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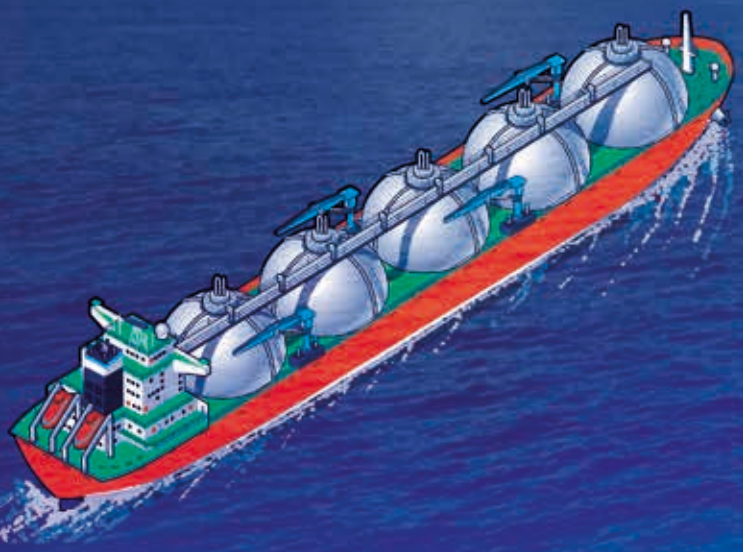

Naoki Shimoda, USA, and Girish Shirodkar, Asia Pacific, Strategic Decisions Group, provide an overview of the global LNG industry.

THE WORLD

The 'age of gas' is now well and truly upon the global energy markets. Fracking has sky-rocketed supply of natural gas from shale and tight formations. Gas has shifted from being a regional fuel to becoming a focal point of global energy supply.

Natural gas has historically lagged behind oil as a fuel since it requires end-to-end investment in pipelines or needs to be cooled to cryogenic temperatures as LNG, for transportation to the end customer. The striking growth in LNG trade over the last five decades is evidence of linkages being forged between the key regional gas hotspots and demand centres. This has also been accompanied by increased spot trade and by greater flexibility in the terms and conditions of long-term gas contracts.

Supply dynamics

The past couple of years have seen the emergence of a few mega trends on the supply side.

Shale gas takes centre-stage in the US

Shale gas has transformed the US energy landscape. Reserves in the US stood at 129.4 trillion ft^3 in 2012, up from 34 trillion ft^3 in 2008.[1] Between 2008 and 2011, US shale gas production rose by over 55% each year to almost 8 trillion ft^3 in 2011, and its share of total US gas production jumped from 5% to 39%. The US has become the top producer of oil and gas, which led to a large drop in Henry Hub (HH) prices, from US$ 13/million Btu in 2008, to US$ 1.9/million Btu in April 2012 before recovering to US$ 4/million Btu levels in 2013 and 2014.[2]

Russia looks East

Russia has finally agreed to supply China with up to 38 billion m^3/year of gas for 30 years through its pipeline network (see Figure 1). The relatively low price that China will pay for Russian gas (US$ 350 per 1000 m^3, roughly 10% below European prices as per analyst estimates) is going to put downward pressure on the current Japan Crude Cocktail (JCC)/HH linked contracts. Experts believe that pipeline gas from Russia can bring prices down from US$ 13/million Btu to US$ 10 - 10.5/million Btu.[3]

Frontier regions

The International Energy Agency (IEA) estimates that Africa holds approximately 74 trillion m^3 of technically recoverable natural gas reserves, roughly 10% of the world's total, with the majority still undiscovered. A significant portion of the gas lies off the coast of Mozambique, whose recoverable offshore discoveries total more than 150 trillion ft^3, with more expected. Tanzania has at least 30 trillion ft^3 of recoverable gas offshore.

Mozambique currently plans to bring LNG on stream before 2018 and Tanzania plans on doing the same before 2020. Development is complicated by the complete absence of basic infrastructure and logistics, which must be built from scratch under regulatory frameworks that have yet to be implemented.

Figure 1. Siberia pipeline and Altai proposed routes in Russia-China deal. Source: Eurasian Development Bank (bne.eu).

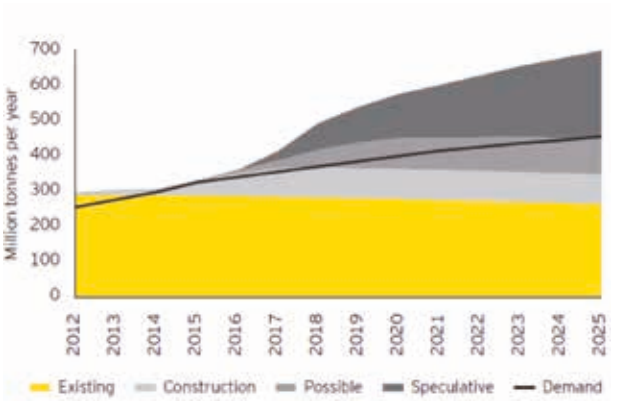

Figure 2. Global LNG demand vs. potential supply (million tpy). Source: EY Oil & Gas forecast 2013.

Potential supply glut expected in APAC by the end of the decade

Many new projects have been announced globally across Australia, the US, Russia, Canada, Mozambique, etc. This is expected to cause a supply glut towards the end of the decade, when supply is expected to surpass demand (see Figure 2). It is expected that the higher cost projects will be squeezed out of the market and either postponed or not reach FID.

LNG liquefaction costs tripled over the past decade[4]

LNG liquefaction costs have tripled over the past decade from US$ 400/tpy to US$ 1200/tpy (see Figure 3). However, the comparison is not straightforward. Plant scope, and consequently costs, can vary by a factor of four, ranging from a simple liquefaction train to a complete facility including storage, pipelines and export jetty, together with associated infrastructure (such as construction camp, township and air strip), before any regulatory or environmental costs are considered.

Australian projects have suffered large cost increases due to the remote location, substantial infrastructure development requirements, limited skilled workforce, tight social investment regulations and rigorous safety and environmental requirements.

The strengthening Australian dollar has also contributed to overall cost. Since 2009, the US/Australian dollar exchange rate has climbed from US$ 0.69 to US$ 0.93 in September 2014, a 34.8% increase, which directly impacts project costs.

As such, floating LNG (FLNG) has emerged as a cost-effective alternative to land-based liquefaction, with potentially lower development costs, lower environmental impact and the ability to monetise smaller gas fields in-situ. Petronas' PFLNG 1 will be the first FLNG project when it is commissioned in 2015.

Shift to Henry Hub

HH-linked gas prices are expected to be cheaper than post-Fukushima oil-linked prices. Given the indicative price formulae for South Korea as 1.15 x Henry Hub + US$ 3 (liquefaction) + US$ 3 (transportation), a HH price of US$ 5/million Btu compares to US$ 68.15/bbl of oil, a massive discount to current oil prices.[5] As Canadian LNG plants start up, LNG contracts could also be linked to AECO-C (the Alberta gas benchmark). Buyers are trying to move away from oil-linked prices[6] – Kansai Electric Power signed a HH indexed agreement with BP for globally sourced LNG, expecting approximately 30% lower import costs.

LNG price volatility is expected to increase as LNG exports may pull up HH prices and capital costs continue to rise.

Increase in spot and short-term LNG volumes

Spot sales help consumers meet disruptions in gas production and smoothen seasonal consumption peaks.

Spot and short-term volumes have increased dramatically, representing approximately 27% (65 million t) of LNG supplies in 2013,[7] up from 19% (41 million t) in 2010 (see Figure 4). LNG trading houses are coming up in Houston, London and Singapore.

Opening Arctic Sea lanes

Russia is planning to use icebreaker tankers to transport LNG in the Arctic's ice-clogged waters. With the Arctic warming up, shipping lanes will open, shaving thousands of miles off longer routes.

Widening of the Panama Canal

The expanded Panama Canal will support LNG vessels with capacities larger than 100 000 m^3 of LNG (roughly 80% of the global LNG tanker fleet),[8] especially for Peru cargoes destined for Europe, or East Coast US shipments for Chile/Asia.[9]

Developments in major LNG producing countries

Qatar

Qatar is the pre-eminent global LNG supplier, contributing 33% of global LNG production (77 million tpy). It has approximately 885 trillion ft^3 of reserves with an R/P ratio of 160.[10] Investing heavily, Qatar has increased its share of global LNG supply from 11% to 33% from 2003 to 2013.

ASEAN

Malaysia and Indonesia's gas supply is mature, but domestic demand is increasing rapidly due to low domestic prices. In Malaysia, Petronas will commission Bintulu Train 9 by 2016 to expand capacity to 29.3 million tpy.[11] Indonesia continues to export 60% of its gas, even as other regions experience gas shortages. BP, Eni and Indonesia's VICO are working on producing the world's first coal bed methane (CBM) LNG by 2015.[12] At roughly 450 trillion ft^3 GIIP (thrice Indonesia's conventional gas reserves),[13] CBM could be a game changer, helping Indonesia end domestic shortages and recapture global LNG demand.

Nigeria

In the Atlantic, Nigeria leads the way with six operating trains (of approximately 22 million tpy). The seventh train (of approximately 8 million tpy)[14] is under planning. This should increase the country's relative importance as an LNG supplier.

Australia

Australia has many liquefaction projects under construction, which should see it emerge as the number one LNG supplier by 2017 with 85 million tpy liquefaction capacity.[15,16] Up to 80 million tpy capacity is currently under construction in Australia with approximately 7 million tpy in Papua New Guinea (see Figure 5).

Russia

Russia has exported its first LNG cargo with the completion of Sakhalin II. By 2020, the Vladivostok and Yamal LNG plants will increase Russia's liquefaction capacity to almost 36.1 million tpy.

The US

Despite domestic markets being awash with shale gas, the US has not yet commenced LNG exports. US law requires export licenses from the Department of Energy (DOE) for export of LNG. However, approvals to export to countries that do not have a free trade agreement (FTA) with the US have proven slow. At the time of writing, applications have been submitted for export of 40.96 billion ft^3/day[17] (approximately 320 million tpy) targeting non-FTA countries and nine projects (approximately 83 million tpy) have been approved for non-FTA countries.

Canada

Canada has large gas reserves, with British Columbia alone claiming 1965 trillion ft^3 (GIIP).[18] The Canadian National Energy Board has approved 11 LNG projects with a sanctioned export capacity of 154.5 million tpy.[19] However, not all of these

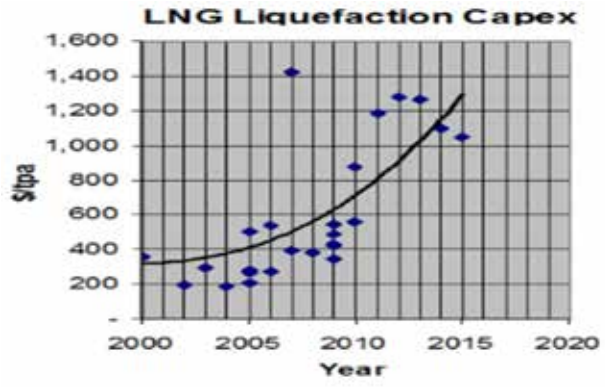

Figure 3. LNG liquefaction Capex per million tpy. Source: Oxford Energy Chart, using Woodmac data.

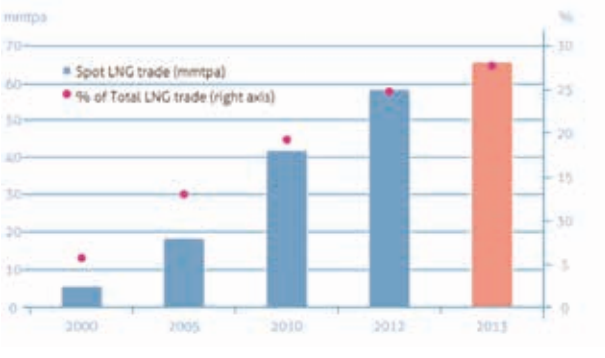

Figure 4. Spot and short-term LNG trade, percentage share of total LNG. Source: 'LNG Industry report 2013', GIIGNL.

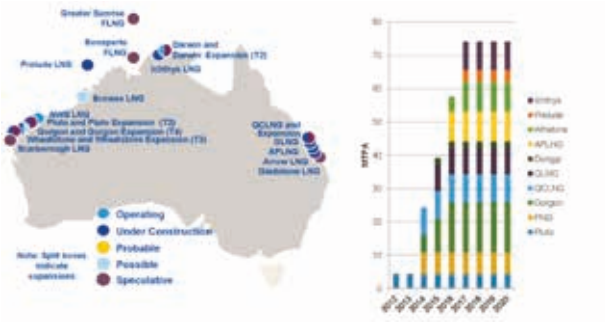

Figure 5. Australia's LNG projects and expected capacity. Source: Chevron Report. Illustration courtesy of Wood Mackenzie.

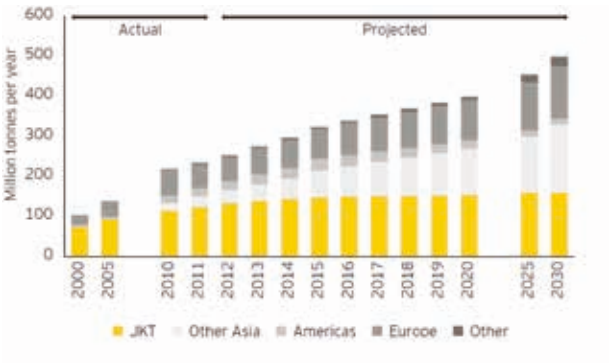

Figure 6. Region-wise LNG demand projection. Source: EY Oil & Gas forecast 2013.

proposed projects are expected to take off. Most Canadian projects are likely to be expensive integrated greenfield units with extensive infrastructure. Kitimat LNG is the most advanced of the proposed Canadian LNG projects (24 million tpy).

Demand trends

LNG demand is outstripping growth for both oil and natural gas. Global LNG sales in 2013 were 237 million t, having grown at 7.6% per year since 2000 (see Figure 6). This is three times as fast as global natural gas demand, which grew at 2.7% per year in the same period. However, natural gas demand has grown three times slower, at approximately 2.7% per year.[20]

Demand side risks

Development of cross-border pipelines

The proposed new/expanded gas pipelines via the Caspian Sea and/or Central Asia into Europe or Asia (e.g., Nabucco/South Stream pipelines into Europe, the Turkmenistan-Afghanistan-Pakistan-India [TAPI] pipeline, and an Iran-Pakistan pipeline) could undercut LNG demand. Given the high costs, not all pipelines will be constructed.

Restart of nuclear power in Japan

LNG demand and prices rose sharply as Japan shut down its nuclear reactors after the Fukushima incident in 2011. With Japan now looking to restart its nuclear reactors,[21] its appetite for LNG may soon be curtailed. As a first step, Japanese safety regulators passed two Sendai nuclear reactors in July 2014, though community approval for re-activating the plant is pending.

Global energy policy

A shift in global energy policies towards renewable sources or even a lack of focus in cutting down carbon intensive coal (in China) would adversely affect LNG demand.

Region-specific demand trends

JKT

Japan, Korea and Taiwan (JKT) are expected to remain the mainstay of global LNG demand, comprising 60% of demand in 2013.[22] JKT is heavily industrialised but without any domestic gas. Japan drives the region's demand by sourcing LNG to mitigate the shutdown of nuclear power plants.

China and India

China consumed 143.8 billion m^3 of gas in 2012 (up 9.9% year-on-year[23]), of which 20 billion m^3 (15 million tpy) was LNG. China's latest Five-Year Plan to 'gasify' the Chinese economy calls for the gas share of the energy mix to rise from approximately 4% in 2010 to 7.5% by 2015, and then to 10% share by 2020 (260 billion m^3/year). Of this, 90 billion m^3 will be imported. Even after considering Russian pipeline imports, significant volumes of LNG will be required. China is expected to power the growth in LNG demand, with some forecasts calling for a tripling of imports to more than 60 million tpy by 2020, with regasification capacity increasing from 31 to 80 million tpy.

India imported 12.9 million t of LNG in 2013, making it the fourth largest LNG importer.[24] Declining domestic production is likely to increase LNG demand to 75 million tpy by 2020.

Emerging South American demand

Although rich in oil and gas, slow energy market reform in South America has seen production fall even as demand for power generation surges, creating an energy gap that LNG started to meet in 2009 via floating storage and regasification units (FSRUs).[25] LNG imports rose 16% in 2013, and will continue to grow, supported by falling Argentinian gas output and delayed gas production in Brazil.

Europe

Gas demand in 35 European countries fell from 594 billion ft^3 in 2008 to 528 billion ft^3 in 2013.[26] This reduced LNG imports to 35 million t last year, significantly below its 2011 peak of 66 million t.[27] As a result of lower demand and higher prices of LNG cargoes in Asia, a lot of LNG is being re-exported from Europe to Asia (4.1 million t in 2011). A high price (relative to coal) and an increasing push towards renewable energy in the region makes future demand for natural gas in power particularly unclear and speculative in Europe.

Conclusion

While there is an increasing demand for LNG, key concerns remain in most major markets. If Japan manages to re-activate its nuclear power plants, its consumption may potentially reduce by up to 17 million tpy (2010 levels).[28] Most of the future demand in Asia also lies in price sensitive economies such as China and India, which may not be realised if gas prices remain high. The persistent macroeconomic weakness, competition from Russian pipelines, low carbon prices and non-market based renewable policies may further squeeze European LNG demand.

On the supply side, a slew of LNG plants are planned to come online in the next five to six years in Australia, Canada, East Africa, Russia, and the US. Consequently, LNG supply is likely to exceed demand in the medium-term, although the rising demand in Asia may consume the additional supply in the long-term.

Pricing in Asian LNG markets would see upheaval with the entry of potentially lower priced HH indexed shale gas LNG. This may impact the profitability of Australian, Canadian and Alaskan LNG projects that have high costs. However, given the uncertainty in HH, it is not a perfect recipe to reduce costs below JCC indexed prices for the long-term, leading to higher uncertainty/volatility in LNG prices. This will necessitate a risk management and portfolio approach from both suppliers and buyers. **LNG**

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