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Multilateral Joint Study on the Liquefied Natural Gas Market

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This report was prepared by the Working Group for the 'Multilateral Joint Study on the LNG Market' under the Economic Research Institute for ASEAN and East Asia (ERIA) Energy Project. Members of the Working Group, who represent the participating East Asia Summit (EAS) countries, discussed and agreed to utilize certain data and information proposed by the Institute of Energy Economics, Japan (IEEJ) to analyse market trend. These data and information may differ from those normally and/or officially used in each country, and therefore, the analysis results presented here should not be viewed as official national analyses of the participating countries.

Foreword

While liquefied natural gas (LNG) is playing an increasingly important role in the East Asia Summit (EAS) countries, there is still some potential to increase its use in the region. LNG may fill the growing energy demand gap in developing economies under stronger environmental pressure.

This concept, named as the 'Golden Age of Gas' was initially posed by the International Energy Agency (IEA) in 2011. However, since 2011, although LNG demand has increased, the increment is smaller than that of coal and it even lags behind the other renewable energy sources in recent years.

What element hinders such a disappointing result for LNG then?

This study tries to address this issue by identifying the elements that hinder LNG use in the EAS region and by deriving policy recommendations to create a brighter future for LNG through extensive and deep discussions with world experts in this field.

The authors hope that this study will provide new insights for the EAS region.

Dr Ken Koyama, Leader of the Working Group

Mr Ichiro Kutani, Sub-leader of the Working Group

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April 2017

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List of Abbreviations

ASEAN	Association of Southeast Asian Nations
EAS	East Asia Summit
ERIA	Economic Research Institute for ASEAN and East Asia
FSRU	Floating Storage and Regasification Unit
IEEJ	The Institute of Energy Economics, Japan
LNG	liquefied natural gas

Executive Summary

The increased use of liquefied natural gas (LNG) is expected to solve many of East Asia Summit region's energy and environmental problems by ensuring a stable energy supply at an affordable price based on its abundant and geographically diversified resource base, as well as reducing carbon emissions by replacing more of the current carbon-intensive energy being used. The LNG market, however, has not expanded as much as expected in the early 2010s. This paper proposes recommendations to policymakers, and the LNG producers and consumers, on how LNG can be used more in Asia.

The expanded use of LNG in Asia will depend on two conditions: LNG's competitiveness against other energy sources, and sufficient investment in every part of the value chain. The following table summarizes 'who does what' to achieve these two conditions.

It may be true that just letting the market work is not enough to expand LNG demand in Asia, as some of LNG's benefits are difficult to reflect in market mechanism. Because market mechanism has its limits, governments should play an important role where there are such limits. In particular, they should provide clear indication and support for policy and development of a well-functioning market. Hence, reliable price benchmarks are the major requisites to promote LNG demand in Asia.

Required Actions and Responsibilities of Industry and Government

	Industry	Government
Producing country	• Adopt effective cost-reduction measures • Remove or relax the destination clause • Create a reliable price benchmark • Develop a well-functioning market • Optimize the supply infrastructure	• Develop a well-functioning market • Improve the investment environment • Optimize the supply infrastructure • Support investment through public finance
Consuming country	• Adopt effective cost-reduction measures • Remove or relax the destination clause and optimize logistics • Create a reliable price benchmark • Develop a well-functioning market • Optimize the supply infrastructure • Invest in upstream by downstream players	• Create a reliable price benchmark • Liberalize the domestic market • Provide a low-carbon policy • Develop a well-functioning market • Encourage natural gas use by government • Optimize the supply infrastructure • Support investment through public finance

Source: Author.

CHAPTER 1

Introduction

1.1. Background and Objective

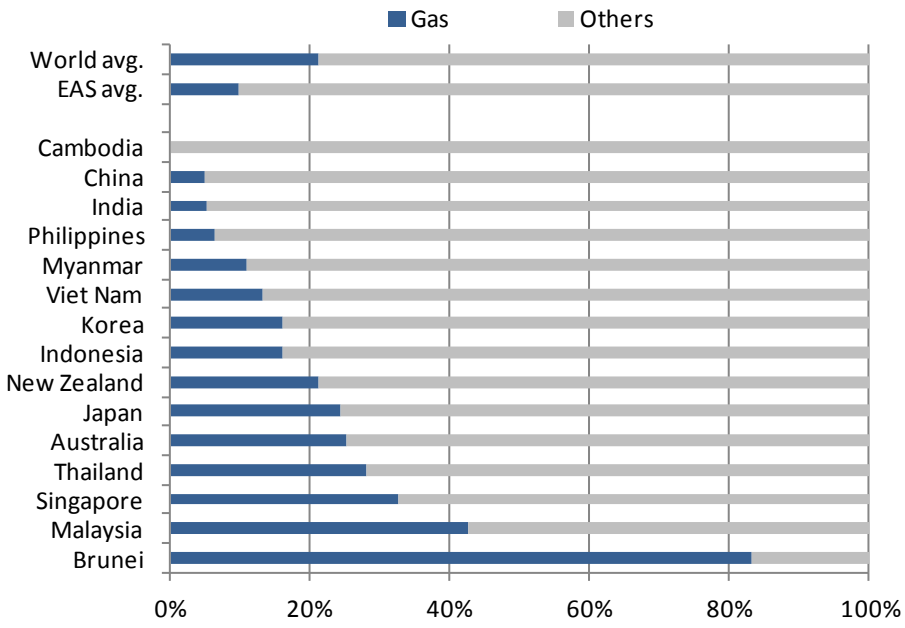
The potential to use natural gas can be increased in the East Asia Summit (EAS) region where energy demand is continuously increasing, and countries are urged to address pollution and climate challenges. Its increased use has three main advantages in the region:

- Abundant resource potential, including unconventional gas;
- Less geopolitical risk as resource distribution is more geographically diverse compared to oil; and
- Lowest emission, including carbon dioxide, among all fossil fuels.

However, in reality, the natural gas utilization rate is not high outside of countries that produce natural gas themselves and some countries that have promoted the use of natural gas through government policy. EAS' average share of natural gas consumption is lower than the world average. This is due to a variety of factors. Therefore, in EAS countries, the advantages of natural gas are not being adequately exploited, and there is a potential for further expansion in the future. EAS countries may also have elements that hinder the increase in the use of natural gas. If this is the case, then policymakers in EAS countries should promote efforts to reduce and eliminate those impediments in their countries as well as in the international LNG market.

This research will propose who should do what among the key stakeholders to expand natural gas utilization in the EAS region.

Figure 1-1. Share of Natural Gas in Total Primary Energy Supply



Avg. = average.
Source: International Energy Agency (2016).

1.2. Study Method and Work Stream

(A) Analysis of elements that hinder LNG use and necessary actions

Literature survey was conducted to analyse elements that hinder LNG use in EAS countries. It then identified necessary actions for different stakeholders to promote LNG demand in the region.

(B) Expert meetings

Multilateral expert meetings were organized to discuss the issues. Each expert provided their views and/or suggestions on the issues. Discussions then took place. Possible issues/questions discussed were:

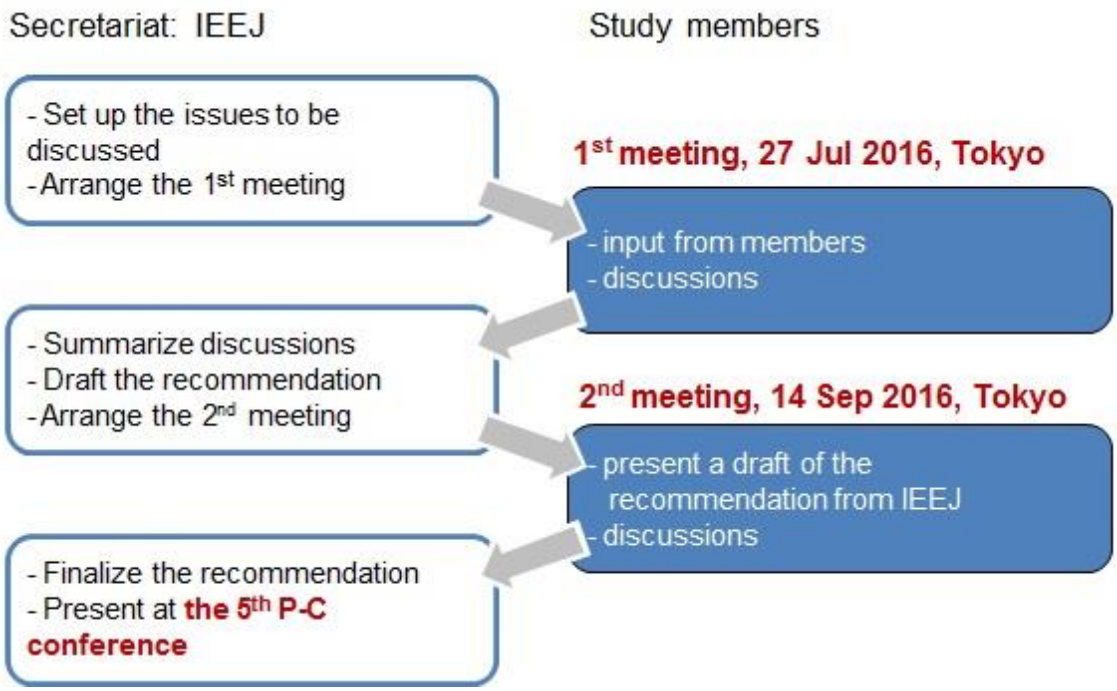
- What elements in the region hinder the promotion LNG demand?
- What actions need to be taken by whom to address the challenges?

(C) Policy recommendations

Based on the literature survey and the working group discussions, the study derived policy recommendations for promoting LNG use in the region. The study's aim was to formulate a policy message for the global society and policymakers at the 5th LNG Producer-Consumer Conference

held in Tokyo in autumn 2016. The study result was successfully presented at the conference and key policy recommendations have been adopted by the conference (Appendix 1).

Figure 1-2. Study Process



IEEJ = The Institute of Energy Economics, Japan.
Note: The 5th P-C Conference is the 5th LNG Producer–Consumer Conference.
Source: Author.

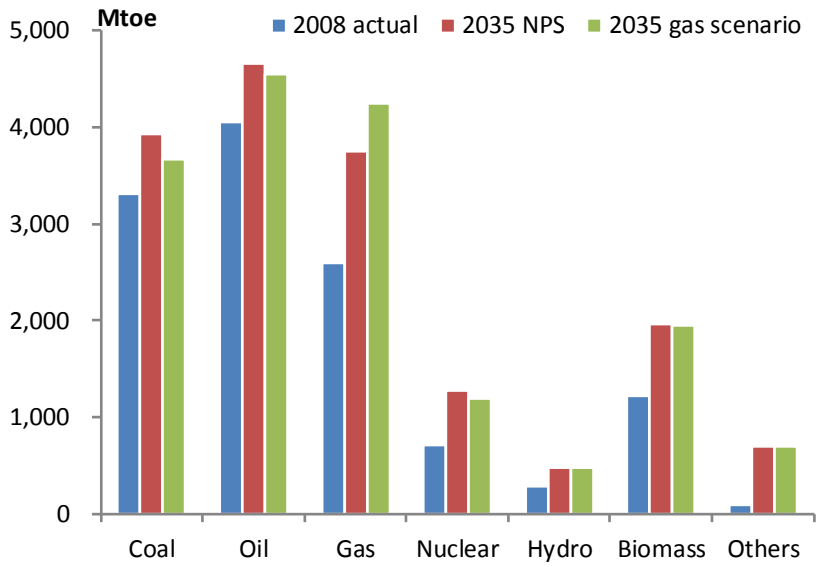
CHAPTER 2

Background

Five years ago, the advent of the Golden Age of Gas was suggested in the *World Energy Outlook 2011,* published by the International Energy Agency (Figure 2-1). It provided a scenario where an abundant natural gas supply at a reasonable price would expand the global natural gas market and simultaneously achieve stable energy supply and reduce carbon emissions by replacing coal consumption. However, such a rosy scenario has not unfolded, except in the United States of America where the significant growth in domestic production has increased the share of natural gas in its energy supply mix. Global gas demand, as a whole, has continued to grow in the last 5 years, but its growth rate has been rather lower than expected for many parts of the world. According to historical statistics, the increment of natural gas demand is smaller than that of coal in most years since 2000. In addition, after 2012, even the increase in renewable energy surpassed that of natural gas (Figure 2-2).

What happened in the global gas market? Why did the Golden Age not materialize?

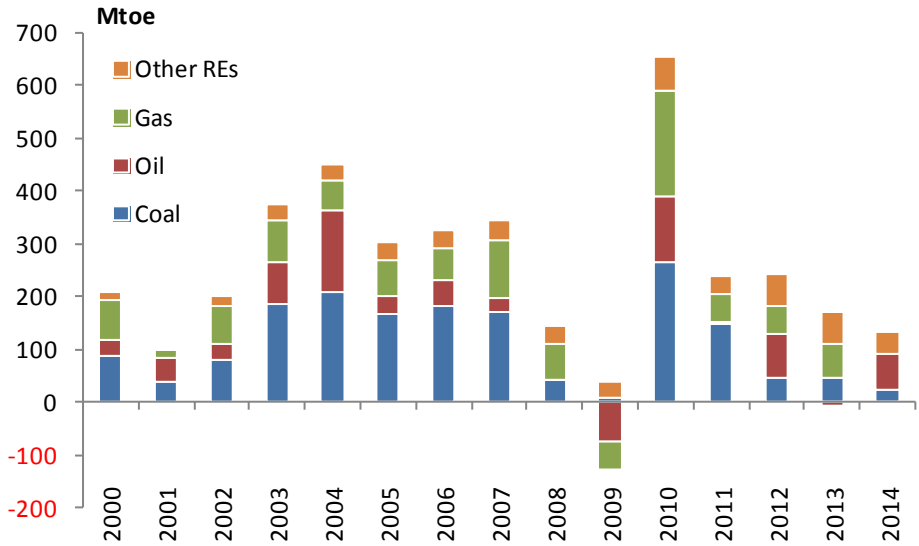
Figure 2-1. Outlook for a Golden Age of Gas



Mtoe = million tonnes of oil equivalent, NPS = New Policy Scenario.

Source: International Energy Agency (2011).

Figure 2-2. Year-on-Year Change of World Energy Demand by Fuel

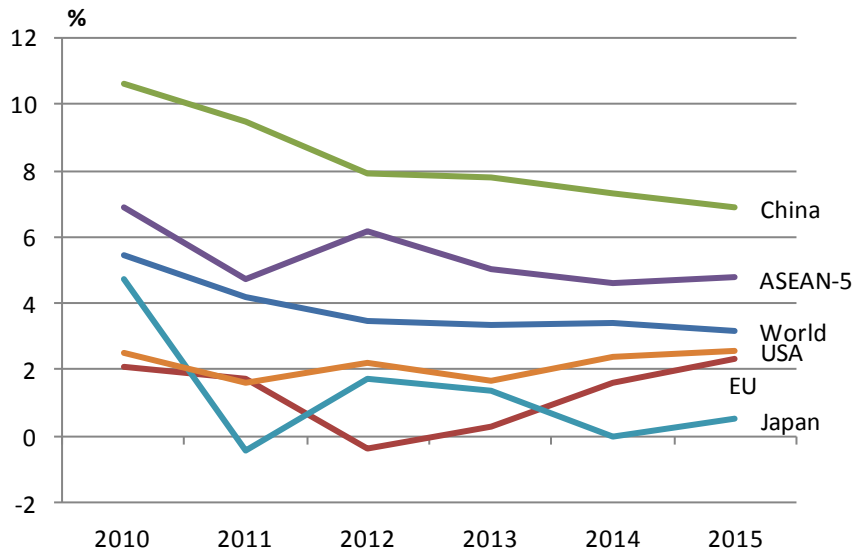


Mtoe = Million Tonnes of Oil Equivalent, RE = Renewable Energy.

Source: International Energy Agency (2016).

Market and policy factors are behind the disappointing rate of market expansion. The biggest market factor is macroeconomic stagnation in both developed and developing countries. In Europe, economic uncertainties triggered by the fiscal crises in several European Union member countries have dampened the region's economic performance, reduced total energy demand, and narrowed the room for growth in demand for natural gas. In emerging countries, most notably China, economic slowdown, if not downturn, resulted in much slower growth in total energy demand and restricted the potential growth of natural gas demand.

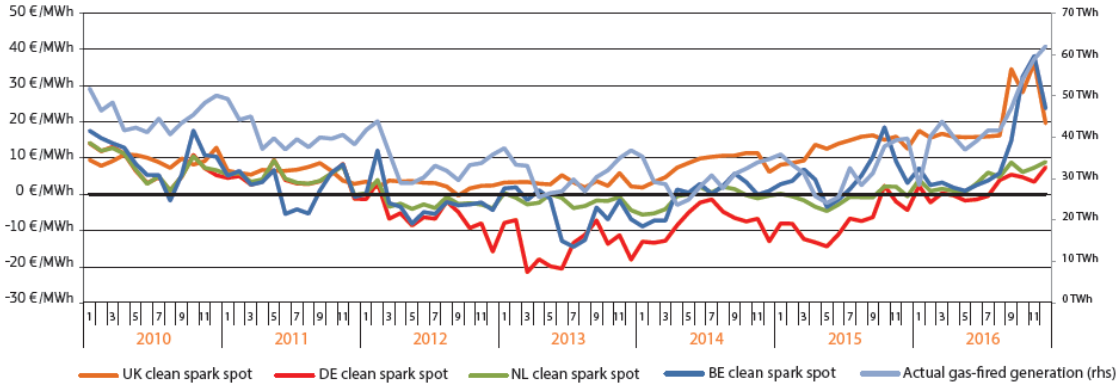
Figure 2-3. Growth Rate of Real GDP



ASEAN-5 = Indonesia, Malaysia, Philippines, Thailand, and Viet Nam, EU = European Union, GDP = gross domestic product, USA = United States of America.
Source: International Monetary Fund (2016)

A second market factor is the relative price competitiveness of coal against natural gas. In almost all major markets, natural gas prices are higher than coal prices. Natural gas is therefore not an economic option in the consumers' selection of energy sources. In Europe, the carbon price set in the European Union Emission Trading System was not high enough to encourage the use of the environment-friendly natural gas. In Asia, the liquefied natural gas (LNG) pricing formula linked to crude oil prices kept the prices of imported LNG at a high level, which kept consumers away from the use of natural gas versus more reasonably priced coal.

Figure 2-4. Clean Spark Spreads of Selected European Markets



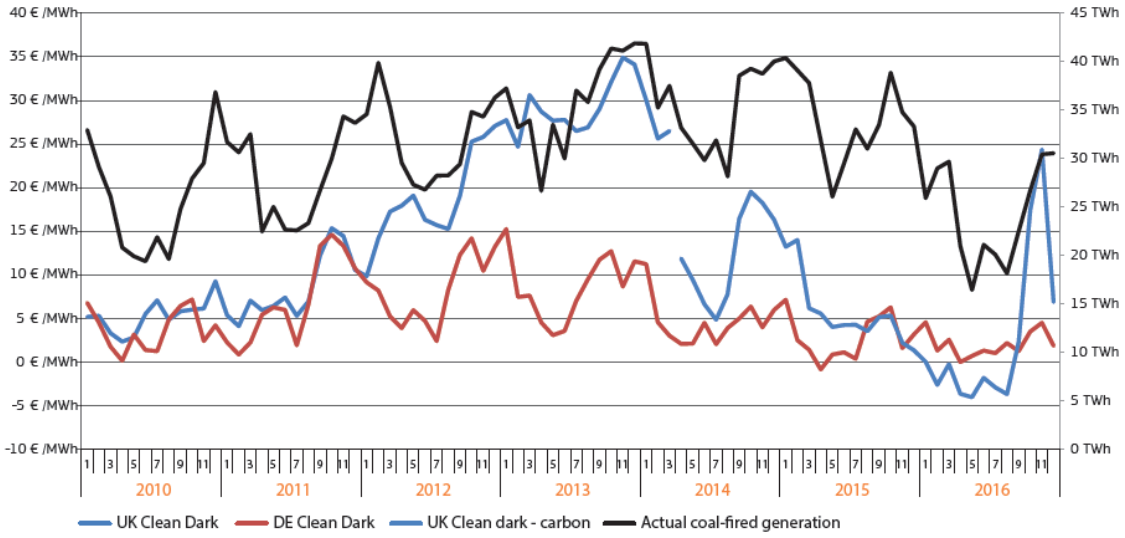
BE = Belgium, DE = Germany, NL = Netherland, UK = United Kingdom.

Notes: Clean-spark spreads is defined as the average difference between the cost of gas and emissions, and the equivalent price of electricity. If the level of spark spreads is above 0, gas power plant operators are competitive in the observed period.

€/MWh = euro per megawatt hour.

Source: European Commission (2016), *Quarterly Report on European Electricity Markets*, 4th Quarter.

Figure 2-5. Clean Dark Spreads of Selected European Markets



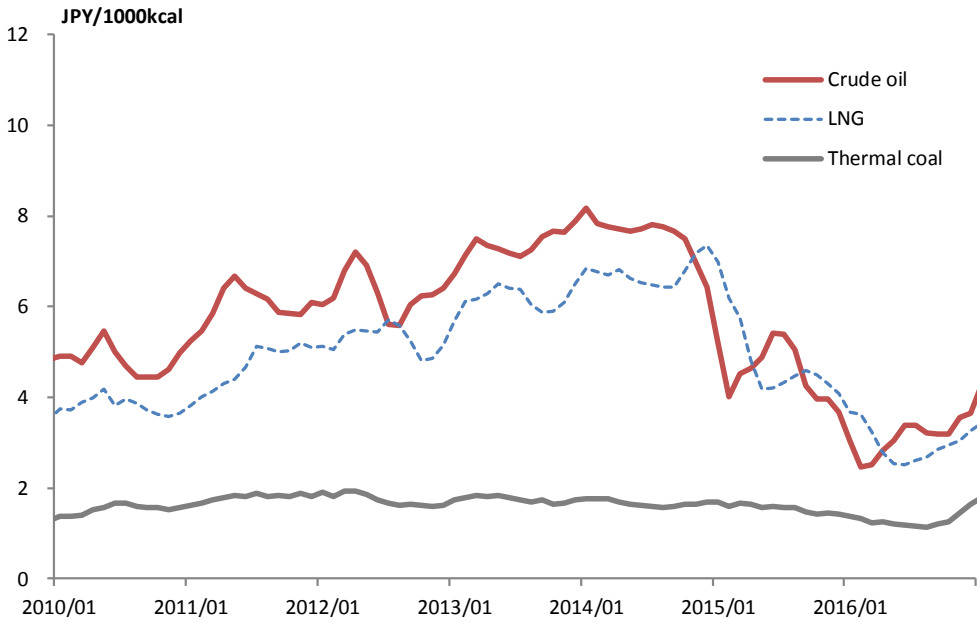
DE = Germany, UK = United Kingdom.

Notes: Clean dark spreads = Defined as the average difference between the price of coal and carbon emissions, and the equivalent price of electricity. If the level of dark spreads is above 0, coal power plant operators are competitive in the observed period.

€/MWh = euro per megawatt hour.

Source: European Commission (2016).

Figure 2-6. Japan's Fossil Fuel Import Price per Unit Heat Content



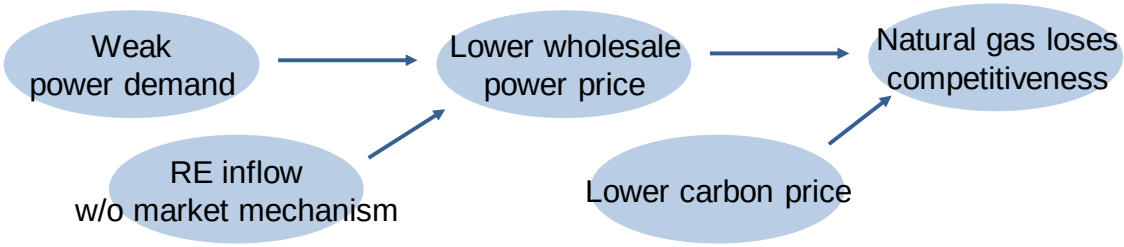
LNG = liquefied natural gas.
Note: JPY/Kcal = Japanese yen per kilocalories.
Source: The Institute of Energy Economics, Japan, EDMC Databank.

Policy factors also worked unfavourably for natural gas. Generous government support made renewable energy a more attractive energy option for consumers. Without any distortion by policies, natural gas is still more cost competitive over other renewable energy as a fuel source for power generation. However, it was disadvantaged by strong government/policy support for renewable energy, either by subsidies or taxation, such as the Feed-in-Tariff scheme.

The mechanism to squeeze out natural gas from power generation market can be explained like this. The fundamental (supply-demand balance) of power market is weak because of a stagnated economy. Although the power market is oversupplied, subsidized renewable electricity increasingly flows into the market and consequently lowers wholesale power price. Under such condition, the coal-fired power plant is the only choice for power generators to profit. In addition, a low carbon price further strengthens the price competitiveness of coal. As such, natural gas-fired power plants lose their ground in the power market.

This phenomenon is present not only in Europe, where renewable energy has traditionally received consistent government support, but also in emerging countries such as China and India where renewable energy is highly valued as an indigenous energy source from an energy security standpoint.

Figure 2-7. Mechanism to Squeeze out Natural Gas from the Market



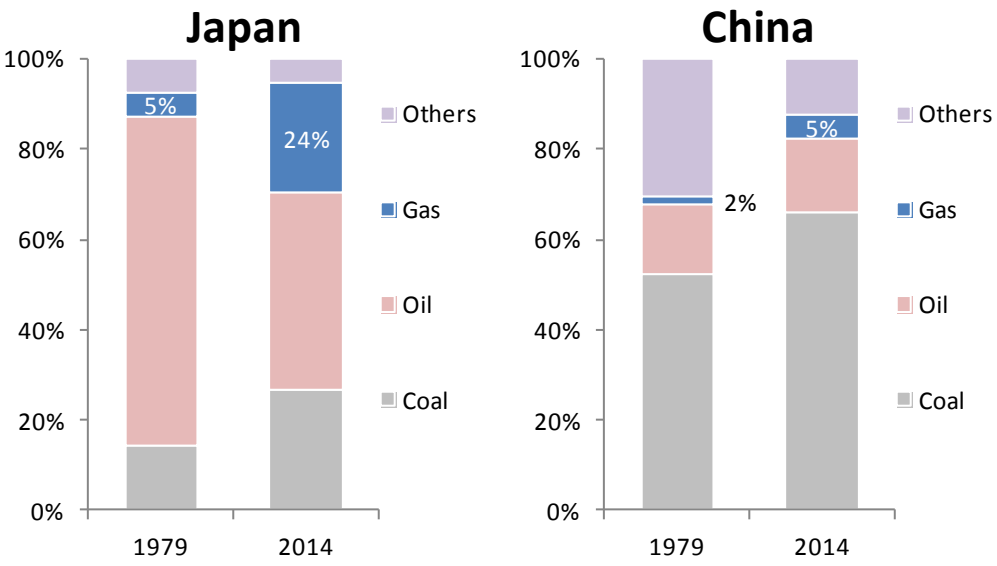
RE = renewable energy, w/o = without.

Source: Author.

Natural gas has numerous security benefits. In Japan, for instance, LNG was introduced as an alternative energy to reduce its high dependence on oil after the two oil crises in the 1970s. LNG has in fact been a highly stable and reliable energy source for traditional LNG importers such as Japan, Korea, and Taiwan. In China and India, natural gas will likely play a very important role in diversifying their energy sources that heavily depend on coal today. In Asia, where energy demand will continue to grow, the security benefits of natural gas cannot be overemphasized. Among various natural gas supply sources, imported LNG will play a far greater role in Asia considering its significant potential for growth in supply[1] and supply flexibility.

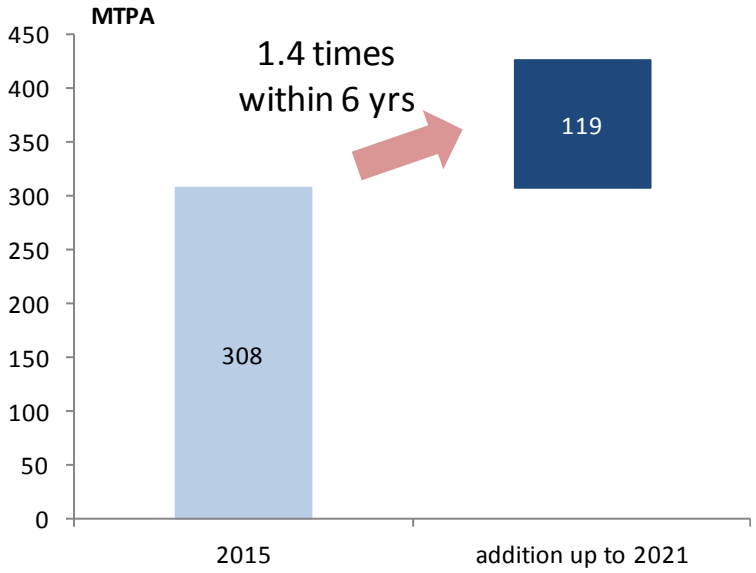
[1] The Energy Information Administration estimated the global technically recoverable amount of unconventional gas as 6,954 trillion cubic feet (approximately 195 trillion cubic metres) in their World Shale Resource Assessments in September 2015. If this resource becomes available, the world's natural gas reserves-to-production ratio will be doubled to around 109 years from 53 years in 2015 (BP (2016)).

Figure 2-8. Change in Total Primary Energy Supply Mix



Source: International Energy Agency (2016).

Figure 2-9. Planned Addition of LNG Liquefaction Capacity



LNG = liquefied natural gas, MTPA = metric tonnes per annum.
Sources: GIIGNL (2015) and International Energy Agency, Global Gas Security Review 2016.

Another important element that hinders the use of natural gas is the lack of natural gas/LNG supply infrastructure. Needless to say, a country needs to develop sufficient capacity for LNG receiving terminal, transmission, and distribution pipelines before it can import and consume. The problem is the relatively high capital expenditure on natural gas infrastructure. Because of this capital-intensive nature, the development of a natural gas/LNG supply infrastructure

requires a minimum/critical amount of concentrated demand to make it economically feasible. A certain amount of demand is also required as collateral to secure the necessary loan for financing a project.

In general, the development of gas infrastructure lags behind electricity, in particular, the low-pressure distribution system. In a developed country, for instance in Japan, gas was first utilized as fuel for street lighting. Hence, gas distribution pipelines were installed to provide public service to the city. However, at present, electricity is the more common source of essential energy service for the people and industry. As such, developing countries have been making strong efforts to achieve 100% electrification. With this shift from gas to electricity, a lot of people from cities in the Association of Southeast Asian Nations (ASEAN) are using electricity rather than gas for cooking, heating water, and lighting. Naturally, the creation of new natural gas demand and the development of new gas supply infrastructure have become more difficult than in the past.

What then needs to be done to realize the expanded use of LNG in Asia? This report recommends several actions by government and industry players to achieve this objective. Chapter 3 discusses this issue in depth.

CHAPTER 3

Working Group Discussions

This chapter summarizes the major discussions during the two working group meetings.

3.1 Dominant Factor to Encourage LNG Use

Although the importance of promoting natural gas demand varies depending on the country and perspective, majority of the workshop participants felt that, to increase LNG demand in the EAS region, it is most important to boost the competitiveness of LNG with respect to other types of energy. In the power generation sector, which is the core of LNG demand, competition is intense with low-cost coal-fired power and the politically supported renewable energy. Therefore, in attempting to increase LNG demand for power generation, the most important thing is to lower the relative price of LNG.

In addition, it was pointed out that there is no adequate regulation of carbon emissions, or existing regulations do not have an effect on the EAS region. Compared to other fossil fuels, LNG has low emissions of environmental pollutants, including carbon dioxide. Therefore, its use is expected to grow as the response to issues such as pollution and climate change becomes stricter. However, adequate mechanisms are not in place for evaluating the environmental value of natural gas, which makes it hard for the demand to increase.

3.2 LNG Price Benchmark and the Liberalization of the Downstream Market

For LNG to be reasonably and competitively priced, there is a need to create a highly transparent and reliable price benchmark for LNG/natural gas, which is lacking in Asia. Several efforts in that direction were presented, such as in China, Japan, and Singapore, but in every case it is assumed that the number of trading participants will be increased to raise transparency and reliability. From this perspective, it will be necessary to gradually abolish government control on price in the domestic market through the deregulation of the market in each country and the participation in LNG trading by an increasing variety of players.

Also, in international trading, interesting activities such as the standardization of sales and purchase agreements, and the removal or relaxation of destination clauses by ASEAN were presented as ways to lower LNG trading barriers and thereby increase the liquidity of trading.

3.3 Cost Reduction of LNG Supply Chain

Various options were presented and discussed in terms of cost reduction in the LNG supply chain. For liquefaction plants, an example presented was cost reduction through modularization, an approach which has actually been used in Australia. For regasification plants, the discussion

touched on the significance of floating storage and regasification units (FSRUs), whose use has been considered all over the world in recent years. FSRUs can be set up with less expense and a shorter construction period than conventional regasification plants built on land. This can be used by countries with comparatively low demand for LNG and as a short-term bridging solution. Due to the progress on this technology, it is expected that hurdles standing in the way of LNG production and importation will be lowered, and the growing LNG demand will consequently be supported in the future.

It was also pointed out that priority should be placed on the maximum use of underutilized capacity in existing LNG and natural gas infrastructure. In some existing infrastructure, not all equipment capacities are being used due to economic, technical, and other reasons, and reversing this situation will be one method of expanding supply capacity at the lowest cost.

If this idea is broadened further, countries new to using LNG will be able to create supply chains at low cost by jointly using, with other companies and other countries, the supply chains previously planned and developed in one company or country. For operators of existing infrastructure, this will have the benefit of improving the operation rate of equipment. In the case of ASEAN, for example between Thailand and Myanmar, it may be possible to efficiently build up LNG infrastructure by adopting this idea of wide-area infrastructure development and use across national boundaries.

3.4 Risk Share and the Role of Government

Long-term demand commitments have previously played a major role in developing new gas fields and establishing LNG supply chains. It was confirmed that demand commitments will continue to be an important element. However, at the same time, it was pointed out that the market environment is changing rapidly. There is increasing preference and trade in spot LNG and increasing competition in domestic gas and power market. In terms of the risk allocation between producers and consumers, it was proposed that a system of taking mutual risks be bolstered, for example by expanding upstream investment by consumers to shift some of the risks from producers to consumers.

In terms of government involvement, there were two contrary opinions. First is that involvement, such as leadership and risk sharing[2], should be limited to frontier projects[3] with high risk. Second is that the core infrastructure of LNG importing facilities and pipelines should be developed with government leadership[4]. It is difficult to establish a common degree of government involvement across the region, and there will be a need for studies on energy industry structures (ownership of business) and the capability of the private sector which differs for each country.

[2] Risk share includes equity investment, loan provision, and loan guarantee.
[3] An example of a frontier project is a project related to deepwater or arctic resource.
[4] In case a private company does not have the capability to build and operate such infrastructure or the business risk is too high for a private company, the government may be required to take the lead role.

CHAPTER 4

Recommendations for Expanding LNG Use

Expanding LNG demand in Asia necessitates two critical conditions: enhancement of the competitiveness of LNG and sufficient investments in all parts of the LNG supply chain. The following sections explore the required actions to achieve such conditions.

4.1 Enhance the Comprehensive Competitiveness of LNG

LNG should be chosen as the preferred source of energy primarily by consumers as well as policymakers if its market share were to expand in Asia. While it is highly likely that the total energy demand in Asia will continue to grow, it does not necessarily promise a bright future for LNG. In choosing a specific energy option to meet the region's incremental energy demand, consumers (from the power industry to the residential sector) consider multiple factors for each energy option. These include price level, stability of supply, volume flexibility, and carbon intensity. Government policies to promote natural gas use can also add an incentive to consumers to choose natural gas.

What is the competitiveness of LNG then? The simplest definition will be its supply price to final consumers. But, as mentioned above, a consumer chooses energy based not solely on the price but also on various other factors. Government subsidies or taxation can be regarded as part of competitiveness because they affect the supply cost to final consumers. The competitiveness of LNG therefore should be regarded in a more comprehensive manner to reflect the factors considered by consumers. Based on these observations, the definition of the competitiveness of LNG in this paper is the comprehensive consumer benefits based on supply cost, reliability of supply, flexibility of supply, and carbon intensity.

4.1.1 Reduce supply cost

The most straightforward means to enhance competitiveness is to reduce the cost of supply across the supply chain. Because it is the instinct of industry players to reduce costs, every cost reduction possibility has likely been explored and exploited by them. However, given the recent developments in the global LNG industry, new possibilities for further cost reductions are emerging.

Adopting effective cost-reduction means

One of the most commonly employed options in the recent development of LNG receiving facilities is the floating storage and regasification unit (FSRU). The FSRU has traditionally been

viewed as a temporary means to receive LNG until an onshore terminal is completed. However, the role of FSRU may be changing today. Most of the countries that recently started importing LNG, such as Jordan and Pakistan, utilize FSRU as their LNG receiving facilities. In 2015, 20 million tons of LNG, or 8% of the total LNG traded in the world, were received through FSRUs. Several future LNG importers, such as Bangladesh and Myanmar, are also planning to install FSRUs to start their LNG imports. Because an FSRU does not require the procurement of a large land area or the construction on onshore sites, it can significantly shorten the construction period and reduce the construction cost (Table 4-1). This lower level of capital investment requirement can be attractive to smaller importers or new markets whose creditworthiness is untested or questionable. It is also a good option for islands that traditionally utilize diesel engine to generate electricity. Lower upfront cost of FSRUs enable islands to alternate diesel generators with cleaner LNG for power generation. Therefore, although the receiving capacity of FSRUs is limited, FSRUs have certainly lowered the hurdle for countries that are just starting to import LNG. FSRUs will play a crucial role as a 'starter kit' to cultivate future LNG markets.

Table 4-1. Comparison between Onshore Terminals and FSRUs

	Onshore terminal	FSRU
Cost	≈ US$100 billion	≈ US$30 billion (new ship) ≈ US$8 billion (altered ship) + additional cost for mooring
Construction period	≈ 5–7 years	≈ 3 years (new ship) ≈ 1 years (altered ship)
Other pros and cons		- Easy to move, diversion - Requires stable marine condition - Lower flexibility of capacity expansion

FSRU = Floating Storage and Regasification Unit.
Source: Japan Oil, Gas and Metals National Corporation (2013).

In the upstream sector, the modular construction of liquefaction plants is another example of the recent cost reduction efforts by the industry. Construction of the whole plant at the plant site tends to be costlier and needs a longer construction period. The modular approach, which sees the manufacturing of several liquefaction facility modules at different locations, and their assembly at the plant site, can reduce capital expenditures and shorten the construction period. The modular approach has already been a highly effective solution to controlling the overall construction costs of projects in locations where there is severe workforce shortage such as Australia. Modularization, however, could complicate the whole engineering process and ultimately create construction delays due to the complexity of on-site assembly. It should be noted that the modular approach requires advanced project management capabilities to fully

reap the benefits of the process.

Project management skills will also continue to be a key factor that can reduce construction costs. Building an LNG liquefaction plant is a 'work of art' that manages the progress of numerous parts of the facility construction while minimizing the construction cost and period as much as possible. Many international oil companies that have developed several LNG plants have accumulated sufficient project management capabilities. Yet to ensure the competitiveness of LNG against other energy sources, the further improvement of project management skills will remain a big task for project developers.

4.1.2 Improve logistic flexibility

Optimizing logistics

As a means to optimize supply logistics, buyer companies have been forming various types of alliances in the last 3 years. The most notable example is JERA, a joint venture for fuel procurement and overseas business founded in 2015 by Tokyo Electric Power Company and Chubu Electric Power Company of Japan. After its foundation, JERA has been actively forming commercial alliances with other buyers such as EGAT of Thailand and EDF Trading of France to enhance flexibilities in their cargo operations. Tokyo Gas has also formed similar alliances with PTT of Thailand and Kogas of Korea to seek further optimization opportunities in its LNG procurement activities. As a growing number of importers with a variety of demand patterns and trading interests are entering the LNG market, more efficiency improvement opportunities through buyers' alliances will arise. Accumulation of trading expertise among LNG sellers and buyers will also enable the more effective handling of the LNG supply and eventually lead to further supply flexibilities.

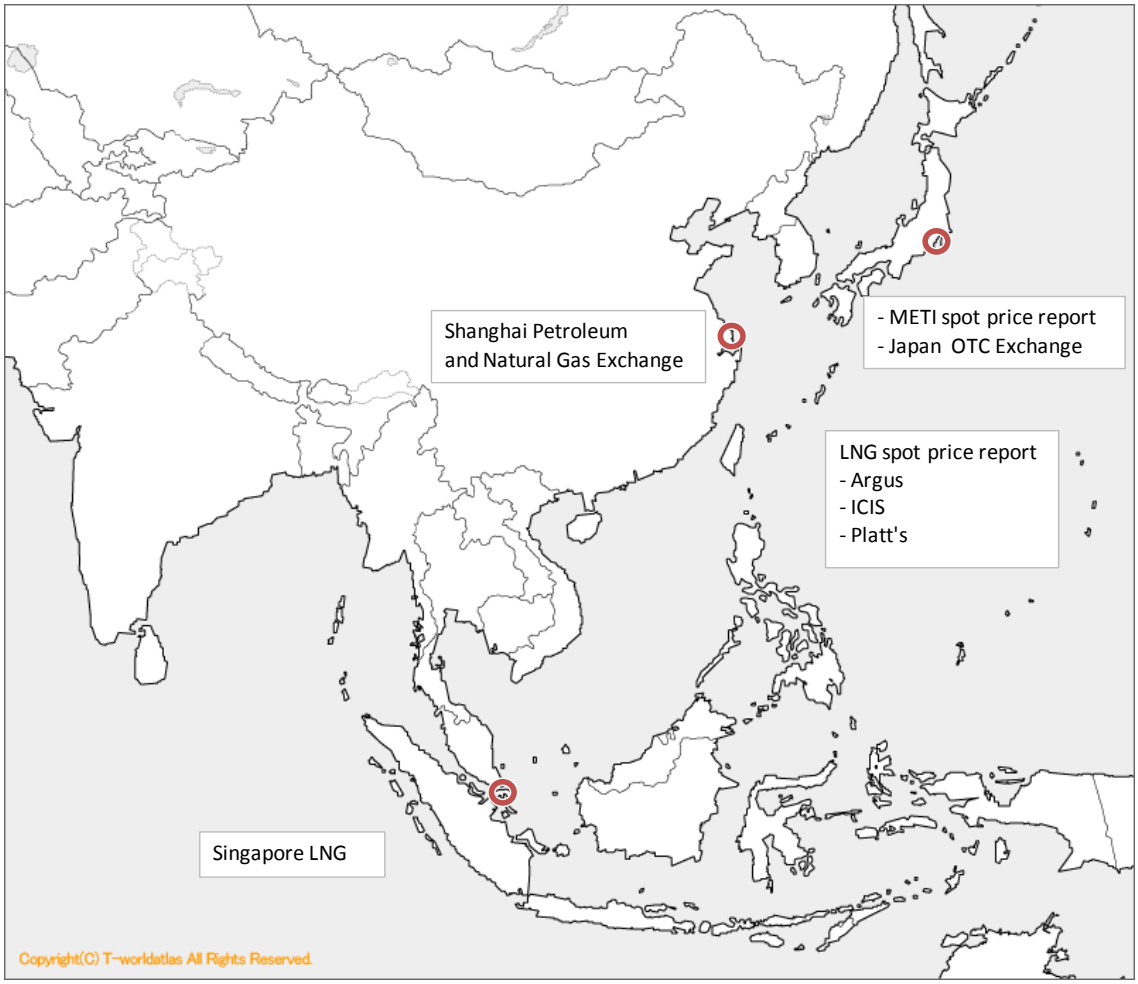
4.1.3 Utilize market mechanism

Creating a reliable price benchmark

Utilizing the market mechanism is another effective means to enhance supply flexibility. In this regard, the creation of a reliable price benchmark is one of the most prioritized tasks because the existence of such a benchmark will enable LNG to be priced in a more transparent and timely manner, and facilitate more active and flexible cargo trading. A reliable benchmark should be based on liquid trading volumes as well as the participation of various market players with different trading interests and risk preferences. The development of Asian LNG hubs, which has been extensively discussed among stakeholders at various occasions, will greatly help the creation of the benchmark. Delinking from crude oil price in the LNG long-term contract should also be pursued along with this effort, as the resurgence of the Asian Premium will likely further deteriorate the future of natural gas in the Asian market.

The reliability of such a benchmark will be fostered and grown primarily by market players, but governments can accelerate the benchmark creation by providing a physical and institutional framework to support the function of such a benchmark and by identifying the possible incompatibilities between destination clauses with competition laws, as done by the European Commission.

Figure 4-1. Attempts to Create an LNG Price Benchmark in Asia



LNG = liquefied natural gas, METI = Ministry of Economy, Trade and Industry, OTC Exchange = over-the-counter exchange.
Source: Author.

Liberalizing the domestic market

Liberalization of the domestic market may be an option to achieve greater efficiency and reduce supply cost in the natural gas market in Asia. In countries where a large state-owned entity dominates the natural gas supply, such market liberalization will create competition among

natural gas suppliers and realize a more competitive and efficient natural gas supply. Liberalization of the market may also encourage natural gas suppliers to innovate ways to reduce supply costs to final consumers. The entry of new suppliers to the market will widen consumers' options and improve supply flexibility. For example, in China, the reform of the domestic natural gas market is expected to reduce pipeline transportation costs. The current supply capacity surplus in the global LNG market might also work favourably for the competitiveness of LNG in a liberalized market. All these effects will enhance the comprehensive competitiveness of LNG.

The market mechanism is a highly effective way to realize an efficient and transparent market system. The framework of the domestic natural gas market should be designed to maximize the benefits of market forces. Yet, liberalization without careful consideration and design may yield unintended consequences by causing distractions and confusion among market players in the regional and domestic natural gas markets. The hasty introduction of market mechanism in countries where the natural gas business is still heavily regulated can cause unstable supply, volatile prices, and deferred investments. Liberalization of the natural gas market should be implemented as part of a comprehensive policy package, as liberalizing the energy market of natural gas alone, while leaving the other energy markets regulated, will likely bring about an unwanted and distorted outcome for the natural gas market. Careful assessment of policy actions is therefore needed in the implementation of natural gas market liberalization to achieve a more competitive natural gas supply. Prioritization and speed of policy implementation, with sophisticated preparation in particular, are extremely important to avoid such unwanted results.

4.1.4 Internalize externalities

LNG has several benefits. Unfortunately, many of these benefits, such as its low-carbon profile, geographical diversity of supply sources, and abundant resource and supply potential, cannot be properly valued by market mechanism. In other words, those benefits of LNG have a nature of externality. Proper reflection of the externalities in the market requires policy arrangements that internalize such externalities.

Providing a policy framework that favours lower carbon energy

An oft-used policy framework to internalize carbon emissions cost, which is one of the most notable types of externalities in the energy market, is carbon pricing. Carbon tax and carbon trading are two of the carbon pricing measures and policies that have been extensively adopted by many countries. While carbon pricing is a straightforward means to internalize carbon externality, there are other types of policies that can achieve a similar effect. The Chinese government's ban on coal consumption in Beijing after 2020, for instance, will make natural gas more extensively used in the power generation sector to replace coal. The Clean Power Plan, which was announced by the United States government in August 2015, is a regulatory action which aims to phase out carbon-intensive coal plants from the nation's mix of power generation assets. This will likely facilitate natural gas demand in the United States of America. The type of selected policies will vary across countries, reflecting each country's prioritized goals or

preferred policy tool. What is important is to ensure that the benefit of natural gas as a lower carbon fuel is properly recognized by consumers.

Table 4-2. Characteristics of Carbon Tax and Carbon Trading

	Carbon Tax	Carbon Trading
Pros	• Fair for every emitter • Low administration cost • Provide foreseeable investment environment	• Easy to control emission amount
Cons	• Difficult to control emission amount	• Allocation of allowance sometimes becomes unfair • High administration cost • Volatile price change sometimes discourages long-term investment

Source: Author.

In this regard, setting a specific numerical energy mix target is another policy option. In July 2015, the Japanese government publicized its energy mix target as of 2030 to ensure the '3E plus S' policy – energy security, economic efficiency, environment, plus safety. In November 2014, the Chinese government also announced its target share for natural gas utilization at 10% as of 2020. Target setting itself does not guarantee the expanded use of natural gas, but providing a clear direction of a preferred energy mix and combining it with policy arrangements, such as regulations, subsidies, or taxation, will help realize a more diversified and thus secured energy supply.

LNG has numerous benefits. But as long as it is traded only by market mechanism, its use may not grow significantly because some of its benefits are difficult to be quantified. Excessive government intervention of course must be avoided. But governments have a role to play in ensuring that the benefits of LNG are reflected in the market if LNG demand were to expand to desirable levels.

4.2 Ensure Investments

The steady expansion of the LNG market requires sufficient investments in all parts of the supply chain, from upstream, midstream, to downstream. Although the global LNG market is forecast to remain in an over-supply situation for the next few years, it is very important to continue to make sufficient investments in the LNG supply value chain. We should be reminded of the danger of complacency.

More attention tends to be paid to investments in upstream and liquefaction parts of the supply chain. However, infrastructure development at downstream, such as power plants, transmission pipelines, and city gas networks, are equally important for the creation of final demand, especially in emerging countries in Asia. This is because completing an LNG supply chain requires a significant amount of upfront investment, and ensuring profits from such a large investment project is always critical to attracting and maintaining investments for the LNG supply chain.

Conditions for sustainable and sufficient investments can be divided into two categories: the reduction of the total size of investment risks, and the allocation of the residual risks that cannot be reduced by policy or industry efforts such as price fluctuations or demand uncertainties. Reducing the amount of risks will be largely undertaken by the governments of both producing and consuming countries, as well as the well-functioning market. Risk allocation, on the other hand, is primarily conducted among the relevant industry parties, including LNG buyers, LNG sellers and, to some extent, the financial institutions that provide financing.

4.2.1 Reduce the size of risks

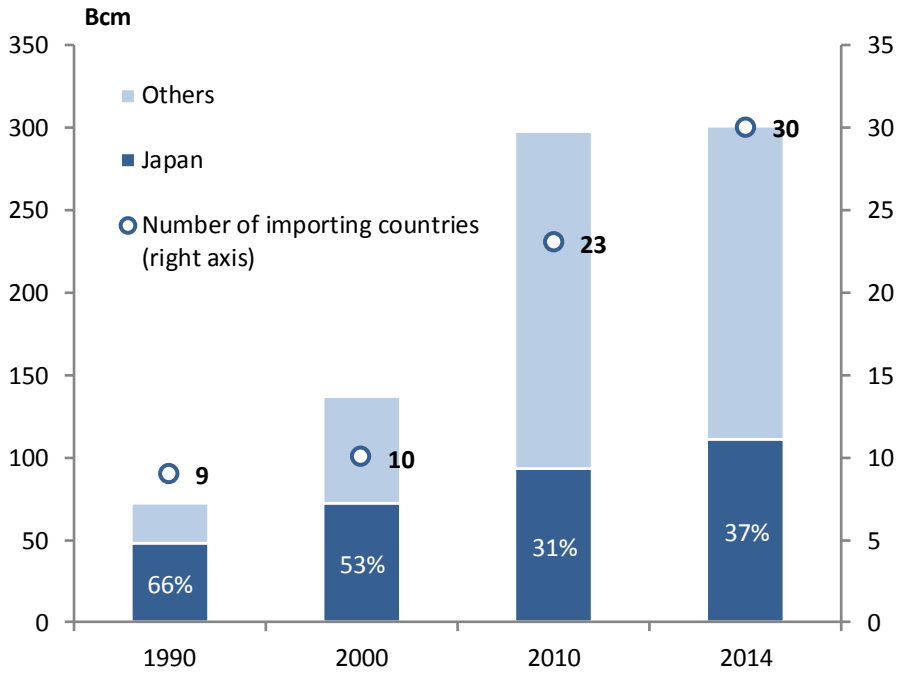
Developing a well-functioning market

Firstly, to promote investment, the total size of investment risks for an LNG supply chain project needs to be reduced. In this regard, creating a well-functioning LNG market will be a major contribution. This is because an LNG market with abundant spot cargo supplies, high liquidity of traded volume, and a variety of players with different backgrounds and trading interests would reduce such volume (or marketing) risks for project investors. In a well-functioning market, the project investors will find buyers for their LNG supply more easily.

The current global LNG market is in a transition stage, thanks to the advent of abundant flexible LNG supply from the United States and the emergence of various buyers from non-OECD[5] countries that procure LNG mainly on a spot basis. The traditional vertically integrated business model based on long-term contracts has greatly contributed to reducing the volume risks for both producers and consumers. However, given the new market conditions where trading liquidity and flexibility are being enhanced, the traditional risk reduction model should be re-examined, considering the new reality, and a larger portion of volume risk for both buyers and sellers should be managed mostly by market mechanism.

[5] Organisation for Economic Co-operation and Development.

Figure 4-2. Increasing Number of LNG Buyers



Bcm = billion cubic metre, LNG = liquefied natural gas.
Sources: BP (2016); GIIGNL (2014).

Improving the investment environment

In the upstream sector, governments of natural gas-producing countries need to improve the investment environment to encourage potential investors to engage more in new LNG projects. The transparency and timeliness of decision-making will be critical. The removal of bureaucratic deadlocks in any approval process will greatly help upstream operators to swiftly realize their projects. Transparent contractual terms and conditions in upstream development are desired. Proactive disclosure of information will also encourage upstream development. The Australian Government, for instance, publishes and provides extensive geological data of the prospective areas of the country for exploration to potential investors.

Some of the abovementioned issues regarding the investment environment originate from the nature of governance or type of political structure that is unique to a particular producing country. Thus, they are not easy to address in a short period. But improvement in the investment environment is a critical factor to realize sustained investment in the LNG value chain. Natural gas-producing countries are expected to continue to make consistent efforts in this area.

Encouraging natural gas use by government support

In the downstream sector, consumer governments can play an important role by promoting more natural gas use in their energy mix. Guidance by a consumer government to encourage natural gas use and fiscal support to develop infrastructure will be key in creating more demand

for LNG. This is particularly pertinent to emerging LNG-importing countries because infrastructure development in the downstream supply chain is one of the major hurdles to increase natural gas use in those countries. In countries where natural gas does not have a dominant demand sector and always faces inter-fuel competition, clear government guidance to expand natural gas use will help create a higher and more stable demand, and minimize the future demand uncertainties for LNG project investments.

Supporting upstream investment by public finance

Public financial support for investment will also be an effective means to reduce the size of risks. As repeatedly mentioned, an LNG project requires a significant amount of initial investment and needs a long time to recover the investment. LNG business therefore is inherently long term in nature. Individual LNG buyers, on the other hand, are facing growing demand uncertainties due to inter-fuel competition, market liberalization, and utilization of nuclear power plants, and are driven to pay more attention to shorter-term contracts.

Because there is a mismatch of interest between the inherent long-term nature of LNG business and the preference for short-term trading of market players in the current LNG market, public financial support for investments will help reduce the mismatch. A multilateral financial institution, such as the Asian Development Bank, can provide finances to help a potential LNG project to materialize. Government oil and natural gas agencies, such as the Japan Oil Gas and Metals National Corporation, and government financial institutions, such as the Export-Import Bank of Korea, had provided financial support for upstream development or liquefaction plant construction in the past.

The economic viability of supported projects, in principle, must be carefully examined to avoid slack financing or a crowding-out problem. A project eligible to receive public support may be restricted to a 'frontier' project, namely: a technically challenging project in the arctic or a deepwater gas field development, or a project in a politically sensitive country that merits government-level support. But in the current unpredictable and volatile oil price environment, upstream projects with high strategic importance from the viewpoint of long-term market stability may merit more proactive commitment from consuming country governments, such as in the form of government financing.

4.2.2 Allocate risks

Removing or relaxing the destination clause

The changing environment of the global LNG market merits the consideration of new risk allocation formats. As repeatedly discussed among the stakeholders, the removal and relaxation of the destination clause should be pursued from various standpoints, including one regarding the enhancement of healthy market competition. Traditionally, LNG sellers have taken upstream risks, such as geological and operational risks associated with natural gas field development as well as technical risks associated with the liquefaction process. LNG buyers, on the other hand, have taken downstream risks, such as demand volume and price fluctuation, by committing to a long-term contract. However, as the global LNG market is experiencing several structural changes owing to the shale revolution, greater diversity of suppliers and consumers, and expansion of spot and short-term contract supplies, it is high time to reconsider the traditional way of allocating risks in the LNG business. A more liquid and transparent LNG market and healthy competition through the removal of the destination clause or the adoption of a new benchmark price will be more beneficial than the traditional LNG market format for the sound development of the Asian LNG market.

In this regard, the use of a standardized contract without a destination clause can contribute to more flexible LNG trading. The ASEAN Council of Petroleum (ASCOPE) is currently working to provide a standardized template for long-term LNG sales purchase agreements that allow the reselling of cargoes. The standardized contract will likely be used extensively among ASEAN LNG producers and consumers.

Investing in upstream equity by downstream players

As a means to share upstream risks, equity investment by downstream players is encouraged. The relative dearth of expertise and capabilities to develop and produce natural gas and LNG commonly precludes downstream players from becoming operators of LNG projects. However, the proactive involvement of downstream players through equity investment in upstream and LNG projects, even with a minor share, will help finance the project and reduce the level of risks undertaken by each stakeholder. The equity investment in upstream or LNG projects can also provide downstream players the benefit of natural hedges against LNG price fluctuations as well as access to a physical supply source. While several electric utility companies have obtained such equity in the past, their exposure had been at a modest level. More proactive participation in the project by downstream players will help realize a potential LNG project.

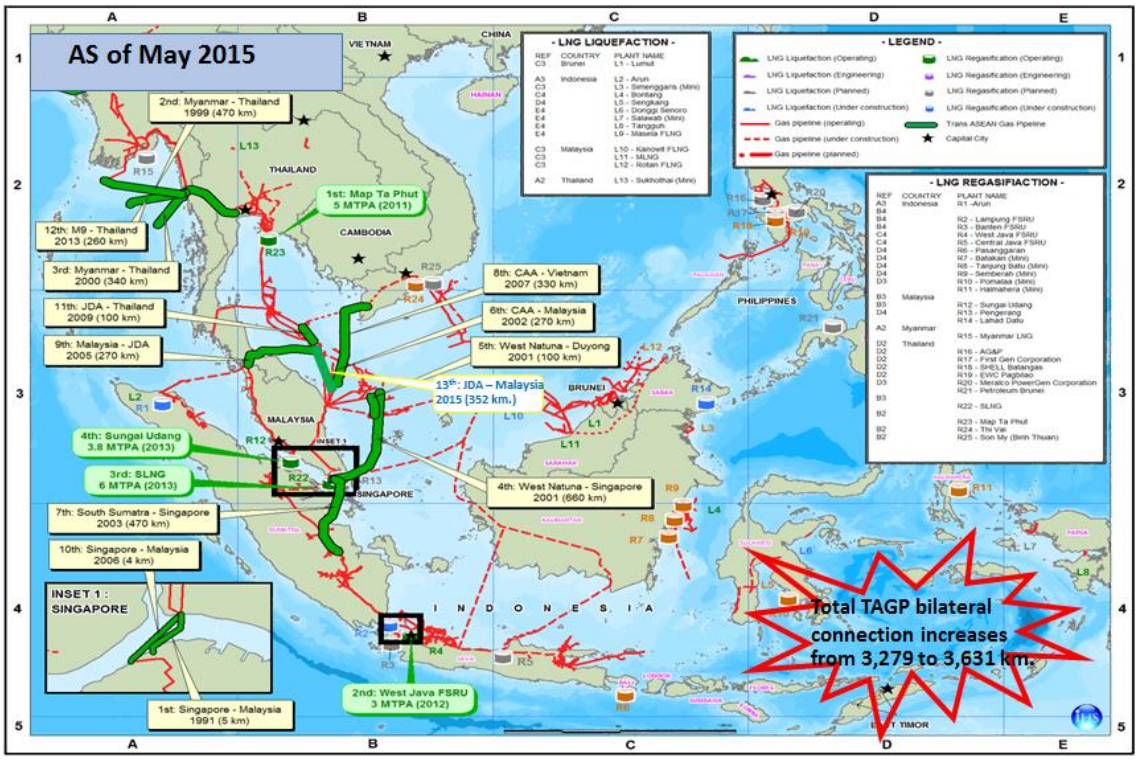
Optimizing the supply infrastructure

Although it is not directly related to risk reduction or allocation, optimizing the use of existing and new infrastructure reduces the need for additional investments, enabling the saved financial

resources to be used for other projects. Some traditional LNG exporting countries have liquefaction facilities that cannot be fully utilized due to economic or technical reasons. Developing infrastructure to supply feed gas at a reasonable cost and utilizing idle facilities may be a more economically rational investment rather than building a new liquefaction facility from scratch. In the downstream sector, building an extensive transmission pipeline network can reduce the number of receiving terminals by allowing the receiving capacity to be concentrated at select locations. Such optimization of receiving logistics will enjoy the benefits of economies of scale as well as reduce the required budget for infrastructure development.

In the case of ASEAN countries whose initial LNG demand will not be large enough to warrant building a full-scale receiving facility, a cross-border pipeline network can reduce the investment requirement for receiving facilities and optimize the total cost for fuel procurement as a region. The Trans ASEAN Gas Pipeline (TAGP) project perfectly fits this concept. The TAGP project is a blueprint to promote cross-border interconnection of gas supply infrastructure. The initiative can ensure necessary downstream investment in an optimal way.

Figure 4-3. Trans ASEAN Gas Pipeline Project



ASEAN = Association of Southeast Asian Nations, CAA = commercial agreement area, JDA = joint development area, M9 = offshore gas block M9 in Myanmar, MTPA = million tonne per annum, TAGP = Trans ASEAN Gas Pipeline.

Source: Web site of ASEAN Council on Petroleum.

As this arrangement can be seen to undermine the energy security interest of each receiving country, mutual trust and consent among relevant countries are needed on the overall design of such receiving infrastructure. In addition, such receiving infrastructure requires the development of an international/regional legal framework, such as the Energy Charter or a bilateral arrangement, to ensure the security of LNG supplies. Energy supply security through cross-border infrastructure must be a mutually beneficial one, and one country's energy supply security should not come at the expense of another country's supply security.

4.3 Summary of Policy Recommendations

The recommendations to expand LNG demand in Asia discussed in sections 4.1 and 4.2 above can be summarized in the table below. Comprehensive policy actions, together with efforts in industry in both producing and consuming countries, are required. The major requisites to promote LNG demand in Asia are: clear support of policy and development of well-functioning market, hence reliable price benchmark.

Table 4-3. Summary of Policy Recommendations

	Industry	Government
Producing country	• Adopt effective cost-reduction measures • Remove or relax the destination clause • Create a reliable price benchmark • Develop a well-functioning market • Optimize the supply infrastructure	• Develop a well-functioning market • Improve the investment environment • Optimize the supply infrastructure • Support investment through public finance
Consuming country	• Adopt effective cost-reduction measures • Remove or relax the destination clause and optimize logistics • Create a reliable price benchmark • Develop a well-functioning market • Optimize the supply infrastructure • Invest in upstream by downstream players	• Create a reliable price benchmark • Liberalize the domestic market • Provide a low-carbon policy • Develop a well-functioning market • Encourage natural gas use by government • Optimize the supply infrastructure • Support investment through public finance

Source: Author.

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Appendix 1. A Statement Paper of the Working Group for the 5th LNG Producer–Consumer Conference

Recommendations
for
expanding LNG market in Asia

November 2016

The Economic Research Institute for ASEAN and East Asia
The Institute of Energy Economics, Japan

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Recommendations for expansion of LNG market in Asia

Summary

The increased use of LNG is expected to solve many of our energy and environmental problems by ensuring a stable energy supply at an affordable price based on its abundant and geographically diversified resource base, as well as reducing carbon emissions by replacing more carbon intensive energy. The LNG market, however, has not expanded as expected in the early 2010s. This paper proposes recommendations to the governments and industry sectors of LNG producers and consumers on how LNG can be used more in Asia.

The expanded use of LNG in Asia will depend on two conditions: LNG's competitiveness against other energy sources, and sufficient investment in every part of the value chain. The following table summarizes "who does what" to achieve these two conditions.

The LNG business has traditionally been undertaken by industry players, and such practice will not change. It is however true that just letting the market work may not be enough to expand LNG demand in Asia, as some of LNG's benefits are difficult to reflect in market mechanism. Because market mechanism has its utility and limits, governments should play an important role where there is such a limit.

Table 1 Required actions and responsibilities of industry and government:

	Industry	Government
Producer	• Adopting effective cost-reduction measures • Removing or relaxing destination clause • Creating a reliable price benchmark • Developing well-functioning market • Optimizing supply infrastructure	• Developing well-functioning market • Improving investment environment • Optimizing supply infrastructure • Supporting investment through public finance
Consumer	• Adopting effective cost-reduction measures • Removing or relaxing destination clause and optimizing logistics • Creating a reliable price benchmark • Developing well-functioning market • Optimizing supply infrastructure • Investing upstream by downstream players	• Creating a reliable price benchmark • Liberalizing the domestic market • Providing a low-carbon policy • Developing well-functioning market • Encouraging natural gas use by government • Optimizing supply infrastructure • Supporting investment through public finance

Source: IEEJ based on the first workshop discussions

Background

It was just five years ago when high hopes for the advent of the Golden Age of Gas were suggested in *World Energy Outlook 2011*, published by the International Energy Agency. It provided a scenario where an abundant natural gas supply at a reasonable price would expand the global natural gas market, and simultaneously achieve a stable energy supply and carbon emissions reduction by replacing coal consumption. However, such a rosy scenario has not unfolded except in the United States, where the significant growth in domestic production has increased the share of natural gas in its energy supply mix. Global gas demand as a whole has in fact continued to grow in the last five years, but the growth rate has been rather lower than expected for many parts of the world. What happened in the global gas market? Why hasn't the Golden Age materialized?

There are market factors and policy factors behind the disappointing rate of market expansion. The biggest market factor is macro-economic stagnation in both developed and developing countries. In Europe, economic uncertainties triggered by fiscal crises in several EU member countries have dampened the region's economic performance and reduced total energy demand that narrowed the room for demand growth for natural gas. In emerging countries, most notably China, economic slowdown, if not a downturn, resulted in much slower growth in total energy demand and restricted the growth potential of natural gas demand.

Another market factor is the relative price competitiveness of coal against natural gas. In almost all major markets, natural gas prices are higher than coal prices, and thus natural gas was not an economic option in consumers' selection of energy sources. In Europe, the carbon price set in the EUETS scheme was not high enough to encourage using greater use of environment-friendly natural gas. In Asia, the LNG pricing formula linked to crude oil prices kept the prices of imported LNG at a high level, which kept consumers away from the use of natural gas versus more reasonably priced coal.

Policy factors also worked unfavorably for natural gas. Generous government support made renewable energy a more attractive energy option for consumers. Natural gas still has cost competitiveness over renewables as a fuel source for power generation, but was disadvantaged by strong government/policy support for renewable energy, either by subsidies or taxation. This phenomenon is present not only in Europe, where renewable energy has traditionally received consistent government support, but also in emerging countries such as China and India where renewable energy is highly evaluated as an indigenous energy source from an energy security standpoint.

Natural gas has numerous security benefits. In Japan, for instance, LNG was introduced as an alternative energy to reduce high dependence on oil after the two oil crises in the 1970s. LNG

has in fact been a highly stable and reliable energy source for traditional LNG importers, such as Japan, Korea, and Taiwan. In China and Indonesia, natural gas will likely play a very important role in diversifying their energy sources that heavily depend on coal today. In Asia, where energy demand will continue to grow, the security benefits of natural gas cannot be overemphasized. Among various natural gas supply sources, imported LNG will play a far greater role in Asia as both its supply and supply flexibility have significant potential for growth.

What then needs to be done to realize the expanded use of LNG in Asia? This report recommends several actions by government and industry players to achieve this objective.

Recommendations for expanding LNG use

Expanding LNG demand in Asia necessitates two critical conditions: enhancement of the competitiveness of LNG and sufficient investments in all parts of the LNG supply chain. The following sections explore the required actions to achieve such conditions.

ENHANCE COMPREHENSIVE COMPETITIVENESS OF LNG

LNG has to be chosen as a preferred source of energy by consumers if its market share were to expand in Asia. While it is highly likely that the total energy demand in Asia will continue to grow, it does not necessarily promise a bright future for LNG. In choosing a specific energy option to meet the region's incremental energy demand, consumers in various sectors from the power industry to residential sectors consider various factors for each energy option, such as price level, stability of supply, volume flexibility, and carbon intensity. Government policies to promote natural gas use can also add an incentive to consumers to choose natural gas.

What is the competitiveness of LNG then? The simplest definition will be its supply price to final consumers. But, as mentioned above, a consumer chooses energy based not solely on the price but also on various other factors. Government subsidies or taxation can be regarded as a part of competitiveness because they affect the supply cost to final consumers. The competitiveness of LNG therefore should be regarded in a more comprehensive manner to reflect the factors considered by consumers. Based on these observations, the definition of the competitiveness of LNG in this paper is provided as *comprehensive consumer benefits based on supply cost, reliability of supply, flexibility of supply, and carbon intensity*.

Reduce supply cost

The most straightforward means to enhance competitiveness is to reduce the cost of supply across the supply chain. Because it is the instinct of industry players to reduce costs, every cost reduction possibility has likely been explored and exploited by them. Given the recent developments of the global LNG industry, however, new possibilities for further cost reductions are emerging.

Adopting effective cost reduction means

One of the most commonly employed options in the recent development of LNG receiving facilities is a floating storage and regasification unit (FSRU). FSRU has traditionally been viewed as a temporary means to receive LNG until an onshore terminal is complete. However, the role of FSRU may be changing today. Most of the countries that recently started LNG imports, such as Jordan and Pakistan, utilize FSRU in their LNG receiving facilities. In 2015, 20 million tons of LNG, or 8% of the total LNG traded in the world, were received through FSRU. Several future LNG importers, such as Bangladesh and Myanmar, are also planning to install FSRU to start their LNG imports. Because FSRU does not require the procurement of a large land area or construction on onshore sites, it can significantly shorten the construction period and reduce the construction cost. In particular, the lower level of capital investment requirement can be attractive to smaller importers or new markets whose creditworthiness is untested or questionable. Therefore, although the receiving capacity at FSRU is limited, FSRU has certainly lowered the hurdle for countries that are newly starting LNG imports. FSRU will play a crucial role as a “starter kit” to cultivate future LNG markets.

In the upstream sector, the modular construction of liquefaction plants is an example of recent cost reduction efforts by the industry. Construction of the whole plant at the plant site tends to be more costly and needs a longer construction period. The modular approach, which sees the manufacturing of several liquefaction facility modules at different locations, and their assembly at the plant site, can reduce capital expenditures and shorten the construction period. The modular approach has already been a highly effective solution to controlling the overall construction costs of projects located where there is severe workforce shortage, such as Australia. Modularization, however, could complicate the whole engineering process and ultimately create construction delays due to the complexity of on-site assembly. It should be noted that the modular approach requires advanced project management capabilities to fully reap the benefits of the process.

Project management skills will also continue to be a key factor that can reduce construction costs. Building an LNG liquefaction plant is a work of “art” that manages the progress of

numerous parts of the facility construction while minimizing the construction cost and period as much as possible. Many international oil companies (IOCs) that have developed a number of LNG plants have accumulated sufficient project management capabilities. Yet in order to ensure the competitiveness of LNG against other energy, further improvement of project management skills will remain a big task for project developers.

Improve logistic flexibility

Optimizing logistics

As a means to optimize supply logistics, buyer companies have been forming various types of alliances in the last three years. The most notable example is JERA, a joint venture for fuel procurement and overseas business founded in 2015 by Tokyo Electric Power Company and Chubu Electric Power Company of Japan. After its foundation, JERA has been actively forming commercial alliances with other buyers such as EGAT of Thailand and EDF Trading of France to enhance flexibilities in their cargo operations. Tokyo Gas has also formed similar alliances with PTT of Thailand and Kogas of Korea to seek further optimization opportunities in its LNG procurement activities. As a growing number of importers with a variety of demand patterns and trading interests are entering the LNG market, more efficiency improvement opportunities through buyers' alliances will arise. Accumulation of trading expertise among LNG sellers and buyers will also enable the more effective handling of the LNG supply, and eventually lead to further supply flexibilities.

Utilize market mechanism

Creating a reliable price benchmark

Utilizing market mechanism is another effective means to enhance supply flexibility. In this regard, the creation of a reliable price benchmark is one of the most prioritized tasks, because the existence of such a benchmark will enable LNG to be priced in a more transparent and timely manner, and facilitate more active and flexible cargo trading. A reliable benchmark has to be based on liquid trading volumes as well as the participation of various market players with different trading interests and risk preferences. The development of an Asian LNG hub, which has been extensively discussed in this annual Conference, will greatly help the creation of the benchmark. Delinking from crude oil price in the LNG long-term contract should also be pursued along with this effort, as the resurgence of Asian Premium will likely further deteriorate the future of natural gas in the Asian market.

The reliability of such a benchmark will be fostered and grown primarily by market players,

but governments can accelerate the benchmark creation by providing a physical and institutional framework to support the function of such a benchmark and by identifying the possible incompatibilities between destination clauses with competition laws, as done by the European Commission.

Liberalizing domestic market

Liberalization of the domestic market may be an option to achieve greater efficiency and reduced supply cost in the natural gas market in Asia. In countries where a large state-owned entity dominates the natural gas supply, such market liberalization will create competition among natural gas suppliers and realize a more competitive and efficient natural gas supply. Liberalization of the market may also encourage natural gas suppliers to innovate ways to reduce supply costs to final consumers. The entry of new suppliers to the market will widen consumers' options and improve supply flexibility. For example, in China, market reform of the domestic natural gas market is expected to reduce pipeline transportation costs. The current supply surplus in the global LNG market might work favorably for the competitiveness of LNG in a liberalized market. All of these effects will enhance the comprehensive competitiveness of LNG.

It is true that market mechanism is a highly effective way to realize an efficient and transparent market system. The framework of the domestic natural gas market should be designed so as to maximize the benefits of market forces. Yet, liberalization without careful consideration and design may yield unintended consequences by causing distractions and confusion among market players in the regional and domestic natural gas markets. The hasty introduction of market mechanism in countries where the natural gas business is still heavily regulated can cause unstable supply, volatile prices, and deferred investments. Liberalization of the natural gas market has to be implemented as part of a comprehensive policy package, as liberalizing the energy market of natural gas alone, while leaving the other energy markets regulated, will likely bring about an unwanted and distorted outcome for the natural gas market. Careful assessment of policy actions is therefore needed in the implementation of natural gas market liberalization to achieve a more competitive natural gas supply. Prioritization and speed of policy implementation with sophisticated preparation in particular are extremely important to avoid such unwanted results.

Internalize externalities

LNG has a number of benefits. Unfortunately, many of these benefits, such as its low-carbon profile, geographical diversity of supply sources, and abundant resource and supply potential, cannot be properly valued by market mechanism. In other words, those benefits of LNG have a

nature of externality. Proper reflection of the externalities in the market requires policy arrangements that internalize such externalities.

Providing a policy framework that favors lower carbon energy

An oft-used policy framework to internalize carbon emissions cost, which is one of the most notable types of externalities in the energy market, is carbon pricing. Carbon tax and carbon trading are two of the carbon pricing measures and are policies that have been extensively adopted by a number of countries. While carbon pricing is a straightforward means to internalize carbon externality, there are other types of policies that can achieve a similar effect. The Chinese government's ban on coal consumption in Beijing after 2020, for instance, will make natural gas more extensively used in the power generation sector to replace coal. The Clean Power Plan, which was announced by the United States government in August 2015, is a regulatory action which aims to phase out carbon intensive coal plants from the nation's mix of power generation assets; this will likely facilitate natural gas demand in the United States. The type of selected policies will vary across countries, reflecting each country's prioritized goals or preferred policy tool. What is important is to ensure that the benefit of natural gas as a lower carbon fuel is properly recognized by consumers.

Setting a specific numerical energy mix target is another policy option in this regard. In July 2015, the Japanese government publicized its energy mix target as of 2030 to ensure "3E plus S,"—i.e., energy security, economic efficiency, environment, plus safety. In November 2014, the Chinese government also announced its target share for natural gas utilization at 10% as of 2020. Target setting itself does not guarantee the expanded use of natural gas, but providing a clear direction of a preferred energy mix and combination of policy arrangements, such as regulations, subsidies or taxation, will help realize a more diversified and thus secured energy supply.

LNG has numerous benefits. But as long as it is traded only by market mechanism, its use may not grow significantly because its benefits are difficult to be quantified. Excessive government intervention of course must be avoided. But governments have a role to play in ensuring that the benefits of LNG are reflected in the market if LNG demand were to expand.

ENSURE INVESTMENTS

The steady expansion of the LNG market requires sufficient investments in all parts of the supply chain, from upstream, midstream, to downstream. Although the global LNG market is forecast to remain in an over-supply situation for the next few years, it is very important to continue to make sufficient investments in the LNG supply value chain. We should be reminded of the danger of complacency.

More attention tends to be paid to investments in upstream and liquefaction parts of the supply chain. However, infrastructure development downstream, such as power plants, transmission pipelines, and city gas networks, are equally important for the creation of final demand, especially in emerging countries in Asia. Because completing an LNG supply chain requires a significant amount of upfront investment, how to ensure the recovery of profit from such a large investment project is always critical to attracting and maintaining investments for the LNG supply chain.

Conditions for sustainable and sufficient investments can be divided into two categories: reduction of the total size of investment risks, and allocation of the residual risks that cannot be reduced by policy or industry efforts such as price fluctuations or demand uncertainties. Reducing the amount of risk will be largely undertaken by the governments of both producing and consuming countries. Risk allocation, on the other hand, is primarily conducted among the relevant industry parties, including LNG buyers, LNG sellers and, to some extent, the financial institutions that provide financing.

Reduce the risk size

Developing a well-functioning market

Firstly, in order to promote investment, the total size of investment risks for an LNG supply chain project needs to be reduced. In this regard, creating a well-functioning LNG market will be a major contribution. This is because an LNG market with abundant spot cargo supplies, high liquidity of traded volume, and a variety of players with different backgrounds and trading interest would reduce such volume (or marketing) risks for project investors. In such a well-functioning market, the project investors will find buyers for their LNG supply more easily.

The current global LNG market is in a transition stage thanks to the advent of abundant flexible LNG supply from the United States and the emergence of various buyers from non-OECD countries that procure LNG mainly on a spot basis. The traditional vertically integrated business model based on long-term contracts has greatly contributed to reducing the volume risks for both producers and consumers. Given the new market conditions where trading liquidity and flexibility are being enhanced, however, the traditional risk reduction model should be reexamined, taking into account the new reality, and a larger portion of volume risk for both buyers and sellers should be managed mostly by market mechanism.

Improving investment environment

In the upstream sector, governments of natural gas producing countries need to improve the investment environment so as to encourage potential investors to engage more in new LNG

projects. The transparency and timeliness of decision-making will be critically important. Removal of bureaucratic deadlocks in any approval process will greatly help upstream operators to swiftly realize their projects. Transparent contractual terms and conditions in upstream development are desired. Proactive disclosure of information will also encourage upstream development. The Australian government, for instance, publishes and provides extensive geological data of the prospective areas of the country to potential investors for exploration.

Some of the abovementioned issues regarding the investment environment originate from the nature of governance or type of political structure that is unique to a particular producing country, and are thus not easy to address in a short period of time. But improvement in the investment environment is a critical factor to realize sustained investment in the LNG value chain. Natural gas producing countries are expected to continue to make consistent efforts in this area.

Encouraging natural gas use by government support

In the downstream sector, consumer governments can play an important role by promoting more natural gas use in their energy mix. As mentioned in the competitiveness section, guidance by a consumer government to encourage natural gas use and fiscal support to develop infrastructure will be key in creating more demand for LNG. This is particularly pertinent to emerging LNG importing countries, because infrastructure development in the downstream supply chain is one of the major hurdles to increase natural gas use in those countries. Because natural gas does not have a dominant demand sector and always faces inter-fuel competition, clear government guidance to expand natural gas use will help to create higher and more stable demand, and minimize the future demand uncertainties for LNG project investments.

Supporting upstream investment by public finance

Public financial support for investment will also be an effective means to reduce the size of risk. As repeatedly mentioned, an LNG project requires a significant amount of initial investment and needs a long time to recover its investment. LNG business therefore is inherently long term in nature. LNG buyers, on the other hand, are facing growing demand uncertainties due to inter-fuel competition, market liberalization, and utilization of nuclear power plants, and are driven to pay more attention to shorter-term contracts.

Because there is a wide gap between the inherent long-term nature of LNG business and the short-term preference of market players in the current LNG market, public financial support for investments will help to fill the gap. A multilateral financial institution, such as the Asian Development Bank (ADB), can provide such finances to help a potential LNG project to materialize. Governmental oil and natural gas agencies, such as Japan Oil Gas and Metals National Corporation (JOGMEC), and governmental financial institutions, such as the Korean

Export Import Bank, had provided financial support for upstream development or liquefaction plant construction in the past.

The economic viability of supported projects, in principle, must be carefully examined in order to avoid slack financing or a crowding-out problem. A project eligible to receive public support may be restricted to a "frontier" project--namely, a technically challenging project such as in the Arctic or a deep-water gas field development, or a project in a politically sensitive country that merits government-level support. But in the current unpredictable and volatile oil price environment, projects with high strategic importance from the viewpoint of long-term market stability may merit more proactive commitment from consuming country governments, such as in the form of government financing.

Allocate risks

Removing or relaxing destination clause

The changing environment of the global LNG market merits the consideration of new risk allocation formats. As repeatedly discussed in the previous series of the LNG Producer-Consumer Conference Dialogue, the removal and relaxation of a destination clause should be pursued from various standpoints, including one regarding the enhancement of healthy market competition. Traditionally, LNG sellers have taken upstream risks, such as geological and operational risks associated with natural gas field development as well as technical risks associated with liquefaction process. LNG buyers, on the other hand, have taken downstream risks, such as demand volume and price fluctuation, by committing to a long-term contract. However, as the global LNG market is experiencing a number of structural changes owing to the shale revolution, greater diversity of suppliers and consumers, and expansion of spot and short-term contract supplies, it is high time to reconsider the traditional way of allocating risks in LNG business. A more liquid and transparent LNG market and healthy competition through removal of a destination clause or adopting a new benchmark price will be more beneficial than the traditional LNG market format for the sound development of the Asian LNG market.

In this regard, the use of a standardized contract without a destination clause can contribute to more flexible LNG trading. The ASEAN Council of Petroleum is currently working to provide a standardized template for long-term LNG sales purchase agreements that allow the reselling of cargos. The standardized contract will likely be used extensively among ASEAN LNG producers and consumers.

Investing in upstream equity by downstream players

As a means to share upstream risks, equity investment by downstream players is encouraged. The relative dearth of expertise and capabilities to develop and produce natural gas and LNG commonly precludes downstream players from becoming operators of LNG projects. However, proactive involvement by downstream players through equity investment in upstream and LNG projects, even with a minor share, will help finance the project and reduce of the level of risks undertaken by each stakeholder. The equity investment in upstream or LNG projects can also provide downstream players with the benefit of natural hedges against LNG price fluctuations as well as access to a physical supply source. While several electric utility companies have obtained such equity in the past, their exposure had been at a modest level. More proactive participation in the project by downstream players will help to realize a potential LNG project.

Optimizing supply infrastructure

Although it is not directly related to risk reduction or allocation, optimizing the use of existing and new infrastructure reduces the need for additional investments, enabling the saved financial resources to be used for other projects. Some traditional LNG exporting countries like Indonesia have liquefaction facilities that cannot be fully utilized due to economic or technical reasons. Developing infrastructure to supply feed gas at a reasonable cost and utilizing idle facilities may be a more economically rational investment rather than building a new liquefaction facility from scratch. In the downstream sector, building an extensive transmission pipeline network can reduce the number of receiving terminals by allowing the receiving capacity to be concentrated at select locations. Such optimization of receiving logistics will enjoy the benefits of economies of scale as well as reducing the required budget for infrastructure development. In the case of ASEAN countries whose initial LNG demand will not be large enough to warrant building a full-scale receiving facility, a cross-border pipeline network can reduce the investment requirement for receiving facilities, and optimize the total cost for fuel procurement as a region.

As this arrangement can be seen to undermine the energy security interest of each receiving country, mutual trust and consent among relevant countries are needed on the overall design of such receiving infrastructure. In addition, such receiving infrastructure requires the development of a legal framework, such as the Energy Charter or a bilateral arrangement, to ensure the security of LNG supplies. Energy supply security through cross-border infrastructure must be a mutually beneficial one, and one country's energy supply security should not come at the expense of another country's supply security.

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Appendix 2. Result of the 5th LNG Producer–Consumer Conference

1. Programme

We successfully presented our statement in Session 4 of the conference.

LNG Producer-Consumer Conference 2016

～Pathway towards Development of Global LNG Market～

Thursday, November 24th, 2016

14:25-15:45 Session 4:

Opportunities in Emerging LNG Markets in Asia

Moderator

- Mr Masakazu Toyoda, Chairman and CEO, The Institute of Energy Economics, Japan (IEEJ)

Speeches:

- Mr Seah Moon Ming, Group Chief Executive Officer, Pavilion Energy Pte Ltd.
- Mr Leonid V. Mikhelson, Chairman of the Management Board of NOVATEK
- Mr Michiaki Hirose, President, Tokyo Gas Co., Ltd.
- Datuk Mohd Anuar Taib, Executive Vice President & CEO, PETRONAS
- Mr Tadashi Maeda, Representative Director, CEO, Executive Managing Director, Jap Bank for International Cooperation (JBIC)

Panel Discussion

- Mr Tadashi Maeda, Representative Director, CEO, Executive Managing Director, Japa Bank for International Cooperation (JBIC)
- Mr Leonid V. Mikhelson, Chairman of the Management Board of NOVATEK
- Ms Yenni Andayani, Gas Director of PT Pertamina (Persero)
- Datuk Mohd Anuar Taib, Executive Vice President & CEO, PETRONAS
- Mr Michiaki Hirose, President, Tokyo Gas Co., Ltd.
- Mr Laurent Vivier, Senior Vice President, Gas, Total S.A.

2. Presentation of key findings of the joint research project

1

Recommendations for expanding LNG use in Asia

—Can the golden age of gas come in Asia?—

November, 2016

The Institute of Energy Economics, Japan (IEEJ)

Chairman & CEO **Masakazu Toyoda**

How can LNG be more used in Asia?

→ **Cooperation between producing and consuming companies/governments are necessary**

2

Agenda No1.
Enhance comprehensive competitiveness of LNG

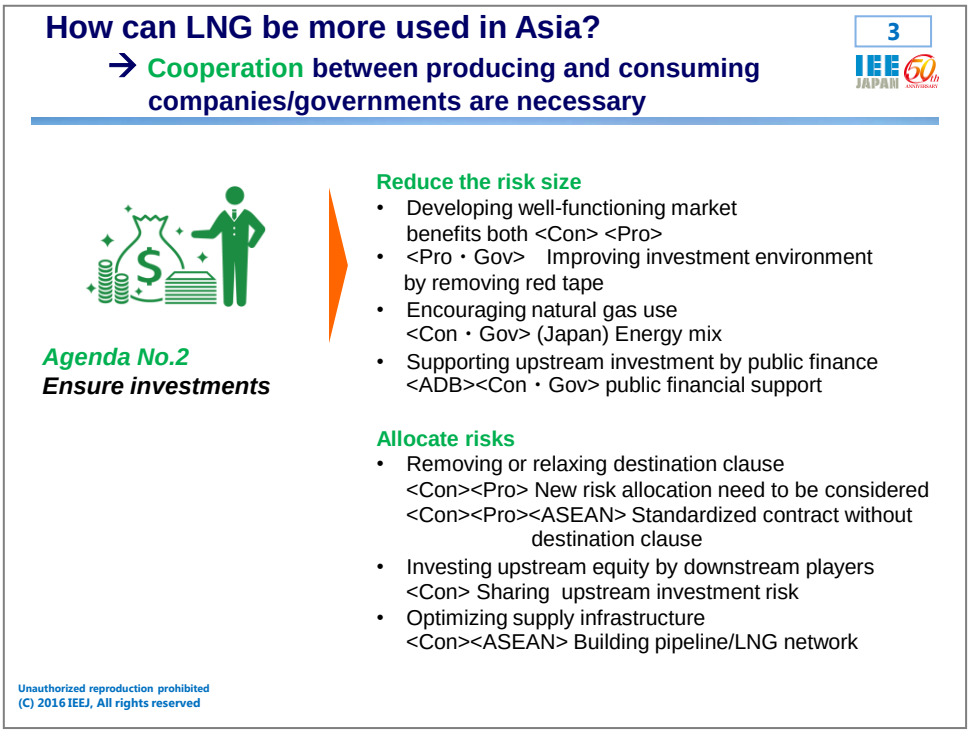
vs cheaper coal
subsidized R.E

Reduce supply cost
<Con> Floating storage and regasification unit (FSRU)
<Pro> Modulization of liquefaction plant,
Improvement of project management skill

Improve logistic flexibility
<Con> Formation of joint venture and alliance
<Con><Pro> Accumulation of trading expertise

Utilize market mechanism
<Con> Creating a reliable price benchmark away from oil indexation through establishing Asian hubs.
<Con・Gov> Identifying incompatibility of destination clause as EC did
Liberalizing domestic market

Internalize externalities
<Con・Gov> Providing a policy framework that favors lower carbon energy
Carbon tax, ETS
(China) Banning coal consumption in Beijing
(Japan) Energy mix



3. Extract from the Official Summary Statement of the Conference

Session 4: Opportunities in Emerging LNG Markets in Asia

• Mr. Masakazu Toyoda, Chairman and CEO, The Institute of Energy Economics, Japan (IEEJ)

Increasing LNG use in Asia hinges on LNG's competitiveness against other energy sources; and sufficient investment throughout the value chain. The LNG business has been led by industry players and is expected to be so in the future.

However, some features of LNG have resulted in difficulties in expanding LNG use solely dependent on market principles in the Asian markets. Taking into account of benefits and deficiencies of market mechanisms, governments need to play important roles when the market does have its own limitation.

Source: Asia Pacific Energy Research Centre, Summary Statement of the 5th LNG Producer–Consumer Conference