Summary of Symposium on Pacific Energy Cooperation 2001 (SPEC2001) – Energy Security in Asia

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The Symposium on Pacific Energy Cooperation, organized first in 1986 as a forum to discuss energy issues and energy cooperation in the Pacific region, had the 16th anniversary this year in the aggregate. The latest meet, or SPEC 2001, was held February 20 – 21, 2001 at the Hotel Okura, Tokyo. Under the main theme of "Energy Security in Asia," 785 participants from a total of 24 countries plus an international organization (EU) attended the conference and had brisk opinion exchanges.

SPEC 2001 consisted of two keynote speeches, four sessions and a panel discussion. Summaries of the keynote speeches, the sessions and the panel discussion are given below.

I. Keynote Speeches

Under the chairmanship taken by Managing Director Tsutomu Toichi of IEEJ, two prominent guest speakers delivered keynote speeches. H. E. Mr. Bijan Namdar Zanganeh, the Minister of Oil, the Islamic Republic of Iran, gave a presentation entitled "The Role of I. R. Iran in Meeting the Growing Oil & Gas Demand in the Asia-Pacific Region and Potential Cooperation with the Region's Consumers." Mr. Phil Watts, Managing Director of the Royal Dutch/Shell did "Security in Trust – Meeting Asian Energy Needs in the 21st Century."

The keynote speech by H. E. Oil Minister Zanganeh of Iran is summarized below.

Perspective of energy market developments

Energy demand will increase considerably, particularly in Asia, with oil and gas playing the dominant role. In the next 20 years oil demand is forecast to rise double the last two decades. In this context, the Persian Gulf countries will remain central to supply as in the past. By overcoming the economic crisis, Asia demonstrated its strength to the rest of the world. The Asian economic crisis sent the global economy slumping and crude oil prices plunging. Asia's revival in recent years has proved that the sustainability of its economic growth has become internalized and that it does not depend on any specific country. In its forecasts, the OPEC Secretariat put that Asia-Pacific countries would account for about 34% of additional global oil demand in the next 20 years, and the Persian Gulf countries would supply about 58% of the additional demand. This can help strengthen the inter-relationships between the Persian Gulf and Asian countries, particularly on oil. On the maintenance of energy security, too, the presence of the Persian Gulf states will play the decisive role in countering instability. The past incidents, notably the two oil shocks, obviously showed that impacts of a Persian Gulf crisis, if any, could be felt worldwide.

Responses to volatility

Stabilization of the energy market is imperative. To prevent supply constraints calls for removal of investment barriers. While producing countries put the security of supply among top priorities, developed countries' technical and financial cooperation is required particularly in downstream sector. The Islamic Republic of Iran, the second largest producer within the grouping of OPEC member states, intends to meet much of excess demand in Asia. Oil and gas sectors involve long-term horizons. Oil exploration must be advanced continuously. Given global energy supply security, efficient use of production capacity is imperative. To upgrade the capacity of the petrochemical sector is essential as well.

Iran and Japan

Exchanges between the two countries are effective. To help increase energy efficiency is above all important in Japan-Iran relationship. Iran's energy efficiency has not improved so much

as expected from its economic development. It is imperative for Iran to change its energy-intensive structure, particularly the transportation sector, then reduce domestic consumption and increase exports. These, in turn, would be effective in bolstering oil supply security. I. R. Iran hopes Japan's greater-ever cooperation in this issue. Iran welcomes Japan's direct investments in oil & gas downstream sectors, gas to liquid (GTL) conversion, and Japanese firms' cooperation in the upstream sector. While the world is changing towards cleaner and less pollutant energies like gas, the Asian region has constraints on its energy use. Asia needs technological development in natural gas production, conversion and transportation methods. Development of GTL and DME, among others, is important as well. Expansion of gas pipelines network will create opportunities for exports from Iran to India and Pakistan, where Iran will effectively meet part of the region's energy needs. We hope Japan's positive cooperation in these projects, which surely contributes much to energy security.

A summary of the keynote speech by Mr. Phil Watts, Managing Director of the Royal Dutch/Shell Group is given below.

Changing energy market – increasing complexities

In Japan and the rest of Asia, energy consumption has doubled in 1970-2000, and is predicted to surge further twofold by 2020 by some forecasts. The share of developed countries is falling to only a third in 2020, when developing countries are likely to claim a massive share. Yet, developing countries will use much less energy than developed countries in per capita terms. Energy consumption shifts in reflection to the economic development phases. In mature economies, energy demand may soon peak as a result of changing industrial patterns, aging populations, increasing energy efficiency and environmental measures. Energy supplies are becoming increasingly diverse and competitive.

Competitive pressures

Energy markets are being transformed by spreading liberalization. Firstly, the refining rationalization will need to change much more. Secondly, deregulated markets still require regulation in some forms. Lastly, new information and communications technologies will transform all our businesses, including the Shell Group, through e-Commerce, derivatives and the like. Yet, businesses also have to respond to societal expectations and need to behave with some principles.

Demanding solutions

We need to act now on what was agreed at COP3 in Kyoto. We need to start learning and challenging, rather than getting the international framework absolutely. Increasing use of gas will play an important part in continuing decarbonization of energy supplies. There is huge scope for innovation, and ranges from hybrid engines to hydrogen vehicles.

Delivering resources

To supply expanding energy needs requires investment and innovation. The Shell Group is pursuing GTL, oil sands, solar, wind and biomass, among others.

Continued volatility

OPEC countries retain a decisive influence on oil markets. But managing oil prices is very difficult. Price volatility is a fact of life for oil companies. Volatility also affects gas markets.

Asian challenges

Asia's energy consumption, having nearly quadrupled since 1970, is predicted to grow twofold in the next 20 years. In Japan, still using considerably less gas than most industrialized countries, the role of gas will be an important issue as energy markets continue to be reformed.

While coal use has also grown strongly in China and India, coal gasification offers a way of using coal more efficiently and cleanly, given pollution and transportation problems.

Realizing the potential of gas

Extending gas use is perhaps the most important medium-term step. The Shell Group has over 30 years of excellent records of not merely infrastructure development but LNG projects, the mainstream in Asia. Some forecasts put that natural gas trade in the Asia Pacific region will double the present records by 2020. In the days ahead, resources development will become important in Asia as well. In this context, the Shell Group is advancing now Sakhalin LNG project.

Trusted partners

International energy companies need three key characteristics: technology leadership, the ability to make things happen, and commitment to enduring relationship. The Shell Group has built good relationships in Japan. We all need trusted partners. In Shell, we believe that our presence must be trusted first.

II. Session 1 "Natural Gas and Energy Security in Asia"

Session 1 was held under the theme of "Natural Gas and Energy Security in Asia" and chaired by Mr. Tadahiko Ohashi, Chief Executive Economist, Tokyo Gas Co., Ltd.

To begin with, Chairman Ohashi explained the purport of Session 1 as follows.

Entering the 1990s, natural gas came to attract attention worldwide. From now till 2020, when the world's primary energy supply is expected to grow 2% a year, natural gas demand is projected to rise faster than the whole, or up 3% yearly. Particularly, the Asian region is expected to record higher growth rates than the world averages (primary energy supply up 3%/year and natural gas demand up 6%/year). Yet, in order to realize the projected growth for natural gas demand, there are large numbers of challenges. This session is designed to discuss such challenges.

The first speaker was Dr. Alexey Mikhailovich Mastepanov, Head, Department of Strategic Development of Fuel and Energy Sector, Ministry of Energy, Russian Federation. His presentation, "Growing Natural Gas Demand and Increasing Supply Perspectives," is summarized below.

Demand for natural gas, renowned as a "clean energy," has been rapidly growing since 1997. Amid mounting concerns over environmental problems, natural gas demand is likely to keep growing ahead as a "fuel friendly to environment."

Particularly natural gas is important in new markets and its demand is likely to soar in the Asian region ahead. IEA puts that China's natural gas demand will surge by 7.5%/year until 2020.

Under the present long-term energy policy, Russia gives priorities to East Siberia and the Far East. In these areas a major portion of fuel and energy resources of the country concentrate, including 43% of coal, 18% of oil and 29% of natural gas. Inclusion of offshore reserves sends these shares rising higher. Our first challenge is how to realize energy supply projects to the remaining areas in Russia.

Particularly on Kovykta gas field, production-sharing contracts have already been approved. Kovykta contains enough reserves to not merely satisfy domestic demand but afford natural gas exports to China and Korea for 30 years. However, because natural gas demand in the future depends on many uncertainties, and because how to raise an estimated US$10-billion funds is still indefinite, we cannot decide the start of gas exports yet. From the gas field developer's perspectives, reliable outlooks for gas demand and gas prices are essential. For this reason, we believe Northeast Asia's natural gas demand outlook must be clarified by a joint feasibility study. Natural gas shipped from Kovykta to China may be inferior to Chinese domestic coals in price competitiveness. Yet, natural gas deserves for "environmental premiums" payable as an international practice. Natural gas supplies from Kovykta and Sakhalin are worthy for consideration as an option to bolster energy security in Northeast Asia. These gas development and export projects involve so huge investments and high risks that the countries concerned should try to lower commercial risks through concerted efforts for preparation and implementation of joint energy strategy.

In December 2000 Russia adopted "Energy Strategy for the time horizon to 2020," which is now under consideration for additional revisions. The Energy Strategy supposes Russia's economic growth at 5-6% yearly, which means the Russian economy will treble the present size by 2020. It also cites two challenges. First is how to satisfy energy demand projected to grow ahead. Second is higher efficiency of energy use (energy conservation). We believe Russia can slash three fourths of incremental energy demand by virtue of energy conservation and structural reforms of the

economy. Energy production forecasts for 2020 put coal output at about 300 million tons, crude oil at about 700 million tons, and natural gas at some 700 billion m^3. Though depending on international market trends, exports are expected to go upward till 2015, then remain flat afterward. We believe, on top of domestic demand, Russia can satisfy export needs by 2020.

Russia's domestic gas prices remain stable at relatively low levels. Gazprom resulted in red in the last two years due to unpaid prices by consumers, etc. Russia plans to raise the present domestic gas price 2.5 times in 2003 and further by 1.5 times by 2005. As a result, the relative prices between coal and natural gas, 1:1.2 at present, will be 1:1.6 in 2003 and 1:1.8 in 2005.

Russia's natural gas development and production currently centers in West Siberia. West Siberia accounts for 87% of Russia's total natural gas output now, but the share is expected to drop to 24-26% by 2020. By 2006 full-scale development will unfold at Shtokmanovskoye field offshore the Arctic. Also, Russia gives priorities to Kovykta gas field and Sakhalin offshore gas field. In the days ahead, ten and a few natural gas development projects are expected to be under way in East Siberia and Far East. Toward realization of these projects, the future shape of natural gas markets should be clarified.

The second speaker was Mr. Takemi Arimoto, Executive Vice President, Osaka Gas Co., Ltd., who made a presentation entitled "Changes in Japan's Natural Gas Market and LNG Import Price." His presentation is summarized below.

My presentation focuses on "features of Japan's LNG contracts" and "changes in international markets."

Japan's LNG imports, first from Alaska in 1969, have been on the constant increase and

reached 52 million tons 1999. Three features can be cited as characteristic of Japan's LNG contracts: (1) long-term contract of 20 years or longer, (2) take-or-pay obligation, and (3) LNG pricing originally cost-based then linked to crude oil prices after the first oil crisis. All these favored producers' convenience. In the background, three factors can be pointed out as resulting in the producers-favored contracts. (1) LNG introduction was called for as a policy because environment became an important issue amid growing energy demand. (2) Gas utilities decided natural gas introduction in their effort to prompt "shifts to higher-calorie gas" (decision by management). (3) Buyers respected producers' needs for fixing LNG outlets in the long run so as to warrant huge initial investments.

The take-or-pay obligation has played a certain role in securing supply stability. Also, because LNG prices have virtually linked to crude oil prices, LNG could compete with crude oil as power generating fuels. For its cleanliness and convenience, natural gas consumption has grown in the power production sector.

Lately, as a result of a slower growth of energy demand and fiercer inter-energy competition in Japan, consumers have felt rigidity of conventional LNG contracts more than ever. In addition, some of Japanese gas utilities, long-standing LNG buyers so far, are moving into the gas upstream sector as one of new options for supply security. As far as LNG projects are concerned, Japanese trading companies are also showing moves that suggest they no longer remain in the position of mere "investors." Japanese oil companies too have become interested in natural gas at last these days. From now on, moving into the upstream sector is likely to become an issue very worthy for consideration for Japanese energy firms.

Japan's LNG demand is expected to grow 1.4%/year up to 2010, or an increase of 9.00 million tons over 1999 records. Given better efficiency of LNG-fired power generation, LNG demand is unlikely to grow much. Town gas demand is expected to increase 4.7%/year but greatly

depends on economic trends. Moreover, industrial gas demand is very much sensitive to prices.

In its demand forecasts, the IEEJ puts that by 2010 LNG demand will increase by 9.00 million tons in South Korea (up 10% a year) and by 7.00 million tons in Taiwan (up 5%). On new markets, the IEEJ foresees China in need of 3.00-5.00 million tons and India 5.00-10.00 million tons as of 2010. When combined, the two countries' demand will be equivalent to Japan's incremental demand in the years to 2010. Yet, the future shape of actual LNG import projects blurs beyond many uncertainties.

The United States resumed the operation of long mothballed LNG receiving terminals. Spain also plans to build new LNG receiving terminals. It should be noted, however, that LNG is positioned as supplemental to pipeline gas in the U.S. and Europe.

Given a time span of the next ten years, an expected growing popularity of distributed power sources, notably fuel cells and gas-fueled vehicles, are expected to offer new fields of gas demand. In this context, too, Japanese firms are required to take risks and move into the gas upstream sector.

With many LNG projects newly planned, LNG supply and demand is slack right now. Oman and Malaysia planned their projects originally by taking increasing demand for granted. Many of long-term contracts with Japan will enter the period of replacement from around 2005. Because a strong demand growth can be expected little in the next ten years, LNG-supplying countries will be required to try to respond LNG buyers' needs better by "reviewing the take-or-pay clause" and "devising trading-form variations."

Buyers on their part need to put "contracts of conventional and new types" to combined use if they want suppliers disarmed with price while securing stable supplies. To this end,

competition among suppliers must be encouraged.

While the Middle Eastern countries are getting involved in short-term spot trading, LNG tankers have little room left in the long run. Also we must keep it in mind that spot trading is subject to price volatility. On LNG swap trading, the pricing formula linked to crude oil prices must be changed as well.

Let's consider natural gas from energy security aspect. Japan's dependence on natural gas imports from the Middle East is lower than oil case. Yet, because the share of natural gas in Japan's primary energy remains at a lower level than in Western countries, to expand natural gas use will become an important issue. Natural gas R/P is said to outnumber 300 years. Moreover, the IGU (International Gas Union) estimated that the greater use of natural gas could slash CO_2 emissions by half.

At present, Japan is advancing liberalization and deregulation of gas market in an attempt to lower gas prices. In South Korea, for example, it was state-run enterprises that took the initiative in cutting the gas price. What we are challenging now is to introduce market principles into the downstream sector and launch into the upstream sector by taking risks. Yet, we should not leave "market violence" free by blind-mindedly indulging in liberalization and deregulation. Recent spikes in oil, gas and electricity prices in the U.S. are a good example of market "violence." I believe the recognition that energy is "utilities" is essential.

Let me describe gas pipeline construction in Japan. A gas pipeline, if available near plants and buildings, could strongly spur the shift to gas among consumers. Of course, to encourage gas shifts actually requires natural gas to have price competitiveness against rivaling fuels. But, because recent progress in liberalization has amounted to a "competition in physical strength," individual gas utilities have become very prudent toward pipeline construction. In Taiwan, for instance, state-run enterprise constructed pipelines first, then opened the pipelines to private firms.

Oil-to-gas shift is a current prevailing worldwide. Western firms have integrated it into their business model. On the other hand, Japanese firms still remain at conception of "bringing gas into Japan." This difference in the recognition is formidable. Western firms already began acquiring a series of promising gas-related patents like microturbines and GTL.

However, there are strong facts that LNG has just a short history and that Japan has prompted LNG. Gas field development in Japan's home waters will be a subject of vital importance. From now on, based on the recognition that "the advent of a gas age is inevitable," the public and private sectors are required to make concerted commitments.

The third speaker was Mr. Didier Sire, Head of Business Strategy in the Marketing and Trading Division, Gaz de France. His presentation, "The Prospect of Natural Gas Market in France," is summarized below.

In an attempt to lower electricity and gas prices, the liberalization processes of the Europe Union started with preparation of a framework. As the steps toward price cuts, it was decided to dissolve conventional monopoly-based system, then introduce the principle of competition.

In 1998 the EU issued the Guidelines for freeing internal gas markets, which required each member state to transpose this Directive into national law within two years. The requirement was fulfilled by August 10, 2000. However, the Guidelines allowed a certain amount of leeway by taking into account the specific characteristics of each state.

Since August 10, 2000, the customers, each consuming 25 million cubic meters/year or more, have been eligible to choose their supplier, which means each country is required to open up at least 20% of its annual gas consumption at home. In 2003, this threshold will be reduced to 15

million cubic meters, that is, to open up 28% of annual gas use. In 2008, the threshold will further be reduced to 5 million cubic meters, or 33% of domestic gas use yearly.

Because gas operators have already purchased gas based on long-term contracts (which include take-or-pay clauses), special consideration was given so that the latest liberalization processes should not penalize them one-sidedly. Among others, stipulated was separation of accounts among transportation, storage and distribution sectors. Third party access to gas network was granted as well. The rates may either be negotiated among the parties concerned or decided by relevant governments, depending on specific conditions to the member states.

Gas liberalization must not be assessed based on a theoretical "percentage opening up of a market." In fact, a mere theoretically raised liberalization rate cannot facilitate competition.

I'm going to describe gas liberalization in individual EU countries. First, Great Britain is completely unique in the EU. Having freed its gas market progressively over the last ten years, the country is the only market 100% open among the EU members. Situations of the remaining member states are described in touch with three points: (1) transportation rates, (2) opening thresholds, and (3) powers of different regulatory authorities.

(1) Transportation rates

The rates are regulated in Spain, Italy and Belgium. In Spain, maximum rates are published and negotiable downward. In Belgium and Italy alike, regulatory authorities publish the rates. In France, Germany, Austria and the Netherlands, the conditions for third party access are settled by negotiations, though closely monitored by relevant regulatory authorities in France and Austria.

(2) Opening thresholds

In Spain, the opening threshold, 3 million cubic meters at present, will drop to a million cubic meters in 2002, and completely opened up in 2003. In Belgium, the threshold is set at 5 million cubic meters as of 2001. In Italy, the threshold stands at 200,000 cubic meters in 2000 and its gas market will be opened 100% by 2003. In the Netherlands, the threshold, having stayed at 10 million cubic meters since 1999, will be lowered to a million cubic meters in 2002. France plans to apply the thresholds and timetable provided in the EU Guidelines. France is likely to take a few months before obtaining an approval of its parliament.

(3) Powers of different regulatory authorities

Regulatory authorities are the only one that can guarantee genuine opening of gas market. For the moment, France, Belgium and Italy alone give their regulatory authorities real powers to sanction operators not respecting competitive and nondiscriminatory market rules.

Next described is how GDF (Gaz de France) has committed to gas liberalization. On July 11, 2000, GDF announced it would take the five measures listed below.

(1) Separation of transportation and trading activities
(2) Strict application of eligibility conditions stipulated in the Guidelines from August 10, 2000 onward
(3) Definition of the conditions for access to the networks
(4) Implementation of competitive pricing structure
(5) Relaxation of contract conditions for eligible customers

GDF believes gas demand will grow considerably in the future in such fields as natural gas-fueled vehicles, air conditioning and decentralized power generation. Accordingly, GDF intends to be active in all phases of the gas chain, from exploration-production to supply, trading and marketing, transmission, distribution, and services. The most important is the ability to adapt to the market. It is essential to be able to better meet customers' needs in terms of price and flexibility. On trading, the high fixed cost of gas makes a long-term contract inevitable. The excellent and

long-established relationships enable most efficient trading. Which of electric or gas utilities grab the leadership will be known eventually amid future developments of deregulation and liberalization.

The fourth speaker was Mr. Cristobal Burgos-Alonso, Head of Gas Unit, Directorate C (Conventional Energies) DG TREN: Energy and Transport, the European Commission. His presentation, "Development and Prospects of Natural Gas Policy in Europe," is summarized below.

The EU is heavily reliant on energy imports as Japan is. Its import dependency, 50% now, is forecast to rise to 70% in the next 20 years. In the years to 2030, energy consumption of the EU-30 (on the assumption that its member states would double the present by that time) is expected to grow at an annual pace of 1-2%. Focusing on supply side, the EU's coal production cost is 4-5 times higher than the world average. Oil production cost is also 2-7 times higher, with the R/P standing at 8 years. Its natural gas reserves account for a mere 2% of the world's total, with the R/P put at 20 years. Thus, in the long run, it's impossible for the EU to become self-sufficient in energy. The EU holds as much as about 15% of the world's energy consumption, but has demonstrated no clout in world energy pricing.

To challenge climate change is a matter of urgent need. The EU pledged an 8% cut in its GHG emissions from 1990 records by 2010. Of CO_2 arising from human activities in Europe, 94% can be attributed to the energy sector. Between 1990 and 2010, the EU's GHG emissions are forecast to increase by 5.2%. Of the incremental emissions, 90% is counted as attributable to the transport sector.

The EU, today, is moving toward a single energy market. By source, market integration will be advanced for oil, electricity, gas and coal in this order.

Next described is the EU's natural gas demand and supply prospects. In reflection to the expansion of new markets and growing gas demand in the power generation sector within the region, the EU's gas demand is expected to increase by 26% from 364 MTOE (million tons oil equivalent) in 1999 to 458 MTOE in 2030. The market share of natural gas is likely to increase from 24% in 1999 to 29% in 2030. Two thirds of the incremental gas demand in the years to 2020 will come from the power generation sector, including CHP (cogeneration).

As of 1998 the EU's long-term contracts of gas imports from Russia, Algeria, Norway and local sources amount to 300 MTOE, and its supply and demand is well balanced. Yet, by 2020, with the existing long-term gas-imports contracts alone, the EU can face a supply shortage of 97 MTOE. How to fill the short supply will be a challenge ahead.

By issuing a gas directive, the EU is about to design a competitive market. The gas directive has several key points: (1) abolition of exclusive rights and non-discrimination, (2) unbundling accounts by integrated companies, (3) third party access, including storage, (4) gradual market opening (20% of total gas consumption by 2000, and 33% by 2008), (5) publication of tariffs, (6) efficient dispute settlement mechanisms (non-abuse of dominant position), and (7) transposition of the gas directive into national laws by member states by August 10, 2000.

Generally the gas directive has shown positive developments, though some member states have delayed a little. But, it has shortcomings as well. Namely, real competition and market opening is not just a question of eligibility. Are suppliers ready for real competition? Are non-discriminatory access conditions well established? Including these, there are many questions to be solved.

Considering why the EU reviews gas security, five factors can be cited: (1) growing gas demand and gas imports, (2) growing gas consumption in the power generation sector, (3) rising

import dependency on supply side, (4) gas market liberalization EU-wide, and (5) expansion of EU member states. With these factors seriously taken into account, compatible goals should be hammered out.

I'd like to conclude my presentation by citing three points below.

(1) Gas will play an important role in the EU energy consumption in the future.

(2) With dependency on gas increasing, the EU will be in need of new and additional gas supply sources as well as new forms of partnerships.

(3) Structural modifications in the European gas market:

- Gas-to-gas competition
- Development of market mechanisms
- Convergence of gas and electricity

Chairman Ohashi generalized Session 1 as follows.

So far we've had an impression that the European gas firms are reluctant toward market opening. But, after the gas directive was issued in 1998, the European gas firms set to change their attitude. On the European gas market in the future, competition can get fiercer, but never disappearing.

Amid the flows of deregulation and liberalization, to ensure energy security is likely to become a matter of crucial importance. If the balance between liberalization and energy security is missed, we should risk the recurrence of recent crunches on the U.S. electricity market.

Also, we had better pay more attention to Russia's huge gas reserves in East Siberia/Far East and its export surplus capacity as an option related to Northeast Asia's energy security.

III. Session 2 “Coal and Energy Security in Asia”

Session 2 featured “Coal and Energy Security in Asia” and was chaired by Mr. Retsu Imaisum, Senior Executive Managing Director, Mitsui & Co., Ltd.

The first speaker of Session 2 was Mr. Xu Dingming, Deputy Director General, Dept. of Industrial Development, the State Development Planning Commission, People’s Republic of China. A summary of his presentation, “China Energy and the Outlook of Energy Policy in the Tenth Five-Year Plan,” is given below.

Through high-growth development since the economic reforms and opening, China has made remarkable progress in energy development, which consequently relieved the pressure of energy shortage. China’s energy industry has achieved successful results: (1) energy output increases (1.1 billion tons coal equivalent in 1999, the world’s third largest), (2) optimized structure of energy consumption (greater generated output by oil, natural gas and hydro), (3) commitments to energy industry-related projects (mine development, natural gas pipeline construction, power development (Three Gorge Dam), large-scale wind power plant construction, dissemination of photovoltaic power generation, etc.), (4) advance in energy industry-related technologies, (5) reforms of energy industry’s management system, and (6) energy conservation (improved energy intensity).

Yet, China also faces following problems in energy development. (1) Despite shrinking energy shortages overall, high-quality energies are still in short supply. (2) Development of energy industries is imbalance, with coal suffering over-capacity, while oil and natural under-capacity. (3) Delays in R&D on clean coal technologies. (4) China is behind the world’s advanced levels in energy conservation and efficient energy use.

At present China is at the stage of preparing energy policies in the tenth five-year plan. The basic policies can be summarized as follows: (1) to look after energy security, (2) to optimize energy structure, (3) to improve energy efficiency, (4) to protect the eco-system and environment, (5) to continue to broaden opening-up, and (6) to accelerate development of western regions. Specific contents are outlined below.

(1) Under the basic policy that energy supply should be covered with domestic sources, China will establish an oil stockpiling system and also foster a clean coal technology industry, including coal liquefaction.
(2) China will challenge development and application of advanced technologies, and establish an energy supply system well fitting market needs.
(3) While endeavoring for rational use of energy resources, China will improve energy efficiency on both production and consumption sides.
(4) China will try to realize long-range development by taking into account "protection of environmental quality" when preparing its energy policies, maintaining economic development, and promoting development and utilization of new and renewable energies.
(5) By accelerating the pace of opening up its energy sector, China will establish investment environment good for foreign capital.
(6) While accelerating the pace of Western-region development, narrowing regional gaps in development, and optimizing locations of production centers, etc., China will put relatively abundant fossil fuels, hydro, wind and photovoltaic power to best use in the future. Priority commitments will be made to such projects as the West-East Gas Pipeline Project and the West-East Electricity Transmission Project, the former designed to move natural gas from the west to the east, and the latter to transmit electricity from the west to the east.

Energy is no longer a national issue, nor soluble by a single country alone. The Chinese energy circle wishes to enhance dialogue and communication with its foreign counterparts, promote

energy cooperation among Asian countries, and contribute to energy security in Asia.

The second speaker was Dr. Sun W. Chun, Senior Executive Advisor for Fossil Energy for International Activities, U.S. Department of Energy, also serving as Chair, APEC Expert Group on Clean Fossil Energy), whose presentation was entitled "Possibility and Conditions for Wider Coal Use." Its summary is given below.

An overview of APEC energy situations unveils that energy consumption has been rising as an underlining trend along with growing populations. This trend will continue in the future, led by the emerging economies of APEC. Particularly, mounting demand is likely in China and India, which is worried to have grave impacts on energy markets. The challenge here is to fulfill energy and electrification needs of developing countries in a manner that meets economic expectations, yet compatibly protects our global environment.

We should develop all possible energy resources and technologies for fossil energy, renewable energy, nuclear energy, etc. to meet growing energy needs. It means construction of diversified energy economics, without excessively reliant on any specific energy resource.

Considering its environmental advantage, low capital requirement and reliability of end use technologies for gas, natural gas is likely to contribute more than ever to the world's energy supply mix. However, it also has a worried phase as seen in recent natural gas price spikes in the U.S.

Because coal, most abundant resources in the APEC community, allows constant supplies for constant price at low levels, it will play the crucial role in establishing a sustainable development. However, acid rain, particulates and greenhouse gas emissions, all resulting from coal burning, will

have to be controlled in a manner to be environmentally acceptable and economically competitive in the growing APEC marketplace. At the same time, effort must be encouraged to accelerate the use in new frontiers of energy, like renewable energy and improvement of energy use.

Today, more than 80% of the world's energy consumption is fueled by fossil fuels. It appears realistic to believe that the figure is unlikely to change in the near future, or perhaps longer. Based on such a prediction, I prefer to look at technological innovations as a means to solve environmental problems, like smog, acid rain and warming, while endeavoring to realize economic prosperity.

The challenges to fossil fuel use in the United States directly parallel those in China and India. That is, the U.S. relies on the same abundant and domestic resource – coal – for the bulk of our electricity needs, and encounters the same environmental consequences, which should be solved. To that end, major commitments made by the U.S. include natural gas development, clean coal technology development under such programs as Vision 21, and R&D efforts on carbon sequestration, new turbine system and fuel cell technology. The U.S. and APEC economies need to work together in energy-related national security issues.

The third speaker, Mr. Hiroki Kudo, Group Manager, Environment Group, the Institute of Energy Economics, Japan, delivered a presentation, "Kyoto Mechanism and Possibility of Expanded Utilization of Coal." A summary is given below.

Coal demand, responsible for 26% of the world's total energy demand as of 1997, has held a constant share in the world's energy mix over the past 30-odds years largely in reflection to coal needs as generating fuels and growing demand in developing countries. In its World Energy Outlook 2000, OECD/IEA predicts no fundamental changes in this trend for the next 20 years.

Considering positioning of coal in OECD countries, expanding markets for economically advantageous natural gas are likely to prompt coal-to-gas shifts. Yet, from energy security aspect, coal use will continue to certain extent. As for developing countries, coal is important in their sustaining economic development. Given its price stability and use of domestic resources, growing coal demand is likely, particularly from power production sector.

In relation to environmental problems, because coal is carbon-richer than rivaling fuels, the likelihood is that the OECD countries intend to achieve their GHG reduction targets by either employing more efficient coal technologies or reducing coal use. In this context, it is required to secure diversity in energy supply mix by continuing coal use at one hand and, at the other, grope for specific measures that can reduce environmental loads cost-efficiently. In developing countries, efforts must be made to solve local environmental problems, typically acid rain, or mitigate impact of GHG emissions on warming. Simultaneously, they need inexpensive energy supply that enables a sustainable economic growth, as well as introduction of technologies that solve environmental problems.

While ensuring energy security, the Kyoto Mechanism can benefit both developed and developing countries simultaneously by furnishing the former with options to achieve GHG reduction targets cost-efficiently, and helping the latter advance economic development and environmental improvement by attracting investments from developed countries.

The Kyoto Mechanism enables developed countries to attain GHG reduction targets cost-efficiently on coal markets. Namely, (1) developed countries can earn reduction credits in return for their investments in coal-related projects, such as efficient coal utilization technology and clean coal technology, in developing countries. (2) They can earn reduction credits in return for their investments in non-coal projects, such as a tree-planting program. Or, (3) they can purchase

emissions permits by taking, from coal suppliers, coals with credits (accruing from domestic reductions or investments in JI/CDM projects).

The Kyoto Mechanism is now under multilateral negotiations on its implementation, and if or not it will really take place is still indefinite. Yet, in preparation for the day the Kyoto Protocol is ratified in the future, we had better take actions from now. For example, we had better (1) obtain price information and grope for what will be market prices in the future, while positively exploiting projects. (2) Collect knowledge about trading scheme, etc. (3) Consider construction of a national system viable into a global one. (4) Examine how to hedge the risks involved in conducting projects. (5) Advance construction of cooperative relationships with potential partners (governments or firms) in carrying out projects.

Questions & answers (to Deputy Director General Xu Dingming of PRC) took place as follows.

Q: The nuclear power policy recently published by the Chinese government is found contradictory in some points. Would you explain China's commitments to nuclear power?
A: Aside from what's published by the press, etc., the Chinese government's posture is to advance the nuclear power policy pursuant to peculiar conditions to our country. First, we hope you to recognize China's national conditions are different from Japan's and other Western countries'. At present, nuclear power in China is very limited.

Q: I believe China will play a key role as a coal supply source, not to mention its domestic coal consumption. What's your view on China's balance as a coal supplier and consumer?
A: In China, we've optimized energy structure and coal share in total energy consumption has dropped. In recent years coal output has declined to 1.00 billion tons from all-time-high 1.4 billion

tons. Also, on production, we are currently stressing the policy to produce high-quality coals. We recognize that these commitments represent how China contributes to our neighboring countries in Asia. I've once heard from my Japanese friend that huge coal consumption in China caused acid rain pouring onto Japan. On this issue, I can say acid rain has been diminishing thanks to our coal production cuts in recent years, combined with high-quality coal production that lowers sulfur contents, etc. Energy is not an issue soluble by a single country but requires global dialogue and cooperation.

Chairman Imaizum generalized Session 2 as follows.

First, in his presentation, Mr. Dingming reported that China has grown into the world's third largest primary energy supplier by solving a variety of energy-stemming problems, which have long constrained the national economy and social development, though China still faces many problems. In relation to China's awareness of environmental problems and efforts to solve them, Mr. Dingming pointed out that energy is not a national issue but requires international coordination and cooperation.

Second, Dr. Chun said, in order to sustain development well into the future worldwide, the world's energy demand should treble or even quadruple within the next half century. Dr. Chun also pointed out that to meet the incremental demand leaves us few choices but to rely on abundant fossil fuels, particularly coal. On the other hand, to overcome adverse effects on environment, Dr. Chun stressed the importance of technological development and technology transfer to developing countries. Dr. Chun also reported status quo of technological innovations, together with cooperation with Japan, India and China.

Lastly, Mr. Kudo explained that coal was carbon-richest among fossil fuels and, therefore, its use could be restrained in the future due to mounting concerns over global warming. On the other hand, Mr. Kudo discussed, because coal was abundant and cheap, continuous coal supply

would be indispensable for Japan and Asia. Also, referring to efficient commitments to warming problems (or to help establish the Kyoto Mechanism including emissions trading), Mr. Kudo called for concerted efforts between public and private sectors at national levels, as well as accelerated moves to create a global system.

IV. Session 3 “Future Role of Nuclear Power in Asia”

Session 3, given the theme of “Future Role of Nuclear Power in Asia,” was presided over by Dr. Tatsujiro Suzuki, Senior Research Scientist, Socio-economic Research Center, Central Research Institute of Electric Power Industry.

The first speaker was Mr. Yang-uoo Choe, Senior Vice President, Korea Electric Power Corporation. His presentation, “Nuclear Power and Its Role in Energy Security in Asia,” is summarized below.

Between now and 2020, energy use will grow slowly in the developed economies, but the greatest increase is forecast to occur in developing countries (responsible for 70% of incremental energy use by 2020). Particularly in China and India, energy use is forecast to double the present levels. This will send Asia’s dependency on imported energy rising and worsen environmental pollution. Nuclear energy is expected to play a positive role in solving these problems.

Nuclear power generation is likely to grow slowly in North America and Europe but rapidly in Asia where energy demand is surging. Many reasons can be cited why nuclear energy is an effective option in dealing with energy demand growth ahead. They include nuclear energy can be procured with more flexible means than fossil fuels and contribute to alleviating urban air pollution, and ample uranium reserves lie in politically stable countries. Because of its high technology content, like uranium enrichment and storage, nuclear power can have a secondary effect, that is, developed countries could contribute to modernization of developing countries through such high technology exports.

Since the 1980s, nuclear power has helped Korea achieve stabilization of electricity in terms of both long-term supply and price amid the economic development. Also, in US, nuclear

power has become competitive-ever thanks to increasing capacity factors, which proves that economic competitiveness and safe operation are fully compatible.

A future challenge of nuclear power is improvement of its economic viability. This can be done by making nuclear energy more competitive than fossil fuels through life extension of nuclear power plants. Efforts to help the public correctly recognize nuclear power will be important as well. In this context, to invest more in social scientific efforts appears effective. To increase efficiency of spent fuel processing is also important.

Nuclear power, emitting no carbon dioxide while power generation, can contribute to preventing global warming. Also, in the point that nuclear power is part of solution to diverse energy supply sources, it can lower dependency on the Middle Eastern oil, which ultimately contributes to energy security in Asia. Nuclear power, capable of meeting Asia's surging energy demand along with its economic development, is one of a few proven technologies that can contribute to sustainable development.

The second speaker, Mr. Gerald Clark, the former Secretary General, the Uranium Institute Secretary, the International Nuclear Academy, gave a presentation, "Nuclear Power Generation and Radioactive Waste Management in Asia," which is outlined below.

At present, nuclear power is responsible for 17% of the world's electricity supply. While nuclear power stands at a crossroads now, many problems will be solved in the next half-century. Particularly, because nuclear power makes virtually no contribution to global warming gas emissions as it relies on fission and not combustion, it is likely to head toward wider use.

Radiation emitted from spent fuels is cited as a problem of nuclear power generation today. This, however, is least dangerous if treated properly (by shielding and containing radioactivity).

Also, it should be noted that, in volume terms, wastes from nuclear power generation are far less than from other sources.

There are two medium-term routes of spent fuel management: (1) "reprocessing" (recycling) and (2) direct disposal (once-through cycle). The reprocessing route has no economic incentive at present due to very low prices for raw fresh uranium. Particularly in Asia, many countries have adopted the once-through cycle, largely up to interim storage. The interim storage is not a high-level solution but allows easy handling by containing spent fuels in a pool. On the other hand, Japan is oriented toward MOX fuel-based reprocessing, which is a method beneficial to energy security.

China and India have had reprocessing plants. China also has surface disposal sites. But, development of these plants has been little in progress. A possible explanation for the slowness is that the scale of nuclear power operations in Asia is relatively small. Permanent deep disposal also faces many problems and there is a universal prejudice against nuclear power. There is no cross-border system for spent fuel either. Without operated in a certain scale, neither reprocessing nor surface disposal of spent fuel could economically be feasible. For these reasons, Asia currently has few alternatives but to continue interim storage of spent fuel.

On spent fuel treatment, both (1) direct disposal and (2) reprocessing options pose fundamental issues. The risk of radiation emitted from spent fuel must be minimized as much as possible. As for reprocessing, it is also important to settle the issue of the Nuclear Non-proliferation Treaty (the possibility of diversion of civil material to military use).

The third speaker was Mr. Hajime Maeda, Director and Executive Vice President, Kansai Electric Power Co., Ltd. His presentation, "Safety and Risk of Nuclear Power in Today's Society," is summarized below.

In regard to the issues that involve social risks, notably energy security and global warming, we do not always easily recognize such risks because of temporal gap and spatial diversity between causes and results. We then tend to undermine the benefits of nuclear power and focus on only the anxiety about its risks. Therefore, by transmitting correct information, open and unbiased discussions are needed now all the more.

In Asia, a total of 88 plants (68 GW) are in operation in Japan, Republic of Korea and Taiwan, and additional 23 plants (18 GW) under construction. Thus, nuclear power comes to play an important role as a major power source in many countries in the world. However, utilization of nuclear power has not so progressed in many countries as planned due to the problems associated with public acceptance (PA).

To encourage PA, the relationship between nuclear power and the society needs to be analyzed from following three aspects: (1) social risks and the role of nuclear power, (2) safety of nuclear power (or technological risk) and social confidence, and (3) cost competitiveness of nuclear power and business risk.

Given the relationship between nuclear power and the society, what's important is to recognize that nuclear power contributes to both energy security and mitigating global warming. In the Asian region, where significant increases in population and economic growth are expected, there are concerns about further decrease in the self-sufficiency of energy resources as well as long-distance transportation of energy resources. We should reduce dependency on fossil fuel by seeking diversification of energy sources, and we are in need of electricity reliable enough as the principal power source. In spite of tripled power consumption since 1970, Japan's CO_2 emissions have only doubled in the same period. Almost 60% of the avoided emission can be attributed to nuclear power generation, which demonstrates nuclear power's contribution to arresting global

warming.

On safety of nuclear power (or technological risk) and social confidence, minimizing technological risk is not sufficient to assure viability of nuclear power, but it is indispensable to regain public confidence. As represented by Japan, Republic of Korea and Taiwan, nuclear power plants in Asian countries feature a high capacity factor and a low forced outage rate. The satisfactory operating history shows that nuclear power is a matured technology with a high level of safety. However, as demonstrated by the accident at Tokai-mura, the safety culture has not necessarily been fully developed across the nuclear industry. To share safety culture will be a target among nuclear operators. While further improving technologies for controlling nuclear energy safely, efforts should be made to secure transparency in all aspects from policy-making to utilization, thereby bringing nuclear energy closer to the people.

On cost competitiveness of nuclear power and business risk, business risk becomes the subject of serious consideration when investing in nuclear power. Technological risk can be well controlled and, by means of continuing efforts to regain public confidence, it is possible to reduce the investment risk to the sufficiently low level. Nuclear power is a cost-stable energy source, contributing to hedging the business risk associated with the shifts in fossil fuel prices. Furthermore, in the current trend for internalizing environmental cost, advantage of nuclear power will become evident. In the area of operational efficiency in Japan, there is still room for improvement, for example, in such points as rationalization of related regulations.

Session 3 concluded with Chairman's generalization and questions and answers, which took place as follows.

From the presentations at this session, we can read three points as important challenges of nuclear power from now on. They are (1) positioning of nuclear power amid liberalization and privatization, (2) perfect management and permanent disposal of wastes, and (3) efficient

transmission of information to help cultivate PA. I personally believe international cooperation offers one of solutions to these three points. I would like to learn views held by Messrs. Choe, Clark and Maeda on this point.

Mr. Choe: I believe it necessary to increase the safety of nuclear power through international cooperation. Waste disposal technologies are advancing, yet we need further efforts for technology advance and spreading the recognition of safety.

Mr. Clark: International cooperation is important. Today, on nuclear power, good news is hardly spreading. California of the U.S. ended in a failure because the state expected too much of hydro and wind power when advancing deregulation. By sharing such a lesson across the international community, to learn each other appears very important. To this end, we need to construct a network that can support international discussion.

Mr. Maeda: International cooperation leads to benchmarking. International comparison enables each country to learn at what level it stands. On wastes, which involve technological issues, geologic prospecting, construction of deep disposal sites, etc., international cooperation still has problems to be solved. On international cooperation in PA, information exchanges appear viable about what efforts have been effective in enhancing PA.

V. Session 4 “New Technology Development”

Session 4, held under the theme of “New Technology Development,” was chaired by Mr. Masaaki Tanaka, Executive Director, Electric Power Development Co., Ltd.

The first speaker was Dr. Samuel Bernstein, President and COE, Energy International Inc., USA. His presentation, “Gaseous Energy Revolution and Technology,” is summarized below.

Gaseous energy revolution

The world is facing significant changes regarding gaseous energy and utilization technology. Key factors in this energy revolution are (1)) deregulation of energy markets, (2) widespread environmental concerns, and (3) new technology developments. These trends of deregulation and concern for environmental protection calling for lower emissions are resulting in small-scale or distributed generation (DG) technologies.

These developments will produce new markets, products and services. Natural gas and other gaseous fuels are already seeing a significant increase in demand. DG offers the advantages of high power quality, reliability, demand reduction and low emissions, especially in countries and regions where power grids are well developed. DG can also offer the potential to bring power to regions that have an incomplete or no electric grid. Significant economic development can occur in these areas as a result of DG introduction.

Gas utilization technology

Current technologies for natural gas power generation: The primary growth market for natural gas is combined-cycle gas turbines (CCGT) for power generation. At the end of 2000, nearly 100,000 MW of new electricity capacity were being developed at over 150 sites in the United States, and almost all of the projects featured gas turbines. The low-cost CCGT technology has

contributed to the growth of independent power producers (IPPs).

Small gas turbines: Small gas turbines under 20 MW are manufactured by a number of manufacturers, and available in stationary or mobile packages, and in use as either standby generating or cogeneration units. Combustion turbines typically have dual fuel-operating capabilities, typically using natural gas as the primary fuel and a high-quality distillate as the back-up fuel.

Large gas turbines: Gas turbines over 20 MW are available in two types: heavy-frame models and aeroderivative designs. The former is used for central power plant applications, while the latter for large industrial cogeneration sites such as oil refinery and chemical plants.

Microturbines: The microturbine is a small gas turbine that produces electric power ranging from 30-300 kW. This technology is entering commercialization after years of R&D by a handful of companies. Microturbines may be used in numerous applications, ranging from remote places and construction sites to portable power to hybrid alternative-fuel vehicles. They are also capable of operating on a wide variety of fuels, such as natural gas, diesel, propane and methanol. Systems with recuperators can produce power at around 25-30% efficiency.

Fuel cells: Fuel cells are another emerging DG option, but market acceptance has been hampered by high initial costs. Recent technological advances are trimming costs and bringing fuel cells closer to commercialization. There are four primary types suitable for commercial/industrial DG applications: PAFC (phosphoric acid fuel cell), MCFC (molten carbonate fuel cell), SOFC (solid oxide fuel cell), and PEM (polymer electrolyte membrane fuel cell). Only the PAFC is commercially available at this time.

The second speaker was Mr. Toshio Tanabe, Director General, Clean Coal Technology Center, New Energy and Industrial Technology Development Organization. His presentation, "NEDO's Clean Coal Technology Strategy for the 21st Century," is outlined below.

Needs for clean coal technology in Japan

Coal is a core alternative energy to oil in Japan's primary energy supply. On the other hand, because coal produces larger CO_2 emissions than other fossil fuels, Japan needs to increase efficiency of coal use, or develop and introduce clean coal technology that can make coal an environmentally friendly fuel.

Main R&D projects on clean coal technology

EAGLE (Coal Energy Application for Gas Liquid & Electricity): This project is designed to establish a coal gasification-based technology to manufacture hydrogen gas for fuel cells, and ultimately combine the three technologies of steam, gas combustion and fuel cell generation technologies into one. The new system is expected to feature generating efficiency of 40-50% and 40%-less CO_2 emissions. With a pilot plant currently under construction, test operations are scheduled to complete by 2006.

HyPr-Ring: This is a process to produce 80% of hydrogen gas and 20% of methane gas by causing coal and water to react under supercritical conditions with CO_2 absorber added. Basic research and demonstration tests at a small pilot plant are under way over the period of 2000-2007.

DME (dimethyl ether): This is a technology to manufacture DME in a cheap and efficient manner by directly synthesizing DME from carbon monoxide and hydrogen that are yielded by gasification of low-grade coals. DME emits no soot, nor SO_x, while burning. Its NO_x emissions are by far less than diesel. Thus, DME is a clean fuel featuring less environmental load and attracts attention as a promising alternative fuel to diesel and LPG.

Coal liquefaction: Two R&D projects on coal liquefaction have been conducted. One is BCL (blown coal liquefaction) process, and the other is NEDOL (bituminous coal liquefaction) process. At present, pilot plant-scale researches are under way on technology to upgrade coal-liquefied oils produced with the two processes. Also, based on the development of these processes, feasibility studies are under way on coal-liquefaction commercial plants in Indonesia and China.

Clean coal technology R&D policy towards the future

R&D on hydrocarbon energy utilization could be much more efficient and cost effective when conducted in a uniform manner. So far the mainstream has been to recover electricity or heat by direct combustion. Simultaneously, however, there have been growing needs for energy use after energy conversion. First synthetic oil from coal liquefaction emerged as an alternative energy to oil during the oil crisis. Today, for environmental reasons, the manufacture of hydrogen, yielded by coal conversion and used in DME and fuel cells, is highlighted as a big challenge. We believe total technology development is rational on direct combustion and conversion uses.

NEDO reorganized October 2000 its Clean Coal Technology Center into the Energy and Environment Technology Development Department. After the reorganization, NEDO initiated total technology development, which covers not merely coals but hydrocarbon energy resources, including oil, natural gas, biomass and wastes.

VI. Panel discussion "Energy Security in Asia – Asia's Initiative for Asian Energy Market"

Lastly, a panel discussion on "Energy Security in Asia – Asia's Initiative for Asian Energy Market" was held under the chairmanship taken by Mr. Katsuhiko Suetsugu, Secretary General, Asia Pacific Energy Forum.

The panelists were: Dr. P. K. Pachauri, Director, Tata Energy Research Institute, India; Dr. Hyun Joon Chang, President, Korea Energy Economics Institute, Republic of Korea; Mr. Ahmad Nizam Salleh, Senior General Manager, Crude Oil Group, Oil Business, PETRONAS, Malaysia; and Mr. Yoshihiro Sakamoto, President, IEEJ, Japan.

First Dr. R.K Pachauri made a presentation entitled "Initiatives for an Asian Energy Market: Perspectives from India," which is summarized below.

The world energy market is likely to undergo major changes ahead. Developing regions would account for 70% of the increase in the world demand for oil between now and 2020. Of it, 45% comes from China, India and the rest of Asia. Hence, this region will be of extreme importance in the stabilization of the world oil market. With larger supplies from the OPEC countries, gas is expected to play a greater role in fuel mix. Also, Asian countries will be the biggest contributors to the growth in demand for coal. With capacity expansion hardly agreeable, the world's nuclear power production will peak around 2010, then turn downward.

Similar trends are likely in India. Its dependence on the Middle East is bound to grow, and the large-scale import of gas will become imperative. There are several options for gas imports, but many obstacles remain. In Asia gas is now procured separately by individual countries, but cost reduction requires joint actions on both demand and supply sides. India has LNG terminals but, given growing gas demand ahead, and for economic reasons too, pipeline is an indispensable

option. As for the use of coal, indigenous resources, India needs Japan's high technological capability, notably CCT (clean-coal technologies). In the transportation sector, Asia is likely to, not follow the Western pattern of a-vehicle-per-capita, but center on public transportation. To this end, on top of technical cooperation, institutional cooperation in such points as management know-how and banking/finance is very important in Asian countries' policy-making.

On these accounts, towards the formation of an Asian energy market, following points are important. First is the formation of a shockproof market, in terms of not merely physical responses but in curbing economic impacts. Second is the establishment of a think tank responsible for preparing a general blueprint of strategy toward a rational market formation. Third is the introduction of new technologies and renewable energies into China, India and others, each representing a large market. Fourth is the regularly held dialogue between producing and consuming countries. Fifth is integrated gas development in Asia regionwide, so that cooperation among countries can afford large-scale and low-cost utilization.

There are as many challenges as chances before us. I believe to build a rational market is what we are obliged to do.

Second, Dr. Hyun-Joon Chang, President, Korea Energy Economics Institute, made a presentation entitled "Cooperation of NE Asia for Energy Security," which is summarized below.

Japan is among a few countries having endeavored to increase energy security in Asia. But, despite the effort, no significant improvement has been noted. A difference from the West is that Asia has no energy networks built for cooperation, because Asian nations have mutually isolated in energy procurement and pursued heterogeneous energy policies. To increase energy security in Asia requires formation of a network and institutional arrangements for it. Yet, by referring to

Japan and Korea, I'd like to point out that scarcity of energy no longer is as threatening as in the past to the economic development. Japan and Korea alike have had huge energy imports in value, and yet recorded trade surpluses.

Three factors can be cited as threatening to energy security in Northeast Asia. First is rapid growth of energy demand. Second is increasing dependency on oil import from outside the region, particularly the Middle East. Third is vulnerability of energy security that depends too much on oil and coal.

Some worry growing energy demand expected in China. But, from a different perspective, it can just be counted as ample business chances available in China.

Then, what are possible directions of cooperation in reality? First, we need joint strategic oil stockpile and cooperative crisis management. Also, we have to consider construction of natural gas pipelines and integrated electricity system. On oil market, to acquire significant bargaining power and purchasing power is essential. Concrete proposals include promotion of free trade and abolition of customs, common oil stockpile, joint resource development, and environmental quality control in oil products.

Today, along with recent progress in the North-South Korean dialogue, a major barrier is about to be lifted from the Asian energy market. The North Korean situation is serious due to energy supply shortage, lack of infrastructure, deteriorating facilities, etc. So, dialogues are under way with South Korea as well as the U.S. and pipeline construction, among others, sounds as a very realistic proposal under such circumstances. Though mutually distrusting in political terms, North and South Koreas are in a complement relation in economic terms, typically in energy, and in need of each other.

Lastly, an Asian energy market needs functional integration that is institutionalized as fairly as in the EU. Cooperation is also needed in tackling such issues as sea-lanes and nuclear wastes. In its report, the U.S. Foreign Affairs Council questioned "if Asia's energy problems inflame regional confrontations or promote cooperation?" No doubt the answer is "promotion of cooperation."

The third speaker was Mr. Ahamad Nizam Salleh, Senior General manager, Crude Oil Group, Oil Business, PETRONAS, Malaysia. His presentation, Energy Security in Asia – Asia's Initiative for Asian Energy Market – The Malaysian Perspective" is summarized below.

Today, I'm talking from oil- & gas-importing country's perspectives. Hit by the oil crises in the 1970s, individual countries have unrolled energy policy of their own. In Malaysia, we formed PETRONAS, which has endeavored for stable energy supplies at home and abroad, efficient energy use, and establishment of efficient energy chain. Energy supply is not affordable by a single country, but requires regionwide involvement in development, capital introduction, etc. Our electricity & gas cooperation with Thailand is among such commitments at regional dimension. Through cooperation, we can contribute to energy security in this region. Broadening it to ASEAN areas allows us to share even larger resources. To that end, we need a Trans ASEAN Pipeline and Grid, which could never be built without the members' strong wills. Including sovereignty, there are many issues to be overcome. Yet, these networks, if established, could contribute so much to energy security that its further expansion Asia-wide could be a viable idea. But for peace, there would be no stabilization. I believe the dialogue between producing and consuming countries as well as stronger ties between them can contribute to stabilization.

The fourth speaker was Mr. Yoshihiro Sakamoto, President, IEEJ. His presentation,

"Asian Countries' Initiatives on Asian Energy Market in Coming Days," is summarized below.

Asia's energy demand in the 21st century will claim one thirds of the world's energy demand as of 2020. Given that Asia is the growth center of the global economy, Asia's energy security is imperative.

Asia's energy consumption is characteristic in surging oil consumption and heavy dependence on the Middle East. Political stability in the Middle East will be a matter of crucial concern for Asia as in the past.

The greatest concern over oil is price volatility. Because the global economy has been threatened by producing countries' menace of supply cuts during the 1970s, futures market represented by NYMEX was formed. By now, however, the initiative in crude oil pricing has shifted to the futures market, of which one fourth is dominated by speculations by hedge funds. As a result, the oil price has become more volatile than ever. With its price jumping from $10/bbl to $37-38/bbl just in half year, we cannot but describe oil as an unusual commodity when compared with other commodities.

Armed with neither a supply cartel nor a futures market, East Asia is exposed to the threats from both of them, and now required to decide how to deal with such threats. Throughout the 20th century, the Western governments and firms have certainly made supreme contribution to the supply of energy resources. In the coming age, Asian countries also should advance toward a market where they will be able to take an initiative as significant players, even if minor. But, relevant problems cannot be solved unilaterally. Concerted efforts are essential in overcoming geographic and geopolitical constraints. Given the diversity of the Asian region, lying ahead is not an easy path. At this moment, the goal is not necessarily clear, either. Even if so, I believe to get Asian countries jointly groping for it will be a very worthy action.

First, taking oil as an example, as of 2020, oil demand of China, Korea, Japan and Taiwan will total 20 million B/D, which is equivalent to Europe's. Is a consuming area of that size unable to form a market of its own? As a supplying area, the Middle East on its part is seeking constant revenues. Demand security aspired by supply side, and supply security aspired by demand side. For common benefits, talks between the two parties are necessary and essential.

Second, even if there are much social repulsion, nuclear power generation running on nuclear fuel is an excellent supply source in part thanks to least cost volatility. Given the safety records of over 30 years, I hope Japan's technology and experience to be transferred to Asian countries.

Third, given abundant coal production in Asia, we have to consider how to make coal use compatible with COP3 resolution, though new technologies, including CCT, still have medium- and long-term subjects. It is hoped to prepare a framework in which Japan can attain the COP3-reduction target even when coal-fired power plants are newly built. Positive efforts are called for preparing the framework for JI (joint implementation) and CDM (clean development mechanism).

Fourth, natural gas is a promising resource across Asia. Supporting measures to encourage natural gas investments need to be strengthened. As Mr. Watts stated yesterday, we are paying attention to the potentials of Sakhalin project.

Fifth, though not necessarily rich of natural resources, Asia is blessed with diligent and highly aspirated human resources. By virtue of such human assets, Asian countries should jointly tackle technology development for efficient energy use as well as new technology development, like combined cycle technology and fuel cells.

President Khatami of Iran, who visited Japan last year, called for "dialogue between civilizations," which stirred great echoes worldwide. I believe, in Asia too, it's worthy to create a forum where consumers and producers can have frank talks.

Chairman Suetsugu's generalization of the presentations and subsequent discussions are summarized below.

The four panelists all cited, in their presentations, how to stabilize volatile oil prices as a common target. Proposals made for this target can roughly be grouped into seven: (1) To strengthen the dialogues with the OPEC having pricing power, as well as super majors influential on the price through their inventory control. (2) Backed by the giant market size of 20 million B/D, Asia should have an initiative in pricing. (3) Asia needs to be networked by constructing pipelines and grids. (4) Asia needs to form a common market by virtue of networking. (5) Sharing of nuclear power technologies. (6) Regional cooperation in R&D on renewable energy and energy conservation. And (7) promotion of coal use. Is the formation of ASIAMEX or a common energy market really possible? I want to learn what views are held by the panelists.

Dr. Chang (Korea): I believe it's possible to form a common market for oil or LNG in Asia. The only pragmatic option for oil price stabilization is Asia's firm commitments to common stockpiling. As for consumer-producer dialogue, small-scale meetings at working level are necessary first.

Dr. P.K. Pachauri (India): Promotion of investments, strategic stockpile and fuel switching, all for supply diversification, are the keys to acquiring an initiative in market formation. Supports to coal resources available regionwide should be strengthened. Consumer-producer dialogue is so important that it should be held frequently. India is poorly conscious of energy conservation. I felt Indians should realize our presence in the world energy market.

Mr. Ahmad Nizam Saleh (Malaysia): Toward the formation of a common market, consumer-producer dialogue and stockpiling are important. Also, it is necessary to understand who are important players on market. I feel uneasy about speculations (on oil futures market).

Mr. Yoshihiro Sakamoto (Japan): When using the function of market mechanism, we must make a proper selection. Even if participants in a competitive market can be disadvantaged, disadvantages to end consumers should be avoided. For this reason, system design, including how to cope with market failures, is a matter of crucial importance.

So far summarized are the presentations and discussions made at SPEC 2001 held two days on February 20 – 21, 2001. SPEC 2001, supported by the Ministry of Foreign Affairs and the Ministry of Economy, Trade and Industry, was jointly sponsored by the Committee for Energy Policy Promotion, the Energy Conservation Center, Japan, the New Energy and Industrial Technology Development Organization, the Japan Electric Power Information Center, Inc., the Japan Institute of International Affairs, and the Institute of Energy Economics, Japan.