



Developing liquidity in the LNG market

Asia's challenges and outlook

January 2017

kpmg.com/energy



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Introduction

- The LNG market remains an illiquid market, where trading based on long-term contracts with inflexible contractual terms is the mainstream. Market participants are hoping for a transformation of the LNG trading market into a liquid and open market.
- The purpose of this report is to bring to light the realities of a predawn market. We will first review the reasons for the need to develop an LNG trading market (Chapter 1), investigate the situation at the forefront of the market through interviews in Singapore and Japan (Chapter 2) and highlight the position of the LNG market by comparing it to other commodity markets (Chapter 3) before reviewing the challenges and outlook for this market (Chapter 4) and offering market participants a perspective for the future as our conclusion ("Conclusion").

The environment surrounding LNG trading has been undergoing significant changes in the last few years, including the fall in spot LNG prices stemming from the fall in crude oil prices since 2014 and the emergence of new LNG importers and suppliers. Nevertheless, the LNG market remains illiquid, with trading based on long-term contracts with inflexible contractual terms still the dominant market practice.

Notably, the Japanese power and gas markets are experiencing heightened uncertainty over the country's LNG demand due to the progress of regulatory reform known as the "Power and Gas Systems Reform." In response to this situation, Japanese LNG buyers including power and gas utilities are beginning to actively optimize their LNG portfolios with respect

to fuel procurement and selling (management)¹ by reviewing contractual terms, procuring LNG more flexibly, agilely reselling their LNG holdings in response to market conditions. Thus, establishing an LNG trading market is expected to be a prerequisite for improving flexibility in LNG procurement and sales.

The LNG market has developed mainly in Northeast Asia — i.e. Japan, Korea and Taiwan — a region without connections to global pipeline networks. Partly due to the influence of the market conditions prevailing in the early days of LNG procurement — which started after the oil shocks in the 1970s — which gave sellers the upper hand, trading based on long-term contracts with inflexible and exclusive contractual terms

Chart 1-1. LNG importers around the world



Source: KPMG based on Wood Mackenzie research

¹ ALM at financial institutions is meant to maximize the profit through the optimization of "funding and investment." Accordingly, referring to it simply as "selling" brings about risks of viewing "optimized operation" in its narrow sense since investment management of the procured fuel as an asset will be more and more important. We expect, however, that the use of these terms will be determined in due course depending on how the development of liquidity in the LNG market and the diversification of the products traded, including financial instruments, evolve and the extent to which market players use the market in response.

gradually becoming the norm in LNG trading. As a result, a liquid market did not develop for a long time.

In recent years, however, the increase in the number of new LNG buyers in Europe, South Asia, the Middle East and elsewhere is causing trends not previously seen in the traditional LNG market. A market participant in Singapore noted, "The widespread use of floating LNG storage and regasification units (FSRU) can be cited as one reason for the increase in new LNG importers. Using FSRU has made it possible to introduce flexible LNG import facilities with relatively small investments."

These new LNG importers are giving diversity to the LNG market by procuring mainly from the spot market relying on long-term contracts² and procuring at price terms that are different from the conventional ones.

Spot LNG prices have been on a downtrend since 2014. The main factor behind this is the fall in LNG prices caused by weak crude oil prices — which were already weak due to the global recession but plunged when it became clear that OPEC

would not resolve to cut production to maintain prices at its meeting in November 2014, as well as eased geopolitical risks. As for factors specific in the LNG market, a market participant in Singapore pointed out, "One factor was that an oversupply created by the LNG supplies from new producers like Papua New Guinea, coupled with lower LNG demand due to a warm winter in Northeast Asia, depressed spot prices." Considering, among other factors, that exports will begin from the LNG projects currently under construction in North America and Australia, the supply of LNG is expected to continue growing (Table 1-1), and the trend of low LNG prices is expected to continue for a while.

At the same time, low LNG prices are expected to affect the plans of future LNG projects. There is an increasing number of cases in which the final investment decision³ is deferred⁴ since low LNG prices have made it difficult to cover the capital cost of LNG projects and financial institutions have become reluctant to finance them. The decrease in the number of LNG projects results in less LNG production in the medium to long term and could ultimately turn into a factor that drives up the price of LNG.

Table 1-1. LNG projects under construction

Country	Project	Volume(bcm/y)	Shipment begins in
Australia	Gorgon(T2)	7.1	2016
Indonesia	Sengkang LNG	2.7	2016
Malaysia	MLNG T 9	4.9	2016
Malaysia	PFLNG SATU	1.6	2016
Australia	Wheatstone LNG	12.1	2017
Australia	Gorgon (T3)	7.1	2017
United States	Cove Point LNG	7.1	2017
United States	Sabine Pass (T3-T4)	12.2	2017
Cameroon	Cameroon FLNG	1.6	2017
Russia	Yamal LNG (T1-T3)	22.4	2017
Australia	Prelude FLNG	4.9	2018
Australia	Ichthys LNG (T1-T2)	12.1	2018
United States	Freeport LNG (T1-T3)	18.0	2018
United States	Corpus Christi LNG (T1-T2)	12.2	2018
United States	Sabine Pass (T5)	6.1	2018
United States	Cameron LNG (T1-T3)	18.3	2018
Total		150.5	

Source: IEA

² Market participants in Singapore note, "The increased demand will be covered with spot contracts."

³ FID (Final Investment Decision)

⁴ "Shock of low oil prices (1): FID postponements on new projects revealed" Rim Energy News

<https://www.rim-intelligence.co.jp/news/select/category/feature/article/580055>

A Singaporean information vendor also notes, "Due to low LNG prices, there are few FIDs made and banks are also hesitant to lend."

Japan has long been buying LNG from Malaysia, Australia, Qatar, etc. based mainly on long-term contracts linked to crude oil price (Table 1-2). However, when nuclear power plants were suspended across the country in response to the accident at the Fukushima No.1 Nuclear Power Plant following the Great East Japan Earthquake in March 2011, the country substituted nuclear power generation with thermal power generation and other means (Table 1-3). This had a considerable impact on Japan's LNG procurement strategy.

The subsequent turn of events made it unlikely that nuclear power generation would restart soon and, in response to this situation, power and gas utilities have been actively increasing spot LNG trading, concluding new long-term contracts, and investing in LNG projects in the US, Australia and elsewhere to significantly increase their LNG procurement as part of an effort to ensure stable procurement of primary energies.

On the other hand, the demand for electricity is not expected to return to pre-earthquake levels after the drop in the wake of the earthquake, partly due to the rapid spread of the awareness for power and energy conservation after the disaster. Japan's demand for LNG is expected to decrease in the long term due to its shrinking population, among other factors⁵, which is causing concerns about potential future redundancies in LNG procurement.

The Japanese government's projection for the power mix until 2030 (Table 1-4) assumes a large increase of renewable energy and restarting of the nuclear power plants. While the reduction in future LNG demand might be smaller than currently anticipated if those assumptions do not materialize, the basic policy of reducing the proportion of thermal power generation will be unchanged. Hence, a higher demand for LNG for thermal power generation in the future cannot be expected.

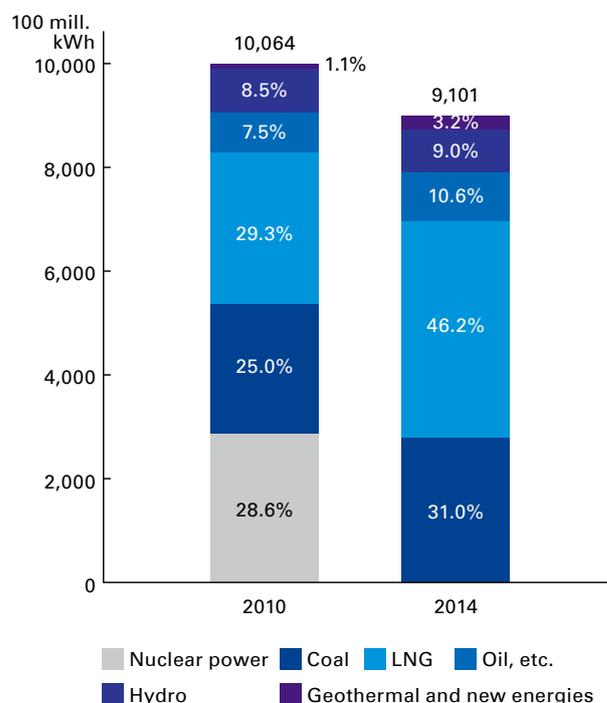
Japan's imports of LNG are expected to increase further from 2018, when imports from North America begin (Table 1-5). Coupled with the expected decrease in future demand, there is a growing sense of oversupply of LNG in the country. Moreover, due to the full liberalization of retail markets that took place in the power sector in 2016 and is to take place in the gas sector in 2017, power and gas utilities will have to bear the market price risks that they had traditionally been able to pass through to the consumers under the full-cost principle and other arrangements. Mitigating risks and securing flexibility in the procurement of LNG has become an urgent issue to enable Japanese power and gas utilities to maintain their market competitiveness under these circumstances.

Table1-2. Origin of Japan's LNG imports(2014)

Country	Import volume (000 tons)	Share
Australia	18,336	20.6%
Malaysia	15,318	17.2%
Indonesia	5,184	5.8%
Brunei	4,431	5.0%
Papua New Guinea	3,403	3.8%
Qatar	16,500	18.5%
United Arab Emirates	5,695	6.4%
Oman	3,002	3.4%
Yemen	957	1.1%
Russia	8,514	9.6%
Nigeria	5,108	5.7%
Other	2,627	2.9%
Total	89,075	100.0%

Source: Agency of Natural Resources and Energy

Table 1-3. Japan's power generation by energy source before and after the earthquake



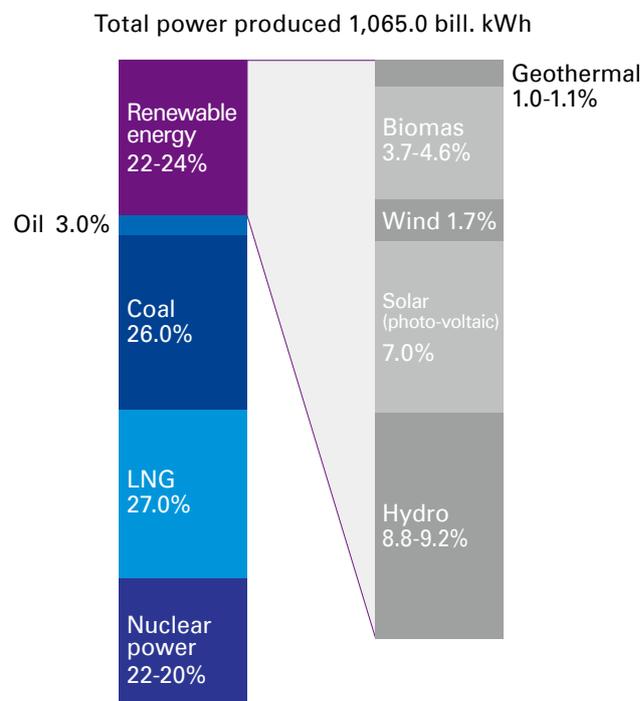
Note: Aggregate of ten power utilities including power purchased from other companies. "Oil, etc." includes LPG and other gases.

Source: KPMG based on "Power generation mix by energy source, May 20, 2016" by Federation of Electric Power Companies (http://www.fepc.or.jp/about_us/pr/pdf/kaiken_s3_20160520_1.pdf)

5 Multiple market participants in Singapore noted, "While LNG demand in Japan is expected to decrease, demand in Korea, China, and Taiwan is expected to increase and be the main drivers of demand growth," and "LNG demand in China and in other Asian countries is expected to grow."

Regarding Japan's LNG market strategy, if Japan tries to be an LNG hub under Japan's initiative, it will tend to result in focusing entirely on a closed strategy. For this reason, it is necessary to build Japan's competitive advantages within an open strategy that takes all of Asia into consideration. Since demand alone does not constitute a market, Japanese players need to find ways to secure profits in two-way trading straddling diverse countries and areas. Moreover, when reselling LNG in the secondary market, they will need to anticipate the possibility of their primary market suppliers becoming competitors. In addition, they will also need to improve their trading risk management to address the transformation of the LNG market into a financial market, as has happened in other commodity markets.

The purpose of this report is to bring to light these realities of a predawn market. We will first review the reasons for the need to develop an LNG trading market (Chapter 1), investigate the situation at the forefront of the market through interviews in Singapore and Japan (Chapter 2) and highlight the position of the LNG market by comparing it to other commodity markets (Chapter 3) before reviewing the challenges and outlook for this market (Chapter 4) and offering market participants a perspective for the future as our conclusion ("Conclusion").

Table 1-4. Japan's power mix in 2030


Source: KPMG based on "Long-term energy demand and supply outlook, July, 2015" by Ministry of Economy and Trade (http://www.meti.go.jp/press/2015/07/20150716004/20150716004_2.pdf)

Table 1-5. Participation of Japanese LNG players in North American LNG projects

	Liquefaction contract holder	LNG off-taker
Freeport LNG	Osaka Gas (2.2 mill. tons p.a.)	Osaka Gas (2.2 mill. tons p.a.)
	Chubu Electric (2.2 mill. tons p.a.)	Chubu Electric (2.2 mill. tons p.a.)
	Toshiba (2.2 mill. tons p.a.)	Toshiba (2.2 mill. tons p.a.)
Cameron LNG	Mitsubishi Corp. (4 mill. tons p.a.)	Tokyo Electric (0.8 mill. tons p.a.)
	Mitsui & Co. (4 mill. tons p.a.)	Tohoku Electric (0.57 mill. tons p.a.)
	ENGIE (4 mill. tons p.a.)	Toho Gas (0.3 mill. tons p.a.)
		Kansai Electric (0.4 mill. tons p.a.)
Cove Point LNG	Sumitomo Corp., Tokyo Gas (2.3 mill. tons p.a.)	Tokyo Gas (0.52 mill. tons p.a.)
		Tokyo Gas (1.4 mill. tons p.a.) Kansai Electric (0.8 mill. tons p.a.)

Source: KPMG based on various materials

CHAPTER 1

Three reasons to develop an LNG trading market

- Triggered by the regulatory reform known as the Power and Gas Market Systems Reform in Japan, the largest LNG consumer, there is heightened momentum to optimize procurement portfolios through more flexible LNG procurement and reselling.
- The addition of new LNG-importing countries and other factors are expected to create a growing need for trading to conduct flexible buying and selling of LNG.
- This chapter discusses the need to develop a global trading market for LNG, similar to those for crude oil and coal; focusing on three reasons.

The domestic energy markets of the Asian countries that consume large amounts of LNG have been relatively slow in implementation of regulatory reform when compared to Western markets. Among them, however, Japan, the largest consumer of LNG, is currently in the midst of a regulatory reform of its power and gas markets ("Power and Gas Systems Reform"), which will fully liberalize the retail gas market from April 2017, following the full liberalization of the retail electricity market in April 2016. The legal unbundling of transmission/distribution in the power sector and the gas pipeline networks in the gas sector are to be implemented in 2020 and 2022, respectively⁶.

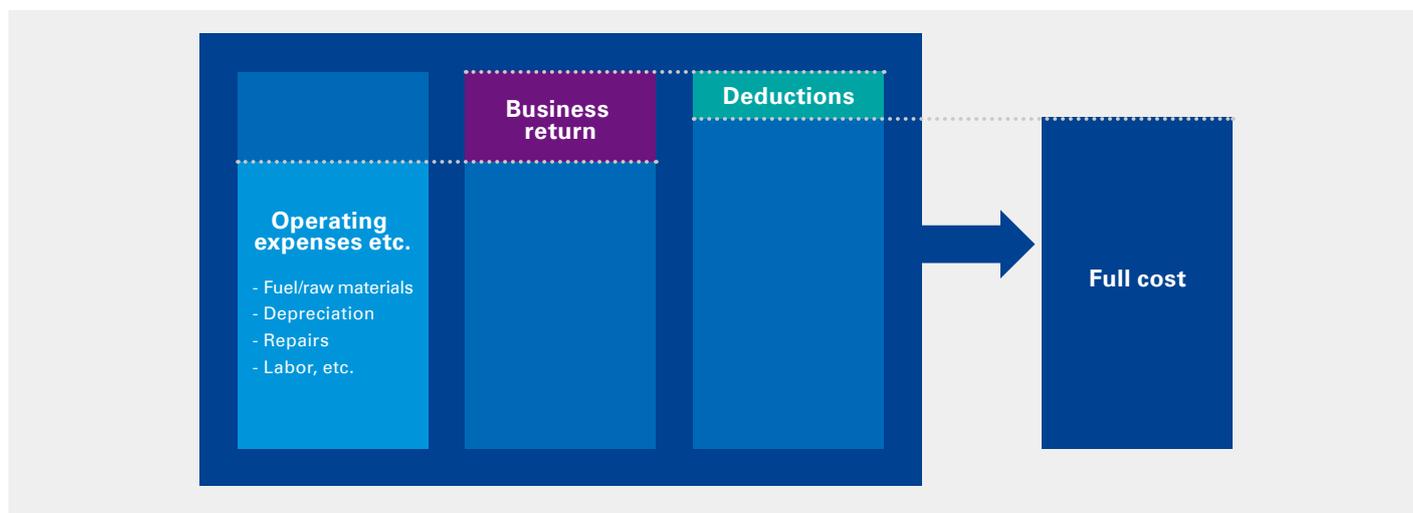
Various factors, including the increased supply capacity of other power sources (e.g. increased renewable energy and restarting of the nuclear power plants) and lower energy demand due to shrinking population and other factors, coupled with intensified market competition as a result of the regulatory reform, are causing concerns over Japan's domestic demand for LNG.

In fact, due to such concerns, there is a growing momentum among Japanese LNG buyers to optimize their procurement portfolios by switching to more flexible contractual terms regarding off-take volumes, contract period, and the destination clause.

These circumstances, combined with other factors such as the increasing number of new LNG importers and other trends encouraging the development of liquidity in the market are requiring LNG players to respond to the transforming LNG market. Due to these reasons, we expect a growing need for trading that enables flexible buying and selling of LNG.

A flexible and global trading market for LNG — similar to those for crude oil and coal — needs to be developed to solve issues such as securing flexibility in LNG trading and utilization of a marketplace to trade LNG.

Chart 2-1. Determination of the "full-cost"



Source: KPMG based on "Regarding gas tariff system, July 12, 2013" (http://www.meti.go.jp/committee/sougouenergy/denryoku_gas/gas_ryokin/pdf/001_05_00.pdf) by Ministry of Economy and Trade.

6 To be implemented concurrently with the "removal of retail rates regulations" after an assessment of the competitive environment over 2018-20.

Securing hedging tools against price risk

- **Japanese power and gas utilities have traditionally been able to pass through the fuel price risk to consumers thanks to the full-cost principle. However, with the full liberalization of retail power and gas markets, they are now facing fuel price risk.**
- **Given the absence of direct hedging tools at present, unlike for crude oil and coal, an LNG trading market needs to be developed to hedge the risk.**

Thanks to the full-cost principle (Chart 2-1) and the fuel cost adjustment system⁷ Japanese power and gas utilities have traditionally been able to pass through the fuel price risk to their consumers. In the case of the power market, however, an assessment of the competitive environment after the full liberalization of the retail market is to be conducted around 2018-20. If this results in a green light for the removal of the rate regulation based on the full-cost principle, which currently coexists with deregulated rates as a transitional measure, Japanese power utilities will be unable to continue with the management premised on the traditional pricing system to control the fuel price risk⁸. In other words, if the rate regulations are abolished in the power sector when transmission/distribution are unbundled in 2020, and in the gas sector when the pipeline networks are unbundled in 2022, Japanese power and gas utilities will need to face fuel price risk (Chart 2-2).

Hedging such price risk requires offsetting the risk from the positions of physical trading by trading futures and swaps⁹, etc. In the case of crude oil and coal, these hedging tools are relatively easy to access in the market. In the case of LNG, however, they are almost nonexistent and those few existing tools do not have sufficient market liquidity. Hence, it is not

currently possible to perform flexible hedging operations in LNG, as in the cases of crude oil and coal.

Given that long-term contracts for LNG imported to Japan have pricing formulae linked to crude oil price, cross-commodity hedging¹⁰ using crude oil trading is a conceivable substitute. In reality, however, this does not allow a perfect hedge that eliminates the basis risk¹¹ between the price of LNG and the price of crude oil, which are not strictly the same. For this reason, developing a liquid LNG trading market is an urgent necessity from the viewpoint of securing a hedging tool directly using LNG¹².

Meanwhile, price indexation in LNG procurement is becoming more diverse, as exemplified by the new LNG projects in the US, which will be linked to Henry Hub prices. The increased diversity in price benchmarks should produce some risk diversification effect, but this alone will not serve as risk hedging. If the LNG market becomes more liquid and reliable LNG price indices become widely used, it will be possible to lock in profit margins by hedging procurement contracts linked to LNG price indices with LNG futures and swaps¹³.

7 The system which adjusts electricity rates based on fuel price fluctuations to reflect changes in the prices of LNG, crude oil, coal, etc. The adjustment is made monthly. A similar system of adjusting for fuel cost is also used in setting gas rates. (Source: "360 Key Terms in the Power System Reform Explained," the Japan Electric Association, 2015. Compiled under the general supervision of the Society of Public Utility Economies and the International Environment and Economy Institute).

8 The electricity rates liberalized to date are already unable to pass through the price risk. However, since those power rates are often reviewed in similar ways to the traditional pricing system, the problem may not present itself immediately.

9 A swap trade is a trade in which floating prices and fixed prices are exchanged.

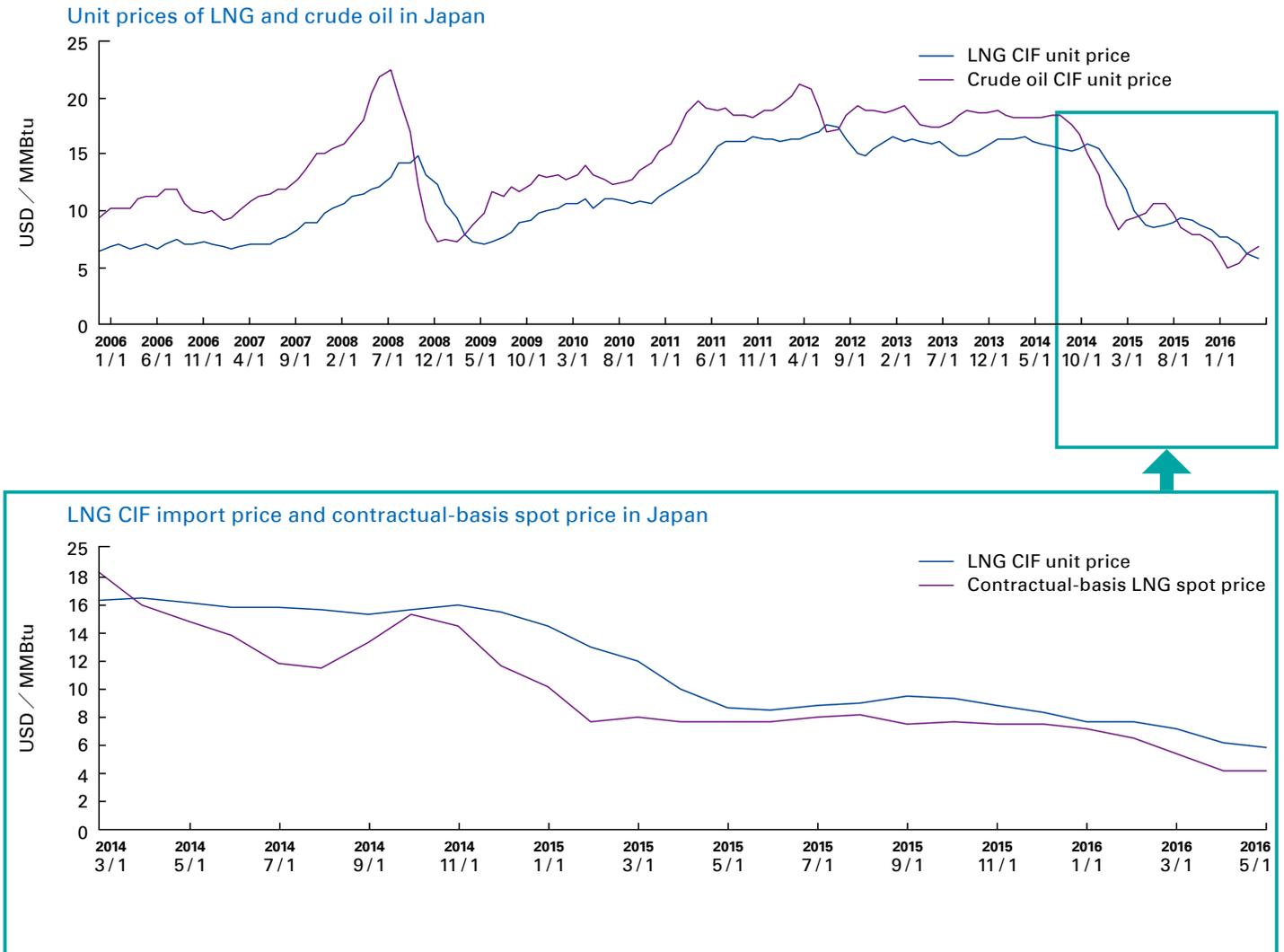
10 If a commodity to be hedged is not listed, hedging can be achieved by using another commodity that has a strong positive price correlation.

11 Basis risk is the risk of incurring a gain or loss as a result of divergences between the prices of two highly correlated instruments.

12 A market participant in Singapore notes, "Players want to move away from oil indexation but have failed to do so."

13 Securing these hedging tools will be critical when the need to address customer needs such as fixed power and gas rates, futures-linked rates arises.

Chart 2-2. Historical development of unit - Cost, Insurance and Freight (CIF) - prices of LNG and crude oil in Japan



Source: KPMG based on "Spot LNG price survey, Statistical tables of monthly authentic reports from March 2014 through May 2016" (<http://www.meti.go.jp/statistics/shot/slng/result-2.html>) by Ministry of Economy and Trade and "Statistics 07. Crude oil and oil products import prices as of July, 2016" (<http://www.paj.gr.jp/statis/statis/index.html>) by Petroleum Association of Japan.

Addressing long positions

- With Japan's demand for fossil fuels as a whole on a downtrend, power and gas utilities run the risk of the supply of LNG procured under long-term contracts exceeding demand.
- With the development of a liquid LNG trading market, players holding over-procured LNG will be able to optimize their risks by reselling them or obtaining price hedging in the trading market.

Amidst a growing sense of oversupply in the global LNG market due to the increase of shale gas production, completion of LNG projects, etc., Japan is experiencing a downtrend in its demand for LNG as well as other fossil fuels as a whole. Deployment of renewable energy in Japan is expected to increase to 2.2 to 3.2 times current levels by 2030 (Table 2-1). In addition, resumed nuclear power generation is expected to account for 20-22% of the fuel mix in 2030 (Table 1-4). As such, the proportion of thermal power generation is expected to be reduced gradually in the future. In such a market environment, Japanese power and gas utilities are facing the risk of the supply of LNG procured under long-term contracts and other arrangements exceeding the demand for LNG which is used in gas-fired power generation, gas retailing, etc. In other words, they are facing a volume risk due to excessive procurement.

Using an LNG trading market may be an effective way of mitigating this volume risk. The development of a liquid LNG trading market will enable players with excessive LNG procurement to optimize their risks by reselling the excess or obtaining price hedging in the trading market. Notably, China, India, and Southeast Asian countries are expected to see continued growth in energy demand and are also becoming more aware of greenhouse gas emissions, which makes it likely that they will have a growing demand for natural gas with smaller CO₂ emission compared to oil and coal. Thus, developing an Asian LNG trading market is also critical to make it possible to trade smoothly between these countries.

Table 2-1. Deployment of renewable energy in Japan by 2030

Renewable energy source (100 mill. kWh)	Most recent year*	2030		
		Level of renewable energy deployment		
		Low	Medium	High
Solar (photo-voltaic)	150	777	1,173	1,280
Other	1,011	1,637	1,949	2,286
Total renewable energy	1,161	2,414	3,122	3,566

* As of end-March 2014 for solar, wind, small and medium hydro, and geothermal as published by METI; 2009 figure for large hydro (METI); biomass includes an estimate (2.28 mill. kW-equivalent) for black liquor and scrap wood-fired power generation in 2005, in addition to METI-published figures for waste and biomass power generation.

Source: KPMG based on "Forecasted installation of renewable energy" (https://www.env.go.jp/earth/report/h27-01/H26_RE_4.pdf) by Ministry of the Environment.

Securing flexibility and agility in management

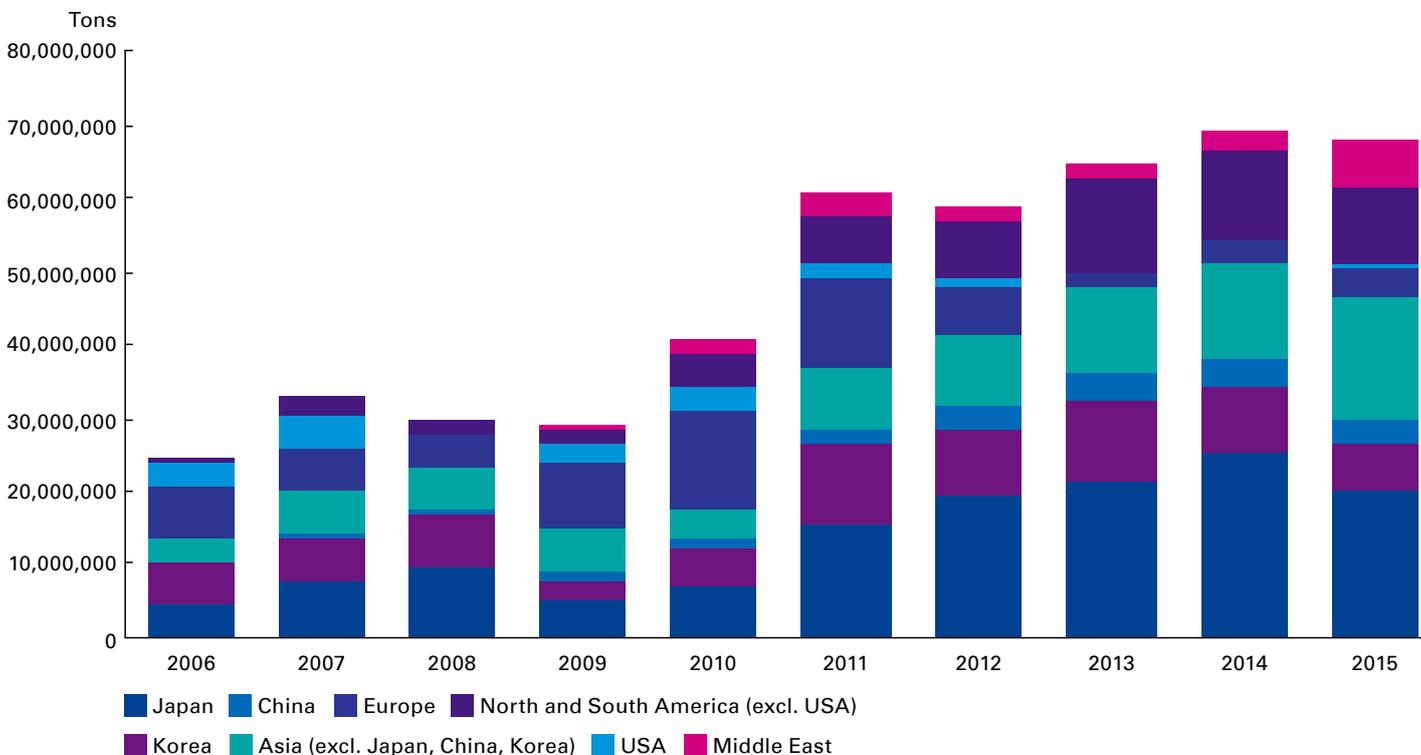
- While LNG procurement under long-term contracts is beneficial in terms of securing volume and stability of supply, they deprive management of the options and latitude to respond flexibly to environmental changes that may occur during the long life of the contract.
- An LNG trading market can be used as a mean of securing flexibility and agility in management.

Procuring LNG under long-term contracts is believed to be better than procuring through spot trading to secure the intended volume and ensuring stability of supply.

For this reason, Japanese power and gas utilities have been procuring LNG mainly under long-term contracts, using spot trading when necessary. When the buyers' bargaining power is relatively weak, however, they may not be able to secure

sufficient flexibility in a long-term purchase contracts that last from over ten to twenty years, depriving of the options and flexibility in management to respond to changes in the environment during the life of the contracts, thus potentially compromising management agility. This is one of the causes of the volume risk that Japanese power and gas utilities may face in the future.

Table 2-2. Volume of LNG imported through spot trading and short-term contracts

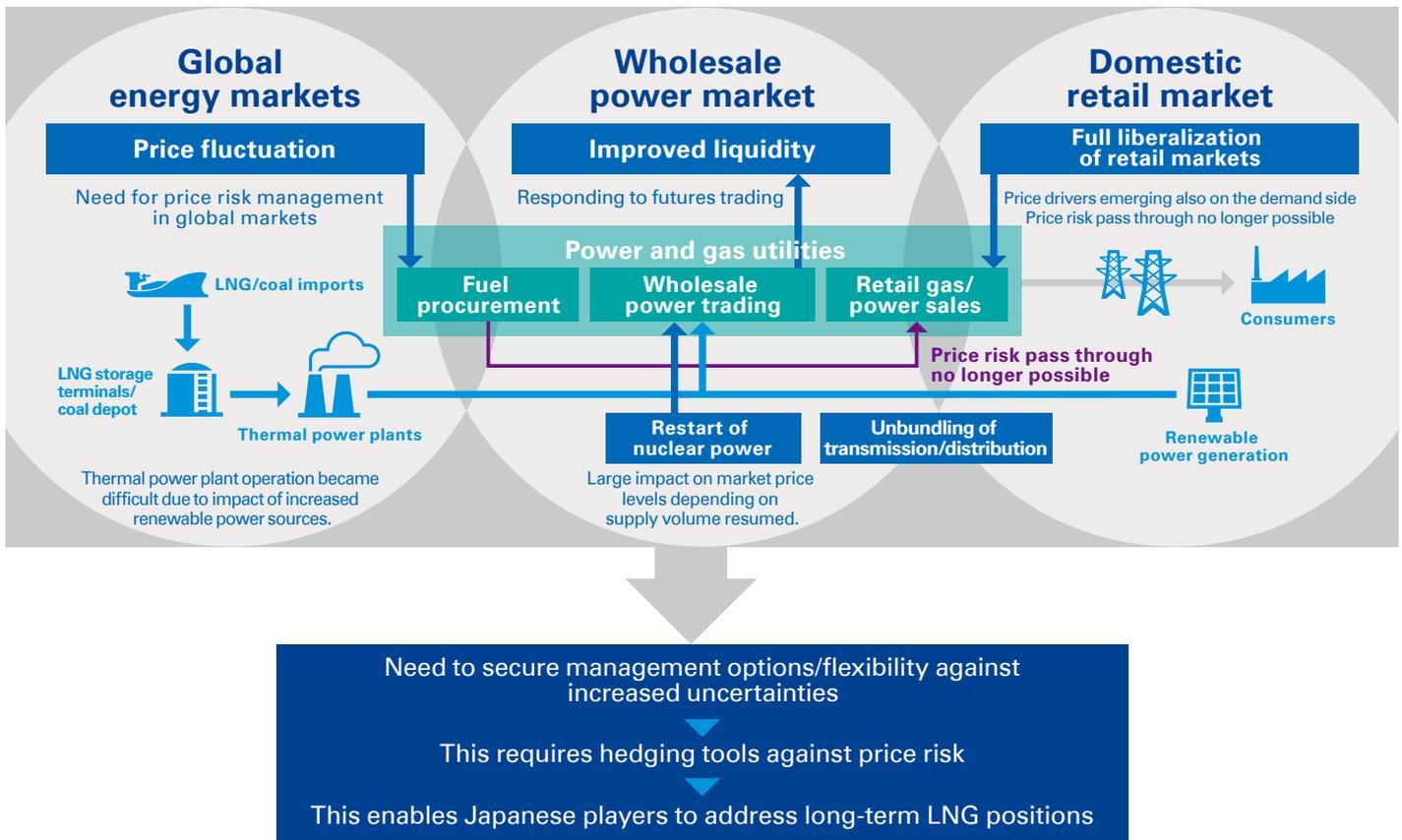


Note:

- Short-term contracts are contracts of four years or less.
- Off-take volume shows net import volume after accounting for re-exports.
- 2006 figure includes spot trading only.
- Calculated assuming 1m³ of LNG=0.45 tons of LNG (2.21m³ of LNG = 1 ton of LNG).

Source: KPMG analysis based on "The LNG Industry Reports from 2005-15" (<http://www.giignl.org/publications>) by International Group of Liquefied Natural Gas Importers (GIIGNL).

Chart 2-3. Need for LNG trading



Strategically reviewing the procurement ratios of long-term contracts and spot trading, taking into consideration their advantages and disadvantages, will be critical to secure flexibility in management options and management agility in a deregulated era. Using an LNG trading market is one possible option to accomplish this.

Having to rely on thermal power generation as an alternative power source due to the suspension of nuclear power plants after the Great East Japan Earthquake, Japanese power utilities used the LNG spot market as an emergency measure to procure natural gas for power generation (Table 2-2).

Triggered by this event, Japanese power and gas utilities increased their spot LNG trading and began reviewing their LNG procurement strategies. Improved liquidity in the LNG spot market will give Japanese power and gas utilities greater flexibility in LNG procurement by making it possible to optimize their procurement portfolios by, for example, making changes in the spot procurement ratio with an eye on the market trend. It will also be possible to optimize procurements portfolios under long-term contracts by price hedging with LNG futures and swaps, forward resale agreements using forward contracts, etc.

CHAPTER 2

Nascent LNG trading hubs in Asia

As an LNG trading market develops in Asia, Singapore and Japan are considered to lead other Asian economies in developing a trading hub, the former owing to its advanced market infrastructure, and the latter to its large LNG trading volume stemming from its enormous domestic demand.

In this chapter, we will explore the future development of the LNG trading market from a variety of angles through interviews with market participants about the potential of these countries to be LNG trading hubs, as well as their challenges and prospects, in addition to examining their initiatives to increase LNG trading.

Singapore's moves towards an LNG trading hub

- **Singapore began commercial operations of its LNG terminal in 2013. Singapore has also announced plans for a second LNG terminal.**
- **Given its size, LNG demand within the country may be relatively small. Although liquidity for physical LNG trading is to be further developed, this is set to improve as Southeast Asia's LNG demand grows. Today, more than 50% of global LNG passes through the Straits of Malacca and Singapore.**
- **Singapore has also awarded two LNG bunkering licenses in January 2016 for companies to supply LNG bunker to vessels in the Port of Singapore by 2017. Physical LNG trading is expected to become increasingly active.**
- **Singapore is also actively promoting the creation of a secondary gas trading market.**
- **The Singapore Exchange created a price index, the SGX LNG Index Group (SLInG), and had launched SLInG LNG derivatives contracts in January 2016.**
- **As the global oil hub and financial center of Asia, Singapore — has an established trading ecosystem that provides an advantage for it to become the LNG trading hub in Asia.**
- **International and national oil companies, financial institutions with commodity trading businesses, trading companies, etc. have set up offices in Singapore, creating a cluster of players.**
- **Singapore's legal system is based on English common law. Singapore is also a leading arbitration centre in Asia.**

Within the movement to develop an LNG trading market in Asia, Singapore is the most advanced along the path to becoming an LNG trading hub.

Singapore began importing natural gas from Malaysia through pipelines in 1992; pipeline imports from Indonesia began in 2001. In the first half of the 2000s, however, gas supply from Indonesia experienced disruptions, causing power failures over wide areas of the country. To address the growing demand for natural gas and to secure a stable supply of energy by diversifying its sources, the Singapore government decided in 2006 to build an LNG terminal, which went into operation and began receiving LNG in 2013. The government continues to develop LNG infrastructure with a plan to build the second LNG terminal.

The Singaporean government is actively promoting not only the development of LNG infrastructure but also the creation of a Singapore-based LNG trading market. In October 2015, the Energy Market Authority of Singapore announced its intention to create the Secondary Gas Trading Market (SGTM), a market for

short-term trading in physical LNG in Singapore.

This is expected to enable optimization of medium and long-term LNG procurement portfolios through price hedging with improved liquidity for physical LNG trading and the establishment of a price index reflecting Singapore's domestic LNG supply and demand.

In January 2016, SLInG LNG derivatives contracts were launched by the Singapore Exchange (SGX). A market participant noted, "While it is unusual to create a market before there is liquidity for the product, the creation of a marketplace was implemented first, given the market's strong demand for an LNG price index." The final settlement prices for LNG futures and swap contracts are published by the SGX and use the monthly average of the Singapore LNG Index Group (SLInG), which represents Free on Board (FOB) spot prices for LNG delivered in Singapore. With this, Singapore aims to distance itself from the traditional oil-indexed pricing system and to establish a liquid index for LNG. SGX also introduced the North Asia SLInG in September 2016 to include LNG delivered to ports in Japan, Korea, Taiwan and China.

International Enterprise Singapore¹⁴ noted, "Singapore is a thriving trading hub with a complete ecosystem for the energy, agri-commodities and metals & minerals trading clusters." International and national oil companies, financial institutions and trading companies undertaking commodity trading activities have set up offices in Singapore, creating a cluster of trading players.

At the same time, securing enough transactions is necessary to establish a Singapore-based LNG price index, but

Singapore's LNG demand is smaller compared to that of Japan or China. Thus, the lack of liquidity in physical trading could become a challenge for Singapore in becoming a trading hub. Nevertheless, LNG demand in Southeast Asia is expected to continue growing, and it is possible that LNG will be received and distributed in Asia through Singapore, thanks to its geographic location. Additionally, Singapore is also considering creating an LNG bunkering station, which is expected to help activate physical LNG trading in the future.

14 International Enterprise (IE) Singapore is a government agency that promotes international trade and partners Singapore companies in going global.



Possibility of LNG trading hubs developing outside Singapore

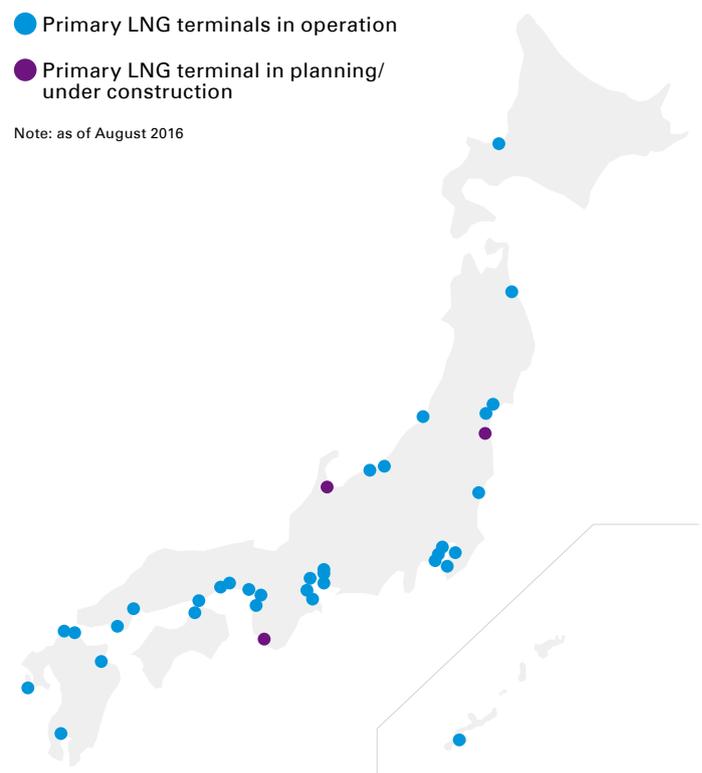
- **Apart from Singapore, potential candidates for Asia's LNG trading hub are Japan and China.**
- **Japan, as the world's largest LNG importer with numerous existing LNG terminals around the country, has an advantage in becoming an LNG trading hub in terms of its tangible physical infrastructure.**
- **In terms of the financial aspects, however, Japan lacks a sufficient cluster of commodity traders. Thus, it needs to encourage the formation of a cluster of market players, as well as to recruit and develop trading expertise.**
- **China's natural gas demand is expected to grow rapidly. Its LNG imports are also expected to grow and LNG infrastructure development is underway.**
- **China has pipeline networks connecting its domestic LNG production sites, as well as neighboring countries, including Russia. An environment that enables arbitrage between pipeline gas and LNG is China's advantage in establishing a liquid gas market.**
- **On the other hand, China's judicial system, corporate governance, and the government's involvement across the gas value chain cause apprehension to foreign players. China could do more to promote the independence of its markets and promote liberalization of wholesale prices.**
- **In addition, both Japan and China need to open up their LNG terminals and other infrastructure to third parties.**

Apart from Singapore, we can assume Japan and China as potential candidates for an LNG trading hub in Asia.

Japan, the world's largest LNG importer with numerous existing LNG terminals around the country, has an advantage in establishing an LNG trading hub in terms of the physical assets. It also has an increasing need to mitigate risks by using a liquid LNG trading market, rather than relying solely on long-term LNG contracts; given the progress of the Power and Gas Systems Reform and the growing uncertainty over its future LNG demand due to a shrinking population, among other factors. Japanese power and gas utilities have begun reviewing their LNG procurement strategies after the Great East Japan Earthquake, and changes can be seen in their posture towards procurement methods, away from long-term contracts to short-term and spot contracts.

The Japanese government is also supporting the development of an LNG trading hub in Japan. In May 2016, the Ministry of Economy and Trade announced the "Strategy for LNG Market Development"¹⁵ and presented Japan's role in fostering the growth of a liquid LNG market. In addition, the Japanese government proposed a plan to create an international LNG trading market in Japan by the first half of the 2020s at a meeting of G7 energy ministers, and expressed its intention to provide the necessary assistance to create a liquid LNG market. Furthermore, the Amended Gas Business Act was passed in June 2015, which is expected to promote third parties' use of the LNG gas terminals currently owned mainly by power and gas utilities.

Chart 3-1. Sites of LNG import terminals in Japan



Source: KPMG based on "Present status of city gas business" (http://www.gas.or.jp/gasfacts_/) by Japan Gas Association.

15 Strategy for LNG Market Development: Creating Flexible LNG Market and Developing an LNG Trading Hub in Japan"

In September 2014, the Japan OTC Exchange (JOE), whose shareholders include the Tokyo Commodities Market (TOCOM), created an LNG futures market. JOE offers non-deliverable forward OTC (bilateral) and futures contracts and the average of the DES Japan Index published by Rim Intelligence is used as the price index (Table 3-1). Like Singapore's SGX, TOCOM and JOE aim to break away from oil-price indexation and to establish an LNG price index reflecting supply and demand of LNG. Therefore they are expected pursue the creation of a marketplace for physical LNG. Like SLInG, however, DES Japan will need to make sustained efforts before it can earn the confidence of the market players and secure liquidity. An informed sources noted, "If power futures become widely used in Japan, it will also invigorate the LNG futures market by creating the need to lock in profits using LNG futures."

There are many cases of Japanese companies establishing offices in Singapore, rather than Japan, to start their trading operations, even among power and gas utilities. The challenges for Japan to become Asia's LNG trading hub will therefore be to encourage the formation of a cluster of market players engaged in trading and to recruit and develop human resources experienced in trading.

China, the other potential candidate for Asia's LNG trading hub, is expected to continue seeing a rapid growth in natural gas demand, and its LNG imports are expected to grow alongside domestic LNG production and pipeline imports from neighboring countries. In addition to having pipeline networks connecting its domestic LNG production centers, as well as neighboring countries including Russia, China is also actively promoting the

construction of LNG terminals in its coastal areas.

An environment that enables arbitration between pipeline gas and LNG is a significant advantage for China in establishing a liquid gas market.

In December 2010, Asia's first LNG spot market was opened on the Shanghai Petroleum Exchange, and a natural gas spot market was also opened later. In addition, a liquid LNG derivatives market is also developing. An informed sources noted, "With overseas LNG market players beginning to reference China's derivative prices, the country's derivatives market is beginning to have an impact on the overall LNG market in Asia indirectly."

Considering the state of development of its LNG infrastructure and the feasibility of price arbitration with pipeline gas, Shanghai has significant potential to become Asia's LNG trading hub. On the other hand, many people have concerns about China's judicial system and corporate governance. Given that the Chinese government is believed to be heavily involved across the country's gas value chain, China will need to promote the independence of its markets and promote the liberalization of wholesale prices to earn the confidence of market players. In addition, like Japan, it will also need to open up its LNG terminals to third parties.

As we have seen above, when we compare the requirements to become an LNG trading hub in Singapore, Japan, and China, Singapore seems to be ahead of the other candidates in many respects, particularly in financial infrastructure, although it has a disadvantage in terms of demand for LNG in physical trading (Table 3-2)¹⁶.

Table 3-1. Comparative table of LNG futures in Singapore and Tokyo

	Singapore	Japan
Contract name	SGX FOB Singapore SLInG LNG Futures	DES Japan LNG futures
Trade type	Futures	Futures
Trading unit (MMBtu)	1,000	50,000
Clearing price	Monthly average of SLInG announced weekly	Average of DES Japan published by Rim Intelligence Co. from the 16th of the month preceding the month including the final trading day to the final trading day.
Maturities traded	Up to 12 months	Up to 12 months

Table 3-2. Requirements for a competitive market: Singapore, Japan, and China

Requirement	Singapore	Japan	China
Demand for LNG as physical trade	D	A	A
Arbitrage between pipeline gas and LNG	U	D	A
Liberalization of wholesale market	A	A	U
Third party access to infrastructure	A	D	D
Participation of financial institutions, traders	A	U	D
Legal, institutional framework	A	U	D

Note:

A=Advantageous for creating competitive natural gas market;

U=Unknown whether advantageous or disadvantageous for creating competitive natural gas market;

D=Disadvantageous for creating competitive natural gas market

Source: KPMG based on "LNG Contract Specifications"(<http://www.sgx.com/wps/portal/sgxweb/home/products/derivatives/commodities/gas/gas/contracts>) by SGX, and "LNG(Non-deliverable Forward / Futures)Contract Specifications" (http://www.j-otc.com/guideline/20160322_LNG_Spec_Web.pdf) by JOE.

16 TOCOM and SGX have signed a memorandum of understanding to cooperate in developing the LNG market in Asia as well as to share their experiences in developing electricity futures including a joint study of the benefits of product initiatives, such as the co-listing of LNG derivatives based on relevant indices. <http://www.tocom.or.jp/jp/news/2016/20161122.html>

Possibility of coexistence of multiple trading hubs

- **Multiple trading hubs could coexist in Asia, rather than just one.**
- **For example, the US has multiple physical hubs for natural gas and Europe also has multiple natural gas hubs, such as the Natural Balancing Point (NBP) in the UK and the Title Transfer Facility (TTF) in the Netherlands.**
- **Considering the size of its LNG market and its growth prospects, multiple LNG trading hubs could emerge in Asia.**
- **A division of roles may be possible: Singapore becoming a paper trading hub and Japan and China becoming physical trading hubs.**
- **Whether a single price index will prevail in Asia as the standard index or multiple indices will coexist, with an index in each region depends on how the market develops.**

As we have seen above, Singapore, Japan, and China, among others, have strong potential to become the LNG trading hub in Asia. However, we can also contemplate the possibility of having multiple trading hubs in Asia.

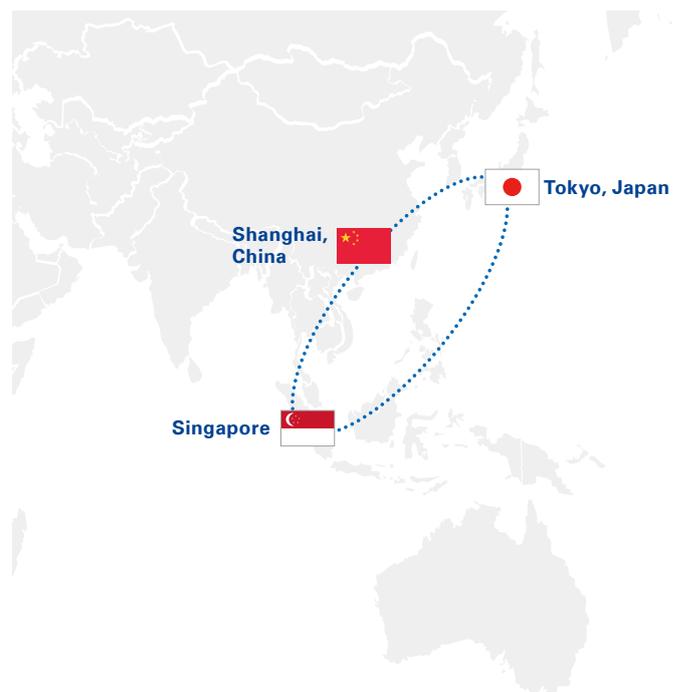
In the US, for example, there are multiple physical hubs for natural gas, although in most cases Henry Hub's price is the reference price for transactions. Europe also has multiple natural gas hubs, such as the Natural Balancing Point (NBP) in the UK and the Title Transfer Facility (TTF) in the Netherlands. While these are hubs for natural gas, not LNG, many industry players think it likely that multiple LNG trading hubs will emerge in Asia considering the size of its LNG market and its growth prospects.

An informed sources in Singapore noted, "We can contemplate the possibility of a division of roles between Singapore and Japan and China together; the former, which has an established environment for trading and a cluster of a large number of players trading LNG, becoming a paper trading hub and the latter, which have large domestic demand for physical LNG, becoming physical trading hubs," as an example of having multiple LNG trading hubs. Furthermore, "The growth of multiple LNG trading hubs could contribute to improving each other's liquidity and lead to the growth of Asia's trading market as a whole."

When it comes to an LNG price index, however, it is unclear whether a single price index will prevail in Asia as the standard index. An informed sources noted, "If DES Japan, SLInG, and JKMTM¹⁷ coexist and come to move in tandem with each other, they will become easy to use indices for the players. Converging to a single index is not necessarily a good thing."

We think that whether the multiple indices will converge into one or will continue to coexist, with an index in each region will be determined as the market develops (Chart 3-2).

Chart 3-2. Cooperation among trading hubs in Singapore, Japan, and Shanghai



17 JKMTM: Japan Korea Marker

CHAPTER 3

Current position of the LNG market as derived from comparisons with other commodity markets

- In addition to the crude oil market and the natural gas markets of the US and Europe which have long since evolved into traded markets, markets have also been developing for other commodities for which the development of a trading market was previously considered difficult.
- Given the wide quality deviations, establishing a trading market was considered difficult in the case of the coal market. However, with the development of a financial market, coal trading is becoming active in the marketplace.
- With a limited number of producers, evolving into a traded market was also considered difficult for the iron ore market. However, as the major producers shifted to market transactions as a result of market deterioration due to the fall in iron ore prices, the establishment of a trading market advanced rapidly.
- Assuming that the LNG market will be influenced by similar events, if there is a breakthrough in this situation, optimization of power and gas utilities' procurement portfolios prompted by the Power and Gas Systems Reform in Japan, which accounts for half of global LNG demand, could be one of the catalysts.

In this chapter, we will examine the current position of the LNG market based on comparisons with other commodity markets that have already become liquid. Crude oil and natural gas in the US and Europe have traditionally been advanced in terms of a trading market. In recent years, liquid markets are developing even for other commodities including coal, which had been considered difficult to be traded in a marketplace. In every commodity that is advanced in terms of a trading market, a liquid market developed through a process in which the wide adoption of financial trading was preceded by the widespread use of physical trading.

What are traded in physical trading and in financial trading are referred to as the "underlying asset" and "derivative product (derivatives)" respectively. Physical trading, also known as "spot trading," is executed by exchanging the payment and physical goods at the prevailing market price. Derivatives — which refer to futures, swaps, and options — are, literary, derivatives of underlying assets developed to be used for hedging by holding positions that offset those of the physical goods. Physical trading and derivative trading are closely linked,

as exemplified by the existence of arbitrage between physical and futures trading.

In a system where the price risk in the upstream could be passed through to the downstream under the traditional full-cost principle, it was sufficient to conduct only physical trading after securing the supply through long-term purchase contracts. There was no need to hedge the future price risk that may arise from the difference between the procurement price in the market and the sales price to the customers through futures trading or other means, or to make use of a range of possible trading to improve one's procurement cost and seek to optimize the balance between risk and return. In the post full-cost era that follows the Power and Gas Systems Reform, however, the liberalization of the downstream market will make the cost pass-through impossible, leaving power and gas utilities exposed to price risk. These changes in the market environment will compel market participants to use financial trading to hedge the risks that cannot be controlled through physical trading alone.

Table 4-1. Formation process of the iron ore market



Conditions in other commodity markets

The crude oil market is one of the oldest of the fuel markets and has achieved a level of development on a par with financial instruments markets. As well, the natural gas markets of the West, which are connected through pipelines, saw the introduction of market mechanisms earlier than the power sector. In addition, even coal — whose large deviations in quality seemingly made it difficult for a market development — is forming a liquid marketplace as a financial market developed in recent years.

In the world of crude oil trading, which boasts the largest trading volume of all commodity markets, three price indices are referred to as the “Big Three”: the Middle Eastern Crude Oil price, calculated by averaging the Dubai crude and Oman crude prices (which are both spot contracts) and the New York Crude Futures price and the Brent Crude Futures price, which are both futures contracts. Derivatives other than futures, e.g. swaps and options, are also available, just as in a financial instruments market.

In the US, the typical benchmark for physical trading in pipeline natural gas is the Henry Hub price. Europe has multiple benchmarks for physical trading, including the NBP. Derivative contracts — much like those for crude oil — are also available. In the world of physical coal trading, globalCoal has established itself as the Asia Pacific benchmark for the settlement of spot trading, while regional API indices are used in the respective regions around the world. Bilateral OTC swap contracts and option contracts are available for some of the APX indices (Table 4-1).

As we have seen above, fuel markets other than LNG have the tools which are necessary to address risk management in the post full-cost era, but the LNG market at present lacks the convenience that is available in other markets. If there is to be a breakthrough in this situation, the Power and Gas Systems Reform in Japan, which accounts for half of global LNG demand, could be one of the catalysts. Further efforts to develop the market is expected to support a smooth expansion in the utilization of the market — from physical trading only to also include financial trading — in response to the needs of the market players facing the enormous challenge of implanting a management system for the post full-cost era.

Formation process of the iron ore market

Although having lagged in development of a liquid market, much like LNG, iron ore can be cited as one of the commodities that has seen rapid improvement in liquidity in recent years. In this section, we will look at the formation process of the iron ore market to date in order to establish a benchmark for examining the current status of the LNG market.

The market for seaborne iron ore is an oligopoly in which three large producers — Brazil's Vale and Australian's BHP-Billiton and Rio Tinto — control the bulk of the market. Before the spot market became widely used, coal trading was predominantly based on the long-term purchase contracts of five years or more by the established steel manufacturers. These were mostly Japanese and Korean and transaction prices were set based on the benchmark price agreed on in the annual negotiations between the iron ore producers and the steel makers. The traditional iron ore market had great similarities with today's LNG market in that East Asia is the center of demand and that it was dominated by market practices based on a pricing system that was hardly transparent in the sense that prices were set based on long-term contracts and through bilateral negotiations.

The spot market for iron ore started in the early 2000s, driven in part by the late-coming but rapidly-growing Chinese steel manufacturers who aggressively expanded iron ore purchases on the spot market. On the supply side, in the meantime, Indian producers began selling more of their products in the spot market — amidst the predominance of the trading based on the long-term contracts of mainly large iron ore producers — which gradually led to the growth of the iron ore spot market.

As the iron ore spot market became more liquid, the reporting frequency of the price indices also improved — from monthly initially to daily in the late 2000s. The Steel Index (TSI) and the index published by Platts, which could be cited as the typical indices for spot iron ore prices, are all indices representing 62% Fe and 58% Fe (these are typical grades for iron ore in the spot market) and CFR¹⁸ prices at import ports in China, a major demand center, not FOB¹⁹ prices in the place of production. As the reporting frequency of spot iron ore prices improved, they also earned the confidence of the market as price indices. Financial contracts that trade spot iron ore prices have also emerged, including swaps listed on the SGX in 2009.

As seen above, the growth of a marketplace for iron ore was gradual, but the collapse in spot iron ore prices caused by the fall in demand due to the recession following the Lehman shock in 2008 was a significant turning point for a further improvement of market liquidity. As spot iron ore prices plunged below the

18 CFR: Cost and Freight

19 FOB: Free On Board

benchmark price, the established steel makers switched from benchmark price-based trading to spot price-based trading. At the same time, large iron ore producers including BHP and Vale expressed their support for spot prices by 2010, solidifying the trend of growing liquidity in the iron ore spot market.

As the iron ore spot market grew more liquid, so did the financial market. Swaps on spot iron ore prices have increased rapidly since the early 2010s and have grown into a liquid market. The CME and the SGX listed futures based on spot iron ore prices in 2013 and futures trading also continue to expand steadily. Increased liquidity in the iron ore futures markets is expected to enable both iron ore producers and steel makers to hedge market risks even more efficiently (Table 4-2).

Table 4-1. Typical spot and futures indices for energy commodities

	Type	Index	Exchange index provider	Comments
Crude oil	Spot	Dubai / Oman	DME	Futures available for both the Dubai and Oman crude oil prices
	Futures	WTI Crude Oil	NYMEX	Futures (New York Crude Oil Futures) on WTI, a generic name for crude oil produced mainly in Texas and New Mexico.
		Brent Crude	ICE	Futures on North Sea (Brent) crude oil traded on former London IPE
Natural gas	Spot	Henry Hub	NYMEX	Price index for physical gas at pipeline hub in Louisiana.
		NBP	ICE	Used respectively as the region's virtual trading point in UK's NBP and Netherland's TTF.
		TTF		
	Futures	Henry Hub	NYMEX	Electronic trading on CME Globex also available
		NBP	OCM	Trading system provided by ICE Endex
		TTF	ICE	
Coal	Spot	globalCOAL NEWC	globalCOAL	Benchmark for Asia Pacific
		API2, etc.	Argus McCloskey	API is a set of indices ranging from API2 (CIF ARA) to API12 (CFR India).
	Futures	globalCOAL NEWC Futures	ICE	Established as Asia Pacific index though volume still small compared to other markets.
		API2, etc.	NYMEX EEX	API2 and API4 (FOB Richards Bay) have higher liquidity.
LNG	Spot	JKM™	Platts	Price index for spot trading of LNG in Japan and Korea
	Futures	DES Japan	JOE	Listed on NYMEX, clearing service provided by CME.
		SLInG	SGX	Named after famous cocktail, Singapore sling.

Source: KPMG based on various materials

Table 4-2. Representative spot and futures contracts for iron ore

	Type	Index	Exchange index provider	Comments
Iron ore	Spot	TSI iron ore	TSI	Five grades including iron ore fines 62% Fe - CFR Tianjin Port (China) / Iron ore fines 58% Fe (low alumina) - CFR Qingdao Port (China) / Iron ore fines 62% Fe (low alumina) - CFR Qingdao Port (China).
		IODEX Iron Ore	Platts	Iron ore fines 62% Fe - CFR Qingdao, North China
	Futures	the SGX TSI Iron Ore CFR China (62% Fe Fines) Index Futures, etc.	the SGX	The SGX TSI Iron Ore CFR China (62% Fe Fines) Index Futures / the SGX Platts Iron Ore CFR China (Lump Premium) Index Futures, etc.
		Iron Ore 62% Fe, CFR China (TSI) Futures, etc.	CME	Iron Ore 62% Fe, CFR China (TSI) Futures, Iron Ore 62% Fe / CFR North China (Platts) Futures / Iron Ore 58% Fe, Low Alumina, CFR China (TSI) Futures

Source: KPMG based on various materials

Current position of the LNG market

Looking at the process in which the iron ore market became liquid, some characteristic developments, as listed below, were observed. In this section, we will examine the current

position of the LNG market by comparing and examining its current condition in respect of these developments:

- **Growth of spot trading**
- **Development of spot price indices**
- **Emergence of financial trading**
- **Collapse of the traditional pricing system**
- **Development of liquidity in futures markets**



Growth of spot trading

While the current LNG market is dominated by trading based on long-term contracts of the established, mostly Japanese and Korean players, a large number of new LNG importers have entered the market in recent years, and these new importers tend to prefer procuring through short-term contracts and spot trading. While the spot trading of the new LNG importers only account for a limited share of the total LNG market so far, the picture of new importers expanding their spot trading resembles China's expansion of its spot trading in the iron ore market.

The trend of favoring spot trading can also be observed in established LNG-importing countries. In particular, spot trading by Japanese players has increased as the power utilities increased their spot market procurement, driven by the shortage of LNG supply as an alternative fuel due to the suspension of nuclear power plants after the Fukushima accident. It is expected that growing use of spot trading by established players, and the entry of new LNG importers, will continue to drive the growth of spot trading in the LNG market.

Development of spot price indices

JLC (Japan Liquefied Natural Gas Cocktail) is a price benchmark that has been widely used in the LNG market for a long time. JLC represents the average CIF²⁰ price of LNG imported to Japan, the world's largest LNG consumer. Although JLC is a price benchmark in the place of consumption, it is based on the LNG import prices compiled in the trade statistics including those under long-term contracts, i.e. it is not an index representing spot prices.

in East Asia, the dominant market for LNG. With daily price reporting started in 2009, the benchmark has gradually been earning the market's confidence.

On the other hand, JKMTM, published by Platts, is a spot price benchmark that is currently becoming popular. JKMTM is a benchmark based on the spot import prices of LNG delivered

Given the emergence of new LNG price indices such as DES Japan and SLInG, players need to watch the developments going forward, including which price index will become dominant as a result of convergence. Although indices for spot LNG prices are in the process of development, price indices in the place of consumption have long been in formation in the LNG market.

Emergence of financial trading

With JKMTM beginning to be widely used in the market as a price benchmark and increasingly used in contracts for physical LNG, bilateral JKMTM swaps have seen significant growth, particularly since 2014²¹. At present, swaps on spot LNG prices

have yet to establish a liquid market, but swap trading through exchanges such as JOE and the SGX is expected to grow.

20 CIF: Cost, Insurance and Freight

21 Platts research



Collapse of the traditional pricing system

Regarding pricing systems, we need to look at developments on both the demand side and the supply side. To look at the demand side first, there is a trend among the Japanese players, who need to respond to the Power and Gas Systems Reform, to increase the use of spot trading to improve flexibility in LNG procurement. In particular, JERA, Japan's largest LNG importer, has announced a policy to significantly reduce the proportion of long-term contracts by 2030 and to cover the reduction with short-term and spot contracts to improve procurement flexibility. In addition, the fact that LNG export projects in North America will start exports of natural gas to Japan based on Henry Hub prices is another development that will encourage a shift away from the traditional oil-indexed pricing system.

On the supply side, we see no apparent trend to seek spot price-based trading at present. However, if the spot market becomes more liquid in the future, it is possible that the supply side will also see advantages in trading based on spot prices. Especially, if a sense of surplus develops in the market when large LNG projects are completed and begin supplying; the supply side may find themselves in a circumstance that compel them to shift to spot price-based trading. However given the relatively large number of LNG players on the supply side, compared with the oligopolistic iron ore market dominated by three large players, there may be difficulty for certain players to take the initiative in the shift to a new pricing system.

Development of liquidity in futures markets

To date, two LNG futures markets have been created: one in Japan, the JOE's futures market based on the DES Japan index, and the other in Singapore, the SGX's futures market based on the SLInG index. However, neither market has secured enough trading volume so far to be able to offer a liquid market. At present, LNG futures markets have not reached a critical mass where liquidity begets more liquidity and further developments of the markets needs to be seen.

marketplace is in the process of developing. At the same time, the traditional pricing system is still present in today's LNG market and financial markets, including futures markets, are far from being liquid (Table 4-3). Nevertheless, it is possible that a sudden change in the market, such as we saw in the iron ore market, becomes a catalyst that causes the collapse of the traditional pricing system. The moves of the Japanese players, the world's largest LNG consumer, could play a pivotal role in the case.

As we have seen above, we are beginning to see some developments in the current LNG market with respect to the growth of spot trading, the development of spot price indices, and the emergence of financial trading, which suggest that a

Table 4-3. Summary of the LNG market's current position

Characteristic developments	Progress
Growth of spot trading	Spot trading increasing gradually
Development of spot price indices	Spot price indices such as JKM™, DES Japan, and SLInG beginning to develop
Emergence of financial trading	Financial trading such as JKM™ swaps beginning to emerge
Collapse of the traditional pricing system	Traditional oil-indexed pricing system remains
Development of liquidity in futures markets	Futures markets created, but lacking liquidity

CHAPTER 4

The challenges in developing a liquid LNG market

- **Although LNG futures markets were created in some countries over the past few years, there is currently no liquidity in LNG futures markets. The three challenges addressed in this chapter need to be overcome for LNG market to establish itself.**

As discussed in Chapter 3, LNG futures markets have been created in Japan, Singapore, etc. over the last few years, but those markets are not sufficiently liquid at present. Boosting of underlying LNG spot trading is essential to improving the liquidity of LNG futures markets. Nevertheless, even though spot trading volumes have been increasing gradually in response to increased LNG demand after the Great East Japan Earthquake and the fall in LNG prices stemming from the

decline in oil prices, we cannot say that the LNG spot market at present is sufficiently active. For Singapore, Japan, China, etc. to grow as LNG trading hubs, trading in the underlying asset, i.e. physical LNG, needs to become more active. To this end, multiple challenges, including those discussed below, need to be addressed.

Concentration of players

- **The evolution of the LNG market into a trading market is believed to be difficult due to the fact that the market players are limited to those few who can afford large infrastructure investments for liquefaction, transportation, etc. However, the iron ore market, which has a high concentration of players, has evolved into a trading market, as seen in the previous chapter.**
- **The newly installed liquefaction/gasification terminals around the world will help resolve the concentration of players, and an increased diversity of buyers and sellers could produce a positive cycle that stimulates further infrastructure investments.**
- **LNG's large trading volume is another factor limiting the number of market players. However, as LNG comes to be traded in smaller quantities thanks to technological innovations in transport infrastructure, new players can be expected to enter the market; potentially bringing depth and diversity to the set of market players.**

Increasing physical LNG trading volumes is considered an important factor that leads to improving liquidity for spot trading and consequently to the development of a marketplace for LNG. In the traditional LNG market, however, supply originated from certain limited regions and from certain limited players with large financial resources, since large development costs were required. In other words, there was a "concentration of suppliers." At the same time, there was also a "concentration of buyers" since the buyers were also limited to East Asia, such as Japan.

Since such concentrations generally make it difficult for a marketplace with trading in both directions to develop and are considered a factor that favors bilateral trading, rather than multilateral trading in an open market (Chart 5-1).

In fact, the traditional LNG market was a closed market where most of the trading was bilateral. However, the LNG industry landscape has experienced significant changes in recent years, including increased LNG production in Australia, an increase in the number of North American LNG export projects, a larger number of LNG-importing countries, and the decline in LNG

prices induced by the sharp fall in oil prices. It is becoming increasingly likely that these changes will become the forces that will transform the LNG market itself. This situation resembles that of the iron ore market, where there was a concentration of players but the development of a marketplace progressed during a period of depressed prices.

At the same time, the increased supply of LNG and the increased diversity of LNG suppliers in recent years have created competition among the suppliers, which has been acting as a driver encouraging the shift to more favorable (more flexible) terms for the buyers in traditional long-term purchase contracts. It has also prompted an increase in shorter-term contracts and spot trading, which may increase at a faster pace in the future given their role in securing management flexibility for the buyers.

Furthermore, there is currently increased spare capacity of LNG supply at low prices, which is encouraging the emergence of new LNG importers, particularly among emerging countries that traditionally viewed LNG as a relatively expensive fuel. If infrastructure development progresses in these new LNG-

importing countries, it will contribute greatly to stimulating the growth of trade in physical LNG. Among the required infrastructure investments includes additional LNG import terminals and storage facilities, expanded natural gas pipeline networks, and LNG bunkering stations. If the development of such infrastructure progresses, it will lead to further increases in the trading volume of physical LNG, which will in turn become the factor that enables the first important step in the development of a LNG marketplace.

Nevertheless, developing LNG infrastructure requires enormous funding. To date this has been undertaken by a handful of players with large financial resources, as noted above. However, increasing the number of LNG importers and LNG demand requires demand-enabling infrastructure. This will require the support of the oil majors and so forth as suppliers, as well as financial support from donors, such as the suppliers and the governments of the large established LNG markets. There are also growing expectations for the development of new financial schemes to leverage the financial resources of players such as large infrastructure funds.

Another requirement is the freedom of access to this infrastructure. Even if the development of infrastructure progresses, that will not help to make the market active if freedom of access is not secured. Regulatory reform that promotes third parties' access to infrastructure such as LNG

terminals and invigorates market competition is essential to enable new entrants to compete with the incumbent players in the liberalized gas market.

If LNG terminals and other infrastructure in importing countries become freely accessible, it would create a virtuous cycle in which competition is stimulated on the demand side and in turn prompts the use of infrastructure by diverse players. Providing access to LNG terminals is also an important agenda in Japan's Power and Gas Systems Reform. Advancing this kind of reform requires governmental support, as well as the creation of programs such as incentives to encourage the owner companies to make their infrastructure available.

Increasing the trading volume of physical LNG may require reducing the minimal unit of LNG traded. Installing natural gas pipelines is considered uneconomical, particularly in areas that are made up of islands, like some areas of Southeast Asia. If there is a need for LNG in such areas, however, initiatives to supply LNG in smaller units that are still economical are needed.

Accelerating such initiatives will require development of infrastructure which is suitable for handling supplies that are finely-tuned to the needs of the receiving side (e.g. small LNG terminals). Since trading in smaller units has an economic disadvantage, technological innovations that enable efficient transportation in small units will also be necessary.



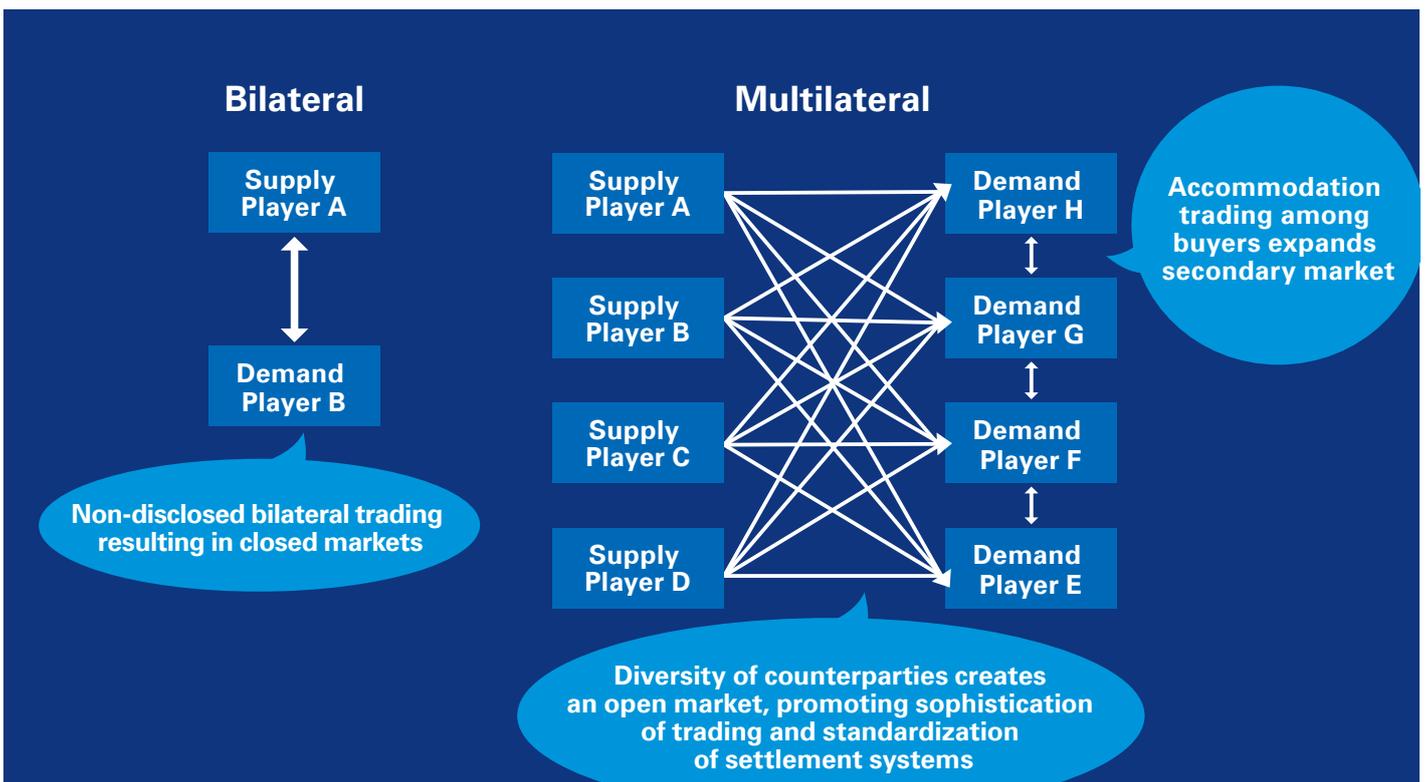
Considering that traditional bilateral trading, such as long-term contracts assuming large quantities, are currently the core of the LNG market, an increase in the number of small trades will not immediately lead to increasing the overall trade volume. Instead, improving trade flexibility in general by increases in short-term trading (particularly spot trading) through an increase in physical trading, an improvement in market liquidity as a result, low cost transportation for small quantities, etc., will prompt the trade volume of physical LNG to grow.

Lastly, a cluster of commodity traders who handle reselling and derivatives in LNG is essential to improving liquidity in the LNG market, in addition to increased activity in physical LNG trading driven by real LNG demand. Having a large number of counterparties is essential for a well-functioning trading market. Therefore it is necessary to create a market environment which

is attractive traders from abroad. There is an important role that the government can play in developing an environment that allows easy entry for overseas players by developing a transparent judicial system and transparent regulations.

At the same time, limiting the government's involvement in the market and letting private sector lead the market to secure transparency and credibility should contribute to the market's healthy development. In addition, building a cluster of traders will require measures in terms of human resources. One strategy for Asian power and gas utilities, who do not have much experience in trading may be alliances with experienced Western firms. By acquiring trading know-how through these alliances, they will be able to set up their organizations properly and to internally accumulate the capabilities required to conduct trading.

Chart 5-1. Bilateral and multilateral trading



LNG's suitability for trading

- **Due to the quality deviations in terms of calorific value equivalents, the development of a trading market is believed to be difficult for LNG. Nevertheless, coal, which has wide quality deviations, has seen the development of diverse local markets, which are collectively developing overall liquidity.**
- **If standardization of physical LNG trading proceeds and overall liquidity improves through the coexistence of multiple indices, leading to the convergence into a single LNG index as a result, there will be more possibility that a reliable financial trading also emerge in the LNG market.**

It is sometimes said that the differences in quality in terms of calorific value equivalents is preventing the improvement of liquidity in the LNG market. Given the issue of quality variations, the fact that the LNG market structure is not so simple as to allow you to forecast prices by simply relying on some limited price drivers derived from the crude oil price, in addition to the different uses on the demand side, may be effecting LNG's low liquidity.

We can gain insights into the problem of differences in product quality by comparing LNG with the market characteristics of coal, which is also used as a fuel for thermal power generation. A range of price indices have developed in the coal market, i.e. by destination (Europe, Asia, China — places which are also major markets), by loading point on the supply side (South Africa, Australia, etc.), and also by specification based on the quality of the coal. Coal has these diverse price indices due to the wide differences in quality depending on the origin. On the other hand, one year contracts are the norm, which is a major difference from the long-term contracts of ten to thirty years in the case of LNG.

While the formation of a large number of coal markets based on these diverse price indices is attributable to a combination of factors, the growth of the demand for coal in China and other Asian countries, the deregulation of Western power markets, etc., are considered important trigger events. The growth of Asia's coal demand (particularly in China and India), which influenced not only the increase in trade volume but also market practices in the West, and the concurrent increase in spot trading are believed to be responsible for the increased diversity in the forms of trading. The resulting emergence of competition among the regional markets and the activities to complement each other's supply and demand imbalances are believed to have led to the development of a wide variety of transaction price benchmarks.

The increase in spot trading is attributable to the advanced deregulation of the power sector in the advanced countries, which shifted the market practice from the traditional one-year contracts to spot trading. The emergence of imbalances among the different coal markets was the result of a change in the market environment in the form of a rapid decline in coal demand due to environmental issues. This had a large impact

on the supply and demand profiles of the regional coal markets, and the need to adjust supply and demand across them led to an increase in the number of market participants joining inter-market arbitration. Following these developments, standard specifications were established and it became possible to make calorific value equivalent price conversions using price indices based on those specifications, which in turn led to the setting of transparent transaction prices.

The development of a process in which rational prices for physical trading are formed also made derivative trading such as futures and swaps possible and added depth to financial trading. After all, even in markets where the product range grows increasingly diverse, transaction prices become reliable on their own when liquidity improves as the trading volume of the physical product in the spot market increases. The growth in the derivatives trading having such assets as the underlying was not an exception even in the case of coal, which has diverse markets.

Considering this, regarding the formation of multiple price indices as an obstacle to the improvement market liquidity could mislead our future prospects. Even in the LNG market, where products of different origins and qualities are traded, the same pattern of increased trading volume in regional markets leading to the formation of reliable price indices in each market, which in turn create a positive spiral in which reliable price indices beget more trade volume and ultimately improve the market liquidity.

Price transparency

- **While anti-competitive market practices such as destination clauses and oil-indexed price terms are believed to be factors impeding improved market liquidity, revisions to contractual terms including the removal of the destination clause and increased spot trading not dependent on oil-price indexation, could improve price transparency.**
- **As more transaction prices transpire as a result of improved LNG price transparency, market players will naturally begin to demand indices to be used as a reference price, which could in turn accelerate the improvement in market liquidity.**

Some long-term contracts between LNG suppliers and buyers prohibit or restrict the resale of LNG under destination clauses. Destination clauses that restrict reselling in secondary markets are a great obstacle in improving LNG market liquidity. It is believed that impediments to liquidity, such as the destination clause, need to be eliminated to create an environment in which both LNG suppliers and LNG buyers around the world transact in a competitive market.

Revisions to contractual terms including the removal of the destination clause are set to increase. LNG buyers are becoming increasingly vocal in demanding revisions to their contractual terms aided by the combination of an environment favoring the buyers — the product of the increased diversity of LNG supply and demand and an increase in overall supply — and low oil prices. LNG buyers are expected to conduct secondary trading more actively with the removal of destination

clauses, it will help to further increase spot trading in physical LNG²². Given that the contracts for the LNG to be imported by Japanese companies from North America are free of destination restrictions from the beginning, some players are looking to conclude short-term contracts with a view to conducting secondary trading in the future.

While the increase in the number of LNG importers has slowed down slightly at present due to low oil prices, there are many cases in the traditional LNG-consuming countries in which the strategy of increasing spot trading is chosen over renewing existing long-term contracts, which have resulted in increased spot trade volume. In other words, spot prices that are competitive to some extent are currently developing based on comparisons between the oil-linked prices under long-term contracts and the spot prices.

22 In reality, as is also common in other markets, both primary and secondary trades are treated without differentiation as short-term physical trades and help to improve liquidity as a whole.



There is criticism that the oil-indexed price mechanism adopted in long-term LNG purchase contracts does not properly reflect the supply and demand of LNG. Moreover, since price formulas vary by contract and are decided bilaterally, transaction prices are unknown except to the parties of the contracts, and even if the formulas were disclosed to third parties, it would be difficult to evaluate contracts without understanding the factors that determine the price. A market that lacks reproducibility of transaction prices makes price comparisons difficult, even if there was a desire to consider reselling the contract itself to another company or swapping it, for example. Until now, this opaque price-setting method has been considered normal market practice in the LNG market.

Meanwhile, as increased spot trading volume, market players will need price indices trusted by all market participants in order to execute spot trading. In other words, there will be a need for a transparent price-setting method in the spot market. For the time being, indices such as JKMTM, DES Japan, and SLLnG will need to gain acceptance, but improving transparency in physical spot trading will have to come first. Once the LNG price indices become widely used, price transparency will improve on its own. Furthermore, increased use of LNG price indices as the transaction price in spot trading or as the benchmark for setting the price in long-term purchase contracts is expected to enhance the reliability of the price formation process and prompt market participants to use them more frequently. This is because the improvement in the effectiveness of the indices in individual trades will produce a synergistic effect and help to further improve transparency in the formation of LNG prices. If the LNG market becomes more liquid in this manner and the reliability of price indices improves as a result, this will increase the need for the players of physical trading to hedge price risk through futures trading, and in turn make futures trading more active.

Increased futures trading will prompt the participation of financial players and result in invigorating futures trading, as well as the price indices establishing themselves. If futures trading becomes active, other derivative markets based on futures, e.g. swaps and options, should also grow in turn. This phenomenon is commonly observed in the pipeline-supplied gas markets of the West. While there are significant differences between pipeline gas and LNG, there are fewer reasons why the LNG market should not become like the pipeline gas market.

When this stage is reached, there will be a strong likelihood of a convergence to a single index that represents the region, like the Henry Hub index in the US and the NBP index in Europe. If there is high market liquidity between the representative price index and the individual physical markets in Asia and between the representative index and local price indices, arbitration between different prices will also become easier. LNG market players will be watching closely in which region such a representative price index will develop.

Conclusion

- **The emergence of a liquid Asian LNG trading market is much awaited to enable LNG buyers, sellers, and traders to optimize their profits while managing the risks appropriately.**
- **Although LNG prices are low and the business environment is challenging at present, the emergence of liquid and transparent physical and financial markets will bring tangible and intangible benefits to market players since the shift from long-term contracts to spot trading is likely to increase volatility in the LNG market, as seen in other commodity markets.**
- **The ongoing Power and Gas Systems Reform in Japan, the largest LNG consumer, will reveal its final form over 2020-22. The progress of the regulatory reform discussions needs to be observed closely since the developments in the regulatory reform and the speed of the transformation will have a large impact on the development of liquidity in the LNG market.**

While LNG demand in Japan is expected to decrease in the long term, global demand is projected to grow. Against this backdrop, traditional market practices, such as inflexible long-term contracts and oil-indexed pricing, have become significant obstacles in optimizing the diverse contracts of the LNG market players as a portfolio. Developing a liquid LNG trading market in Asia is essential to enable LNG buyers to optimize their profits while managing the risks appropriately.

Furthermore, establishing a liquid LNG trading market is expected to bring significant benefits to the sellers as well, since it will make it easier to find LNG buyers at fair prices. For new LNG projects, it takes some time to establish stable operations. However, LNG sellers may need to compensate for the loss of the buyers when the production was disrupted due to operational troubles of the plants. In the period when the liquidity of the market is low, it may lead to a rise of spot prices, and may spoil the sellers' profitability. In the future, initiatives to develop a trading market for LNG are expected also from the sellers.

The development of an LNG trading market will also offer significant business opportunities to traders who broker LNG trades, but the role of the traders will also evolve as the LNG market becomes more liquid. Since the business model of the traditional trading companies, i.e. earning a margin by intermediating LNG sellers and buyers, is expected to become less significant as LNG buyers increase their participation in the trading market, they will need to establish business models that can add more value to trading itself.

With LNG prices staying low and the business environment becoming more challenging, developing a liquid and transparent LNG trading market is expected to expand the profit opportunities available in the LNG market and bring about great benefits for all three parties: the LNG sellers, buyers, and traders.

Lastly, the impact that the Power and Gas Systems Reform in Japan, the largest LNG consumer, will have on the liquidity of the LNG market needs constant monitoring. Once the retail power and gas markets are fully liberalized and the power/gas grids are unbundled, the uncertainty due to price fluctuations will heighten across the value chains of power and gas utilities. Demand projections will no longer be based on projections of the macroeconomic environment alone, as the effect of volume fluctuations due to customer acquisitions and losses resulting from retail competitions will become more important. Amidst these market environment changes, optimizing and managing the risks associated with the enormous LNG assets through trading will become one of the most critical management challenges for power and gas utilities.

With the expected decline in domestic LNG demand due to a shrinking population in Japan, and the addition of a range of factors that will accelerate the fall in LNG demand, e.g. increased renewable energy and coal-fired power generation, and the restarting of the nuclear power plants, it is not difficult to imagine that the Japanese players will be the most eager to see improved convenience in the LNG market.

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