Chapter 2

Trends in the Global Gas Market

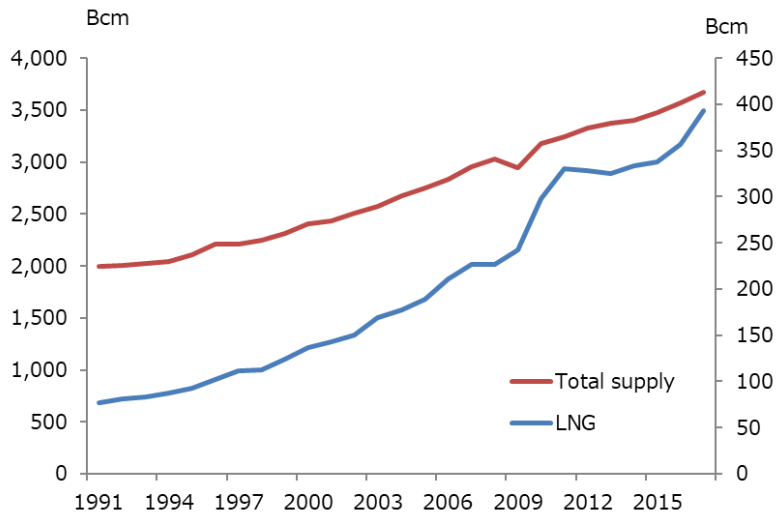
As discussed in Chapter 1, energy prices in Myanmar are regulated and international price levels do not directly affect the country's energy demand. However, the current energy pricing policy may be reviewed and possibly reformed during the period under study (through 2040). Moreover, international price levels, particularly that of liquefied natural gas (LNG), will likely affect LNG imports in the future. Based on these considerations, this chapter explores the supply–demand balance of the international LNG market and its price outlook.

1. Long-Term Outlook of Liquefied Natural Gas Supply and Demand

1.1 Overview

LNG demand in the world has increased remarkably in recent years, from just over 110 million tonnes in 1997 to almost 300 million tonnes in 2017. The LNG industry is relatively young (the first cargo of LNG was shipped from Algeria 54 years ago, in October 1964), and it is expected that the industry will continue to change and evolve.

Figure 2.1: Natural Gas and Liquefied Natural Gas Supply in the World



Bcm = billion cubic metres, LNG = liquefied natural gas.
Source: BP (2018).

The LNG industry's latest expansion phase was characterised by unprecedented transformation. The supply capacity increased dramatically between 2009 and 2011. Then, when the Fukushima Daiichi nuclear plant accident in March 2011 prompted the shutdown of all nuclear power plants in Japan, power companies rushed to secure LNG cargo to compensate for the energy loss. The traditional LNG transaction formula, which assumed a long-term contract, could not fully accommodate the new situation with significantly expanded supply and demand and wide discrepancies in location. Instead, new trading patterns such as spot trading, short-term contracts, arbitrage, equity lifting, and portfolio trading are spreading widely in the global LNG trade.

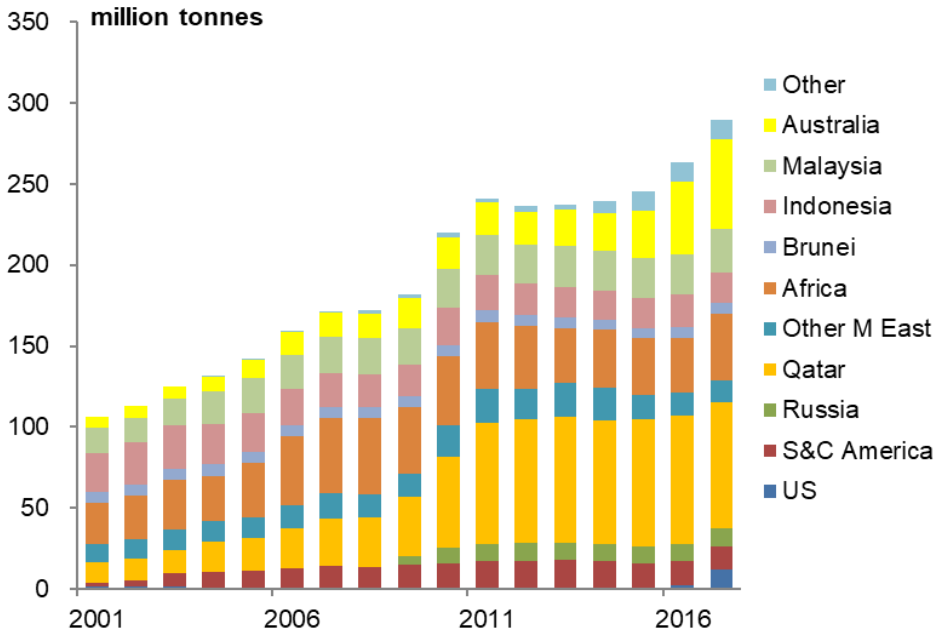
As of 2018, trading patterns are evolving further with the global LNG supply capacity increasing significantly and other LNG importers emerging, such as China. In the ongoing expansion phase, Australia and the United States (US) are increasing their presence as production centres. The wave of big project startups is almost over as the Ichthys and Prelude projects are scheduled to begin in 2018. LNG from the US will bring another layer of flexibility and liquidity to the market, as its supply is free from destination restriction.

On the other hand, emerging LNG importers are more price-elastic than traditional importers such as Japan and the Republic of Korea (henceforth, Korea) and prefer spot or short-term contracts with volume flexibility. This is because the emerging importers have more energy supply options such as domestic production, pipeline imports, coal, or even renewable energy; and LNG is regarded as a 'balancing' energy source rather than 'baseload'. Such demand characteristics are urging LNG producers to be more flexible in their supply to secure buyers.

1.2. Major Producers and Consumers

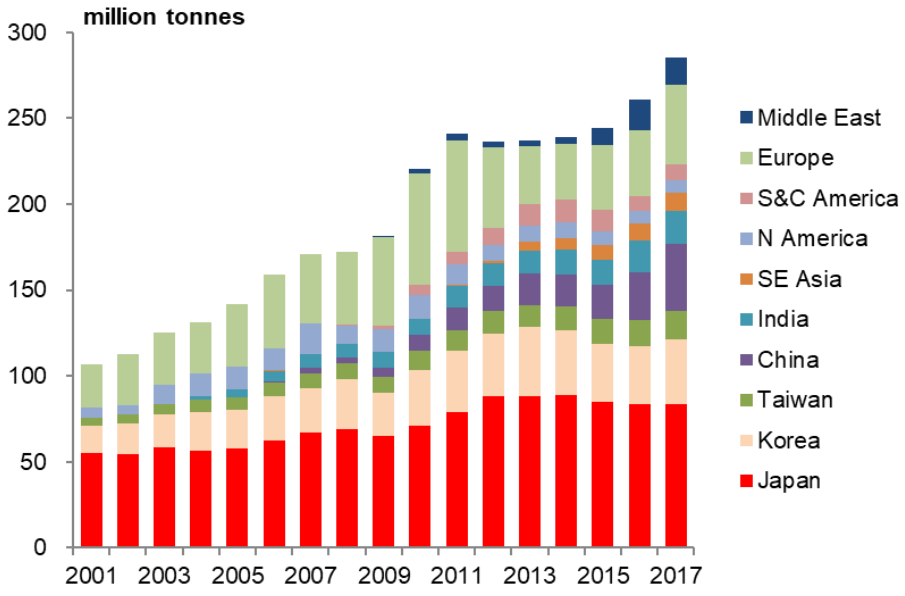
On the supply side, Qatar is by far the largest supplier of LNG, followed by Australia and Malaysia. By region, the share of traditional Southeast Asian suppliers has waned while the presence of the Middle East and Australia has consistently grown (Figure 2.2). With regard to demand, Japan has been the largest consumer of LNG for more than three decades; however, demand has been expanding rapidly in China, which surpassed Korea as the second largest LNG consumer in 2017 (Figure 2.3).

Figure 2.2: World Liquefied Natural Gas Suppliers



Other M East = other Middle East, S&C America = South and Central America, US = United States.
Source: International Group of Liquefied Natural Gas Importers (n.d.).

Figure 2.3: World Liquefied Natural Gas Consumers



N America = North America, S&C America = South and Central America, SE Asia = Southeast Asia.
Source: International Group of Liquefied Natural Gas Importers (n.d.).

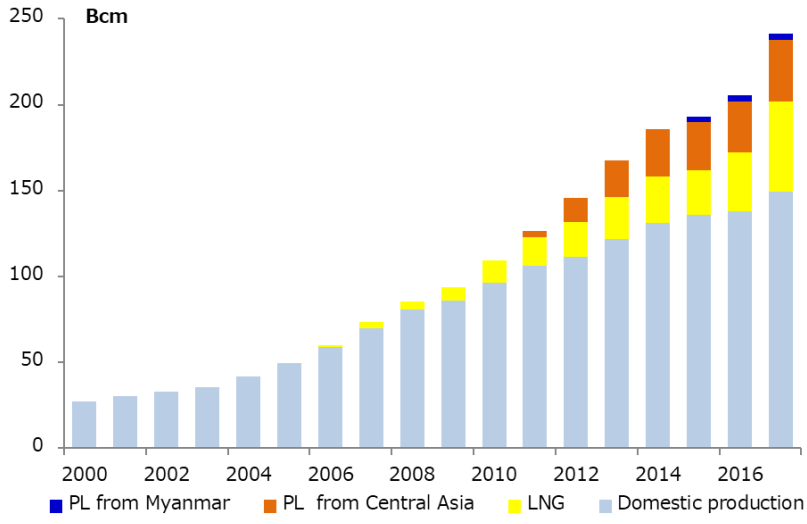
1.3 Key Players and Factors in the International Liquefied Natural Gas Market

China

China is undoubtedly one of the most important players shaping the future conditions of the global LNG market. As one of the largest LNG importers in the world (second only to Japan in 2017), the country already has a significant presence in the international LNG market. However, natural gas only accounted for 7% of the country's total primary energy supply as of 2017, and LNG only supplies 22% of the country's total natural gas demand. Thus, notwithstanding the country's increasing presence and influence in the international LNG market, LNG accounts for only 1.5% of the country's total energy supply. As this share is currently very small, there is significant potential for LNG demand in China to grow.

Of the various factors affecting China's future LNG demand, the most significant is the country's macro economy. In China, natural gas is mainly used by the power and industrial sectors, both of which are more influenced by economic activities than the residential or commercial sectors. Thus, macroeconomic conditions affect the country's natural gas demand more directly. Energy policy is also an important factor. The surge in China's LNG imports in 2016–2017 was largely due to the government's policy to restrict coal consumption to mitigate air pollution in the northeast of the country. The development of its natural gas resources also affects the natural gas balance of the country and thus the volume of its LNG imports. As China is driven to develop more difficult gas resources, including unconventional resources, the speed and extent of the future development of its gas resources will become increasingly uncertain.

Figure 2.4: Natural Gas and Liquefied Natural Gas in China



Bcm = billion cubic metres, LNG = liquefied natural gas, PL = pipeline.
Source: BP (2018), *Statistical Review of the World*. London.

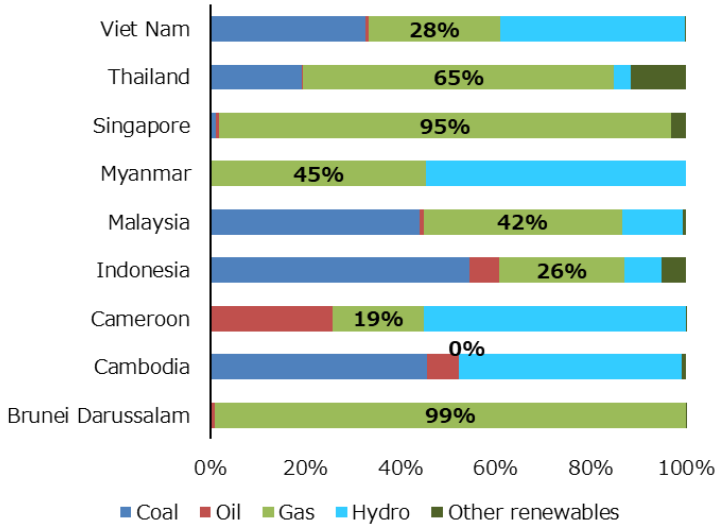
There is also notable uncertainty about when and what volume of natural gas will be imported from Russia by pipeline. In 2014, China agreed to begin importing natural gas from Russia in 2019 (through an international pipeline named the Power of Siberia) at a volume of 38 billion cubic metres per year (equivalent to 28 million tonnes of LNG). However, it is not certain whether the supply will actually start as scheduled, nor what the supplied volume will be, as it is not likely to reach peak volume in the short term due to the variable availability of natural gas. If the project is significantly delayed, China will need to enter the LNG market to make up the volume shortfall.

ASEAN markets

The Association of Southeast Asian Nations (ASEAN) used to be a major LNG-exporting region; however, due to declining domestic natural gas production and increasing domestic energy demand, three ASEAN countries (Indonesia, Malaysia, and Singapore), have begun to import LNG. While ASEAN as a region is predicted to remain a net natural gas exporter until 2030, the region's LNG imports are expected to grow.

The primary LNG demand sectors in ASEAN are the power and industrial sectors. Natural gas is already a major fuel for power generation in many ASEAN countries (Figure 2.5). Due to the sustained growth of electricity demand, public preference for cleaner fuel, and declining domestic production, natural gas will remain a preferred choice for new power generation requirements.

Figure 2.5: Power Generation Mix of Major Association of Southeast Asian Nations Countries (2016)



Hydro = hydropower.
Note: Energy balance data of the Lao People's Democratic Republic are not included in the International Energy Agency Energy Balances database.
Source: Compiled by the Institute of Energy Economics, Japan based on data from the International Energy Agency (2018).

In 2012, Indonesia, the largest LNG supplier in the world until the mid-2000s, became the first ASEAN country to import LNG. This was made necessary by the geographical distance between its demand centre and its natural gas resources. Although most of its natural gas exists in the country's western regions such as Sumatra or Java, efforts to develop its natural gas resources are increasing in the east. At the end of 2017, Indonesia had four receiving terminals in operation (three floating and one onshore) with a total receiving capacity of 9.1 million tonnes per year. In 2017 the country imported 2.64 million tonnes of natural gas.

In Singapore, fossil fuel imports have been the dominant energy supply source as the country is not endowed with energy resources. Singapore began to import natural gas by pipeline from Malaysia in 1992 and from Indonesia in 2001. However, in the first half of the 2000s, Singapore experienced several disruptions to its supply from Indonesia. Indonesia and Malaysia were both facing growing domestic natural gas demand, and were thus expected to have less natural gas available for export. With natural gas playing an increasing role in power generation, in 2006 the Government of Singapore decided to import LNG to diversify its gas supplies further and enhance gas security. The plan was suspended after the 2008 Lehman Crisis, but was restarted under the strong initiative of the Government of Singapore, and the country began to import LNG in 2013. Singapore aims to be a 'hub' of the Asian LNG market and has been quite active in expanding its receiving terminal facilities to allow LNG bunkering or to launch an LNG futures trading market.

In Malaysia, as in Indonesia, a geographical gap between natural gas resources and gas demand has forced the country to begin importing LNG. Although Malaysia is still the world's third largest LNG producer (after Qatar and Australia), the country has imported LNG since 2013. This is because the country's major centres such as Kuala Lumpur are located in the Malay Peninsula on the west side of the country, while its major natural gas resources are in Sarawak in the east. The demand in the Malay Peninsula used to be supplied from offshore production, but as this began to decline and demand to increase, Malaysia had to find another supply source to meet the demand in the peninsula. Building a pipeline connection from Sarawak to the Malay Peninsula was difficult because of the great distance between the two (over 1,000 kilometres). Therefore, Malaysia decided to import LNG. At the end of 2017, a single LNG terminal was operating in Port Dickson.

In 2011, Thailand began importing LNG at the Map Ta Phut receiving terminal, to fill the gap between the growing demand for natural gas and declining domestic offshore natural gas production. PTT initially procured LNG on a spot-contract basis, but began to

import LNG on long-term contract with Qatar in 2015. Demand reached almost 4 million tonnes per year in 2018, and most of the imported LNG is used by the power generation sector. Domestic production is likely to continue to decline, and LNG demand is also forecasted to increase in the future. Since the existing terminal can accommodate 10 million tonnes of imported LNG per year, the country's LNG import can increase if additional demand for natural gas is developed.

In the Philippines, decreasing production of natural gas is driving the country to find an alternative source. The service contract of the Malampaya gas field will expire in 2024, and the field is expected to cease production after this date. The field supplies gas to three power plants in Batangas, and these supply 30% of the total power demand in Luzon (the country's most populous island). The only realistic alternative to the field's gas production is LNG, and the country is planning to initiate LNG imports as early as 2023.

ASEAN is expected to be a key market for small-scale LNG projects. In archipelagic countries such as Indonesia and Philippines, many islands have been using oil products for power generation for a long time, and replacing old and inefficient oil-fired power generation with more efficient natural gas systems is seen as economically justifiable. The largest barrier to extending small-scale LNG to smaller islands is cost. Therefore, to extend the small-scale LNG supply network in ASEAN it is critical to consider how sufficient demand is aggregated and generated, and logistic operation can be optimised.

South Asia

South Asia is another driver of future LNG demand growth. In India, the largest LNG users are oil refineries, followed by the fertiliser industry and industrial users. All of these users are very sensitive to prices as they have alternative options for sourcing energy other than importing LNG. Although LNG is also used for power generation, due to subsidised electricity prices imported LNG is not a preferred fuel, despite a decrease in import prices since 2016.

Unlike China, India does not import gas via pipelines. International pipeline connections are planned from Turkmenistan and from Iran, but these projects have not progressed due to security and geopolitical concerns, and they are not expected to materialise soon.

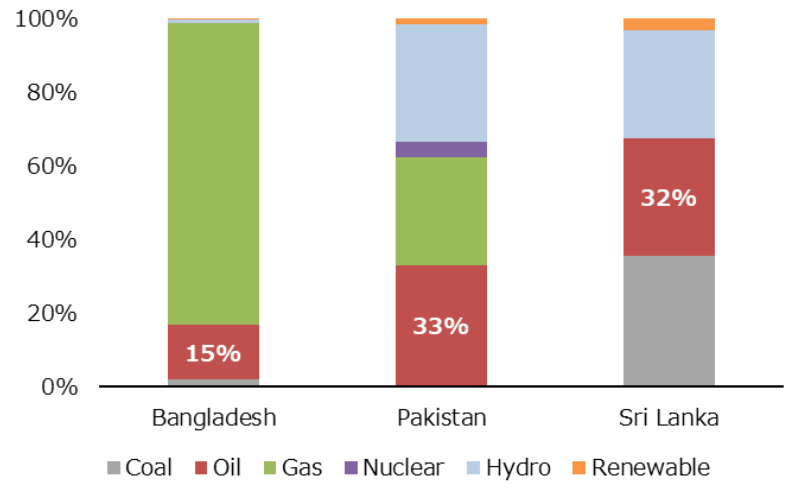
Since India's LNG demand is highly price-elastic, the market balance and price level of international LNG markets will greatly influence the country's import volume. Regulated energy prices discourage Indian buyers from procuring LNG if the market price is high.

Infrastructure for LNG-receiving facilities is another challenge. Currently LNG is mainly used in coastal areas near receiving facilities due to a lack of infrastructure. If pipeline infrastructure to the country's interior is developed, it will cultivate new demand.

Elsewhere in South Asia, LNG demand in Pakistan, Bangladesh, and Sri Lanka has attracted considerable attention over the past few years due to the regions' significant demand potential. Pakistan imported almost 3 million tonnes of LNG since 2016, and its demand growth is expected to continue. Bangladesh began importing LNG in 2018 to address its severe energy supply shortage problem, partly a result of stagnant domestic natural gas production.

Besides the ever-increasing domestic energy demand, South Asian countries share a high dependence on oil in the power sector (Figure 2.6). Most of this is fuel oil or diesel oil whose price is linked to international crude oil prices. If the LNG price stays below oil product prices, which is mostly the case, replacing oil with LNG will make economic sense.

Figure 2.6: Power Generation Mix in Pakistan and Bangladesh (as of 2016)



Hydro = hydropower.
Source: International Energy Agency (2018).

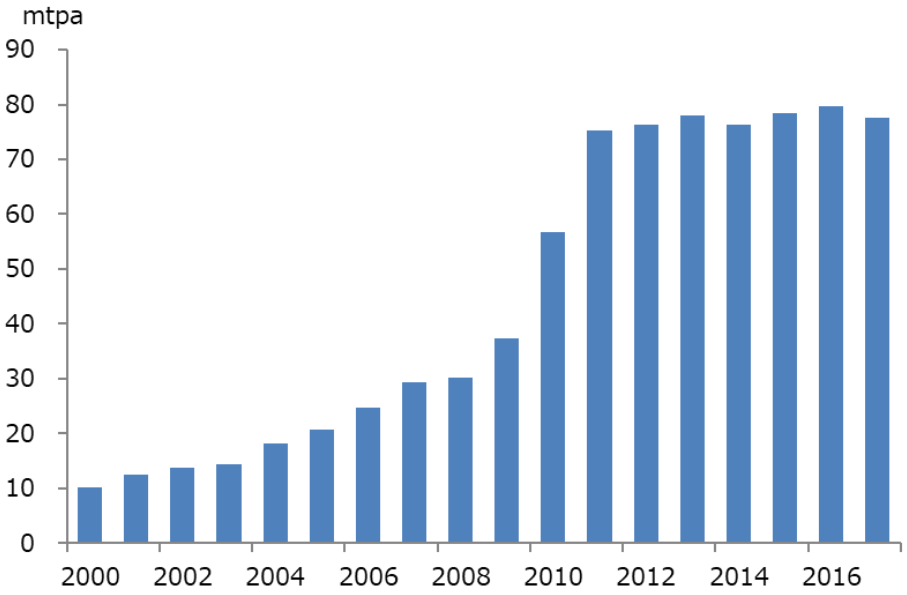
Pakistan and Bangladesh are also both natural gas-producing countries; however, their future in this regard is not bright. In Pakistan, natural gas production peaked in 2012 and has been slowly declining. In Bangladesh, although domestic production is still growing, this growth is too short by far to meet the rapidly growing domestic demand, and it is uncertain how long production will continue to grow. Thus, it is inevitable that these two countries will need to find an additional source of natural gas. One positive factor for these two countries is that they already have the necessary infrastructure for the use of natural gas,

which will greatly facilitate the introduction of imported LNG.

Qatari expansion

Qatar is a major supply-side player that affects the future balance of the world LNG market. In April 2017, the country announced that it was lifting the moratorium on new liquefaction capacity development that it adopted in 2005, and announced plans to expand its annual liquefaction capacity from 77 million tonnes to 100 million tonnes by 2024. Saad Sherida Al Kaabi, the chief executive officer of QP (Qatar's national oil company), suggested that this could even be raised to 110 million tonnes (Shoeb, 2018). Due to its vast natural gas reserves, the historical record of supply stability and reliability, and the cost competitiveness of its LNG, Qatar has played a key role in ensuring the sound development of the global LNG market. This capacity expansion will strengthen Qatar's presence and influence on the world LNG market in the future. The expansion project is expected to include the debottlenecking of existing liquefaction trains and construction of new trains. Japan's Chiyoda Corporation has been awarded a front-end engineering design study of the debottlenecking projects.

Figure 2.7: Qatar's Liquefied Natural Gas Export Volume



mtpa = million tonnes per annum.
Source: International Group of Liquefied Natural Gas Importers (n.d.)

Qatar's expansion plan, however, may cause adverse side-effects for the future LNG market because other new and relatively high-cost liquefaction projects may grow concerned about competing against Qatar to secure LNG buyers and thus defer final investment decisions. Of course, the Qatari expansion alone will be unable to meet the growing global demand for LNG, and timely investments in other projects is necessary. Any

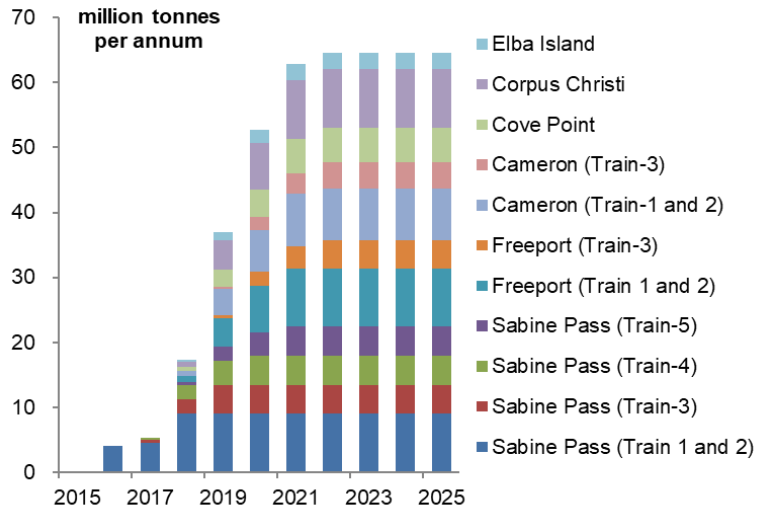
unexpected delays in the Qatari expansion may result in unexpected supply crunches during the 2020s if investment in other projects is insufficient. Therefore, the size and timing of the Qatar expansion will be a critical supply factor to shape the future LNG market balance.

Surge of the United States' liquefied natural gas supply

The US is one of the oldest LNG suppliers in the world. LNG exports from Alaska contributed greatly to the early development of the Asian LNG market. Backed by the significant expansion of its natural gas resource base and production, the US began to export LNG from the lower 48 states in February 2016, and it may reach an annual supply capacity of around 60 million tonnes by 2020.

The American LNG supply has the potential to bring significant change to both the physical supply–demand balance and trading pattern of the global LNG market. The rapid expansion of the country's supply capacity (around 18 million tonnes per year at the end of 2017) has already provided a new global supply source and accelerated the supply surplus since 2014. The scheduled supply capacity expansion will help maintain the current surplus balance well into the 2020s. The peculiar aspect of American LNG is its flexibility. Unlike traditional LNG suppliers, the US does not impose any destination restrictions on its LNG, and exports can be resold to other parties depending on market conditions. This flexibility will activate the spot trading of LNG cargoes, and may change current pricing practices based on the crude oil price by creating a more transparent benchmark. Such pricing practice changes can take time, but it can certainly change the structure of the LNG market.

Figure 2.8: United States Liquefied Natural Gas Export Capacity Outlook



LNG = liquefied natural gas.
Source: Institute of Energy Economics, Japan based on publicly available information.

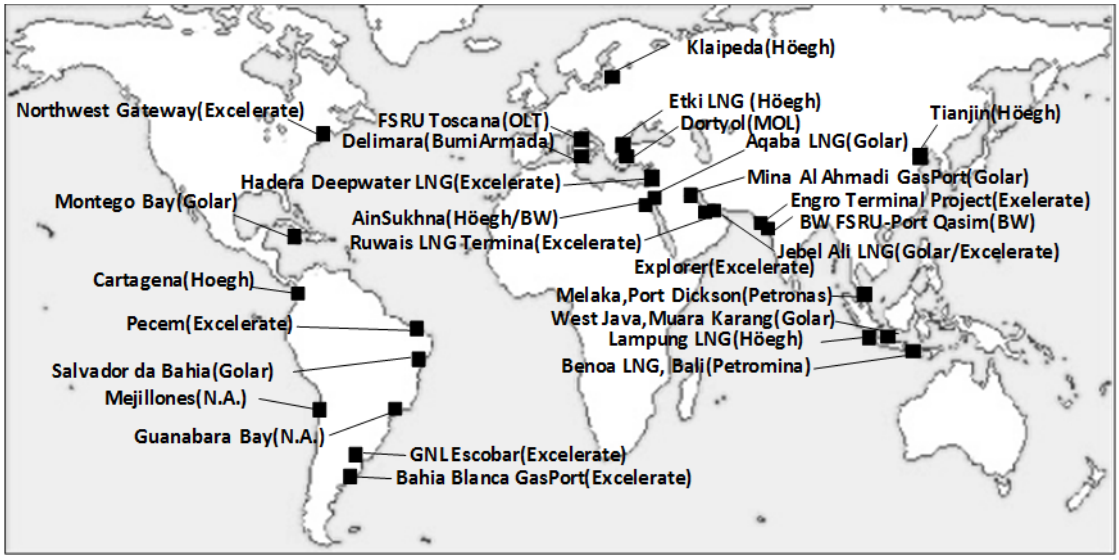
Adoption of floating technologies

The application of floating liquefaction and regasification technology is expanding in the international LNG market. Floating liquefaction refers to a liquefaction facility on a floating object. The only floating liquefaction facility in operation at the end of 2017 was the Petronas Floating LNG project in Malaysia; two more projects, Prelude Floating LNG in Australia and Cameroon LNG in Cameroon, are under construction as of the end of September 2018. The biggest benefit of this technology is that land is not needed for the construction of a liquefaction facility. Minimising construction work at the site saves time securing land and minimises the labour cost of constructing the facility. Drawbacks of floating liquefaction include high initial capital expenditures per unit, limits on future capacity expansion, and operational vulnerability to sea and weather conditions. These drawbacks may be solved by modifying and utilising existing LNG tankers as floating liquefaction facilities, adopting lease arrangements once the technology becomes universally acceptable, and using learning-by-doing processes in operation.

Floating technology has been adopted and utilised more widely for regasification. At the end of 2017, 29 floating storage and regasification units (FSRUs) were in operation. Like floating liquefaction, FSRUs do not require an onshore site, thus offering a number of benefits to the receiving country.

There are several drawbacks to an FSRU. Its operating expenses are higher than those of conventional onshore receiving terminals, and its receiving capacity usually cannot be expanded. In an LNG-importing country whose LNG demand is expected to grow steadily, an onshore receiving terminal is a more reasonable option in the long term. However, FSRUs are often preferred in emerging countries because the initial capital expenditure is significantly lower (roughly half that of an onshore facility of the same capacity), and it can be introduced more quickly, usually within a year or so. The lower initial payment in particular will be a very appealing aspect of FSRUs, as emerging LNG importers often have limited financial resources for infrastructure development. In fact, FSRUs have played a significant role in lowering the hurdle of LNG introduction and enabled several countries to access LNG. In February 2018, 53 FSRU projects are planned to begin operating, and the application of this technology is likely to grow quickly in the future.

Figure 2.9: Floating Storage and Regasification Units Projects in the World

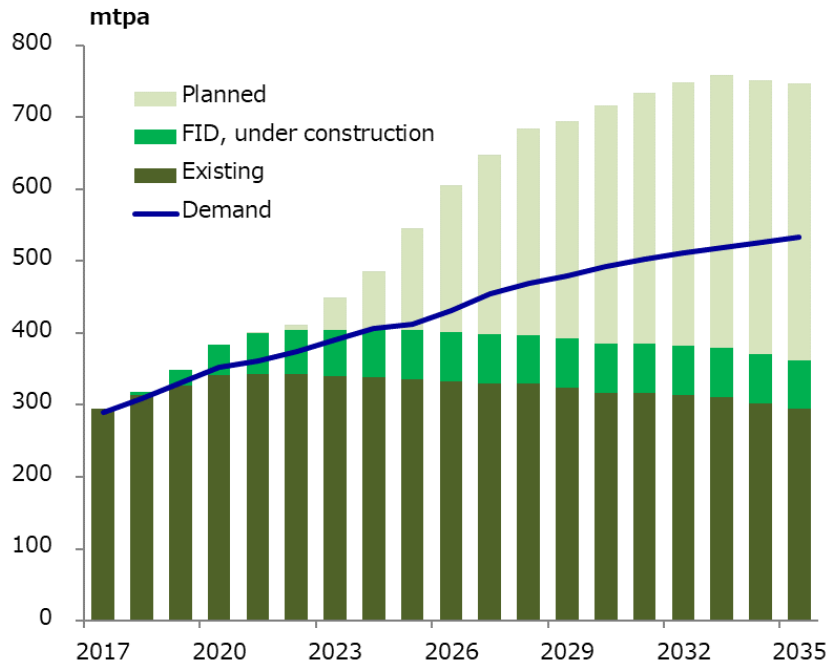


FSRU = floating storage and reunification units, N.A. = not available.
Source: Compiled by the Institute of Energy Economics, Japan based on publicly available information.

1.4 Long-Term Liquefied Natural Gas Demand and Supply Balance

Based on the above observations and the world energy outlook provided by the Institute of Energy Economics, Japan (IEEJ) (IEEJ, 2017), Figure 2.10 shows the long-term LNG demand and supply outlook. The IEEJ estimated LNG demand by assessing natural gas demand, natural gas production, and pipeline trade in existing and future LNG-importing countries. The world LNG demand is expected to rise to around 350 million tonnes in 2020 and 500 million tonnes in 2030. On the supply side, three categories of capacity are calculated: existing capacity, capacity under construction, and planned capacity awaiting final investment decisions. The sum of existing capacity and capacity under construction is considered to be firm. This capacity will rise to around 400 million tonnes in 2020, but will gradually decline towards 2035 as existing capacity depletes.

Figure 2.10: Long-Term Liquefied Natural Gas Demand and Supply Balance until 2030



FID = final investment decision, mtpa = million tonnes per annum.
Source: Institute of Energy Economics, Japan analysis.

The firm capacity will exceed demand until the mid-2020s, suggesting that the surplus supply balance will continue in the short and medium term. After the mid-2020s, however, demand will overtake the firm capacity, and the market may become tight if the planned capacity is not realised. In 2016–2017, only one or two final investment decisions (FIDs) were realised due to lower international oil and gas prices. In 2018, only two FIDs were made (as of September). The risk of a supply crunch has increased gradually but steadily. To avoid supply shortages, timely FIDs and swift realisation of planned liquefaction projects are strongly needed.

3. Long-Term Price Scenarios

The most decisive factor in economic evaluations is the estimation of international oil and gas prices. In this sense, price scenario setting is an important factor that determines the success or failure of a project.

3.1. Natural Gas Price

In the summer of 2014 triggered by the shale revolution in the US, crude oil and natural gas prices plunged from historic highs. The world crude oil price began to recover in 2017, largely due to sustained global demand growth and collective production cuts by the Organization of the Petroleum Exporting Countries and other countries. Due to the recovery of the crude oil price and its remaining link to the LNG price, the LNG price in Asia began to rise again although the Henry Hub, a benchmark price in the US, remains low.

In the US, the first LNG exports from the lower 48 states were shipped from Sabine Pass, Texas in February 2016. When these exports began, the difference between the Henry Hub and Asian LNG prices was small, and American LNG exports did not make economic sense. However, thanks to rising crude prices since 2017, the differential has widened, activating exports to Asia.

In the global gas market, Asia is expected to remain the main source of demand growth. The European market will maintain its advantageous market conditions whereby it can secure import supplies from a wide range of sources (including Russia, Africa, the Middle East, and the US). Meanwhile, the price gap between the European and the Asian markets will gradually diminish due to a number of new LNG projects being launched around the world, especially the Pacific rim region.

Based on the above analysis, the following price forecast is provided:

(i) Although they will not reach previous levels, by 2020 natural gas prices will rebound from the present level to the following:

  (a) US Henry Hub = $3.0/million British thermal units (MMBtu)–$5.2/MMBtu

  (b) British National Balancing Point = $5.8/MMBtu–$8.9/MMBtu

  (c) Asian LNG cost + insurance + freight = $8.1/MMBtu–$10.4/MMBtu

(ii) Gas prices will continue to increase after 2020 but much more slowly as an ample gas supply will come into the market at higher prices.

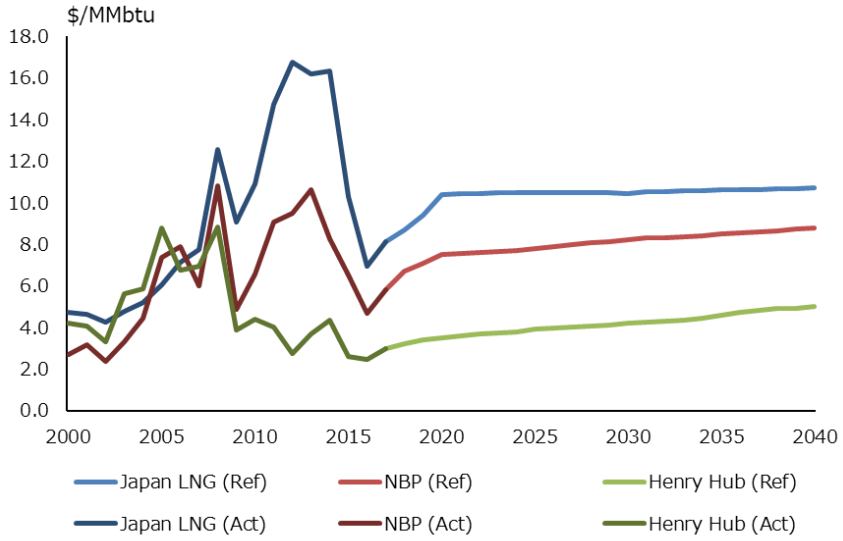
(iii) Price differences among markets will continue, but will be much smaller than the Asian premiums seen in the early 2010s, being regulated by a much easier market arbitrage balance after the Panama Canal expansion in 2016.

Table 2.1: Natural Gas Price Outlook

	Asia LNG CIF $/Mmbtu	Europe NBP $/Mmbtu	US Henry Hub $/Mmbtu
2017	8.1	5.8	3.0
2020	10.4	7.5	3.5
2030	10.5	8.2	4.2
2040	10.7	8.8	5.0

CIF = cost + insurance + freight, LNG = liquefied natural gas, MMbtu = million British thermal units, NBP = national balancing point, US = United States.
Source: Institute of Energy Economics, Japan analysis.

Figure 2.11: World Natural Gas Price Outlook



Act = actual, LNG = liquefied natural gas, MMbtu = million British thermal units, NBP = national balancing point, Ref = reference.
Source: Institute of Energy Economics, Japan analysis.

3.2. Crude Oil Price Outlook

The 2014 shale revolution substantially affected crude oil prices in the US. After collapsing to $35 per barrel (bbl) in December 2014, oil prices have gradually bounced back, reaching $75/bbl in September 2018. Despite supply pressure from US, tight oil has thus far been less evident than in the mid-2010s. If the crude oil price exceeds a certain threshold price, tight oil production may increase once again. In addition, advanced hydrofracking technologies are being applied to conventional oil fields, which may lead to increased recovery.

On the demand side, oil consumption will maintain solid growth backed by the global economic growth. Most of this will be seen in countries not in the Organisation for Economic Co-operation and Development. Although electric vehicles have attracted a lot of attention, this fleet remains too small to reduce demand noticeably. This study projects that the global oil demand will continue to grow until at least 2030; prior to this date, the global oil demand is not likely to peak nor will the price of oil fall significantly due to lower demand.

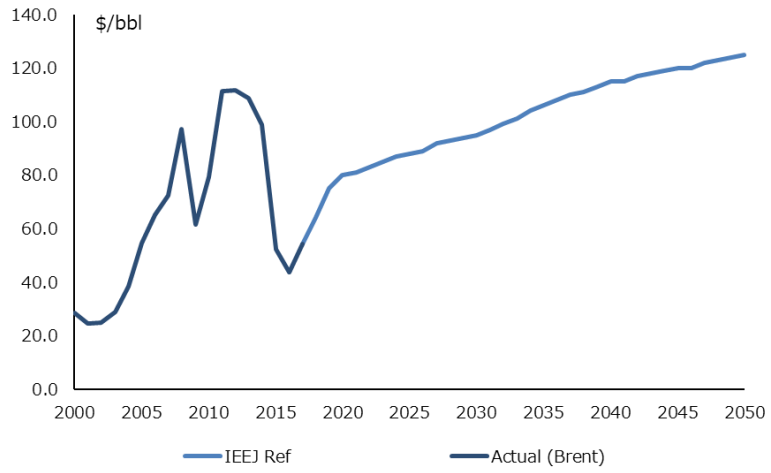
Based on this evaluation, it is estimated that the international price of crude oil will rise gradually to $95/bbl in 2030 and $115/bbl in 2040.

Table 2.2: Oil Price Outlook

Year	Brent $/bbl
2017	54
2020	80
2030	95
2040	115

bbl = barrel.
Source: Institute of Energy Economics, Japan analysis.

Figure 2.12: Oil Price Outlook



bbl = barrels; IEEJ = Institute of Energy Economics, Japan; Ref = reference.
Source: IEEJ analysis.

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