Global LNG Outlook

James Henderson

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Global LNG System

North America Exports LNG, Russia Becomes ‘system shock absorber’

Niche Markets
(South America, Middle East etc.)

Asian Markets
(Japan, Korea, Taiwan, China, India)

Hub-Indexed Pipeline Contracts / direct hub sales

‘Normal’ Storage Inventory Level

US Liquefaction

US Producers

European LNG Buyers & Suppliers of Flexible LNG

Upstream Sellers

Domestic Production

Pipeline Imports

Domestic Production

Pipeline Imports

Pipeline Imports

US Exports LNG provided price difference between HH and Asia is > circa $6.50/mmbtu. Flow reduces as Storage level falls. Incremental supply ends up in Europe.
European Balances - 2016

- 2016 was expected to be the first year of a period of plentiful supply as global LNG supply built up and ‘spilled over’ into Europe, reducing imports of Russian pipeline gas.
- The out-turn was different due to:
  - European Demand Recovery (especially gas in power in UK & NW Europe, partly offset by Turkey)
  - Delay & problems commissioning new LNG facilities
  - No/little growth in domestic and Norwegian Production.
- Based on 9 months of IEA and Eurostat data for Europe region (including Turkey), the balance for 2016 is: (with 2014 and 2015 shown for comparison)

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2015</th>
<th>2016*</th>
</tr>
</thead>
<tbody>
<tr>
<td>European Demand</td>
<td>475.7</td>
<td>495.9</td>
<td>515.0</td>
</tr>
<tr>
<td>Production**</td>
<td>255.1</td>
<td>248.2</td>
<td>245.0</td>
</tr>
<tr>
<td>Pipeline Imports - Russia</td>
<td>147.7</td>
<td>159.8</td>
<td>170.6</td>
</tr>
<tr>
<td>Pipeline Imports - Other</td>
<td>31.6</td>
<td>30.0</td>
<td>49.1</td>
</tr>
<tr>
<td>Storage Withdrawal</td>
<td>-7.3</td>
<td>6.4</td>
<td>0.6</td>
</tr>
<tr>
<td>LNG Imports</td>
<td>48.6</td>
<td>51.5</td>
<td>49.7</td>
</tr>
<tr>
<td><strong>Net Supply</strong></td>
<td>475.7</td>
<td>495.9</td>
<td>515.0</td>
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</tbody>
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* Based on Actuals to end September, Full Year LNG & Storage
** Net of Norwegian LNG exports and re-exports generally.
LNG trade is causing convergence across regions

SOURCES: Platts, EIA, Argus, CME
Impact of carbon price and coal price on gas is also significant

Sources: Rogers (OIES)

NB Assumes mid range HHV efficiencies of 55% for gas; 41% for coal

Coal Price (€/tonne) – right axis
Gas switching price with coal – EU ETS CO2 price
Gas switching price with coal – EU ETS CO2 price and UK minimum Carbon price
Gas in UK advantaged relative to coal
Gas in Continental Europe advantaged relative to coal

UK CO2 Price
- £4.94
- £9.55
- £18.08
2017 and beyond – The ‘Big Five’ Uncertainties

• Demand for Natural Gas and LNG in Asia, particularly speed of Japanese Nuclear re-start and longer term – Chinese and Indian LNG demand.

• New LNG Markets in 2020s, including Bunkers

• European Demand Recovery.

• Timing and pace of new LNG FID’s.

• Response by Russia to ‘overspill’ of excess LNG into European market in 2018 – 2023 period.
Asian LNG Demand – Large Uncertainties

Low Case

High Case

Japan Nuclear restart pace and extent

China gas demand growth & Russian pipeline timing

Source: GIIGNL, Author’s Calculations
Other Markets – LNG Demand

Middle East
- Egyptian Zohr field start-up v. important

South America
- Significant El Nino uncertainty
European Gas Demand Assumptions

Source: Base Demand post 2015 from Anouk Honore, OIES

Production is set to decline by 100bcm by 2030 (including Norway) so net imports will rise by 100-140bcm over the next 15 years.
Global LNG Issues

- Tendency to create its own ‘commodity cycle’ due to 5 year FID – start-up lead time and focus on historically high growth but generally ‘opaque’ Asian markets.

- We saw the dramatic growth of LNG in the 2008 to 2011 period. That growth trend was long anticipated but slow to get underway due to project delays and some (minor) start-up problems.

- Given the delays and unforeseen shutdowns during the commissioning period experienced on Sabine Pass and the Australian projects (notably Gorgon) we have again been subjected to the ‘Boy who cried Wolf!’ syndrome.

- 2016 saw some LNG growth (significantly towards the end of the year) but none of this made its way through to Europe.
Global LNG Supply 2008 – 2030
Existing, Under Construction & FID’d

Source: Author’s Assumptions
Forecast to 2021 – Existing, Under Construction and FID’d Projects

- MCM/D
- Forecast to 2021 – Existing, Under Construction and FID’d Projects
- Predicted before Overview
- Actual
- Future Overviewed
- 100 bcma
- 200 bcma
- 300 bcma
- 400 bcma
- 500 bcma

Russia has a strategic geographical advantage

- Russia is strategically placed between the world’s largest gas importing regions
- Gazprom’s surplus capacity gives it a strong bargaining position, especially in Europe
- With Europe being the sink for surplus LNG, Russia’s gas marketing strategy is of vital importance to global gas players
- Russian gas can also compete in Asia, although one window of opportunity has arguably been missed
Russia has approximately 250bcm of current pipeline export capacity, including 120bcm via Ukraine.

Nord Stream 2 and Turkish Stream (2 line) could add a further 86bcm of capacity by the early 2020s.

Gazprom has sufficient supply and infrastructure capacity to maintain or grow market share in Europe as indigenous production declines.
Gazprom’s long term take or pay contracts with European customers to 2030

Even at 70% ToP, Gazprom’s average annual sales exceed 100 Bcm/year until the mid-2020s; as contracts need to be renegotiated the key questions will be competitiveness and future of gas demand

Source: ERI RAS in Henderson and Pirani (OIES 2014)
Gazprom has adjusted its pricing strategy

- Gazprom has demonstrated that it is prepared to shift towards market prices
- Price formation in long-term contracts may still be nominally linked to oil prices, but reality shows that actual prices are close to spot levels
- Renegotiation of contracts has introduced discounts, rebates and spot-linked pricing, and Gazprom is increasingly trading on European hubs
- Oil-linked price look set to remain competitive in 2017 despite recovery in oil price, although if LNG wave eventually arrives then a reaction may be required
Russian gas can be very competitive with US LNG in Europe

On a short-run marginal cost basis (SRMC) the key variables are the US$/Rouble exchange rate and the price of Henry Hub gas.

At current levels Russian gas can compete with, and slightly undercut US LNG in Europe.

In the longer term, Russia would logically adopt a strategy to keep the European gas price between the short and long-run cost of US LNG - $4-8/mmbtu

- Allow some US LNG to enter Europe but prevent new FIDs based on European economics.
LNG ‘Glut’ cleared by:

- Additional coal to gas switching in Europe.
- ‘Induced’ spot demand in Asia.
- Reduced US LNG send-out
Europe does not need Russian Gas above 150 bcma until 2023. System needs new LNG beyond current supply under development in 2027, so prices rise to LRMC by then.
European Balance – High Asian LNG & European Gas Demand Case 2015 - 2030

- LNG Available for Europe
  - Russian Pipeline Gas (150 bcma minimum)
  - Other Pipeline Gas
  - Domestic Production (including Norway)

New LNG Supply Needed

2019 - 2024

5 Years

2019 is the only future year where less than 150 bcma of Russian pipeline gas is needed.
Europe needs Russian Gas above 150 bcma in all future years (apart from 2019). System needs new LNG beyond current supply under development in 2024 so prices rise to LRMC.
Qatar revises plans for LNG output

Qatar has decided to end its moratorium on North Field development. Is the country's plan to expand output by 21bcma within 5-7 years a sign of concern over future gas market outlook?
The LNG Market is changing as Aggregators and Traders expand influence

- The dynamics of the LNG market are changing as new types of player come to the fore
- By 2020 over 40% of LNG could be available through “aggregators” and “asset-light” traders
- Portfolio optimisation by the majors could help finance the next wave of LNG
Conclusions

Key Unknowns
- Asian LNG Demand – Japan, China, India, new markets
- European natural gas demand – expected to be stable or grow modestly. Continued contraction would exacerbate 2019 glut.
- Potential (need for !) for LNG cost base reductions if LNG to taken seriously by policymakers.
- Success of Gas Industry in making the case for gas vs coal in the context of COP21 commitments and gas’ huge potential contribution to reducing coal and diesel particulate pollution.

Outlook
- Balanced or very soft LNG market to 2020 based on projects under construction; conditions for new FID projects onstream in early to mid 2020s extremely hard to read.
- Demand Response to low prices:
  - Coal Switching (at gas prices below ~ $3.5/mmbtu; (~$5.00 in UK)
  - Induced demand in Asia
  - US LNG offtake constrained if spreads to Europe are less than SRMC.
- Supply – first signs of big players making investment decisions for 2020s
  - Qatar
  - Aggregators
Thank You for your attention.

James Henderson
Director, OIES Natural Gas Programme
james.henderson@oxfordenergy.org