LNG TRADE FLOWS

Hans Stinis
Shell Upstream International

ABSTRACT

The LNG industry has witnessed a great deal of change recently, and indications are that this will only continue. Global gas demand is projected to grow at 2% per year, driven by strong economic growth and energy policies in non-OECD countries. At the same time, LNG demand is expected to grow at 5% per year, representing 16% of total gas demand by 2030. Two thirds of the growth in LNG demand will come from Asia and the Middle East, driven by strong economic growth and growing skepticism towards nuclear. New LNG markets are emerging, with exporting countries becoming importers (e.g. Malaysia, Thailand), seasonal buyers moving towards annual (e.g. Argentina) and importing countries becoming potential exporters (e.g. North America). Markets are being created through new applications, particularly LNG into transportation. Russia/CIS and the Middle East are key regions, with significant growth of gas exports to both Europe and Asia. A record number of LNG constructions are anticipated in the next 5 years, with Australia set to be the largest LNG exporting country around 2020. The shale gas revolution in 2008 created new supply competition for LNG supply projects. Across the industry there is growing interest in shale gas, with China believed to have the largest shale gas potential next to North America. This paper will examine these developments and how they are likely to impact LNG trade flows in the next decade.

INTRODUCTION

The LNG industry has witnessed a great deal of change recently, and indications are that this will only continue. Global gas demand is projected to grow at 2% per year, driven by strong economic growth and energy policies in non-OECD countries. At the same time, LNG demand is expected to grow at 5% per year, representing 16% of total gas demand by 2030. Two thirds of the growth in LNG demand will come from Asia and the Middle East, driven by strong economic growth and growing skepticism towards nuclear power.1

New LNG markets are emerging, with exporting countries becoming importers (e.g. Malaysia, Thailand), seasonal buyers importing on a full year basis (e.g. Argentina) and importing countries becoming potential exporters (e.g. North America). Markets are being created through new applications, particularly LNG into transportation. Russia/CIS and the Middle East are key regions, with significant growth of gas exports to both Europe and Asia. A record number of LNG constructions are anticipated in the next five years, with Australia set to be the largest LNG exporting country around 2020.

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AIMS

The focus of this paper is to provide Shell’s views on the long term gas and LNG supply and demand outlook to 2030.

GLOBAL GAS DEMAND OUTLOOK

Global primary energy demand could grow to ~400 million barrels of oil equivalent per day (Mboe/d) by 2050, driven by the strong growth in non-OECD economies. GDP per capita is expected to triple by 2030 in

1 Shell analysis
China and India bringing more than 2.5 billion people up the energy ladder. Meeting the growth in demand will require large scale and sustained investments in all forms of energy.

Natural gas, being the cleanest burning fossil fuel, will play a key role. Shell expects global gas demand to grow by 60% from 2010 to 2030, driven by strong economic growth and energy policies in non-OECD countries, making it 25% of total primary energy mix.

We see many differences in gas market development around the globe, still reflecting the regional nature of domestic/continental gas markets and the large influence that government policies play in shaping the right conditions for sustainable gas market development. The regional gas markets today have limited connections and hence very different gas pricing fundamentals. All large gas markets are expected to grow except Europe.

Shell analysis
Europe is a mature gas market with an accelerated build up of gas infrastructure since the 1960s. Nowadays we see an increased focus on energy efficiency and an increasing share of renewable energy. Indigenous gas supply in the United Kingdom, Norway and the Netherlands will decline in the coming decades and there is no line-of-sight for a replication of the US shale gas revolution in Europe. Though the mature gas market in Europe will see relatively minor growth, there will be significant new gas imports to replace declining domestic production.

In many Middle East countries the gas demand is driven by low, sometimes subsidized, domestic gas prices and regional industrialization. It is a region with many large gas export projects, but also countries in which domestic demand is outpacing indigenous supply and where no or limited cross-border gas pipeline infrastructure is planned to be built.

The abundant gas supplies in the US create new opportunities for gas to power and gas in industry, with renewed interest for gas to be used as feedstock into high energy intensive industries. We strongly believe that the relatively low Henry Hub gas prices will continue to drive gas market growth in North America.

In Asia, China will be the main driver for growth. In 2000, China’s gas demand was ~24 billion cubic metres (bcm). The rapid development of China’s gas infrastructure has already increased its gas demand to ~130 bcm in 2011 – a more than fourfold increase.

Global gas supply from conventional gas (both associated and unassociated gas from Russia, CIS, and MENA) and unconventional gas (mainly from Australia, North America and China) will grow in tandem with demand. Gas infrastructure globally is growing at an immense pace. We see large interregional pipelines being constructed connecting suppliers with far-away demand centres. In the last years we saw first gas coming from Turkmenistan to China and expansion of the Russian pipeline system into Europe. Growth in infrastructure will allow gas to play a role in all parts of the global economy.

GLOBAL LNG OUTLOOK

With the anticipated growth in demand, all forms of supply will grow including LNG. Shell expects LNG demand to grow at 5% per year to represent 16% of total gas demand by 2030. LNG demand has grown in the first decade of this century to ~250 million tonnes (mt) in 2011, and is expected to double to 400 mt in 2020, potentially reaching 500 mt by 2025. Two thirds of the growth in LNG demand will come from Asia and
the Middle East, driven by strong economic growth and growing skepticism towards nuclear power. In Asia, we expect to see a 5% average annual increase in gas demand, dominated by China and South East Asia, and growth in all sectors of demand.3

<table>
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<th>Global LNG Demand Growth 2000 to 2025 (Mtpa)</th>
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<tr>
<td>Mtpa</td>
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<td>Japan/Korea/Taiwan</td>
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The LNG market has doubled every 10 years in the last two decades from some 50 mt in 1990 to over 240 by 2011. In 2001, the world had 40 LNG regasification terminals in 11 countries. By the end of 2011 there were 89 regasification terminals in 25 countries, more than doubling in the space of a decade.

LNG IMPORT COUNTRIES

In 2011, LNG trade grew stronger with global imports at 244 mt, an increase of 10% from 2010 and 40% from 2009. About 60% of the demand came from the traditional LNG markets in Asia and the growing economies of China, India and lately South East Asia. The global market increased by some 20 mt or nearly 10% in 2011, with an 8 mt increase from Japan alone following the Fukushima incident.

3 Shell analysis
Traditional LNG markets like Japan/Korea and Taiwan will continue to grow and we expect Japan to remain the largest LNG importing country. More growth is expected from other non-traditional Asian markets driven by the resurgence of the China, India and South East Asia economies.

China will be the biggest engine for growth in the region. In 2000, China’s gas demand was ~ 2.3 bcf/d. The rapid development of China’s gas infrastructure increased its gas market to over 12 bcf/d in 2011 – a more than fourfold increase. At 12.6 bcf/d in 2011, China consumed more gas than any OECD country except the US, and the first seven months of this year saw a 12% year on year increase in China’s gas demand.

The recently issued China gas policy 2012, compared to the 2007 version, encourages a wider application of natural gas use within more sectors. The policy reinforces the use of gas for specified industries and sets this as a priority. We expect the Chinese gas market in 2030 to be around the same size as the European gas market is today at some 54 bcf/d.

South East Asia will grow in significance with Indonesia, Malaysia and Singapore starting imports of ~10 mt based on their available regasification capacity in 2013 to support growing domestic gas demand.

The South East Asia markets are projected to grow in the next five years adding an additional ~150 mt of regasification capacity globally by the end of the decade.

European LNG imports have been gradually reducing year on year since 2010, due primarily to the economic downturn, the role of coal versus gas, and renewable energy sources in the power sector. Europe became the balancing market in 2011 with diversions from UK and Belgium and the less liquid gas markets in Southern Europe (i.e. Spain, Italy, Portugal, and to a limited extent France) supporting the increasing demand from Asia. Europe’s ability to continue to alleviate the market tightness will be under challenge when its gas supply from indigenous production particularly from the UK and the Netherlands will start to decline from 2015 on. LNG imports will fill the gap, especially to supply the markets in North Western Europe where access to pipeline gas from Russia and CIS will be less likely. The growth outlook for Europe would leave LNG at around 20% of gas supply by 2020, compared to 15% today, as domestic reserves decline and Europe seeks to establish security of supply from LNG.

LNG production in 2012 is likely to be ~2% lower compared to 2011. This will be the first time the size of the LNG market shows a year on year reduction on volumes. Existing supplier issues continue to add to the uncertainty with global liquefaction utilization under pressure due to continuing issues with sabotage (Yemen), domestic gas demand (Egypt) and technical upstream supply issues (Algeria). The supplies from existing LNG plants will contribute 70 to 95% of total global supply in the medium term. The average utilization rates of the good performing LNG plants exceed 93%; however, the industry average is pulled down by the poor performing plants, almost all affected by gas availability for export (with a ~60% utilization rate). In the first six months of 2012, around 28 mt (23%) of global LNG production came from these struggling plants. Delays in new supplies are adding to supply uncertainty for the mid-term; only Pluto Train 1 added new capacity in 2012 with Angola Train 1 start-up deferred to Q1 2013.

In 2012, the continuing LNG demand growth in Asia led to a global redistribution of LNG imports. We expect these market conditions to remain and only later this decade will the market substantially rebalance with new LNG supply coming on-stream in Australia and US. These new LNG supplies from Australia will allow it to become a larger LNG exporter than Qatar at the turn of this decade. The large demand growth in Asia inspires new upstream supply project developments; however, we believe new supplies will not outpace LNG demand growth by the end of this decade as project sponsors continue to want to see long term off-take commitment to underpin new LNG investments.

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4 PFC Energy
5 PFC Energy
We believe that there is more upside potential in LNG demand, particularly in emerging markets, than downside risk. Main drivers for higher demand can be attributed to a number of factors. For non-OECD markets, one factor is the continued delay and failure to mature domestic unconventional gas or offshore resources, e.g. South America and the Middle East. The pace at which political and economic reforms are implemented in these countries could enable larger volumes of LNG imports, acceptance of international LNG prices, and last but not least the development of large domestic pipeline infrastructure to enable greater penetration into the interior markets. In OECD markets, base case demand uncertainties will mainly be energy policy choices and the role of gas in the power sector.

GLOBAL LNG SUPPLIES

LNG supply will grow in response to the increase in demand, requiring substantial investments, and continued innovation and interdependency between the supplier and customer countries. The LNG industry has witnessed a great deal of change recently, and indications are that this will only continue. The industry has thrived in the last 50 years and is on the cusp of a second wave of growth, with a major expansion of supplies towards the end of the decade mainly from Australia, North America and potentially East Africa.

Similar to the share of the global demand, the East of Suez supply represents 70% of the total production in the next decades. Australia is set to be the largest exporter of LNG ahead of Qatar by 2020. With the abundance of unconventional and new supply projects in the pipeline, new export regions are expected to emerge from North America, East Africa, Russia and possibly the Eastern Mediterranean.
Qatar has become the world’s largest LNG producer and LNG from Qatar has a strong economic position due to plentiful liquids rich gas reserves and moderate development costs. All Qatari trains are now operating with 77 mtpa (~105 bcm/year) of export capacity. The supply growth in the short/mid-term will come from de-bottlenecking of existing mega trains. Qatar has imposed a moratorium on new gas projects from the 900 trillion cubic foot (tcf) North Field until at least 2013 and may not be building new LNG liquefaction plants this decade.

Australia is set to become the largest LNG producer ahead of Qatar by 2020, with potentially 12 new Financial Investment Decisions (FID) to take place in the next 10 years. Key risks to delivery schedule relate to domestic gas policies, project cost pressures, resource constraints and regulation changes.

The shale gas revolution in North America and to a lesser extent in Australia has changed the gas market globally and impacted the LNG industry since 2008. Thanks to increased shale gas production in North America, domestic demand for gas has grown leading to increased gas consumption in industry, which grew at rate of 12% per year (150 bcm) and in power at 11% per year (220 bcm) in the period 2009 - 2012. The region has more than sufficient supplies for the long term to meet its growing domestic demand, with potential surplus for exports. LNG exports from North America are likely to materialise in the coming years. If all the North American LNG projects currently waiting for permits were to go ahead, this could represent some 29% of global LNG markets by 2020 (129 mtpa). The recently completed US Department of Energy study supports (potentially unlimited) LNG exports due to its economic benefits and this could pave the way to more and faster LNG exports from this region. However we do not believe that all project applications will be granted or will be built. There will be political and financing constraints, leading to our view that less than half of current permits will be built.

GLOBAL UNCONVENTIONAL GAS OUTLOOK

Outside of North America, there is ~260 trillion cubic metres (tcm)\textsuperscript{6} of recoverable unconventional gas (UCG) resource potential within Australia, Europe, MENA, Asia, Russia and Latin American regions, which is largely untapped and has the potential to further impact the global gas market. The success experienced in North America has spurred the interest in these countries to develop their own UCG resources for self sufficiency.

\textsuperscript{6} IEA World Energy Outlook 2012
In our current outlook, UCG contribution towards global supply will mainly come from North America, Europe, China and Australia. In order to understand the impact of more UCG on LNG trade flows, it is important to understand the dynamics of UCG developments in these regions.

**China** has a huge resource base of ~36 tcm of remaining technically recoverable UCG resources. The Chinese government has set ambitious targets for coal bed methane (CBM) production to reach 30 bcm by 2015 and shale gas production to be greater than 60 bcm by 2020. This can only be achieved through an accelerated implementation of infrastructure development, incentives for shale gas development, an increasing number of players/operators to participate in shale gas development and gas price reform roll out. Although shale gas production is increasing in its share of supply, it will not be sufficient to meet the total demand and gas imported as LNG or through pipelines will still be required to supplement supplies. More gas supplies in China could create greater demand for gas; this however does not mean that imported supplies would no longer be required.

UCG opportunities have been identified in **Europe** and **Russia**, although no wells have been drilled to produce and as such the potential has not been tested. Europe, unlike North America, is densely populated, and logistics, planning, and environmental concerns about the impact of fracking will play a big role in unlocking this resource. We predict limited volumes contributing to the European gas supply before 2030.

Like North America, **Australia** has a huge UCG resource base with projects already identified to develop these resources before the end of the decade. Australia lacks a sizeable gas market to monetise the region’s CBM and shale reserves. Limited domestic demand coupled with a growing LNG market in Asia has motivated producers in Australia to pursue gas monetisation through LNG exports. Any future resources found and developed will most likely be exported. Target market due to proximity and existing supply lines will be Asia Pacific.

The UCG potential of South America and the Middle East is still relatively unknown. Large uncertainties due to low gas prices, unattractive fiscal terms and access to water could constrain growth of UCG in these regions.

The success and pace of these developments will have the potential to change the global gas market, just as it has radically changed the North American gas market. Moreover, with the light tight oil (LTO) revolution which is predicted to flood the markets from 2016 on, the volume of associated gas produced would add to the overall uncertainties for future global gas markets.

**CONCLUSION**

Gas and LNG have and will continue to play a very important role in the global energy picture. The growth in gas demand has already led to many new opportunities for LNG, to bridge the long distances between supply and demand regions and to unlock remote gas reserves. If it is to continue to thrive in the future the LNG industry will require substantial investments, continued innovation, and interdependency between the supply and demand countries.

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7 IEA - Golden Age of Gas