Minutes of SPEC 2002: Session II "Natural Gas in Asia – The Challenges of A Changing Market"

"CNOOC and China's LNG Industry," presented by Mr. Wang Zhong'an, General Manager, Planning Dept., CNOOC, China

1. Introduction about CNOOC (Slides 3~10)

CNOOC, founded in 1982 to have an alliance with foreign partners in offshore exploration & production (E&P), is the third largest oil company in China. Net profits reached about some US$1 billion in the last three years and E&P business has contributed to the profits most. The company has five segments, including service companies (a full chain service), logistic companies, downstream business (petrochemical, LNG, power projects), financial companies, and research companies.

The core business is E&P having a workforce of 2,000 employees. It also has excellent engineering abilities of design, manufacture and installation of equipment regardless of onshore or offshore. In addition, CNOOC has recorded a strong growth of E&P and downstream services and is a leading company in LNG projects. The companies responsible for the core businesses of E&P and sundry services, among others, are all listed on the stock market and have a good reputation in industry and capital market. CNOOC is the only Chinese firms ranked Baa1 by Moody's.

Its oil & gas production and the size of assets have kept growing (Slides 7 & 8). Cited as major producing areas are the Bo Hai Bay, the South China Sea and the East China Sea (Slide 9). The table below (translated from Slide 10) shows performance of CNOOC Ltd. in 2001.

Performance of CNOOC Ltd. (2001)

Gross revenues	20,820	Million yuan
Operating profit	14,400	Million yuan
Net profit	7,958	Million yuan
Returns on capital stock	32.2%	
Returns on gross working capital	27.6%	
Production	261,379	Barrels oil equivalent/day
Reserves	1.8	Billion BOE

2. China's natural gas supply (Slides 12~16)

In China there are four major on land gas-producing areas, including Ordos, Sichuan, Xinjiang and Qinghai. Among offshore gas fields, the largest is Y-13-1 with total capacity of producing 3.4 billion cubic meters (BCM) a year. Among others, there are DF1-1 producing 2.4 BCM/year and Xihu. There are also a number of minor gas fields.

There are two LNG projects arranged by CNOOC. One is the Guangdong project and the other Fujian project. The former has the first-phase capacity of 3.00 million tons/year to be expanded to 6.00 million tons/year. The Guangdong project will import LNG from NWS, Australia and supply to the Pearl River Delta. The latter, having an initial capacity of 2.60 million tons/year to be increased to 5.00 million tons/year, will procure LNG from Tangguh, Indonesia.

3. LNG options (Slides 18~30)

Geographically the Chinese on land gas fields are located far from consuming areas, while no mass offshore gas fields have been discovered after Y13-1 and Xihu finds. The currently proven reserves of 1.37 trillion cubic meters (TCM) can hardly meet rapidly expanding demand, and there is no sign either that indicates China is rich of gas resources. However, China has an option to import LNG or pipeline gas from widely available sources.

The key to gas market development in China is that the supply side should be emphasized rather than demand potentials. What's essential is to take strategic viewpoints, like a supply source development to help meet demand and an energy mix in order to achieve more stable supply.

As shown in the table below, China's per capita primary energy demand is much lower than other countries' (Slide 20 inserted).

Two cases of primary energy outlook are shown below.

Primary Energy Outlook for 2020

	Case 1	Case 2
Assumptions	Per capita energy demand will reach the world average or the non-OECD Europe's level in 1999.	As forecast by APERC, per capita energy demand will stay at extremely low levels.
Primary energy supply in 2020	1,461-million population * 1.60 TOE per capita = 2, 336 MTOE	1,461-million population * 1.30 TOE per capita = 1,898 MTOE

While primary energy demand is projected as outlined above, what will be actual energy supplies China can secure in 2020 by source? First, coal production can double 2000 records to 2 billion tons/year, though this number may be subject to argument. Oil production can be kept at present level or 160 million tons/year. Natural gas output will increase from 80 BCM/year to 100 BCM/year. As for hydro plus nuclear, China has a very ambitious target ranging from 220 GW to 240 GW (approx. 800 TWh). With all these added up, energy supply of 1,420 MTOE will be possible. The gap between the sum total and the projection amounts to 916 MTOE in Case 1 and 478 MTOE in Case 2.

As for energy imports in 2020, oil is put at 240 million tons (vs. total demand of 400 million tons), with import dependence rising to 60%. Natural gas can be expected as one of the sources to

make up the rest of the gap (from 238 MTOE to 676 MTOE). Considerable increases in coal and the renewables can hardly be expected.

Of gas imports, pipeline gas projects under discussion amount to 20-30 BCM/year and LNG import projects under preparing to 560-1,100 million tons/year, which means a total of 25-40 MTOE/year. More international pipelines look little feasible for the present. On the contrary, LNG offers China an attractive option, because it is the buyer's market right now.

The power industry is the basic customer of LNG projects. If necessary incentives are available, LNG-fired power can be competitive in cost terms. As shown below (Slide 28), China's electricity demand level remains low right now. In newly developing large-scale power sources from now on, particularly in coastal areas, to employ clean fuels having least impacts on environment is essential.

Per Capita Power Demand Outlook as of 1999

	kWh/capita		kWh/capita
World average	2,280	Hong Kong	5,178
OECD average	7,841	South Africa	4,479
Canada	16,571	Malaysia	2,641
USA	13,451	Non-OECD Europe average	2,511
Japan	8,131	Chile	2,416
Taiwan	7,483	Brazil	1,874
France	7,142	South America average	1,510
South Korea	5,448	Thailand	1,405
		China	936

A case study on power demand outlook for China's coastal areas has been conducted. The Province "S" had a population of 90 million in 2000, per capita GDP stood at about U$1,100, and GDP has grown10% in the past few years and would grow 8-9% in the next ten years. It had installed capacity at 20 GW as of 2000, which meant power supply of 0.22 kW per capita, or 1,100 kWh/year. Also the electricity was almost all were generated at fossil-fired power plants. Total primary energy supply in the Province "S" was put at about 70 MTOE, which included coal consumption of 100 million tons.

What can be drawn from the case study is that over the next 20 years at least 30 GW of new capacity should be installed and one thirds of the capacity could be gas-fired. We also gained a conclusion that, due to insufficient domestic supplies, there would be critical needs for gas imports in the form of either international pipeline or LNG.

4. Conclusion

In macro economic policy terms, with environment and supply security taken into account, natural gas is an unavoidable option for China. If so, because it is impossible to satisfy potential demand with domestic gas production alone, LNG imports are found as a relatively realistic option.

Despite many difficulties, a number of LNG terminals will be set up in the coastal areas and, by interconnecting the terminals, China will finally form a vast network. CNOOC is very confident in leading gas business in China.

5. Questions & Answers (the LNG price offered to China)

Many talk about the world LNG price is going to slide by 30-40%, the answer from Mr. Wang was that the lower contract price of LNG deal under present market condition is reasonable. But he didn't confirm that the LNG price contracted between Guangdong and NWS is 30~40% lower than the world price.

"Natural Gas Utilization in Indonesia," presented by Dr. –Ing. Evita H. Legowo, Director, PPPTMGB, Lemigas, Indonesia

1. Indonesia's proved gas reserves and demand outlook (Slides Nos. 3~9)

Indonesia's energy demand outlook for 2010 shows that, compared with the status as of 2000, oil share will decrease (from 54.84% to 42.69%), natural gas demand will increase (but its share down from 27.7% to 26.9%), and coal share will rise (from 11.40% to 23.11%).

2. Indonesia's gas business strategy (Slides Nos. 10~12)

Among characteristics of gas business are that natural gas production depends on demand and that natural gas moves in an integrated LNG chain. Without the market taken for granted, long-term contracts dominate distribution. Gas projects are highly individual and not transferable one another because each has its own design specifications.

The price plays the key role in gas business. Infrastructure, notably transportation and distribution pipelines, is important as well. Gas pipeline construction projects are proposed to Indonesia, ASEAN and China.

3. Changes of gas market (Slide No. 13)

Since 1996 LNG has been shifting from the conventional seller's market to the buyer's market. From now on, LNG business is likely to become tougher and more complicated than ever in the presence of multi-sellers (who supply LNG to the plural number of countries) and multi-buyers (who procure LNG from the plural number of sources).

What's more, the likelihood is that the sellers of gas will launch into downstream operations, while the buyers into upstream. Construction of integrated international gas pipelines is likely as well.

4. Domestic gas business changes and present status of regulations in Indonesia (Slides Nos. 14~26)

In Indonesia gas was used first at fertilizer plants in around 1963. Today, in addition, gas is used for exporting (LNG) and domestically in power generation, the petrochemical industry, fertilizer plants and industrial fuels.

Indonesia had the new Oil & Gas Law born in 2001. Among its principal provisions is the Article 8, which states that a priority shall be given to domestic natural gas needs, strategic oil stockpiling shall be implemented, and oil supply shall be put under the governmental regulation. In addition, it is ruled that natural gas transportation systems, when installed and operated for public interests, shall be opened to all users.

Also the Article 23 distinguishes oil & natural gas business licenses (into processing, transportation, storage, trading), while the Article 27 provides that the Ministry of Energy and Mineral Resources shall prepare a master plan for construction of natural gas transportation & distribution networks.

The Article 28 of the Oil & Gas Law provides that the prices of oil and natural gas shall be left to a sound and fair competition mechanism. The Article 46 cites the matters under jurisdiction of the regulatory agency, which include natural gas transportation tariffs through pipeline, natural gas prices for household and small-scale business customers, and gas transportation and distribution businesses.

While the Oil & Gas Law provides that domestic gas use shall be first, Indonesia alone is difficult realize necessary infrastructure for domestic use (Slide No. 20).

Tangguh LNG project has proven gas reserves of 14.4 TCF, out of which 5.8 TCF is served to other projects to back them up.

5. Present and future domestic gas utilization in Indonesia (Slide No. 27)

In 2002 Pertamina's gas production was 2,853.83 BSCF (billion standard cubic feet), or 7.818 BSCFD (a day). It is broken down into LPG 0.45%, LNG 66.95%, fertilizer plants' feedstock 8.06%, power generating fuels 8.91%, gas companies' feedstock (largely household demand) 3.02%, steel industry 1.01%, and flaring & other losses 6.28%.

Indonesia currently has gas reserves of 176 TSCF (trillion standard cubic feet) and is expected to have increasing gas demand in the future. So, Indonesia also realizes a lot of tasks to be done. Namely Indonesia needs "advanced technologies and infrastructure," "market integration system and regulatory framework" and "new of gas rating policy" to be implemented under a general strategy.

So far domestic gas utilization (in quantitative terms) has remained under 40% of total gas output. Expansion of domestic gas utilization has such barriers as difficulties in installing new and additional infrastructure at home. On the other hand, now that the new Oil & Gas Law was enacted,

Indonesia now comes to the transition stage.

Under such circumstances, Indonesia must have an optimal strategy to increase domestic utilization largely as industrial feedstock and fuels.

In specific terms strategies must be examined particularly from such angles as “natural gas supply and demand in major domestic consuming areas (on the premise of gas reserves),” “ (natural gas) infrastructure construction and gas utilization technologies,” “rating policies specific to area, sector and form of utilization,” “forms of gas utilization,” “clear-cut gas utilization policies,” “coordination among gas producers, transporters and consumers and clear-cut policies and cooperation by local governments,” and “research and development (R&D) on more efficient utilization of fossil fuels.”

6. Conclusion (Slide No. 28)

To speed up new gas field development requires regulations and investments that can contribute to the development, as well as transparency among producers, transporters, traders and consumers.

The most critical issues in gas business development are competitive gas price, infrastructure availability and climate conducive to investment.

On the assumption that constant utilization of natural gas last in the future, profits of byproducts and the development of value-added (gas) market can have increasing importance ahead.

“An Outlook for Natural Gas Market in the APEC Region,” presented by Dr. Yonghum Jung, Vice President, APERC

1. Natural gas demand outlook up to 2020 in APEC (Slides Nos. 3~5)

Natural gas, a premium fuel because it is clean and easy to use, is capital-intensive and costs much higher than other fuels. Our primary energy supply projection up to 2020 shows few significant changes for the present, but natural gas probably would grow (up 2.6% per annum) faster than other fuels, particularly by eroding coal and oil. The natural gas growth is attributable mainly for environmental reasons and the easy-to-use factor.

Focusing on incremental demand in 1999~2020, natural gas demand growth is expected in the sector of power generation, which will be responsible for nearly 70% of the increments. The regions where growing demand is likely are North America, Russia and China. When combined, these regions account for two thirds of the increments. By 2020 China’s natural gas demand will become comparable to combined natural gas demand of Japan, Korea and Taiwan.

2. Changing landscape of LNG business (Slides Nos. 6~7)

So far, due to huge capital investments required for the upstream and downstream sectors, LNG business has been dominated by long-term contracts (which means suppliers require initial high capital commitments from the buyers).

But, the landscape is changing. Though not yet so matured or global as the oil market, the natural gas market is undergoing changes in such forms as introduction of shorter and more flexible contracts. First, there are significant cost reductions by 30~40% at both liquefaction facilities and LNG tankers. More cost reductions are likely in the future. Also, the market is currently glutted partly because there are huge supply potentials without buyers committed. Besides, there is the emergence of short-term and spot markets.

Judging from substantial cost reductions, and if priced with cost-plus approach, natural gas can have its price more competitive than before against alternative fuels.

3. Regional comparisons for LNG pricing (Slides No. 8~10)

The price formula employed by Japan reflects changes in a basket of crude oil prices (JCC). It enables a better deal than other formulas when the crude oil price goes down.

Contracts are becoming increasingly flexible as well. For example, in the renewed contracts between a Malaysian LNG project and the Japanese buyers, namely TEPCO and Tokyo Gas, some of the contract volumes are put under short-term agreements and FOB transportation.

In Europe, where the LNG price is linked to the basket price of fuel oil, light oil and coal, among others. Most recent development is that the price arrangement includes the electricity pool price in some cases. Thus, pricing mechanism is still becoming more flexible even in Europe.

In the U.S., the natural gas price is linked to the Henry Hub futures price. As for LNG, its price is also linked to the price of pipeline gas, mostly from Canada. The price is normally determined by the location of LNG terminals.

The natural gas price in the U.S. can rise partly due to seasonal factors. But, basically natural gas in the U.S. and Europe is priced cheaper than in Asia. The differential is the so-called Asian Premium. According to linear regression results, the LNG price and the crude oil price are found correlated as much as around 85~90%.

4. Natural gas projects in China (Slide Nos. 11~13)

Among natural gas projects in China, LNG projects in Guangdong and Fujian in the eastern coastal area are at the implementation stage. Among others, many projects are under consideration and include pipeline construction from Russia's Irkutsk to Beijing and another pipeline project originating from Sakhalin.

China currently promotes natural gas shifts and, therefore, intends to advance both LNG and pipeline gas. The primary factor behind China's natural gas shift is environmental problems.

There are many rumors that Guangdong has the LNG price lower by 30-40% than the market price, which we are not able to confirm. We should be careful in interpreting this kind of rumor because the price is not the only factor. We have to consider all other factors, including contract volumes and contract terms.

The estimated LNG price for Guangdong ranges as big as $2.05-3.0/MMBtu.

We calculated the price that enabled natural gas to penetrate the market while competing coal. The estimated price by Shell is higher than APERC's estimate probably because the company included environment abatement investments in its estimation.

5. Netback pricing (Slides Nos. 14~18)

Conventionally natural gas has been priced in terms of cost-plus approach by adding up all costs incurred in the supply chain. But, nowadays, the more common practice in Asia is to get the price based on netback values, calculated back from the delivered price of the cheapest alternative fuel.

The APERC has two exercises done, in which the costs were compared between natural gas-fired power plants and heavy-fuel-oil-fired and coal-fired ones. The results showed gas-fired plants cost higher than oil-fired ones, and even more expensive than coal-fired ones.

6. Implications (Slide No. 19)

- The long-term outlook for natural gas is good. It is because an increasing number of governments encourage natural gas as the fuel of power plants. In the short run, shrinking demand due to the economic slowdown can pose greater investment risks on the seller's side.
- Over the next two decades, huge capital investments are required for meeting demand surges. But, given the tightening financial market, to raise necessary funds appears difficult.
- Cost reductions in the LNG chain will be in progress.
- Along with continuing deregulation, privatization of state companies, among others, will be under way.
- Given more supply than demand, contracts will be more flexible in favor of buyers.
- Convergence of natural gas prices will be under way.

It won't be a world of competition between local pipelines and LNG any longer.

With the Middle Eastern suppliers starting LNG supplies to Europe on top of Asia, and South East Asian suppliers to the U.S., among others, diversification of supply sources will advance and natural gas will become a global commodity.

7. Questions & Answers

Question by Mr. Kobayashi of Nippon Steel Corporation: At NSC I'm responsible for direct LNG imports and, therefore, carefully watching flexibility of LNG trade. Particularly I'm interested what are the types of new pricing scheme that could be introduced into Japan?

Answer: The framework of LNG trading is changing drastically, but I don't think there is much change in the Japanese pricing formula. But, I think the situations are quite different between Continental Europe, having the option of pipeline gas and netback pricing in use, and Japan having no alternative but transportation by vessel. For this reason, the development can be slower in Japan than other economies in the world.

"Challenges of A Changing Market," presented by Mr. Roger B. Bounds, General Manager, Shell International Gas, Singapore

1. Advantages of natural gas-fired power generation (Slides Nos. 2~3)

Natural gas has become the fuel of choice for fossil-fired power plants worldwide, and is increasing its share. The growth of electricity markets worldwide is paired with economic development in individual countries (and the recent development in India, China and South America has been particularly remarkable). The reasons for selecting natural gas fuel for fossil-fired power generation include (1) low environmental impact (least CO_2 emissions), (2) high efficiency, (3) low capital cost, and (4) quicker construction than rivaling fuels. As for environmental impact, the recent policy to restrict CO_2 emissions has had a massive effect (shifts from coal-fired to natural gas-fired power). Advance in fossil-fired power generation technology has helped the emergence of efficient plants, notably gas combined cycle (see the graph in Slide 3).

2. Developing markets and issues (Slide No. 4)

There are a few significant drivers that will influence the landscape of the Global LNG markets.

New markets and production areas are emerging for the next decade. India, China, Northern Taiwan and the United States will join the traditional buyers of Japan, Korea and Taiwan within this decade. Access to such markets will be key for the LNG suppliers.

In addition the traditional markets of Korea and Japan have been developing new models of market regulation and considering the entry of new and potentially non-traditional investors in their markets.

The LNG trade is also becoming more global in nature with LNG ships trading between the Atlantic Basin and Asia Pacific and Middle East projects able to play a swing role between the two regions.

As many of you will know, interest in LNG is getting bigger in North America. There are several projects of LNG receiving terminal at East and West coasts. Nth USA is a pioneer for natural gas (LNG) business and pricing mechanism is based on forward price of Henry Hub at NYMEX. However new terminal developments in the US (as everywhere) require significant capital expenditure, regulatory approvals and financing capabilities.

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Because natural gas (LNG) projects involve huge equipment investments in gasification, liquefaction and pipelines, among others, how to raise necessary funds for project financing is really a big challenge.

As for evolution of existing technologies, FLNG (floating LNG) and new technologies like offshore re-gasification (which eliminates the need for LNG terminal) are emerging.

3. Gas deregulation in Korea (Slide No. 5)

In the AP market, the big market for LNG has always been Japan. However, in the last five years, this has been complemented by the emergence of Korea and Taiwan as buyers of substantial volumes. In particular, Korea has established itself as the foundation buyer from two new LNG projects, Qatar's RasGas and Oman LNG in the Middle East. Korea has also established itself as builder and charterer of LNG ships.

Hence, Japan, together with Korea, will continue to play a leading role. In the immediate term however there are challenges in the market that need to be faced including the pressures that arise from restructuring and deregulation in our buyers' markets, an uncertain global economic outlook evident and the consequences of the September 11 tragedy and the current ME conflict.

As the traditional markets face deregulation and lower barriers to entry, increasingly, they have to develop new ways of doing business, which in turn provide challenges and opportunities for all the participants in the LNG value chain.

In Korea, KOGAS is the sole natural gas importer and manages and controls LNG receiving terminals. As deregulation goes on, it is planned that KOGAS will be divided into several companies who will supply gas to domestic power stations and city gas for industry/commercial/residential use.

In markets in Korea, Japan and elsewhere and other sellers await the outcome of market reforms to secure new contacts. However there is now the risk that as governments digest exactly what energy security means, there will be a probable slowing of reform as uncertainty encourages further delay of energy market reforms. While reforms are unlikely to stop they may be delayed and possibly modified to better accommodate energy security issues, either real or perceived. This may delay

commitments to new contracts.
(see the chart in Slide No. 5).

4. Japanese market changes (Slide No. 6)

The Japanese domestic market also undergoes electricity and gas competition. There are intensifying competitions both among power companies and between electric and gas utilities.

Japanese LNG buyers are moving onto more FOB contracts and away from their traditional Ex-Ship contract, with more flexible shipping arrangements and utilisation of the buyers' own shipping. One of the drivers for this is decreasing LNG ship building costs and buyers who look for a reduction in price by introduction of more flexible LNG transactions.
However it may be argued whether the FOB contracts actually lead to a cost reduction as there are implications for ship fleet operations and sharing and it is a question for real discussion whether the LNG shipping industry will move to a similar basis as the oil market where availability of ships is no longer such an issue.
It is also interesting to note that the Japanese buyers are active in participating upstream in the chain of LNG. Osaka Gas together with Shell participates in Australian Greater Sunrise development, while TE/TG participate in Bayu-Undan on-shore Australia.

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5. Regional/global business impacts from recent trends (Slide No. 7)

As always there is considerable discussion in the industry around the direction of LNG prices. Recent deals have had to take into account a wide range of factors including new markets with different value drivers. Pipeline gas will play an important role in meeting demand and will be one element that sets the scene for LNG demand and pricing. While on the production side, technical change, innovation and larger plant economics are all being leveraged to meet this challenge through reduced costs.
The traditional markets of Japan and Korea continue to have a significant impact on the market and even though LNG contracts are shifting to be more flexible, it is expected that the basic terms of the industry contract will remain in place.

6. Shell International LNG supply activity (Slide No. 8)

Slide No. 8 shows where Shell is active. Particularly noteworthy are India, Spain and the U.S. Naturally Sakhalin project is important as well.
On a global basis, there are several trends which have emerged and will impact the businesses…

As a buyer Shell can assist project developers to optimize projects by providing short-term volume opportunities for example one to five year deals or lifting surplus cargoes. However LNG trading and short-term deals are only a very small part of the industry. So this short term facilitator role should not be overstated. However as a ship incur charter fees of approx. $25 m year and a cargo may be valued at $5 to 10 million FOB even a single cargo deal is not insubstantial.
It is recognized that there have been changes in the industry over the last few years that may increase the importance of this short-term role. Capacity has been acquired in LNG terminals before supply has been committed and LNG projects have taken their final investment decision without some output unsold. In this environment Shell have ordered ships against portfolios of projects, rather than tied to one project.

7. Asia/Pacific market with limited changes (Slide No. 9)

On the Asia/Pacific LNG market, Japan and Korea are likely to keep playing the key role (with the market moved by the two countries).

While the form of LNG contracts become increasingly flexible, the mainstreams formed by long-term contracts will remain unchanged.

What will be the conventional take-or-pay clause is particularly interesting.

On LNG pricing, a crucial point is its links to oil. If any alternative system is to be employed, transparency of new pricing must be demonstrated for both buyers and sellers.

In this way, on the natural gas (LNG) market, conventional contract system is likely to remain prevail though some changes can also be observed.

"Prospect of LNG Market in the Asia-Pacific Region," presented by Mr. Shigeru Muraki, Executive Officer and General Manager, Gas resources Department, Tokyo Gas, Japan

1. Issues to be discussed (Slide No. 2)

Natural gas use in Asia-Pacific still remains at an immature stage compared to its potential supply capacity. In this context, natural gas has a big chance of growth.

On the other hand, while LNG has been a dominant form of natural gas traded in this region, the market now undergoes rapid changes. Particularly, in order to increase competitiveness of LNG, progress has been made in improving supply terms and increasing flexibility of LNG trading.

How to make "improved competitiveness" and "stable supply" compatible amid these market changes is the most important issue for natural gas from a long-range viewpoint.

2. Energy-supply mix in Asia-Pacific (Slide No. 3)

The natural gas share in the Asia-Pacific region's energy supply mix is 8%, which is one-thirds of the world average, while coal holds the largest share at 43%. Focusing on Japan, 82% of the country's energy supply depends on imports. Particularly almost the whole of oil and natural gas needs are covered with imports.

A difference between oil and natural gas is that natural gas shows lower dependence than oil does on the Middle East thanks to supply diversification.

3. World natural gas trade (Slide No.4)

Most of natural gas trading in the world is taking place in North America and Europe through pipelines, while LNG accounts for only a quarter. In sharp contrast, 93% of natural gas traded in Asia-Pacific is in the form of LNG.

4. Natural gas demand outlook for East Asia (Slide No. 5)

The EIA (Energy Information Administration) of the U.S. Department of Energy put in its energy outlook for Japan, China and Korea that, when combined, the three countries would have their natural gas demand growing by 5.5% per annum in the years to 2020. My personal views are that this figure sounds pessimistic for Japan and optimistic for China and Korea.

Various factors can be cited as contributing to the high potential demand. They include "sustainable economic growth," "growing needs for global warming abatement," "needs to improve the balance of energy supply sources and diversify supply areas," "improvement of natural gas' competitiveness in inter-energy competition," "delays in nuclear power plans and renewable energy development" and "technological development in the natural gas chain." Good examples of the last one are ACCGT (advanced combined cycle gas turbines), MGT (micro gas turbines) and FC (fuel cells).

5. LNG demand and supply outlook for Asia (Slide No. 7)

In Asia, during 2001, Japan, Korea and Taiwan imported a total of 77 million tons of LNG, which accounted for 72% of LNG traded worldwide.

In Japan natural gas, projected to reach 68 million tons by 2010 and 80 million tons by 2015, can hold 20% of energy supply as of 2015, comparable to the U.S./European levels.

In China, if the present two LNG import projects are favorably under way, natural gas demand will amount to some 10 million tons by 2010. In addition, if LNG imports are under way in the Shanghai district, natural gas demand can reach 15 million tons-strong by 2015.

Due to the Dabhol project at a standstill, the future of India's LNG imports is uncertain. So

are the North American West Coast and the Philippines. Yet, we had better suppose their imports could start as of 2010. On these accounts, LNG demand in the Asia-Pacific region is projected to total 120 million tons in 2010 and outrun 155 million tons by 2015. Given the existing projects, their capacity expansion and new projects under planning/consideration, I believe there are enough supply capacities to meet the projected demand.

6. Natural gas supply potential in Asia-Pacific (Slide No. 6)

Among LNG projects in Asia-Pacific, start-ups are slated for Malaysian Tiga project, expansion of Australian NWS, and expansion of Qatar/Oman. New projects include Bayu Undan in the Timor Sea, Sakhalin II and Tangguh, all to be commissioned by 2010.

Natural gas trading through pipelines, running Sakhalin-Japan, Irkutsk-China or any other routes, can be realized from 2010 onward.

7. Transition of LNG market (Slide No. 8)

So far LNG trading has been closed and fixed to long-term contracts with the costly take-or-pay clause. This has been justified because stable supply must be secured in the long run. Also the LNG price has been determined with the formula linked to the crude oil price.

On the other hand, amid such moves as advancing market liberalization and privatization of state-run enterprises these days, not only inter-energy competitions but also rivalry among gases are intensifying as an underlining trend.

As a result, various changes are unrolling (or anticipated) on the LNG market. They include fiercer competitions among LNG buyers, growing difficulties in forming consortium, shifts to individual negotiations (e.g. Australia's NWS expansion project), the emergence of marketers/traders as in the U.S./Europe, and bidding-based procurement systems.

On trading too, given uncertainties hanging over the future of the market, the strong likelihood is that short-term contracts and spot trading can expand (open market transactions, currently 5~7% of the whole LNG trading volume, can increase to 15% or so by around 2015).

However, as long as LNG projects involve huge investments and require stable supplies in the long run, long-term contracts will no doubt remain as the base of the projects.

In order to increase flexibility of trade, to ease "restrictions on destination" is important as well. By doing so, opportunities of trading, like spot trading, swapping and arbitrage trading, can increase. What's more, there will be a chance of trading that can bridge the Pacific and Atlantic markets.

Also on supply terms, which currently center on the price, contracts of more tailor-made type for each buyer will become increasingly popular. As for pricing, a formula less sensitive to the crude oil price volatility (gentle slope) and a system linked to the prices of petroleum product,

electricity, etc. instead of crude oil will be under consideration. Fixed pricing can be a candidate as well.

Cost competitiveness of LNG must be improved by reducing installation cost and operation cost of the LNG chain.

In the dawn of a competition age, LNG sellers and buyers alike are trying various commitments to the LNG value chain. Super majors, like Shell and BP, are entering transport business and downstream markets. LNG buyers, such as Tokyo Gas, are also making strategic commitments to LNG transport business and upstream investments.

8. Key challenges in a changing market (Slide 9)

There are two key challenges. One is the security of competitiveness (in terms of competitiveness of both natural gas and natural gas companies). The other is the security of stable supply in the East Asian countries (of which natural gas supplies depend on imports). From now on, the natural gas price is required to demonstrate competitiveness on the market. The aforementioned "gentle slope" and fixed pricing are now partially employed in new contracts.

Given growing natural gas demand for power generation as a result of advancing electricity liberalization, the strong likelihood is that natural gas can be linked to the electricity price or to the burner-chip price of petroleum products once pipeline supplies become available as in Europe.

No doubt the LNG price will go down. Moreover, in the next few years, the price can be cut by much more than 10%. Yet, we should realize, in return for changing pricing formulas, we have to face increasing difficulties in making simple comparisons of different formulas, impediments to further cost reductions in the LNG chain, and possible impacts of supply-demand balance on the price, among others.

The take-or-pay level is lowering steadily. Further flexibility of supply can be secured by getting long-term contracts combined with medium-/short-term contracts.

In addition, easing the destination restrictions enables strategic LNG trading in practice, whereby competitiveness of natural gas can be improved by putting excess production, transportation and receiving capacities into effective use.

On the other hand, in order to secure stable supply, it is essential, as discussed before, to base our gas trading on medium-/long-term contracts first, then seeking greater flexibility. Also, natural gas is advantageous in the point that supply diversification is possible (Southeast Asia, Oceania, the Middle East and Russia).

Upstream players' participation in the downstream sector, or vise versa (downstream players launching into the upstream) can contribute to strengthening stable supply, though intensifying competition as a side effect.

In order to stabilize natural gas supply in the long run by realizing international pipelines, it is

imperative to get the importance of pipeline commonly recognized by gas-producing countries, transit countries and consuming countries by overcoming their conflicting interests. An international consensus must be built on pipeline management/operation as well.

Chairman's Generalization of the Presentations

In the Asia/Pacific region, the expanding gas market, which centers on LNG, will no doubt make the LNG price globalized. As demonstrated by the Guangdong shock, LNG can shift to a new price level, while expanding natural gas supplies surely contribute to warranting energy security.

Concurrently with the expanding framework of LNG market, the formation of the "multi-layered" gas market with pipeline gas supply included is under way with Russia joining North East Asia. Also, pipeline networks are expanding and enriching among the ASEAN nations. On the other hand, India, Indonesia and the Philippines, among others, began using LNG, which can contribute to promoting multi-layered trading.

In concluding this session, the panelists are kindly required to give some comments on following matters.

- What impacts the changing gas market can have on oil and electricity trading?
- Will ASEAN Pipeline Network be formed from energy security aspect? Within the ASEAN network, how LNG is positioned? Also, will introduction of Russian gas (both pipeline gas and LNG) help expand supply capacity (in Asia/Pacific)?
- In North East Asia is expansion/enrichment of networks possible with Russian gas resources included? Also, is the ASEAN network formation possible in Southeast Asia? What factors promote or impede the network formation in each region?

Panelists' Comments

Dr. Yonghun Jung, Vice President of APERC

- I think there is huge potential of LNG expansion. Including natural gas-fired projects, new construction has been under way in Korea, China, Taiwan, elsewhere, which means expansion is an inevitable course.
- On Russian gas supply, I think pipeline gas needs long-term contracts and has volume restrictions, which mean it takes a few years before having significant demand volumes. For these reasons, I think it is hard to introduce gas from Russia.
- In terms of political and legal systems, Russia has PSA agreements unsettled. Russia also has problems in regard to stable tax laws. Besides, pipeline gas appears poorly feasible, because a pipeline from Irkutsk at least involves a transportation distance of 3,000~4,000 km, and the one

from Yakutsk even longer.

- On these accounts, Russian gas can be supplied in LNG form (in the short run). In the longer run, pipeline gas introduction is possible for any reasons other than economics

Dr. –Ing. Evita H. Legowo, Director, PPPTMGB

- From a long-range viewpoint, I think it is a very good chance to start construction of the ASEAN Gas Pipeline Network now. We should realize this project so that Indonesia and Singapore, among others, can be interconnected.

Mr. Wang Zhong'an, General Manager, CNOOC

- Considering the future of natural gas, I don't think China could make up its supply-demand gaps in 2020, put at 238~676 MTOE, fully with natural gas alone. It is oil security that will be the key to North East Asia. Compared with oil, barriers to coal and LNG security are rather minor (in such points as contract term and price volatility).
  In the longer run, increasing natural gas supply can contribute to minimizing security problems of energy as a whole.

Mr. Roger B. Bounds, General Manager, Shell International Gas

- How to form energy networks effectively is important in developing the market. It is a very ambitious plan to make regional networks boost to international connections. We want to follow with interests. Also, I really hope Japan to introduce Russian gas in LNG form.

Mr. Shigeru Muraki, Executive Officer & General Manager, Tokyo Gas

- In East Asia, natural gas supply through pipelines is important from stable supply aspect in the long run. In order to form pipeline networks that cover China, Korea, Japan and Russia, there are several subjects to be solved. One is how to advance the efforts to build up an international framework. The other is, in case of pipeline, lack of storage functions to absorb seasonal demand fluctuations, emergency backup and the like is particularly problematic for Korea and Japan. To solve these issues, governments' initiative is essential, not to mention private firms' efforts.
- In addition, given extremely increasing competitiveness of LNG, we had better recognize pipeline gas is not always advantageous in cost terms (taking Sakhalin as an example). Pipeline can never have good economics unless a market-based viewpoint should be satisfied on how to realize efficient transportation and consumption of gas.
- Russian gas is strategically important in East Asia. As for Sakhalin, Tokyo Gas is now endeavoring to reach an agreement with Sakhalin Energy by March on a-million-ton LNG

purchase contract. Also, Sakhalin Energy plans to continue its examinations of the possibility of pipeline gas supply in the future.

- In Europe gas from Algeria is served in both forms of pipeline and LNG. Similarly, if Japan is served Russian gas in both pipeline and LNG, I firmly believe Russia could be an effective source in terms of both economics and stable supply.

Chairman's Summary

- From security aspect, natural gas can be counted as a resource having various characteristics good for security.
- Though not discussed today, how to deal with DME and GTL, among others, is among the changing gas factors subject to discussion.
- As for the Russian gas issue, whether Russia can be a reliable partner of North East Asia or not is important in both social and political terms. But, no doubt Russian gas will be supplied to East Asia in the future.
- This is an issue that requires concerted efforts among producers, buyers, consumers, policy-makers and energy economists for producing some good ideas.

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