<th>% share</th>
</tr>
</thead>
<tbody>
<tr>
<td>OGDCL</td>
<td>29%</td>
</tr>
<tr>
<td>PPL</td>
<td>16%</td>
</tr>
<tr>
<td>MPCL</td>
<td>15%</td>
</tr>
<tr>
<td>Eni Pakistan</td>
<td>13%</td>
</tr>
<tr>
<td>OMV Pakistan</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Top 5 % Share</strong></td>
<td><strong>81%</strong></td>
</tr>
<tr>
<td>Others</td>
<td>19%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

*FY16 data not yet available; FY15 used as proxy

### Domestic Consumption Sector Wise

<table>
<thead>
<tr>
<th>Sector</th>
<th>% share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>41%</td>
</tr>
<tr>
<td>Commercial &amp; Residential</td>
<td>24%</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>21%</td>
</tr>
<tr>
<td>General Industry</td>
<td>9%</td>
</tr>
<tr>
<td>Transport</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Pakistan LNG Model

**Importer**
PSO

**Gassification Unit**
Engro Elengy Terminal

**Buyer**
SSGC

**Consumer**
Industry & Household

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**Performance of LNG in Pakistan**

- 1st LNG terminal commissioned in Mar-15 with a storage and Re-gasification capacity of ~600mmcf.

- Till Dec-15, the terminal was handling ~200mmcf of LNG. Post-finalization of remaining contracts during CY16, LNG handling increased to ~400mmcf. Room for an additional ~200mmcf remains, for which negotiations are underway and are expected to be finalized by Jun-17.

- The terminal is operational and has received 61 cargo ships during CY16.

- Finalization of contracts for importing LNG
  - Long-term | Qatar | 300mmcf | 15 Year contracts (Renewable after 10 years)
  - Medium-term | Guvnor | 100mmcf | 5 Year contract
Industry Developments | Terminals and Pipelines

Gwadar-Nawabshah LNG Terminal and Pipeline Project:
• Pakistan-China G-G arrangement
• Construction of ~700km pipeline – transportation capacity of ~1.95bcfd – from Gwadar to Nawabshah. Estimated cost amounts to USD 2bln

North-South Gas Pipeline Project:
• Pakistan-Russia G-G arrangement
• The pipeline will enable efficient transportation of RLNG (imported from Russia) from terminals in Karachi to users in Lahore. Length of the pipeline is 1,100km – transportation capacity of ~1.2bcfd – with a estimated total cost of USD 2bln.

Turkmenistan-Afghanistan-Pakistan-India Pipeline Project:
• A gas pipeline from Turkmenistan to India via Afghanistan and Pakistan; length: 1,680km
• Turkmenistan will provide ~3.2bfcfd of gas (Pakistan’s share: ~1.3bfcfd). Estimated capital cost of the project is ~USD 7.6bln.
2nd LNG Terminal (Expected CoD: Jun’17):
• Installation of FSRU-based LNG Terminal - handling capacity of ~600mmcf/d – and related infrastructure at Port Qasim
• Constructed by a consortium - Pakistan GasPort Consortium Limited (PGPC) – led by Pakistan GasPort Limited (PGPL), and including Fauji Oil Terminal and Distribution Company (FOTCO)

3rd LNG Terminal (Expected CoD: 2HCY18):
• Installation of FSRU-based LNG Terminal - handling capacity of ~750mmcf/d – and related infrastructure at Port Qasim. Expected cost is USD 250-300mln
• Project being constructed by Global Energy Infrastructure Limited (GEIL), a Turkish company former
Industry Developments | Other

Short and Long-Term LNG contracts:

• In Jan’17, GoP invited bids for 240 LNG shipments. Post-bidding process, the following are the results as per lowest bids submitted:
  • Medium-term | 5 years | Gunvor | 60 ships | 100mmcmd
  • Long-term | 15 years | ENI | 180 ships | 100mmcmd

Currently only Gunvor has been awarded its contract, whereas ENI’s offer has not yet been accepted on grounds of high offer price.

Pakistan LNG Limited (PLL) and Pakistan LNG Terminal Limited (PLTL):

• PLL & PLTL are state-owned companies and subsidiaries of Government Holdings (Private) Limited (GHPL).
• PLL is mandated by GoP to procure LNG from international markets and enter into onward arrangements for supply of gas to the end user. PLTL has been established to manage and procure LNG storage and regasification service.
• Both companies are currently incorporated and operational.
Challenges for LNG in Pakistan

- The end consumer for the use of LNG has not yet been finalized.
- Pricing mechanism for commercial and households use of LNG is yet not clear.
- The emergence of circular debt may hamper the continuity of smooth operations.
Bibliography

2. BP Statistical Review of World Energy June 2016 | www.bp.com
4. US Energy Information Agency (EIA)
5. Impact of US LNG exports on Europe | www.energymining.org
6. Engro Elengy Terminal (Private) Limited

Analysts

<table>
<thead>
<tr>
<th>Analyst</th>
<th>Details</th>
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