Prospect of Natural Gas Market in East Asia[1]

(Summary)

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Part 1 Present State and Problems of the East Asian Natural Gas Market[2]

Chapter 1 Present State of the East Asian Natural Gas Market

1-1 Overview of the East Asian Natural Gas Market

World natural gas consumption totaled some 2.6 trillion cubic meters in 2002, centering on North America, former Soviet Union and Europe. East Asia (Japan, South Korea, China and Taiwan) accounted for only 5% of global consumption . In Europe and America, natural gas is locally or regionally produced or supplied mainly through pipelines, with limited liquefied natural gas (LNG) imports. In contrast, East Asia depends heavily on LNG imports for its natural gas supply. East Asia accounts for 69% of global LNG transactions; in particular, Japan alone accounts for some 50%, and is the world's largest LNG importer.

In East Asia at present, Japan and Taiwan consume some 70% of natural gas for power generation. Natural gas is used primarily for city gas in South Korea, and for fertilizer production in China. In South Korea, winter demand for natural gas triples summer demand. As for gas supply systems, private companies import, wholesale and retail natural gas in Japan. In South Korea and Taiwan, national enterprises monopolize importing and wholesaling. In China, which is in transition to a market economy from a planned one, the government and national and public enterprises dominate the natural gas industry. As for gas supply infrastructure, South Korea has developed national trunkline in East Asia, while Japan has a less developed pipeline network, but has a large number of LNG receiving terminals.

In China, natural gas accounts for only 3.4% of primary energy supply. In a bid to increase the share of natural gas to 8-10% by 2020, the Chinese government has been promoting LNG import projects and developing gas supply infrastructure. However, price gaps between natural gas and competing fuels like coal are cited as a major problem facing the development of China's natural gas market.

1-2 LNG Transactions and Prices

In 2002, LNG exports to East Asia totaled 77.2 million tons, with Japan, South Korea and Taiwan imported 70%, 20% and 10%, respectively. China is said to become an LNG importer in 2005.

Japan's annual LNG imports on long-term contract basis increased from 46.64 million tons in 1995 to 54.67 million tons in 2002, but actual annual imports slipped below contract-based levels for most of the years. In contrast to Japan, South Korea

[2] This report is based on the data and information on January 2004. The term "East Asia" typically refers to Japan, South Korea, China and Taiwan in this report.

imported more than contract-based levels for many of the years. This is because the huge demand gap between seasons has prompted South Korea to increase spot purchases in the winter demand season, while keeping long-term import contracts as base load supply.

From 1995 to 2000, LNG prices for East Asia remained in a US$ 3-5/MM Btu range. LNG prices for Japan, South Korea and Taiwan under medium- and long-term contracts are basically linked to the JCC (Japan Crude Cocktail) price and move similarly. Their moves are somewhat similar to LNG prices for the European Union and U.S. domestic gas prices, which are generally lower than those for East Asia.

1-3 Demand and Supply Outlook

East Asian natural gas demand in 2002 totaled 140 billion cubic meters (BCM). According to the Asia Pacific Energy Research Center, the regional demand is expected to rise 5% annually and reach 338 BCM by 2020, with natural gas demand projected to increase 1.3% annually in Japan, 4.2% in South Korea, 6.3% in Taiwan and 9.5% in China. As a result, China is expected to account for 49% of natural gas demand in East Asia in 2020, against 23% in 2002, becoming the largest natural gas consumer in the region.

On the other hand, natural gas production in East Asia is estimated to reach 76 BCM in 2020.

LNG supply capacity for East Asia stands at 74.59 million tons per year at present. Capacity for currently planned and expansion projects is expected to increase 30.14 million tons by 2010 and 39.40 million tons by 2020. In addition, potential projects cover 51 million tons. This means that LNG supply potential for East Asia in 2020 can be estimated at 195.13 million tons (269 BCM). Regional natural gas and LNG supply potential comes to 345 BCM for the year, exceeding the projected demand of 338 BCM. If necessary infrastructure is in place, regional supply and LNG imports will fully cover total natural gas demand in East Asia in 2020. However, it is possible that Although the natural gas demand-supply balances may tighten if demand exceeds the projected level in East Asia or if LNG demand expands faster than expected in the rest of the world (including North America and India). Natural gas imports through pipelines are now under consideration from Russia (Sakhalin 1, Kovykta, Sakha and Western Siberia) and Turkmenistan. Potential pipeline gas imports are estimated at 76 BCM (55 million tons in LNG).

Given the above, potential natural gas supply in East Asia in 2020 totals 421 BCM, well above the projected demand of 338 BCM. Therefore, it may be concluded

that potential natural gas supply in East Asia can fully meet demand in 2020. However, pipeline and LNG projects are competing with each other. All projects under consideration may not necessarily be implemented. Since any LNG project requires massive investment in infrastructure development and results in long-term contract relations, good relations between relevant countries are important for realizing those projects. Particularly, attention should be paid to the possibility that international pipeline projects could be affected by political relations between relevant countries.

Chapter 2 Features and Problems of the East Asian Natural Gas Market

2-1 Inflexible Trading Terms and Conditions

LNG tradings in East Asia have so far featured direct negotiations between sellers and buyers, massive-quantity purchases over long terms with take-or-pay clause, lack of volume elasticity, or flexible reductions in quantities for delivery. They have also included “even delivery” meaning that fixed quantities are delivered periodically, irrespective of varying demand. Another notable condition is the destination clause that limits resale of LNG cargoes. These terms and conditions can guarantee a stable supply while being inflexible. In recent years, LNG importers have demanded to increase the flexibility for their LNG contract terms and conditions. Additionally, compared with European and American transactions, East Asian LNG deals feature more diversified supply sources, longer transportation distances, more contract quantities and more ex-ship contracts.

Table 2-1-1Inflexible Terms and Conditions in LNG Contracts

Trading partners	Buyers: Power and gas utilities form buyer consortiums to buy LNG on same terms and conditions. Sellers: Gas-producing nations’ state-run companies, multinational oil majors, trading companies and the like form seller groups.
Quantities	Annual contract quantities (ACQ) are fixed under contracts, serving as the basis for rights and obligations regarding delivery.
Terms	Long-term purchase contracts (over some 20 years in general)
Delivery receipt elasticity	Downward elasticity: 5% to 10% in general Take-or-pay clause.
Delivery terms	Ex-ship contracts account for a dominant part (some 80%) and FOB deals for some 20% (FOB contracts are dominant for Indonesian LNG). Even deliveries.
Destination limits	Ex-ship contracts generally include sale and purchase agreements to fix delivery locations. Some FOB contracts fix delivery locations.
Delivery plans	Delivery plans are made every year for the next year to set one-year shipment schedules.

The destination clause in a LNG sale and purchase contract fixes a delivery location. This is to prevent buyer from reselling LNG to a third party in order to protect seller's revenue. The clause is applied to European gas pipeline contracts as well.

Based on the single EU market scheme for free distribution of goods and services in Europe, however, the European Commission demands to repeal the destination clause that it views as illegal to the EC competition law. Among natural gas exporters, Norway and Nigeria have already agreed to repeal the clause. In October 2003, Russia agreed with Italy's ENI to abolish the clause. Algeria is moving to eliminate the clause for pipeline gas exports, but no agreement has been made between Russia and buyers other than ENI, or between Algeria and EU LNG importers.

2-2 Background and Problems of Inflexible Terms and Conditions

Japan's power utility sector has undergone changes in response to slower power demand growth, electricity market liberalization and global warming issues. These business environment changes have affected LNG transactions. Until the 1980s, power utilities had no problem with consuming LNG in quantities fixed under contracts, since they had been switching to LNG from other fuels for power generation. As such switching has declined and electricity demand growth has slowed down since the early 1990s, however, conditions for LNG delivery receipts have become a problem. As LNG's role in power generation has shifted towards to the middle/middle peak use, demand has grown for flexibility in conditions for delivery receipts. The gas utility sector has steadily shifted to LNG since its LNG introduction in 1969. In 2000, LNG accounted for as much as 87% of feedstock for city gas. This means that LNG demand in the sector is unlikely to grow faster than the sector's total sales.

Progress in liberalization of the power and gas utility sector has required more flexibility of LNG transactions. Since the LNG introduction, Japanese importers' acceptance of relatively higher prices and their responsibility for taking delivery of fixed massive quantities have persistently allowed investment to be made in LNG projects. Most of the LNG importers are regional monopoly electricity and gas utility companies and have been allowed to pass on their price and volume risk of their LNG to the customers with granted rate of return pricing system. . However, liberalization of power and gas markets has made such a mechanism outdated. Uncertainty demand and wilder demand fluctuations have made it difficult to set fuel procurement targets in terms of price and volume. In a liberalized market, power and gas companies are required to pursue not only the price competitiveness but also flexible supply to meet

customers' demand patterns in order to secure customers. As a result, power and gas companies are forced to pursue diversified and flexible fuels and materials for procurement.

With these changes have led LNG importers to modify their LNG procurement policies. In the past, they had given primary priority to stable supply and long-term contracts, and secondary priority to the economic efficiency and flexibility. At present, however, they give higher priority to the economic efficiency and delivery flexibility, although stable supply remains important.

2-3 Higher LNG Prices than in Europe and the U.S. (Asian Premium in LNG prices)

The most notable fact in the East Asian natural gas market is that natural gas (LNG) prices in East Asia have been higher than in Europe and the United States. In the 1990s, East Asian LNG prices were 30% to 50% (about $1/MMBtu) higher than European levels. Compared with U.S. prices, East Asian levels had been 70% to 150% higher in the first half of the 1990s[3]. U.S. natural gas prices are dependent on the demand-supply balances and wildly fluctuate. Thus, their price trend is different from those of East Asia LNG prices, which are linked to Japanese crude oil import prices.. In fact, the price difference between East Asian and the U.S. has narrowed in 2000s due to soaring U.S. gas price. In order to mitigate the price fluctuation, market players use futures transactions at NYMEX, IPE and the others. In continental Europe and Japan, price mechanism based on benchmark averages for several months have been adopted to moderate price fluctuations.

2-4 Japan's LNG Pricing Factors and Their Changes

Various factors, including the following historical, geographical and structural market factors, are conceivable behind Japanese LNG prices that have been higher than European and U.S. ones:

(a) The Asian LNG market has remained a supplier's market for a long time, because the number of LNG projects and sellers has been relatively limited.

(b) Japanese LNG importers have depended primarily on long-term contracts and had little opportunity to fundamentally modify prices and other purchasing conditions in the midst of contract periods.

(c) Japan's power and gas utilities had long remained under business and rate of return

[3] Japan's LNG imports totaled 53.88 million tons with an average import price of $4.26/MMBtu in 2002. If one dollar lower, savings could have reached some US$ 2.8 billion (or JP¥ 350 billion). For this estimate, one million tons is translated into 52 trillion BTU and the dollar's value is put at JP¥ 125 (an average for 2002).

regulations and got limited incentives for lowering prices under cost of service system.
(d) Since huge investment has been required for LNG projects, LNG suppliers have had to secure a massive amount of stable income to make their investment viable.
(e) Unlike European and American natural gas markets, the Asian market has had no well-developed pipeline system and is far away from natural gas sources. Therefore, these market conditions have led to a unique price system.

However, factors for LNG pricing have changed in the following ways in recent years:
(a) Softening of LNG demand-supply balances: Japan's LNG demand growth has slowed down since the second half of the 1990s. Some LNG projects have started their operation without securing buyers covering 100% of their supply capacities.
(b) Increasing medium-term and spot transactions.
(c) Liberalization and deregulation of power and gas markets.
(d) Relaxed cost/risk in supply side: Declines in gas liquefaction and LNG tanker construction costs. Increasing FOB contracts.
(e) Growing interaction with Atlantic LNG market: Growth in European and American LNG imports. Middle East LNG developers aggressively sell LNG both in the Pacific and Atlantic markets. Many plans for LNG receiving terminals on the U.S. West Coast.

Chapter 3 Recent LNG Transactions and Impact of Liberalization

3-1 Liberalization of Power and Gas Markets in Japan and South Korea

The liberalization of power and gas markets in Japan and South Korea is designed to introduce the market mechanism into the power and gas industries, reduce government interference in these industries, increase their efficiency and benefit customers. In this sense, the liberalization has been influenced by precedent experiences in Europe and the U.S. Japan has deregulated power and gas industries and liberalized power and gas markets since the mid-1990s. As of 2003, it liberalized 26% of the power market and 40% of the gas market. In South Korea, since state-owned companies are in charge of significant part of power and gas industries, their privatization accompanies the liberalization of these markets. South Korea launched its deregulation and liberalization policy at the same time as Japan. However, at present, little progress has been made. Japan plans to expand the scope of liberalization in both power and gas markets, which have seen a rising number of new participants into the markets. In South Korea, on the other hand, no domestic consensus has been formed on privatization and liberalization of power and gas sectors. The liberalization policy has been effectively suspended. Although only one

power-generating corporation is expected to be privatized in the near future, South Korea is still considering specific measures for privatization of power and gas utilities and liberalization of power and gas markets. Any future progress remains uncertain.

Table 3-1-1Chronology of Japan's Power Market Liberalization

1994	The Electric Utility Industry Council proposes to introduce the market mechanisms to increase business efficiency in the power industry, to rationalize safety regulations and the like.
1995	The Electricity Utilities Industry Law is revised to introduce the IPP (independent power producer), Special Electric Utility and the yardstick assessment.
1999	The Electricity Utilities Industry Law is revised again to introduce third party access to power transmission grid, partially liberalize the retail market (2,000 kW or more, and 20,000 volts or more: covering 26% of the market) and add Specified-Scale Electric Utility (Power Producer and Supplier) as a new category.
2003	The Electricity Utilities Industry Law is revised again to expand the liberalization (the scope is to cover high-voltage customers with contract more than 500 kW, or 40% of the market, in April 2004; and high-voltage customers with contract capacity at more 50 kW, or more than 60% of the market, in April 2005).
2007 (planned)	Debates start on full liberalization of the market including households. Decisions are to be made on establishing power exchange, eliminating inter-regional transmission tariff, tougher regulations to implement information firewall and to ban internal subsidization and discriminatory treatment, relaxation of balancing rules, and other measures. A neutral organization is launched to secure neutrality, fairness and transparency of power generation and transmission.

Table 3-1-2 Chronology of Japan's Gas Market Liberalization

1995	The Gas Utilities Industry Law is revised to liberalize the market for bulk customers with annual contract of more than 2 MMCm; create Bulk Gas Service Providers; require the three largest gas utilities (Tokyo Gas, Osaka Gas. and Toho Gas) to prepare TPA guidelines; and introduce the yardstick assessment for gas rate revisions.
1999	The Gas Utilities Industry Law is revised again to expand the liberalization to cover customers with annual contract of more than 1 MMcm, or 40% of the gas market; shift to the Notification System for wholesale services; and require the four largest gas utilities (Tokyo Gas, Osaka Gas, Toho Gas and Saibu Gas.) to submit TPA terms and conditions.
2003	The Gas Utilities Industry Law is revised again to expand the liberalization to cover customers with annual contract of more than 0.5 MMcm, or 44% of the gas market, in 2004, and those with annual contract of more than 0.1 MMcm, or 50% of the market, in 2007. Gas Pipeline Service Provider is created as a new category. More companies are required to submit TPA terms and conditions. Third party access to LNG receiving terminals on negotiation-basis is introduced. Community Gas Companies are allowed to handle natural gas.

3-2 Impact of Liberalization on LNG Procurement

3-2-1 Changes in Contracts

The liberalization has prompted LNG buyers, power and gas companies in most cases, to demand changes in LNG contract terms and conditions. In particular, they have taken new actions since the beginning of the 2000s, as the time has come to renew contracts and negotiate prices.

(a) Contract parties: As conflict of interests and competition have emerged between buyers as a result of market liberalization, they have shifted from the traditional buyer consortium negotiations to individual negotiations and contracts with sellers.

(b) Contract periods: As buyers expect stagnant growth in gas demand or even a fall in demand on fierce competition, it has become difficult for them to fix delivery quantities over any very long period of time. They have tended to shorten contract periods or combine long-term base contracts with short-term ones for uncertain demand.

(c) Flexibility of delivery: Buyers have called for increasing the delivery flexibility (allowable amount between demand and contract quantities). More downward quantity tolerance for demand decrease and upward quantity tolerance for sudden demand increase.

(d) Delivery terms: Buyers have shifted from Ex-Ship delivery to FOB delivery and have begun to own and arrange LNG carriers to save shipping costs. LNG tanker ownership changes have led to the possibility of new transactions including spot deals, swaps, backhauling and arbitraging.

(e) Delivery plans: In the past, shipping plans had been made every year for the next year for even shipments and deliveries throughout a year irrespective of seasonal demand fluctuations. At present, however, uneven shipments have been seen to meet real demand profiles reflecting seasonal demand changes.

Additionally, Master Agreements have emerged as a new trading scheme. These agreements provide for terms and conditions without specifying cargoes or quantities and allow parties to promptly implement spot transactions only through confirmation letters specifying necessary simple information. This can be seen as a procurement method to meet demand changes. In the future, Japan may see new LNG market players such as marketers, aggregators and traders, who are specialized in specific parts of the LNG value chain and already found in European and American markets.

One of the major challenges of power and gas liberalization for LNG buyers is that demand may change as a result of competition. Thus, LNG procurement contracts are now designed to flexibly meet a demand increase on obtainment of bulk

customers and a decline on loss of such customers.

Buyers now pursue flexibility and competitive prices simultaneously. The East Asian LNG market now features abundant supply potential and has become a buyer's market. Under the circumstances, buyers' requests are often accepted. Prices have been under downward pressure. But buyer's request to obtain the flexibility and lower prices is a real challenge. It is important to note that in some cases there is a trade-off between the flexibility and economic efficiency.

Table 3-2-1Recent Examples in LNG Procurement Deals

NWS Expansion	・Japanese consortium broke up and buyers shifted to individual negotiations. ・Supply to KOGAS set for winter only.
Malaysia Satu contract renewal	• The maximum annual contract quantity remained unchanged. • The contract period was shortened to 15 years. • Short-term quantity was introduced to considerably increase the flexibility of delivery receipts. • Some of contract quantities shifted to FOB terms for improvement of transportation flexibility and reduction of freight costs. • Downward and upward quantity tolerance were expanded to flexibly adjust procurement quantities.
Sakhalin 2	・Tokyo Electric Power and Tokyo Gas are to purchase on FOB basis. ・Start-up period for lesser quantity and quantity option were set.
Darwin LNG	・Tokyo Gas and Tokyo Electric Power invest on gas field development, and LNG production and marketing and use their own LNG carriers for transportation based on FOB.
Malaysia Tiga	・Annual delivery to KOGAS totals 1.5 million tons (with an option on additional 500,000 tons) over seven years. ・Delivery receipt terms reflect seasonal demand changes (20% in summer and 80% in winter)

3-2-2 Cooperation between LNG-Consuming Countries (Users)

In addition, it is reported that partnerships between East Asian LNG users has emerged since 2003. Chubu Electric Power, Taiwan's CPC (Chinese Petroleum Corporation) and KOGAS agreed to accommodate each other with LNG cargoes. Tohoku Electric Power and KOGAS concluded an agreement on mutual cooperation on LNG procurement. Chubu Electric and KOGAS inked a contract for seasonal LNG swaps. These deals indicate that users that are geographically close to each other are forming partnerships to meet short-term demand changes. They can be appreciated as contributing to flexibility of their procurement and stability of supply.

LNG-consuming countries' cooperation through swapped flexible supply arrangement is important for easing risks stemming from uncertainties about demand

and demand-supply. On the other hand, attention should be paid to the destination clause in existing contracts. The destination clause prevents free trading. If the clause is relaxed, swap and arbitraging will be active.

Part 2 Considering Solutions to Problems in the East Asian Natural Gas Market

Chapter 4 Market Environment Changes and Countermeasures

4-1 Changes in the LNG Market

4-1-1 Suppliers' Responses to Market Environment Changes

Liberalization of gas and power markets in LNG importing countries in East Asia and the emergence of China and India as new LNG importers have led to drastic changes in traditional and inflexible LNG transaction terms and forms. In consideration of energy market changes, LNG importers tend to demand the introduction and expansion of flexibility in prices, quantities, delivery and other terms and conditions in LNG import contracts. In the future, LNG import contracts may be diversified further. We would like to consider LNG suppliers' responses to these market environment changes in LNG importing countries.

Under the Malaysia Tiga project, the LNG supplier made some responses to new trends in LNG importing countries through negotiations with Japanese gas utilities. The supplier agreed to combine long- and short-term deliveries and set quantities for optional purchases depending on export capacity. Both Ex-ship and FOB terms were agreed for delivery terms. The introduction of flexibility has had a great impact on later negotiations on renewal of other contracts for LNG supply to Japan. The flexibility expansion has also been applied to contracts for new LNG projects including expansion of existing projects. As for Australia's NWS expansion and the Sakhalin 2 project, some Japanese gas and power utilities are to receive their LNG on FOB basis.

Pricing terms of Guangdong, China's first LNG project from NWS expansion project are recognized as a benchmark among LNG market players.

4-1-2 Changes in the LNG Chain

Intensifying competition in the borderless energy market has not only led to an increase in players in the market but also prompted these market participants to pursue profits at various segments of the gas supply chain. Natural gas market participants are pursuing their new roles, while looking for and developing their business strategies. We would like to analyze recent trends of players in each segment of the LNG chain.

(a) East Asian Natural Gas-Consuming Countries

1) LNG Importers Participating in Upstream and Liquefaction business

KOGAS, CNOOC (China National Offshore Oil Corporation), Tokyo Electric Power and Tokyo Gas acquired stakes in LNG upstream business. Incentives have worked for LNG importers to acquire knowledge and know-how about the whole LNG supply chain and for suppliers to share LNG development costs.

2) Importers Entry into Transportation by Owning LNG Tankers

Osaka Gas, Tokyo Gas, Tokyo Electric Power and some others now own LNG tankers to reduce transportation costs.

(b) Oil Majors

Traditionally, oil majors' activities were limited to mainly in gas field development and gas liquefaction plants and selling LNG to users. Recently, however, these majors including BP, Shell and BG have advanced into LNG transportation, LNG receiving terminals, and gas marketing and gas-fueled power generation in LNG importing countries under their strategies of integrating the whole of the LNG chain.

1) Internal LNG Transactions

Some majors have become LNG importers to create gas and power demand in the energy consumption sector, trying to pursue new value added with intensifying liberalization.

2) Tanker Ownership

Majors such as Shell, BP and BG have begun to own a growing number of LNG tankers that are not assigned for specific projects.

3) Branded LNG

Some majors sell LNG to importers without specifying supply sources. In this case, LNG suppliers have freedom of choice on LNG supply sources in transactions.

4) Acquisition of Stakes in LNG Receiving Terminals to Utilize the Capacity

Players that were engaged in specific segments of the LNG chain develop new business strategies to take part in the whole LNG chain from upstream to downstream, while diversifying their roles. These moves have stemmed from their adaptation to new market environmental changes including the emergence of more competitive markets. In a sense, LNG suppliers and users launched new moves for the uncertainty in competitive market, contributing to starting up new LNG projects and securing LNG supply capacity. Energy security in liberalized markets can be achieved through securing flexible supply to meet demand fluctuations. In the future, East Asian natural

gas-consuming countries may be required to enhance efforts to ensure gas supply security by procuring sufficient quantities of LNG at reasonable, competitive prices.

4-1-3 Non-East Asian Factors behind Changes

Among the factors for future changes in the East Asian natural gas market, we should also consider those outside East Asia. Important regions in this respect include India, which has emerged as a new LNG importer, China, as well as North America, which has many new LNG receiving terminal projects. As for potential supply source to meet demand in the North American market, particularly, we must pay attention to LNG projects in the Asia-Pacific region including the Middle East and South America as potential supply sources. Another important factor outside East Asia is Russia's natural gas pipeline project for the East Asian market.

At present, U.S. LNG receiving terminals are all located on the East Coast and the Gulf of Mexico, having limited effect on the East Asian LNG market. If many LNG-receiving terminal projects on the North American Pacific Coast are realized, however, East Asian LNG flows may be diversified in response to a wider Asia-Pacific market including the U,S, market. In this sense, the natural gas demand-supply balances in the North American market could affect East Asian LNG importers. LNG transactions for North America, where competing with pipeline gas, may combine spot deals with short-, medium- and long-term contracts. In India, 12 LNG-receiving terminal projects have been approved.

When these new markets emerge, market players, transaction terms and conditions, and contract forms as well as LNG flows could be diversified Especially, should close link between the North American and Asian LNG markets be reality, various effects including pricing are expected. Attention must be paid to future developments regarding these new markets.

4-2 Responses to East Asian Natural Gas Market Problems

As reviewed so far, the East Asian natural gas market has seen the introduction and expansion of flexibility in LNG transaction terms and conditions responding to market environment changes, including progress in liberalization. In addition, the number of players has increased and their roles are changing in the LNG chain. However, East Asia LNG flows so far remain inflexible, being limited to flows from fixed suppliers to fixed importers. Transforming inflexible LNG flows into multilateral ones to increase liquidity and create flexibility may contribute to solve the structural problem in the Asian natural gas markets such as inflexible supply

structure and higher LNG prices. We here would like to consider key measures that could contribute to solve these problems. See Chapter 5 to 9 for details.

(1) Regional Cooperation

While economic globalization is expected to work to intensify market competition, demand for natural gas is likely to expand in East Asia. LNG flows are possible to spread from the traditional East Asian market framework to the Asia-Pacific market and even to the Atlantic market. And there is growing uncertainty over the future LNG demand-supply balances: Under such circumstances, it is undesirable for East Asian countries to compete for energy supply. Such competition could be detrimental to the region's stable development. In order to avoid undesirable competition to obtain energy sources, East Asian countries should first share understanding about the regional natural gas market. Next, they should recognize the necessity for their mutual partnership and cooperation in achieving their common goal of a competitive, stable supply. Based on the partnership and cooperation, they should jointly tackle the regional market's two structural problems – the inflexible supply structure and higher LNG prices. These partnership and cooperation are expected to pressure on LNG suppliers, leading to more favorable terms and conditions for LNG import contracts, including greater flexibility of LNG flows.

(2) Expansion of Spot Transactions

The expansion of spot transactions can be cited as one of factors to change the current inflexible LNG flows. Spot transactions in the LNG market are conditioned on a) surplus production capacities and, b) the availability of transportation means (LNG tankers) meeting specific cargo positions.

(a) Factors behind surplus LNG supply capacities include the following:

- A surplus capacity during a transition from the commencement of an LNG project to the stable delivery of annual contract-based quantities.
- A production capacity addition by de-bottlenecking of liquefaction plants.
- Importers exercise rights to revise downward annual delivery in accordance with demand slowdown.
- Importers not exercising contract-based options to receive additional supply.

(b) As for transportation means, some factors attributable to tanker owners or LNG importers could cause some of the tanker capacity to be unutilized. .

However, probability is limited for spot LNG market to be developed as is the case with oil. For the immediate future, the LNG market may see only ad hoc spot

transactions.

(3) Expansion of Swap Transactions

The destination clause in conventional LNG import contracts prohibits importers from reselling LNG. On the other hand, the take-or-pay clause forces importers to make payments for LNG imports even if they fail to take LNG deliveries due to any unpredictable decline in demand. Swap transactions allow importers to avoid opportunity costs stemming from such unpredictable developments and adjust demand and supply among themselves. On FOB basis, the elimination of the destination clause is not unfavorable for LNG suppliers in terms of their shipping arrangements. On Ex-ship basis, however, the elimination may affect LNG suppliers' shipping arrangements based on their export plans. In the future, however, suppliers may be required to accept importers' requests to increase flexibility. While take-or-pay clause viewed as essential for sale and purchase agreements, LNG suppliers may consider eliminating or relaxing the destination clause. The elimination or relaxation of the destination clause may encourage more flexible LNG transactions may allow LNG-importing countries in the Asia-Pacific market to accommodate each other with LNG to adjust their demand and supply on a broader basis. This would contribute to expanding the LNG market further and to launching new LNG supply projects. For LNG users, such development would mean stable supply capacity in the market. This would be significant to energy security.

(4) Pricing Formulas

Under an LNG-pricing formula for the East Asian market, LNG prices have so far been based on crude oil prices as a benchmark. As China and India have emerged in the LNG market, however, LNG suppliers are trying to improve LNG's competitiveness in these emerging markets. This is expected to lead to diversification of LNG-pricing formulas. In LNG-consuming countries in the future, competition will intensify mainly between gas fired power generators. As the energy industry has become borderless, players in other industries may advance into the energy market. Various LNG importers are pursuing various LNG-pricing formulas that are favorable for their competition in the markets.

(5) International Natural Gas Pipelines

The East Asian market has no international natural gas pipelines at present. International pipeline development will allow natural importers to diversify their gas

supply sources and means. This is very significant to the enhancement of energy security. International pipelines, as a new natural gas-importing alternative, may give importers some bargaining power in their negotiations with LNG suppliers, exerting downward pressures on LNG prices. Furthermore, pipeline development will also be important for supporting gas to gas competition. In international pipeline development, considerations should be given not only to the economic viability of specific projects but also to the promotion of mutual trust between relevant countries to avoid gas supply disruption and other problems emerging from political issues. Additionally, we should note that development of energy supply through pipelines could become a factor to promote regional political and social stability and enhance cooperation between relevant countries.

Chapter 5 Necessity and Future Possibility of Natural Gas Cooperation in East Asia

5-1 Necessity for Regional Cooperation and its Background

East Asian natural gas-consuming countries differ in terms of introducing the market economy principle. But they have commonly realized that liberalization of domestic markets is a basic trend and that energy supply security is important as the foundation of sustainable economic growth. In this sense, the following basic understandings are apparently being solidified:

First, natural gas will play a greater role as a primary energy source from the viewpoint of environment problems while oil's status declines.

Second, East Asian countries will be more dependent on energy imports from countries outside the region. In this sense, stable procurement of natural gas at competitive prices will become very important.

Third, expanding LNG demand in Europe and the U.S. will prompt the LNG market to grow more global with LNG flows being diversified.

Fourth, the gas business environment will continue to change. Liberalization will force gas market players to become more efficient, rationalize themselves and save costs. In order to survive business environment changes, they will try to develop various strategies different from traditional ones.

Based on these shared basic understandings, East Asian countries should pursue efficient, optimum regional cooperation at government, private-sector and government-private alliance levels and implement specific relevant measures. This may contribute to stabilizing the East Asian natural gas market. It is very significant for East Asian countries to try to enhance mutual trust, not only to pursue individual national interests, to take an approach based on the whole region's long-term interests

toward the regional energy security and to promote long-term multilateral and bilateral cooperation.

5-2 Possibility of Partnership and Cooperation

5-2-1 Possible Areas for Partnership and Cooperation

As natural gas-consuming countries in East Asia pursue efficient, optimum measures for stable development of the regional market, cooperation and coordination between their governments are very important. Unless these countries work together toward their partnership and cooperation, while toning down their respective national interests, excessive competition for energy resources could be possible. That would damage the stability of the East Asian economy. Cooperation between governments may be bilateral or multilateral. Relevant efforts in the past include bilateral government talks, symposiums or workshops including both government and private sectors, and discussions on a Japan-South Korea Free Trade Agreement. In the past, there has been no specific institutional setting for multilateral cooperation, but some multilateral moves have emerged, including an ASEAN+3 agreement on " Natural Gas Development Promotion Initiative."

Private-sector partnerships can include the following:

(a) Flexible natural gas supply arrangement: Regional coordination meeting seasonal demand changes in gas-consuming countries.

(b) LNG transportation: Utilization of surplus capacities of LNG tankers on the importers side.

(c) Participation in the LNG chain: Joint participation in the LNG chain from gas field development to LNG transportation.

(a): Flexible natural gas supply arrangement means that LNG importers make mutual coordination to meet demand fluctuations. Flexible supply arrangement is also beneficial to respond to emergencies. Specific example for these cases in the past include Japan's extra LNG procurement because of the suspension of nuclear power plant operations and LNG supply arrangement between Japan-South Korea to meet seasonal demand changes. These measures contribute directly to stabilizing LNG demand and supply in the whole of East Asia. They may also lead to enhancement of mutually complementary relations through mutual trust in a competitive market. Flexible supply arrangement may take the form of spot reselling or swap, which conflicts with the destination clause in LNG contracts. The elimination or relaxation of the destination clause is a common issue facing LNG importers in East Asia.

(b): Regarding the LNG transportation, partnerships may include a full

charter-out of LNG tanker capacities owned by importers and their joint transportation. Such partnerships may be established as LNG importers trying to optimize transportation plans.

(c): Regarding joint participation in LNG projects, LNG users that have different consumption patterns should consider forming consortiums as a framework to negotiate with supply side players. If they share risks through their joint participation in LNG projects where huge investment is required, they may enhance partnership.

As for international pipeline issues, Japan should consider not only its own natural gas procurement potential through pipelines but also its appropriate engagement with natural gas development and pipeline construction in Eastern Siberia and the Russian Far East to stabilize natural gas supply in the whole of East Asia. Natural gas pipeline projects may contribute to diversification of supply sources and energy security for the region, which now depends on LNG imports.

Realization and promotion of such partnerships and cooperation could enhance East Asia's bargaining power in the international natural gas market.

5-3 Prospects and Problems for Future Enhancement of Partnerships in the East Asian Natural Gas Market

East Asian countries have had common basic understandings about the environment surrounding the gas market. The problem is that such common understandings have failed to lead to full-scale development of a positive partnership and cooperation. The failure may be attributable to differences in their policies regarding energy security priorities, structural domestic energy industry reforms and transition to market economy. Viewing energy security as their "common goal," East Asian countries have differed over how to interpret energy security. It remains difficult for them to develop their common understanding into specific actions to achieve their "common goal," with top priority being given to regional interests rather than national interests, even at cost of their respective sovereignty or independence.

The first disincentive to East Asian countries' partnership and cooperation is their perception gap. Even in Europe, which has achieved a single energy market as a leading example of regional cooperation, to some degree a perception gap still exists, due to differences between national energy situations. However, European countries have had a strong political willingness to overcome such differences and enhance their cooperation through sincere discussion, negotiation and compromise, in order to avoid wars and increase the competitiveness of the whole Europe. As a result of such willingness, they have created regular and organized institutional settings on a

step-by-step basis to overcome their differences. East Asian countries should sufficiently discuss their common goal and create institutional setting for a regular, organized exchange of views to share regional interests.

The second disincentive is the uncertainty over energy security strategy of China, which is expected to have the largest growth in energy demand in Asia. It is important to watch whether China will give top priority to its national interest-based energy security or to its harmonization with energy security for the whole East Asia.

East Asia's political problems are the third disincentive. They include North Korea's nuclear development, the long-lasting political conflict between China and Taiwan, problems originating from Japan's past war and historical events, and various problems between Russia and East Asian countries. Since North Korea's nuclear development involves security for the whole East Asia, countries in the region may be required to take careful responses through their cooperation. Considering international pipelines as the region's new energy infrastructure, for example, a pipeline through North Korea may be one option. As a prerequisite for such an option is political and social stability of the country or region that a pipeline passes through, these political problems are feared to undermine the relationship required enhancing partnership and cooperation. In this respect, however, we could argue that promotion of energy cooperation could help enhance the partnership relation.

The fourth disincentive is the resistance of incumbent players. Severe business environment changes have worked to intensify competition between energy companies in the region. The pursuit of efficiency based on partnership and cooperation for the whole region could accelerate the process of forcing certain players out of the market. In such a case, incumbent players who suffer losses may make resistance to the promotion of regional partnership and cooperation.

The fifth disincentive is the economic efficiency that would be the most fundamental constraint. When a specific project is to be implemented to enhance partnership in a competitive market environment, its economic viability will be a decisive factor. Any project, if having the economic viability, may make progress, with the partnership being promoted. But institutional problems such as market regulations and incumbent players' resistance could undermine projects even if they have potential economic viability. Even some projects having insufficient economic viability may be able to produce "macro benefits" such as enhancement of energy security. For example, an infrastructure development for Eastern Siberia may fail to have economic viability for its own due to huge investment requirements. If the program is projected to enhance energy security and contribute to reducing "Asian premiums" on energy prices,

it can be said that viability of such projects may depend on how these favorable effects would be taken into account.

It is hoped that East Asian countries will promptly consider building a specific framework for their cooperation in achieving the regional energy security toward their long-term complementary coexistence. To this end, each country must have a strong political willingness to enhance cooperation in tackling common problems and must form a relevant domestic consensus.

In reality, however, some countries may take much time to form such consensus and implement specific measures for their domestic reasons. Therefore, we may have to pursue bilateral cooperation as well as multilateral cooperation. In this respect, relation between Japan and South Korea is important. Since Japan and South Korea have similarities in progress of domestic economic liberalization, crisis management for a stable energy supply and many other areas, their cooperation could become a breakthrough toward building regional cooperation. The promotion of the partnership and cooperation between Japan and South Korea could become a stimulant to realize East Asian energy cooperation. Pursuing multilateral cooperation including China and Taiwan, while advancing the Japan-South Korea partnership and cooperation would be one of the realistic options.

Chapter 6 Possibility and Impacts of Spot Market Expansion

6-1 Present State and Background of Spot Transactions of LNG in the East Asian Market

In 2002, spot LNG transactions in the world totaled 11.44 BCM up by 6.4% from the previous year, and accounted for 7.8% of total LNG transactions. The Atlantic market, including North America and Europe, captured some 82% of spot LNG transactions. In the Asia-Pacific market, spot transactions in 2002 came to 2.11 BCM, of which South Korea accounted for some 85% and Japan for the rest. Spot LNG transactions in the Asia-Pacific market are far less than in the Atlantic market, but have been steadily growing. Factors behind the steady growth include the followings:

(a) Adjusting Demand-Supply Imbalance

In South Korea, particularly, seasonal demand fluctuations are substantial[4]. In order to cover the demand-supply gap, KOGAS has exploited spot purchases to cover

[4] Japan's maximum monthly demand for natural gas for power generation is 3.96 million tons in July, about 1.51 times as much as the minimum of 2.62 million tons in April. In South Korea, the maximum demand is 2.23 million tons in January, 2.95 times as much as the minimum of 0.75 million tons in June.

winter demand that existing long-term LNG import contracts cannot fill.

(b) Deregulation Prompts LNG Importers to Pursue Flexibility in Procurement

In addition to the seasonal demand fluctuations, an important point in South Korea is that KOGAS prefers flexible spot transactions to additional long-term contracts because of uncertainties about its breakup and privatization. In Japan as well, market liberalization has prompted LNG buyers to avoid inflexible delivery under long-term contracts and prefer more flexible terms and conditions for procurement.

(c) Efficient Cargo Arrangement Meeting Demand/Supply Needs

East Asian LNG users have begun to develop mutual cooperation arrangements for efficient cargo transactions meeting their demand/supply needs. Under arrangements of mutual LNG supply arrangement within the region, efficient cargo swaps have become possible.

(d) Dealing with Emergency

In 2001 when Indonesia's Arun gas liquefaction plants suspended operation, Tohoku Electric Power implemented emergency procurement from alternative sources. In the 2002-2003 winter, when all the nuclear power plants of Tokyo Electric Power were shut down, the utility expanded LNG thermal power generation by increasing spot LNG procurement. At the same time, South Korea was forced to make critical demand-supply adjustments, as LNG demand expanded rapidly for power generation reflecting increasing LNG competitiveness against oil and extra space heating demand in the unusually cold winter. Such emergency LNG procurement over the past few years has stimulated expansion of spot transactions in Asia.

6-2 Constraints on Spot Transactions in East Asian Market

East Asian spot LNG transactions, though expanding, are still limited in terms of volume and their share of total LNG transactions. Constraints on spot transactions in the East Asian market include the following:

(a) Constraints Based on the Terms and Conditions of Long-Term Contracts

As traditional long-term contracts have dominated LNG projects for the East Asian market, spot and other new flexible transactions have lagged behind. The take-or-pay and destination clauses in long-term contracts have also worked to limit expansion of spot transactions.

(b) Limited Market Players

Major stakes in LNG projects where huge investment is required are usually held by state natural gas companies, oil majors and other big companies that have excellent in financial and technological background. The Herfindahl Index[5], a measure of market concentration, is higher for the LNG market than for the oil market, indicating higher market concentration for the LNG market. The LNG market concentration in Asia is some 1.4 times higher than the world one, suggesting that suppliers have greater market power in Asia. As a result, the Asian LNG market used to remain a supplier's market. Suppliers have given priority to a stable supply under long-term contracts in the market in order to secure return of investment, which may result in constraints on expansion of spot transactions.

(c) Limited LNG Transportation Capacity

Financing for LNG tanker, as well as gas liquefaction plant, has traditionally been conditioned on long-term LNG supply contracts that guarantee return of investment. Basically, LNG tankers have been tied to long-term contracts. Only the specific number of LNG tankers required for existing project have been built. The lack of LNG tankers has been a bottleneck to transport surplus LNG

(d) Infrastructure Characteristics and Underdevelopment of Futures Market

The U.S. has gas pipelines totaling 278,000 miles, and North America has 39 gas trading hubs. The largest among them is the Henry Hub, whose gas trading price is determined with high degree of liquidity and transparency and serve as a benchmark for the New York Mercantile Exchange (NYMEX) futures market. The NYMEX natural gas futures contract, launched in 1990, is positioned as a marker for the U.S. LNG market. Such sufficient infrastructure system, large transaction quantities, the transparent futures market with a diversity of players support spot LNG transactions in the Atlantic market. Gas to gas competition can diversify market players, expand transaction quantities and give creditworthiness, transparency and liquidity to transaction prices. On the contrary, East Asia lacks such infrastructure and market systems to facilitate LNG spot trading.

[5] The Hirschman-Herfindahl Index is the sum of the squared market shares of the firms, serving as a measure of market concentration. The higher the index is, the higher market concentration is supposed to be.

6-3 Conditions for Expansion of Spot Transactions in the East Asian Market

The following conditions are important for expansion of spot transactions in the East Asian LNG market:

(a) New Market Participants

The emergence of many new market participants is expected to bring about a breakthrough in the East Asian LNG market, where the number of players is limited. In this respect, the prospect of the Sakhalin project that has rich gas reserves and a geographical proximity to East Asia is attracting attention.

(b) Diversification and Increasing Flexibility of LNG Contracts

More than 10% of total LNG production capacity is reported as a potential surplus capacity, allowing for a buyer's market for the time being. Importers in on-going market liberalization are pursuing more flexible LNG procurements. Increasing flexible LNG contracts may lead to surplus production through increased flexibility of contract quantities, encouraging sellers to take advantage of the spot market. At the same time, buyers with their own LNG tankers may result in more increase spot procurement. It should also noted that Japanese power utilities require more flexible LNG procurements since they are replacing existing old oil fired power plants with LNG-fired ones as peak shaving power sources .

(c) Increasing LNG Tankers and Changes in Tanker Operations

LNG tanker construction costs have been reduced by some 40% from the peak. In response to projected growth in LNG demand, a lot of LNG tanker orders have been placed. New tankers for Asia are basically planned for new LNG projects, but an increase in the absolute number of LNG tankers may bring about surplus transportation capacity that may solve the bottleneck for emergency LNG procurement. This may allow easier spot transactions. A shift from Ex-ship contract-based tanker operation to that of FOB may also expand spot transactions. The rising number of LNG tankers and that of FOB contracts may lead to flexible operation or capacity surplus of existing LNG tankers that are owned mainly by exporters. Surplus tankers may emerge from existing contracts and be used for spot transportation[6]. Additionally, If LNG tankers with their chartering contracts terminated are be used in the market, they may be utilized for spot transactions.

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[6] South Korea already takes LNG delivery primarily on an FOB basis and has had spot/swap cargoes. If surplus LNG transportation capacity expands further, Japan and South Korea may exploit the surplus capacity for increasing spot/swaps. But further studies are required on various matters including specific view of market players.

(d) Relaxation of the Destination Clause

Destination clause in traditional long-term LNG contracts enables exporters to secure and maintain fixed stable trading relations with buyers and steadily recover investment costs. The clause has also prevented various effects emerging from buyers' resale of LNG to third parties, including market expansion that sellers cannot control as well as emergence of resale profit. It has been a barrier for buyers to maximize profit through free resale. In the recent Atlantic market, however, the destination clause has been repealed for some contracts. If such a move spreads to the East Asian market, Japan, South Korea and Taiwan may be able to develop mutual flexible supply arrangement and other flexible LNG transactions to cope with the demand fluctuations.

6-4 Spot Transaction Expansion's Impacts on East Asian Natural Gas Market

The following are seen as possible impacts of spot transaction expansion on the East Asian market:

- The liquidity of the LNG market and transactions as a whole may increase.
- The spot transaction expansion may meet the needs of buyers pursuing more flexibility, increase economic viability of gas and help increase gas demand.
- Sellers may change their strategy.
- New market players such as aggregators may emerge and expand their activities.
- Gas to gas market may emerge
- Various pricing methods may be explored if flexibility is increased.
- Diversified pricing and increased volatility
- More linkage with other markets including the U,S,

As a result of these development, while LNG prices may fall to a certain extent, importers may need to take more price risks. Surplus LNG output and free LNG tankers may be put into the market, prompting traders to emerge for seller-buyer matching services for spot transactions. Various pricing formulas may be pursued in addition to the present JCC-linked one. If transactions grow more liquid, market players may require some pricing benchmarks reflecting East Asian market conditions. In a long run, the introduction of international gas pipelines in East Asia may result in competition between pipeline gas and LNG as seen in Europe and the U.S. This may exert downward pressures on prices, leading to competitive pricing. However, East Asian spot LNG prices are expected to be influenced by U.S. market developments. . If higher U.S. natural gas prices encourage traders to ship their cargoes to the U.S., East Asian prices may become interrelated to Atlantic or Asia-Pacific prices. It will be

critical for importers to cope with this kind of price fluctuation.

Chapter 7 Possible Exploitation of Cargo Swaps and Its Impacts

Spot transactions in a broad sense include selling and buying of cargoes, irrespective of cargo sources. A cargo swap means a swap of two or more cargoes from different-term contracts. Cargo swaps are divided into two types – one for demand/supply adjustment (inter-season swap) and another for shortening transportation distances.

7-1 Swaps for Demand/Supply Adjustment (Inter-Season Swaps)

Swaps for demand/supply adjustment are done by multiple LNG buyers (and sellers) with different demand patterns in solving seasonal demand-supply gaps. Such swaps primarily benefit buyers. Japanese power utilities have already implemented swaps or made some framework with KOGAS or CPC, as specified below. In particular, KOGAS makes frequent swap transactions since South Korea sees a tighter natural gas demand-supply balances in winter when its demand is far more than in summer.

7-1-1 Specific Cases

(1) Chubu Electric Power and CPC

A basic agreement was reached on August 31, 2000 for Chubu Electric Power to take delivery of 240,000 tons in LNG (for four cargoes) purchased by CPC under a long-term contract with Indonesia's Pertamina. CPC is supposed to buy back the same quantity in the future.

(2) Tohoku Electric Power and KOGAS

The two concluded a mutual cooperation agreement on April 18 2003, to discuss LNG supply arrangement in emergency, adjustment of delivery to meet demand fluctuations, contracting, chartering schemes and other measures that benefit both companies.

(3) Chubu Electric Power and KOGAS

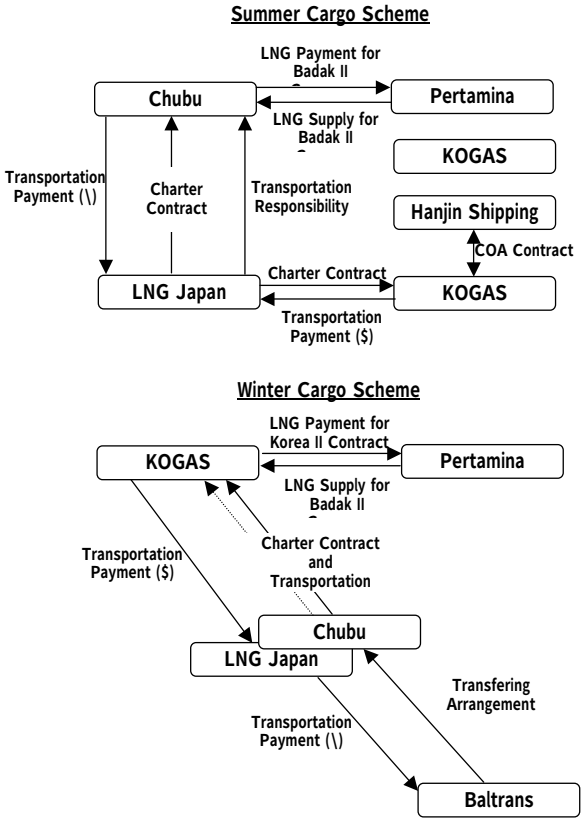
On August 11 2003, the two companies announced the implementation of seasonal LNG swaps.

Table 7-1-1 Outline of Seasonal Swaps between Chubu Electric Power and KOGAS

	Summer 2003	Winter 2003	
Chubu Electric Power	Chubu takes a cargo instead of KOGAS (plus one tanker).	Chubu gives a cargo for KOGAS (minus one tanker).	
KOGAS	KOGAS gives a cargo for Chubu (minus one tanker).	KOGAS takes a cargo instead of Chubu (plus one tanker).	
Notes	・Transaction quantity: 60,000 tons ・The cargo arrives at the Chita LNG receiving terminal in August.	・Transaction quantity: 60,000 tons ・KOGAS takes delivery in December.	

Source: Chubu Electric Power Website

Figure 7-1-1 Inter-Season Swap Scheme between Chubu Electric Power and KOGAS



Source: Chubu Electric Power Website

7-1-2 Advantages

(a) Effective Utilization of Existing Take-or-Pay Cargoes

As sellers require buyers to take delivery evenly throughout the year, take-or-pay cargoes can emerge in a season when demand is low. In such case, a buyer whose contract amount is more the actual demand (demand < delivery receipts) must pay costs for unnecessary cargoes. A buyer whose contract amount is less than the actual demand (demand > delivery receipts) must pay costs to procure additional cargoes in the spot market. Swaps can prevent such opportunity costs from emerging for these buyers.

(b) Saving Storage Costs

A buyer who swaps a cargo a year can save a 130,000-kiloliter LNG tank, for which construction is estimated to cost approximately JP¥ 18 billion[7].

Potential opportunity cost savings through seasonal swaps can be estimated at US$ 615 million (some JP¥ 68 billion) for South Korea under various assumption.

(Facts and Assumptions)

・South Korea's annual average spot purchases totaled 1.25 million tons between 2000 and 2003.

・It is assumed that all those spot purchases can be swaps. South Korea is thus presumed to receive that quantity from other buyers in demand seasons (January-February and November-December) and deliver the same quantity back to them in a non-demand season (March-October).

・South Korea is presumed to pay cargoes that it cannot receive in a non-demand season.

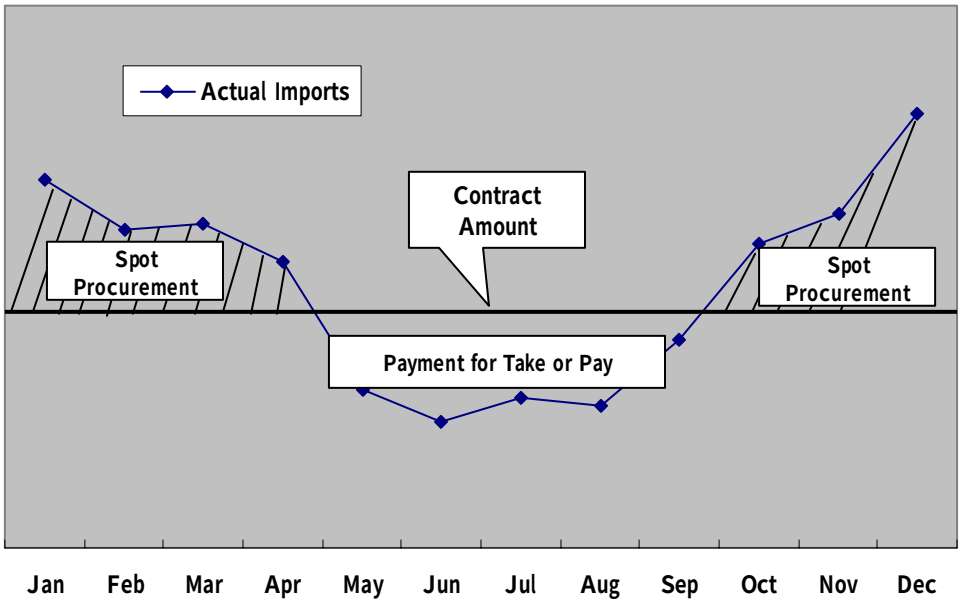
・The average import price during a demand season for the 2000-2003 period (US$ 247.3 per ton) and an average during a non-demand season (US$ 245.1 per ton) are applied for the estimation.

(Estimation)

1.25 m. tons x US$ 247.3/t. + 1.25 m. tons x US$ 245.1/t. = US$ 615 m. (about JP¥ 68 b.)

[7] A running cost for boiled-off-gas treatment for a half-year storage of 130,000 KL procured in a non-demand season is estimated at less than JP¥ 100 million. But repair and maintenance costs for tank may increase year by year. Annual running costs thus may exceed JP¥ 1 billion.

Figure 7-1-2 Inter-Season Demand Gas (Simplified Conceptual Diagram)



Source: IEEJ

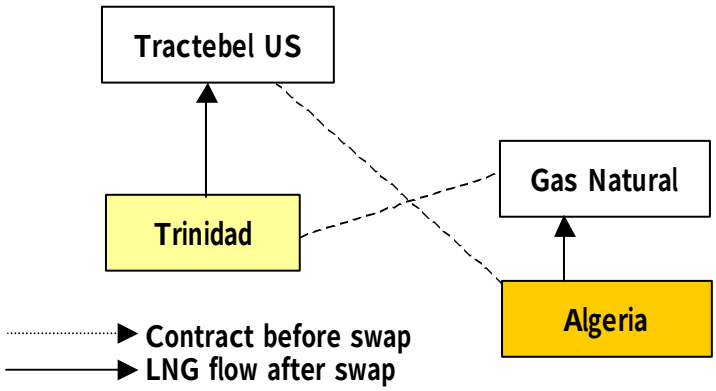
7-2 Swaps for Shortening Transportation Distances

Swaps for shortening transportation distances means that destinations are swapped for each other for multiple LNG transactions to shorten transportation distances. Such swaps have already been done in the Atlantic market. But they have never been done in the Aisa Pacific market. Factors behind these swaps may include fair distribution of profit, and cross-shareholding and other close relations between players.

7-2-1 Cases in the Atlantic Region

We would like to look at a case in the Atlantic cases that cover Gas Natural of Spain and Tractebel LNG North America of the U.S. as buyers, and Atlantic LNG of Trinidad and Tobago and Sonatrach of Algeria as sellers (see Figure 7-2-2).

Figure 7-2-1 Atlantic Swaps to Shorten Transportation Distances



Source: World Gas Intelligence, July 17,2002

Table 7-2-1 indicates distances before and after the swap from Aznew in Algeria and Point Fortin in Trinidad and Tobago to Everett in the U.S. and Barcelona in Spain. The distance before the swap is some 2.8 times as long as that after the swap.

Table 7-2-1 Shortening Transportation Distance

Distance before Swap (one-way)	(miles)
Aznew-Everett	3,271
Point Fortin-Huelva	3,417
Total	7,688

Distance after Swap (one-way)	(miles)
Point Fortin-Everett	2,024
Aznew-Huelva	363
Total	2,387

Source: IEEJ

In reality, transportation costs largely depend on capital costs of LNG tankers. Therefore, the capacity utilization rate becomes the issue. Unless a surplus capacity is utilized, transportation efficiency cannot be achieved. This means that transportation costs cannot necessarily be saved in proportion to the reduction in the total transportation distance. However, fuel costs can certainly be saved, and if the surplus capacity is utilized, the capacity utilization rate will rise. Therefore, transportation costs may be saved. According to World Gas Intelligence (July 17,2002), transportation costs are as follows:

Arzew－Everett	US$ 0.5/MM Btu
Arzew－Huelva	US$ 0.17/MM Btu
Point Fortin－Huelva	US$ 0.52/MM Btu
Point Fortin－Everett	US$ 0.34/MM Btu

Being based on these costs with one ton in LNG considered equal to 53.52 MM Btu, indicates the following cost savings on an annual swap for one million tons of LNG under the above scheme:

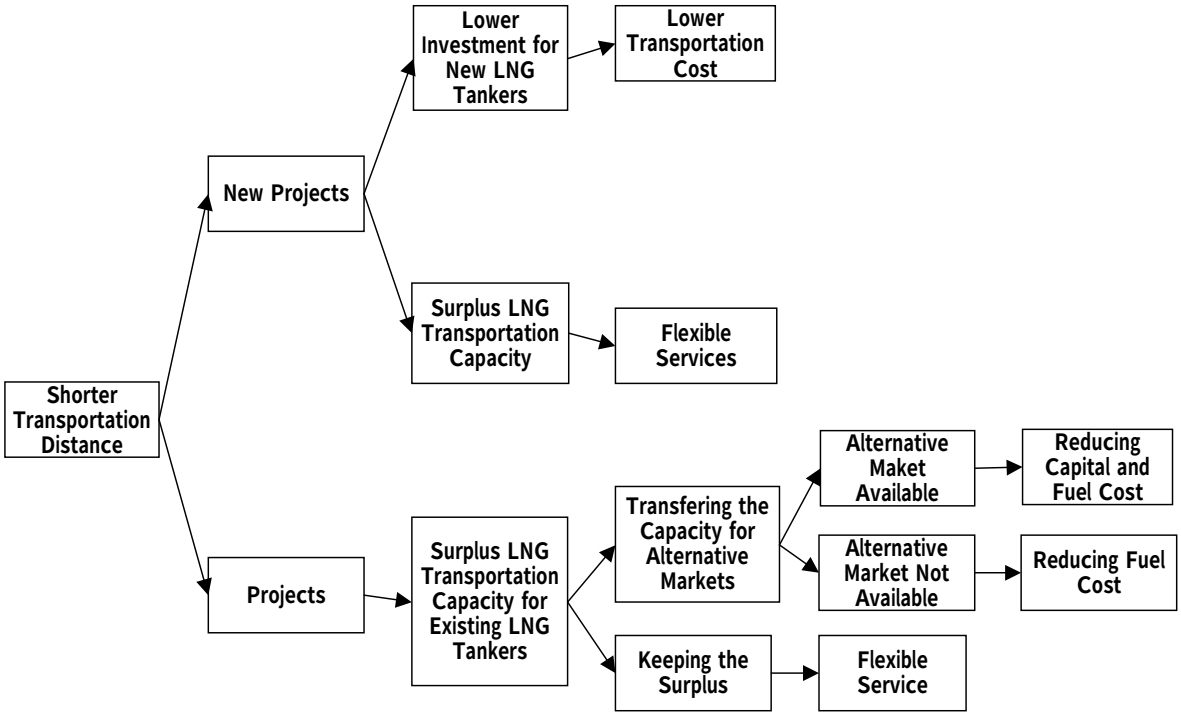
1 m. tons x 53.52 MM Btu x (US$ 0.5/MM Btu - US$ 0.17/MM Btu) +
1 m. tons x 53.52 MM Btu x (US$ 0.52/MM Btu - JP¥ 0.34/MM Btu) = US$ 26.7 million. (about JP¥ 3 billion.)

If an LNG import price is JP¥ 30,000 per ton, a price for one million tons is JP¥ 30 billion. The transportation cost savings worth JP¥ 3 billion against the total import price are significant.

7-2-2 Advantages

A benefit from swaps for shortening transportation distances can be translated into transportation cost savings. While shortening transportation distances for new LNG projects can reduce the number of LNG tankers to directly save transportation costs. However, for existing LNG projects, any significant transportation cost savings cannot be achieved unless demand exists to fulfill surplus transportation capacities. In that case, only fuel costs for transportation can be saved for existing projects. Under FOB contracts, more LNG transportation can bring about more benefits to buyers. Under ex-ship contracts, more LNG transportation can lead to more benefits to sellers.

Figure 7-2-2 Flow of Benefits from Shortening of Transportation Distances



7-2-3 Possibility of Swaps for Shortening Transportation Distances in Aisa Pacific Region

(1) Swap Transactions

Would swap transactions for shorter distance be feasible in the Asia Pacific region? We here would like to consider the possibility of various patterns of swap transactions to shorten transportation distances in the Asia Pacific region.

Distances between LNG plants and LNG receiving terminals are roughly known (see Table 7-2-2). Other preconditions for the estimation are as follows:

・An LNG tanker sails at an average speed of 18.5 knots.

・Any tanker capacity is presumed at 60,000 tons.

・Any tanker can be in operation for 348 days a year. Any tanker may have to remain at a dockyard for maintenance checks for 30 days every two and half years, which is translated into 12 days a year. Five days a year are set for operation allowances.

・The number of days for a voyage consists of the number of days required for a roundtrip voyage, one day for loading at an LNG plant, and two days for unloading at an LNG receiving terminal.

Table 7-2-2 Transportation Distance Examples

Transportation distance (one-way) (Unit: miles)

	U.S. (Kenai)	Russia (Korsakov)	Malaysia (Bintulu)	Australia (Withnell Bay)	Qatar (Ras Laffan)
Japan (Ogishima)	3,269	890	2,486	3,587	6,518
South Korea (Inchon)	4,025	1,343	2,209	3,634	6,175
China (Shenzhen)	4,761	2,085	1,160	2,717	5,056
Taiwan (Yungan)	4,486	1,800	1,214	2,643	5,221
India (Dahej)	8,686	6,029	3,137	3,786	1,290
North American West Coast (Ensenada)	2,292	4,498	7,345	8,174	11,409
U.S. East Coast (Everett)	1,353	3,708	6,656	8,106	10,688
U.S. South (Lake Charles)	6,594	8,790	11,539	11,718	9,738

Simulation results under these preconditions are as follows:

Case 1 (Middle East-Japan, Southeast Asia-India)

(Preconditions)

・Annual transportation covers 3 million tons of LNG.

An LNG tanker with transportation capacity at 60,000 tons makes 50 voyages to transport 3 million tons annually.

・Number of days for one voyage = Number of sailing days (Roundtrip) × 2 ＋ 3 days (Loading and Unloading)

・Feasible annual number of voyages = 348 days ÷ Number of days for one voyage

(One year has 348 days of operation under the above preconditions)

・Number of necessary LNG tankers = 50 voyages ÷ Feasible annual number of voyages

(Number of tankers for transporting 3 million tons annually) (Number of voyages for transporting 3 million tons annually)

○ Before swap: Middle East-Japan, Southeast Asia-India

(Middle East-Japan)

Number of days for one voyage = 13.5 days x 2 + 3 days = 30 days

Feasible annual number of voyages = 348 days ÷ 30 days = 11.6 voyages (per year)

Number of necessary LNG tankers = 50 voyages ÷ 11.6 voyages = 4.31 tankers

(Southeast Asia-India)

Number of days for one voyage = 7.4 days x 2 + 3 days = 17.8 days

Feasible annual number of voyages = 348 days ÷ 17.8 days = 19.55 voyages (per year)

Number of necessary LNG tankers = 50 voyages ÷ 19.55 voyages = 2.56 tankers

(Before swap, total number of necessary LNG tankers)

4.31 tankers (Middle East-Japan) + 2.56 tankers (Southeast Asia-India)= 6.87 tankers

○ After swap: Middle East-India, Southeast Asia-Japan

(South East Asia-Japan)

Number of days for one voyage = 5.3 days x 2 + 3 days = 13.6 days

Feasible annual number of voyages = 348 days ÷ 13.6 days = 25.59 voyages (per year)

Number of necessary LNG tankers = 50 voyages ÷ 25.59 voyages = 1.95 tankers

(Middle East-India)

Number of days for one voyage = 1.8 days x 2 + 3 days = 6.6 days

Feasible annual number of voyages = 348 days ÷ 6.6 days = 52.73 voyages (per year)

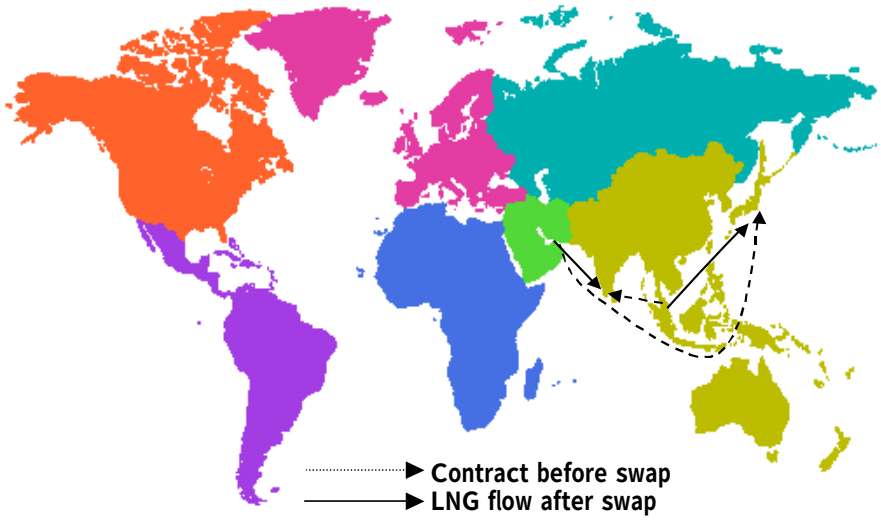
Number of necessary LNG tankers = 50 voyages ÷ 52.73 voyages = 0.95 tanker

(After swap, total number of necessary LNG tankers)

1.95 tankers (Southeast Asia-Japan) + 0.95 tanker (Middle East-India)= 2.9 tankers

The number of necessary LNG tankers declines to some 42% of the pre-swap level

Figure 7-2-3 Swap Case 1 (Middle East, Japan, Southeast Asia, India)

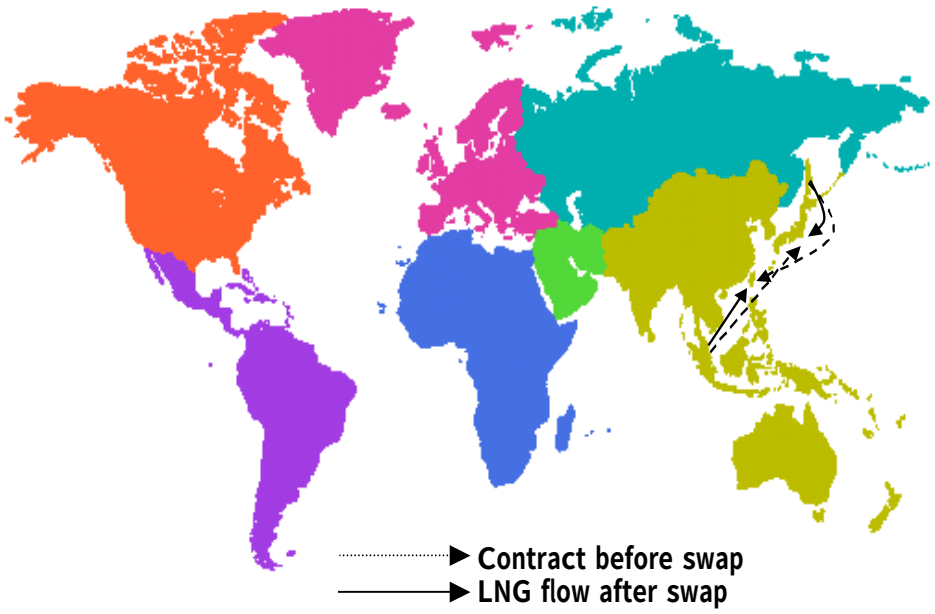


Case 2 (Sakhalin, Japan, Southeast Asia, Taiwan)

○ Before swap: Southeast Asia-Japan, Sakhalin-Taiwan

○ After swap: Sakhalin-Japan, Southeast Asia-Taiwan

The number of necessary LNG tankers declines to some 63% of the pre-swap level



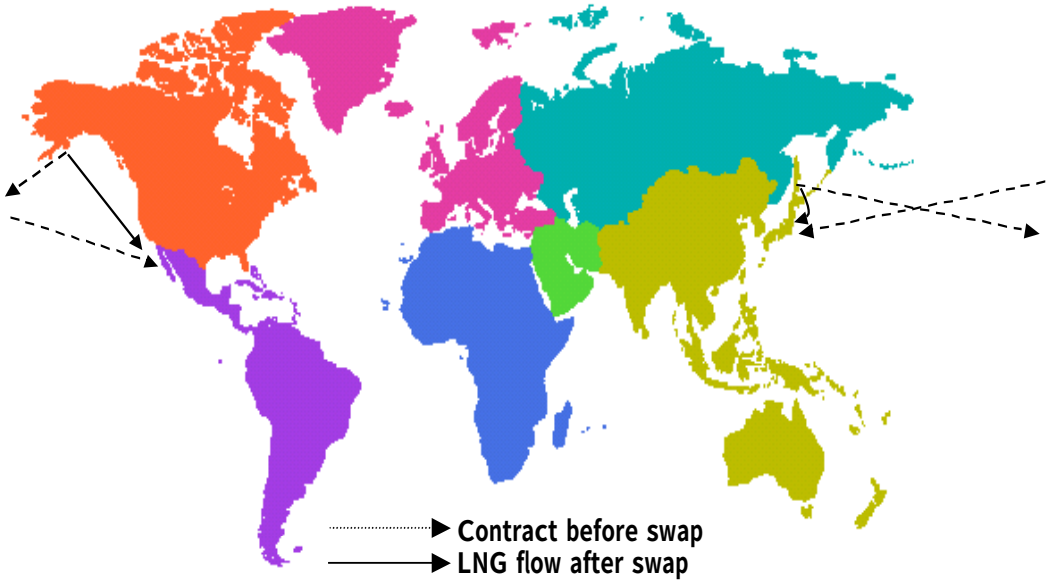
Case 3 (Sakhalin, Japan, Alaska, North American West Coast)

○ Before swap: Alaska-Japan, Sakhalin-North American West Coast

○ After swap: Sakhalin-Japan, Alaska-North American West Coast

The number of necessary LNG tankers declines to some 50% of the pre-swap level

Figure 7-2-5 Swap Case 3 (Sakhalin, Japan, Alaska, North American West Coast)



(2) Non-Swap Measures

A. Arrangement Between Existing and New Contracts to Shorten Transportation Distances

(Case)

○ Before: Middle East-Japan

○ After: Sakhalin-Japan, Middle East-India

The number of necessary LNG tankers declines to some 45%

Figure 7-2-6 Middle East-Japan -> Sakhalin-Japan, Middle East-India

B. Backhauling[8]

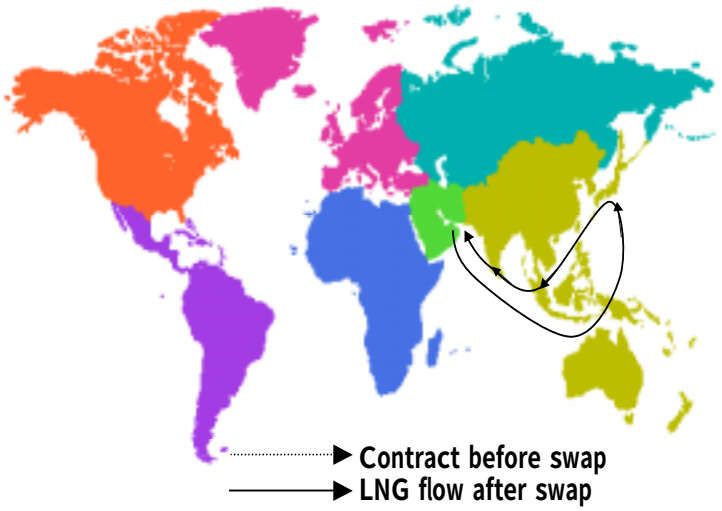
(Case)

○ Before backhauling: Middle East-Japan, Southeast Asia-India

○ After backhauling: Middle East-Japan-Southeast Asia-India-Middle East

The number of necessary LNG tankers declines to some 71% of the pre-backhauling level

Figure 7-2-7 Backhauling (Middle East, Japan, Southeast Asia, India)



7-2-4 Conditions for Swaps for Shortening Transportation Distances in Asia Pacific Region

(1) Sellers and buyers must agree to share benefits from swaps for shorter distance in a mutually satisfactory manner. Specifically:

(a). Distribution of financial benefits

(b). Benefiting from more frequent utilization of LNG tankers in which sellers or buyers have stakes.

(2) A surplus transportation capacity resulting from efficiency improvement can be utilized effectively. Specifically:

(a). If a scheme for shortening transportation distances is linked to the commencement of a new LNG project, stakeholders may be able to benefit from transportation cost savings for surplus capacities.

(b). Surplus transportation capacities can be exploited in the spot market

(3) Buyers' supply security can be maintained through diversification of supply sources.

(4) Different sellers can cooperate with each other. Even if swaps are ideal to shorten transportation distances, it may be difficult for sellers that are competing each other to cooperate each other.

In order to meet these conditions, sellers and buyers must cooperate to increase the flexibility of LNG transactions.

Chapter 8 Possible Changes in LNG Pricing Formulas and Their Impacts

8-1 Japan's LNG Pricing Formula

The history of LNG pricing for Japan began with fixed prices. The prices were later linked to the government sale price of crude oil as a benchmark. Since the late 1980s, most LNG prices have been linked to an average CIF price of the Japan Crude Cocktail (JCC). The JCC-linked pricing formula has basically been adopted by South Korea and Taiwan as well.

The present pricing formula for major part of Japan's LNG imports consists of a factor linked to crude oil prices (aX) and a fixed factor having no link to crude prices (b), as indicated below:

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[8] Backhauling means that a tanker is loaded on its return trip.

P = aX + b

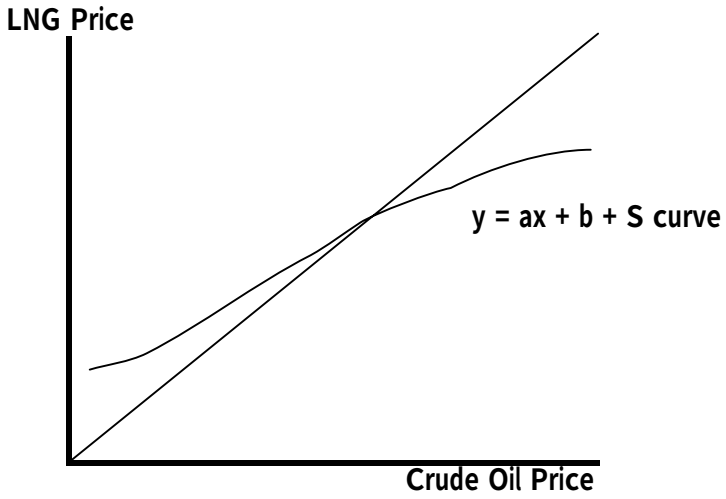
P: LNG price for relevant month

a: Fixed factor

X: Crude oil price for a certain period of time

b: Fixed factor

Figure 8-1-1 Image of Pricing Formula



Source: IEEJ

One reason why Japan adopted an LNG pricing formula linked to crude oil prices might be that a large percentage of electricity was generated by oil-fired power plants in the past. However, the share of oil-fired power has continued to decline to the recent level of 8% below. Therefore, the significance of the LNG pricing formula linked to crude oil prices may be in doubt.

8-2 LNG Pricing Formula Options – Their Features and Impacts

8-2-1 Asian LNG Importers for Price Revision

Since LNG price for China's Guangdong and Fujian provinces was reportedly some 20% lower than those for existing contracts for East Asia, calls have grown for revising the traditional LNG pricing formula. An LNG pricing formula for India's Petronet project, though still linked to the JCC, has set the floor and ceiling to reduce the impact from oil price fluctuations.

In response to these developments, Japanese, South Korean and Taiwanese LNG importers have begun to revise prices and delivery conditions. Following the revision of contract conditions for the Malaysia I project and others in 2002, LNG

buyers are expected to try to improve not only prices but also contract terms and conditions that have been viewed as inflexible. Some reports say agreement has been achieved to cut LNG prices to the Chinese contract level for the Sakhalin II LNG project for Tokyo Gas and Tokyo Electric Power.

8-2-2 Analysis of Pricing Formula Options

The following are cited as future LNG pricing formula options:

(a) In the P=aX+b formula, reducing the fixed factor of "a" to make prices closer to fixed ones (Chinese and Indian types for lowering and stabilizing prices)

(b) Increasing the fixed proportion and decreasing oil-linked proportion (for lowering and stabilizing prices)

(c) Contracting flexible deliveries for seasonal demand fluctuation and fixed delivery portion separately

(d) Fixed prices for stability not to be affected by oil price fluctuations

(e) Linkage to price of coal, fuel oil, and crude prices or electricity prices. (Continental European type that allows LNG to be competitive against other fuels in power generation)

(f) Linkage to price of fuel oil, Gas oil and other petroleum products prices (Continental European type that allows LNG to be competitive in the gas market)

(g) Linkage to NYMEX futures prices (U.S. gas market-linked type to emphasize and reflect market mechanism)

These options are divided into two groups – (A) adjustment of the present JCC-linked formula and (B) adoption of any other formula than the JCC-link:

(A) Adjustment of JCC-Link Formula ((a)-(d) as cited above)

The reasons for pursuing such an adjustment include a decline in the inevitability of links to crude oil prices, reducing of higher Asian prices, and avoidance of excessive LNG price fluctuations due to volatile oil prices. Fiercing competition through deregulation, the need to cut fuel costs, and increasing seasonal demand fluctuations are also cited as factors for importers to pursue new pricing formulas.

(B) Adoption of Non-JCC-Link Formulas ((e)-(g) as cited above)

One reason for pursuing non-JCC-linked formulas is the growing fluctuation or diversification of cusumers' needs such as widening seasonal demand fluctuations. The growing range of LNG consumers, and changes and diversification of demand patterns lead to requirements for various pricing formulas rather than the single oil-linked one. East Asian LNG importers could seek to incorporate LNG's competing

fuels into a LNG-pricing, as seen in Continental Europe ((e)-(g) as cited above). As competition develops and matures, they may seek a pricing formula linked to NYMEX futures prices to emphasize and reflect market, as seen in the U.S. and the U.K. ((g) as cited above). Signs of changes are already seen in pricing formulas for winter spot cargoes for South Korean LNG importer. Interviews with LNG importers in South Korea and Taiwan indicate they are positive toward their possible adoption of new pricing formula options. As the Atlantic LNG market expands, these changes are expected to accelerate and expand their impacts on East Asian LNG procurement.

Chapter 9 Possibility and Impact of International Natural Gas Pipeline in East Asia

9-1 Present State of Natural Gas Pipeline in East Asia

East Asia has no international natural gas pipelines. This is because Japan, South Korea and Taiwan have respectively and traditionally depended on LNG imports. In contrast to the historical background for East Asia, pipeline transactions have been dominant in Europe and the U,S, with limited LNG role. In the long run, however, the existing option of pipeline gas supply from Sakhalin and East Siberia will be increasingly important to the East Asian gas market for of energy supply diversification and security. If natural gas supply via international pipelines is realized in the East Asian market, it may trigger competition between pipeline gas and LNG to exert some pressure on LNG suppliers.

9-2 Present State and Future Prospects of Major Natural Gas Pipeline Projects for East Asia

Some international pipeline projects for East Asia are under consideration, but any progress is left for the future. Reasons for little progress include the following: (a) A huge investment is required. (b) Falling LNG import costs and political problems making these projects less attractive. (c) Gas demand for existing users has been growing more uncertain and progressing liberalization of energy markets. (d) Mutual confidence between exporters and importers is still insufficient due to conflict of national interests.

9-3 Impacts of International Pipeline Development on East Asian Natural Gas Market

Two key factors are required to overcome the above constraints. The first is a substantial increase in gas demand in East Asia. The second is that, when substantial demand increase is indeed in reality, international pipeline is selected as a new means for supplying gas. Three drivers to create the two factors are; (a) growing concern for

energy security, (b) increased consciousness about environmental measures in worsening environmental problems, and (c) rapid progress in development and diffusion of gas utilization and development technologies. These drivers may prompt East Asian countries to give priority to utilization of natural gas as a key regional energy source and pay attention to development of natural gas supply infrastructure.

Conceivable impacts of international pipeline development in East Asia include the following: (a) East Asian energy supply security would be enhanced. (b) Price competition would emerge between LNG and pipeline gas. (c) Domestic pipelines would be developed further to expand gas supply networks. (d) Intensification of gas to gas competition would strengthen downward pressures on prices, enhancing the competitiveness of natural gas against other energy sources. This would promote a shift from oil and coal to gas, expanding gas demand dramatically. (e) Gas importers could aggregate import quantities to strengthen their bargaining power against exporters and put downward pressures on import prices. These effects are expected to dramatically improve the liquidity of gas transactions in East Asia. Should gas be more commoditized at the same time, new problems may emerge, including the need to deal with gas price volatility risks.

Conclusion

Various noteworthy factors are emerging in regard to the East Asian gas market, including a further increase in gas demand, liberalization of electricity and gas markets, new LNG importers like China, cost reductions in the LNG supply chain, and planned construction of LNG receiving terminals on the West Coast of North America.

While natural gas demand is expected to increase substantially, it is increasingly important for East Asian LNG buyers to reduce the higher prices and to make inflexible transaction terms and conditions more flexible. One reason for the increasing importance is that market liberalization and deregulation are urgently requiring power and gas utilities to procure LNG at more competitive prices. Another reason is that more flexible supply options are growing important as future uncertainty for electricity and gas demand for utilities in intensifying competition. In South Korea, a huge gas demand gap between winter and summer has prompted the importer to pursue flexible LNG procurement. The possible replacement of oil-fired power plants with LNG-fired ones to cope with peak power demand may also necessitate more flexibility in LNG procurement.

Measures that are expected to play a key role in solving the problems include (a) the promotion of macro and broad energy (natural gas) cooperation in East Asia, (b)

the development of flexible procurement options including spot and swap transactions, (c) the improvement of conditions for LNG-pricing formulas and diversification of such formulas, and (d) the construction of international pipelines as a new supply option.

In the future, such factors as (a) LNG users' growing interest in more competitive and flexible LNG procurement with on-going liberalization of gas and electricity markets, and (b) sufficient supply potential and growing surpluses in the LNG supply chain are certainly to drive structural changes in East Asian LNG (natural gas) trading.

The East Asian LNG market seems unlikely to become a commoditized market like in the North America because of inflexibilities including the substantial market concentration (strong market power), and the low liquidity in gas trade and transactions due to the underdevelopment of trunk pipeline and other infrastructure networks. Since East Asia has been the center of traditional LNG transactions, existing LNG contracts with traditional trading system are dominant, which may make it difficult for LNG transactions or the regional market to change rapidly.

But the direction and trend of market changes are clear. Taking advantage of a buyer's market that has continued, LNG buyers in the Asia-Pacific region have successfully obtained more flexible and competitive terms and conditions on new contracts or renewals of existing contracts. These flexible terms and conditions include more competitive prices, shorter-term LNG procurement contracts and options for more short-term LNG procurement.

In the future East Asian market, precedent agreements that favor buyers will serve as a benchmark for buyers to seek similar or more favorable terms and conditions for LNG procurement. One of favorable terms and conditions sought is expansion of flexibility that is expected to result in more short-term or spot LNG transactions in the Asia-Pacific market. In addition to swap transactions for adjusting demand-supply gaps, those for reducing transportation distance and costs, as seen in the Atlantic market, could emerge in the Asia-Pacific market as the Sakhalin LNG project and the new LNG market on the West Coast of North America will be in reality.

The introduction and expansion of flexibility in LNG import contracts are closely related to a supply surplus in the LNG market. But this surplus does not mean a physical oversupply as in the oil market. This is because LNG transactions are basically bilateral, and also because LNG projects are launched, in principle, only when enough demand exists. In the current market environment where competition between different energy sources is intensified in various ways, LNG buyers are now required to secure flexibility in LNG procurement terms and conditions to meet future demand

fluctuations and other changes. This is the reason for the introduction and expansion of flexibility.

Suppliers recognize the need to respond to such market changes. LNG supply projects are competing to offer greater flexibility to buyers in order to secure market and monetize their assets. Many LNG project developers are competing for their projects to be launched, leading to a buyer's market where buyers can obtain more favorable terms and conditions (or flexibility) in LNG procurement contract. The flexibility in LNG contracts is expected to expand in future.

While buyers have tried to obtain optimum flexibility, including combination of crude oil-linked and fixed prices, minimizing take-or-pay obligation and expanding delivery quantity tolerance in order to cope with future demand fluctuations and improve their competitiveness, we should note that long-term contracts are to be maintained for LNG imports even in the competitive market. Promoting market competition is apparently able to coexist with long-term commitments to LNG delivery. As LNG flows grow more global, LNG trading mechanisms may be diversified.

What will result from buyers' pursuit of competitive and flexible terms and conditions for LNG procurement and structural market changes? The first possible result will be that LNG (or natural gas) prices (procurement costs) for Asian buyers would have declined from levels for traditional transactions or contract forms and conditions on average.

The LNG price fall will enhance the competitiveness of LNG (or natural gas) against other energy sources in individual markets. Enhancing price competitiveness, coupled with exploitation of combined cycle gas turbine and other efficient gas utilization technologies, may contribute to promoting the utilization of gas. As a result, gas demand and its share of primary energy supply may increase in Asian countries over a medium or long term.

Lower LNG (natural gas) procurement costs may serve to reduce overall energy costs, contributing to enhancing international competitiveness of each gas-importing country's economy and industry (although its impact is not so large, as gas share in total energy is small). Since Asian LNG import prices have so far remained higher than in European and U.S. prices[9], the reduction of Asian prices to narrow their gap with European and U.S. prices may contribute to Asian economies' competitiveness against European and U.S. economies.

LNG prices' general decline thus has potential advantages, but the process or background for the general price reduction may be accompanied by the following

challenges or problems. As players seek favorable procurement terms and conditions individually, LNG procurement price gaps may emerge and expand between LNG import projects or between importers.

Various business opportunities have emerged in regard to LNG transactions. These business chances can also be turned out as risks at the same time. Depending on importers' (companies') experiences, personnel, business capabilities and strategies, therefore, their LNG import prices and business performances (successes or failures) could differ to a significant extent, and business performance gaps between importers (companies) could emerge. As competition between market players is expected to intensify on possible progress in liberalization of gas and electricity markets in Japan and other Asian countries. Business performance gaps regarding LNG procurement may be very significant to competition between importers.

Even if prices decline generally , price volatility is supposed to increase in more competitive and freer markets as a problem. For example, wild price fluctuations have emerged in the U.S. that is the freest market with the most advanced commoditization.

Given various constraints as noted above, the East Asian LNG market is unlikely to be transformed into a market, which is as flexible and liquid as the U.S. gas market. As far as a mainstream pricing formula in the East Asian LNG market is linked to crude oil prices, price volatility may depend only on crude price fluctuations.

If new pricing formulas other than the oil-linked one are sought and introduced in the course of future structural LNG market changes, however, the situation will be different. In particular, if gas price is determined by demand-supply balances, price volatility can increase considerably. In such a case, price fluctuation risks may face Asian LNG market players. They may thus have to seek tools and mechanisms to manage such risks. As for the LNG demand-supply balances in East Asia, many LNG projects are under planning to commercialize gas fields. Therefore, the East Asian LNG market is viewed as a buyer's market where supply potential exceeds demand. However, it must be noted that the LNG demand-supply balance cannot be interpreted in the same way as that of oil.

If all planned LNG projects start production, a physical oversupply will appear. However, huge investment is required for any LNG projects, even though LNG chain development costs, gas field to LNG receiving terminal, have been reduced to a significant extent. Although expansion of existing projects is somewhat different from new projects, basically, any project will not be realized unless return of investment

[9] However, the U.S. gas prices became higher than Asian LNG prices in recent years.

(and appropriate profit) is secured.

Then what kind of LNG projects will emerge among a large number of LNG supply projects? Any projects emerging in the market should have an advantage in cost competitiveness and feature creditworthy players in every segment of the LNG chain. At the same time, such projects should have low political risks in exporting counties. Projects that have competitive advantages over others can be implemented.

These are clear basic conditions for realization of LNG supply projects, as indicated by past projects. LNG projects without securing outlet have rarely made progress. LNG projects that emerge in the market must also be able to meet buyers' needs concerning market environment changes in gas-consuming countries. At the same time, projects emerging in the market must be able to introduce above-mentioned changes into LNG chain.

If LNG (gas) price volatility increases in future structural market changes, as noted earlier, management of price volatility risks may grow more important for sellers as well as buyers. The existing LNG projects were realized by means of steady return and relevant financing security under the traditional transaction scheme. In the future, however, LNG projects will have to meet new requirements including enhancement of price competitiveness and supply flexibility. Further reductions in supply costs, responses to users' requests for flexibility, development of sales channels and management of pricing risks are new challenges for the suppliers and lenders. LNG market players will increasingly be required to seek innovative business approaches and not to stick to traditional business models.

Ultimately, however, the most important factor even in a competitive market is the price (cost) competitiveness. In this sense, cost-competitive LNG and gas projects and their sellers and lenders, though they are required to adopt innovative approaches, have a greater chance to win enough financing and succeed. On the contrary, projects that are less competitive will certainly be put into a disadvantageous position in a competitive market environment. Thus, LNG (natural gas) projects may be selected more strictly and their advantages or disadvantages may be specified more clearly. Financing providers have to pay attention to this point among others.

The final point is that gas supply security measures and policies will be emerged as a critical issue, given increasing share in primary energy sources and growing demand as a result of increasing LNG competitiveness. More competitive and freer LNG transactions may lead not only to a general decline of LNG prices but also to a change from traditional transactions with top priority to stable procurement based on long-term contracts. Therefore, various short-term fluctuation and demand/supply

situation could affect LNG supply more easily.

In any event, gas is expected to expand its share in primary energy sources and grow as a mainstay energy source. Various options should be considered to secure supply security, including diversification of import sources and means (such as combination of LNG and pipeline gas imports), and development of domestic pipeline networks and gas storage facilities.

The East Asian LNG (natural gas) market's expansion is certain to accelerate in structural market changes in the future. This is because improving competitiveness of LNG and more flexible transactions will increase the competence, convenience and utility of LNG (natural gas). In order to expand and develop the East Asian LNG (natural gas) market, governments and companies (in particular, users) in the region are required to enhance their cooperation to pursue common interests and solve common problems, while realizing that they are competing in the market.

Over

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