Pricing on gas: focus on LNG sectors

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What are the benefits of LNG?

Environmental Benefits

Table 3: Comparing alternative technologies and fuels

<table>
<thead>
<tr>
<th>Alternative</th>
<th>$SO_x$</th>
<th>$NO_x$</th>
<th>PM</th>
<th>$CO_2$</th>
<th>Cargo capacity</th>
<th>Capital Investments</th>
<th>Operating costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>Restricted</td>
<td>Very high</td>
<td>Low</td>
</tr>
<tr>
<td>MGO</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Not restricted</td>
<td>Low</td>
<td>Very high</td>
</tr>
<tr>
<td>HFO/Scrubber</td>
<td>+</td>
<td>--</td>
<td>+</td>
<td>-</td>
<td>Slightly restricted</td>
<td>High</td>
<td>Medium$^a)$</td>
</tr>
</tbody>
</table>

++ very good, + good, − bad, -- very bad

Source: SSPA, TC/1208-05-2100
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Table 2: Reduction potential of LNG per pollutant

<table>
<thead>
<tr>
<th>Air pollutant emission (in gas mode)</th>
<th>Reduction potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>85-90%</td>
</tr>
<tr>
<td>SOx</td>
<td>~100%</td>
</tr>
<tr>
<td>PM</td>
<td>~100%</td>
</tr>
</tbody>
</table>

Source: http://www.lngbunkering.org/Lng/environment/benefits-of-LNG
LNG: Market drivers

- LNG markets are not isolated: LNG prices depend ultimately on regional gas markets
- Long-term gas price drivers:
  - marginal cost of supplying markets
  - pattern of demand growth: generation, domestic, GDP
  - government policies: conservation, supply security...
- Short-term gas price drivers:
  - day-to-day uncertainty on local supply/demand balance: gas production & transportation, weather, power generation…
  - availability of “tools”: storage, flexibility, fuel switching,…
  - positioning of each market participant
LNG: Trade Volume 1990-2016

Source: IHS Markit, IEA, IGU
Short, Medium and Long-Term trade (2010 - 2016)

Sources: IHS, IGU
This growth is the result of several key factors:

- The growth in LNG contracts with destination flexibility, which has facilitated diversions to higher priced markets.
- The increase in the number of exporters and importers, which has amplified the complexity of the industry and introduced new permutations and linkages between buyers and sellers. In 2016, 29 countries (including re-exporters) exported spot volumes to 35 end-markets. This compares to 6 spot exporters and 8 spot importers in 2000.
- The lack of domestic production or pipeline imports in Japan, South Korea and Taiwan, which has pushed these countries and others to rely on the spot market to cope with any sudden changes in demand like the Fukushima crisis.
- The decline in competitiveness of LNG relative to coal (chiefly in Europe) and shale gas (North America) that has freed up volumes to be re-directed elsewhere.
- The large disparity between prices in different basins from 2010 to 2014, which made arbitrage an important and lucrative monetisation strategy.
- The faster development timeline and lower initial capital costs of FSRUs compared to onshore regasification, which allow new countries to enter the LNG market.
- The large growth in the LNG fleet, especially vessels ordered without a long-term charter, which has allowed low-cost inter-basin deliveries.
Figure illustrates the magnitude of the fall and convergence of global gas prices across the past two years.
The Figure shows that fuel switching in favour of gas is the key driver of the downward slope of the European gas market demand curve. As ‘price taking’ LNG import volumes increase, they effectively push the European gas market down this demand curve to a lower clearing price, at which gas-fired power stations soak up the surplus LNG. This interaction between pipeline contract flexibility, LNG import volumes and power sector gas demand is set to drive European hub pricing dynamics over the next 2 – 3 years.
Natural gas production by region in the New Policies Scenario

LNG Trade Routes

The remaining natural resources of gas are sufficient to meet the global demand growth to 2040 in all three scenarios of current policies, new policies, and sustainable policies. Proven reserves are at some 215 trillion cubic metres (tcm) at the end of 2016, equal to around 60 years of production at current output rates. The global production of natural gas will increase from 3,621 in 2016 to 5,304 in 2040.

Source: World Energy Outlook, 2017
Global Inter-regional gas trade faces by 525 bcm in the period to 2040, meaning yearly growth rate of 2.4% on average, near to the rate over the past 25 years. The importance of inter-regional LNG trade grows substantially with nearly 90% of the incremental volumes traded over long distances taking the form of LNG compared to just under two-thirds in the past 25 years.

Source: World Energy Outlook, 2017
How is the market for LNG shipping evolving?

LNG vessel fleet in the New Policies Scenario

The number of the LNG vessels increased from the 340 to 460 between 2011-2016, which reflects 70 million cubic meters in 2016, with a rise of 35% from 2011 levels. Currently, the LNG shipping market is in over-capacity phase which resulted in low charter rates. New LNG vessels will be needed in the first-half of the 2020s and, along with the growth of the US LNG export.
How might LNG change the game?

Selected LNG exports in the New Policies Scenario

As per the New Policies Scenario, a rise of 40% in gas production is projected in the United States up to 2040, mainly due to the growth in the shale gas production. The move towards a more diverse, flexible and liquid global gas market has important implications for investment with significant benefits such as energy security. In short-term, uncertainties over the market outlook and the shift in contractual and pricing arrangements will likely be in favour of smaller supply projects or the expansions of the existing facilities. However, the challenges for long-term investments will be the sufficient confidence between sellers and buyers in the emerging gas orders to make it the basis for their future plans.

Source: World Energy Outlook, 2017
LNG PRICING OVERVIEW

Figure 2. Monthly Average Gas Prices (2009 – January 2015)

Source: HIS, Cedigaz, US DOE
LNG PRICING OVERVIEW

Figure 3: Liquefaction Capacity by Region in 2008, 2014 and 2020

Sources: IHS, Company Announcements
LNG MARKET TRENDS

Figure 4. Non Long-Term Volumes, 1995-2014

Source: HIS, US DOE, IGU
Natural gas makes a major contribution to meeting energy demand growth in the New Policies Scenario, with global demand rising by 45% between 2016 and 2040. With a few notable exceptions (including China), gas consumption is usually not an explicit focus of sustainability policies at national level. However, all fossil fuels grow in the Current Policies Scenario, while gas is the only fossil fuel to show significant growth in the New Policies Scenario.

Source: World Energy Outlook, 2017
Global gas consumption in road and maritime transport in the New Policies Scenario

Gas demand in transport rises by over 200 bcm between 2016 and 2040 in the New Policies Scenario, two-thirds of which stems from increases in road transport (Figure 11.7). China, the United States and India are the main sources of this growth, where gas is used both in freight and passenger vehicles (the latter notably in India), helping to reduce PM2.5 emissions in built-up areas. In the maritime sector, a switch away from heavy-fuel oil to natural gas occurs primarily to reduce local air pollution, most notably sulfur emissions.

Source: World Energy Outlook, 2017
Global primary energy demand in the Sustainable Development Scenario

Transport sector

Source: World Energy Outlook, 2017

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Global LNG trade in the Sustainable Development Scenario continues to grow at a robust pace to 2030. LNG imports to Europe, Japan and Korea remain broadly flat throughout the 2020s, but demand for LNG continues to grow in developing economies in Asia. LNG is critical in these regions to meet energy demand that might otherwise be provided by coal. After 2030, LNG demand in Europe, Japan and Korea drops by 30%, offsetting most of the sustained growth in other Asian countries.
LNG MARKET TRENDS

A number of key factors have contributed to the rapid growth of non long-term trade in recent years:

➢ The growth in LNG contracts with destination flexibility, chiefly from the Atlantic Basin and Qatar, which has facilitated diversions to higher priced markets.

➢ The increase in the number of exporters and importers, which has amplified the complexity of the trade and introduced new permutations and linkages between buyers and sellers. In 2014, 26 countries (including re-exporters) exported spot volumes to 28 end-markets.

➢ The large increase in demand in Asia and in emerging markets such as Southeast Asia and Latin America, which accelerated tightness in the LNG market.

➢ The decline in competitiveness of LNG relative to coal (chiefly in Europe) and shale gas (North America) that has freed up volumes to be re-directed elsewhere.

➢ The large growth in the LNG fleet, which has allowed the industry to sustain the long-haul parts of the spot market (chiefly the trade from the Atlantic to the Pacific).

➢ The legal enforcement
Energy Production

Global trends

World energy production was 13 800 Mtoe (Million Tonnes of Oil Equivalent) in 2014, 1.1% more than in 2013. Fossil fuels accounted for 81.2% of it—a 0.4% decrease compared to 81.6% in 2013. Oil production increased the most (+2.1%), followed by coal and natural gas (+0.8% and 0.6% respectively). Together the production of these three fossil fuels increased by +1.3% in 2014.
Natural gas

Reserves-to-production (R/P) ratios 2015 by region

As was the case for oil, global proved natural gas reserves in 2015 fell slightly, by 0.1 trillion cubic metres (tcm), or -0.1% to 186.9 tcm, sufficient to meet 52.8 years of current production. Small declines in Russian and Norwegian reserves drove the decline. Reserves have increased by 20.6 tcm over the past decade. The Middle East region holds the largest proved reserves (80 tcm, 42.8% of the global total), and has the highest regional R/P ratio (179.5 years). Lags in reporting official data mean that 2015 figures for many countries are not yet available.
Export Liquefaction Terminals and increasing supply

LNG Trade Routes
SPOT PRICES CONTINUE TO REFLECT STRONG DEMAND FOR LNG
LNG Pricing Overview

PHYSICAL AND FINANCIAL LIQUIDITY INCREASE AS MARKET EVOLVES
LNG Pricing Overview

- Diverse marine segments choosing LNG
- LNG bunkering network developing globally
- LNG road fuelling network developing in China (2000+ stations) and EU (100+ stations)

Source: SHELL LNG OUTLOOK 2018

DEMAND FOR LNG IN TRANSPORT GROWS GLOBALLY
World LNG Estimated Landed Prices: Jan-18

- Cove Point: $5.24
- Canaport: $8.87
- Lake Charles: $2.87
- Belgium: $10.86
- Spain: $7.54
- UK: $7.18
- Korea: $10.86
- India: $10.73
- China: $10.86
- Bahia Blanca: $10.52

Note: Includes information and Data supplied by IHS Global Inc. and its affiliates ("IHS"); Copyright (publication year) all rights reserved. Prices are the monthly average of the weekly landed prices for the listed month. Landed prices are based on a netback calculation.

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Thank you!