

Energy Situation in East Asia and Its Impact on the Strategic Environment

TSUNEKAWA Jun

1 Introduction

The world supply-demand situation of energy has been eased due to energy-conservation effects and alternative energy development in consumer countries after two oil crisis in 1970s. The energy consumption in Asian developing countries, however, expanded along with the rapid economic development of China, NIEs, and ASEAN. There was wide-spread concern that the increasing energy demand in East Asia would tighten the world energy situation. Energy consumption in China, with a huge population of more than 1.2 billion, expanded rapidly after it declared the reform and door-opening policies. As a result, China changed itself from an oil exporting country to a net importing country in 1993. Kent Calder warned that limitation of energy supply capacity and growing Chinese energy demand will tighten the world energy situation, possibly causing frictions or conflicts to secure energy.¹

The prices of crude oil remain low since 1986 and they have favorable effects on the economic development of East Asian emerging markets. The Asian currency crisis in 1997, however, stagnated economic activities of East Asian countries. This caused energy consumption of East Asian emerging states to decline, further easing energy supply-demand. The prices have long remained low, marking no substantial increase after Calder's warning. Slowing demand due to the Asian currency crisis further lowered prices. Crude oil prices, however, rebounded due to the reaction to a decline in such prices in 1998 and a cooperative production cut by both OPECs and non-OPECs in 1999. In the course of recovery of Asian countries hit by the crisis, it was feared that this price increase might delay the economic recovery of East Asian economics and also adversely affect the world economy. For this reason, assuring constant supply of energy became an important matter of concern again for consuming countries.

Energy security is a matter of how to secure necessary amount of energy constantly at a reasonable price for national life. Energy is conventional strategic goods and oil in particular is an important energy source accounting for more than 40% of the world primary energy² consumption. Its large reserves are lopsidedly endowed in the politically unstable Middle East. If the supply of oil is disrupted or

¹ Kent E. Calder, *PACIFIC DEFENSE Arms, Energy and America's Future in Asia*, Leighco Inc., 1996.

² Energy sources basically used as is in the form in which they exist in nature, including oil, natural gas, coal, hydraulic, nuclear, and geothermal power, and recently often hot-talked solar, wind, and other new energy. This paper deals with oil, natural gas, and coal.

the price soars abruptly due to an oil embargo or production cut practiced by Middle East countries with their political intention, the economy of consuming countries will collapse, suppressing national life. Two rounds of oil crisis that occurred in the 1970's may well be its evidence. *The Limits to Growth* made public by the Club of Rome in 1972 asserted the limit of resources, also referring to only some 30-year equivalent of oil reserves.³ The proven reserves of oil increases with improving exploration technology and rising prices. In fact, reserve/production ratio of oil stands at 41 years at the end of 1999. Judging from the amounts of reserves of oil and natural gas, the supply is less likely to be depleted in the near future. Moreover, in recent years, switching from oil to natural gas is being accelerated mainly in developed nations. Natural gas is more abundantly reserved and the R/P ratio remains for longer years than oil. The reserves of natural gas are also rather equally endowed worldwide compared to that of oil. Development of new energy is also in steady progress, indicating fewer possibilities of oil prices to rise sharply.

East Asian countries, though yet to completely free from the aftereffects of currency crisis, are expected to head for a favorable growth again in medium terms, supported by their healthy economic fundamentals. It is apparent that demand for energy will expand as the economy grows. China's energy demand, in particular, will expand greatly. Not to confined to China, it is also necessary, if inferred from the rate of growth in primary energy demand, to keep eyes on demand expansion in ASEAN and India. Temporary disruption due to a trouble along the transport route still remains likely though supply disruption with a political intention is unlikely if considering closer economic dependence with each other, advanced cooperative relations between oil producing and consuming countries, and abundant reserves. If energy demand increases, marine transport from the Middle East to the Far East also increase in volume, making it ever more important to secure the safety of transport routes. There have also surfaced a number of projects to lay natural gas pipelines from the Far East Russia and Central Asia and it will become necessary to give consideration to the safety management of these pipelines and maintenance of good cooperative relations with those countries en route of pipelines.

The issue of global environment has also emerged as a problem with energy security and it is necessary to sustain economic development not only by securing energy resources in quantity but also by using energy more efficiently and promoting development of/conversion into cleaner energy. There will be worldwide continual demand for concurrent achievement of 3 "Es" (Environment, Economic Growth, and Energy Security). Japan is a resources-scarce country and depends upon overseas supplies for most of its energy. With East Asian developing countries' demand for energy expanding, the concurrent achievement of these 3 "Es" has become an

³ Donella H. Meadows, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*, New York, Universe Books, 1972.

important task for Japan as well. Japan will be required to further cooperate, bearing East Asia or APEC as a whole in mind, in developing technology for efficient use and emergency stockpiling of energy resources.

2 World Energy Situation

(1) Reserves

It is oil that occupies the main part of the world's primary energy consumption and oil forms conventional strategic goods as well as basic materials for the modern industrialized world. The above-mentioned Club of Rome's report (*The Limits to Growth*, 1972) gave warnings that reserves of oil as basic materials for modern civilization would last only about 30 years and asserted that natural resources are limited and emphasized the necessity of conservation of resources for human existence/prosperity. The first oil crisis in 1973 was just its realization. The calculation of minable oil is based on: Proven reserves (R) remaining at that time/annual production (P). This resulted in 30 years as minable mentioned in the report. In recent years, it is a predominant thought that reserves increase with rising prices and advancing exploration technologies.⁴ Movable years of oil stood at 30 years when *The Limits to Growth* was made public while the 1999 year-end figure went up to 41 years with proven minable reserves⁵ of 1.033 trillion barrels at the end of the same year. These figures respectively mean minable years if continually mined at the present rate of production and reserves that can be profitably mined on 1999 year-end price levels. On the other hand, profitability-disregarded reserves or so-called "ultimate reserves" of oil are said to be 1.7 to 2.5 trillion barrels and, in this case, the figure of minable years exceeds 65.

It is, however, unthinkable that oil consumption will remain at the current level until even ultimate reserves are exhausted in 65 years in the future. In the meantime, it seems that supply disruption or sharp price increases will take place, expediting a changeover from oil to more abundantly-reserved/investment-effective natural gas or coal and development of new energy. For reference, reserves/minable years of natural gas and coal at the end of 1999 are 146 trillion cubic

⁴ The relation between reserves and minable years was approached, in the 1970's, using RPR (Reserve-Production Ratio) or the ratio of remaining reserves to current production while in recent years, a dynamic approach is predominant, asserting that reserves increase with rising prices and advancing mining technologies. *The Limits to Growth* is a theory of limits based on the RPR approach.

⁵ Reserves are divided into proven reserves, proven minable reserves, ultimate reserves, and extra-minable reserves, of which proven minable reserves are meant for the purpose of this paper if reserves are simply referred to. Proven reserves mean the amount verified to actually exist as resources that can technologically and economically be mined onto the ground surface while ultimate reserves are the total amount of resources supposed to exist all over the world including unsearched/unproved areas as well as able to be mined. Total reserves mean a total of proven reserves and extra-minable reserves (amount of resources that could be mined if the economy may be disregarded).

meters/61.9 years and 984.2 billion toe (tons of oil equivalent, hereinafter referred to as “toe”)/230 years respectively (Table 1).

Reserves and minable years are not absolute indices since both depend upon the current economic situation. Technological innovation and exploring-technology improvement also increase proven reserves and expectedly improve energy utilization efficiency as well. Oil resources are neither reserved unexhaustively nor quickly giving out or sharply decreasing to shrink their minable years. In addition, energy resources are diversified enough for desirable measures to be taken while oil resources are still sufficient, with emphasis on conversion into natural gas or coal, improvement in utilization efficiency, and development of new energy.

As seen from regional endowments of resources, switching from oil to natural gas is also important as a measure to diversify sources of energy supply. Oil is endowed in the Middle East by as much as 65.4% of the world reserves, proving its extremely high concentration on the Middle East. The second largest distribution in Central and South America is only 8.5%. Natural gas is still abundantly distributed in the Middle East by 33.8% but the former Soviet Union is ranked first in its reserves, accounting for 38.7% of all. Since Asia-Pacific and Africa have another share of 7.0% and 7.7% respectively, indicating regionally more dispersed reserves than oil, natural gas should also importantly be used more to diversify supply sources.

(2) Production

As seen from the world production trend, oil and natural gas are on a moderate increase since 1986 (Fig. 1). Oil production declined in 1999, reflecting declined investment in exploration due to economic slowdown in East Asian economies as well as due to the drop of crude oil prices between 1997 and 1998⁶ (Fig. 2), production cuts by oil producing countries in concert from March, 1999, etc. Oil production in 1999 amounts to 3,452 million tons, down 2.3% from about 3,500 million tons in the preceding year. A remarkable event in oil production in and after 1990 was the former Soviet Union's production cut. The former Soviet Union's annual oil production of 607 million tons in 1989 decreased to 353 million tons in 1996 as investment in development declined due to slowing economy.

Production of natural gas increased in 1999 partly because LNG prices for Europe declined in the same year against an increase in such prices for Japan (from 3.05 dollars per 1 million Btu in 1998 to 3.14 dollars the same), combinedly under the influence of a relatively small increase in prices as well as switching from oil and coal under way. Natural gas production of the year stood at 2,097 million toe, up 2.5% over the previous year's level. It is North America that boasts of the largest natural gas production to account for about 32% of total but the rate of increase from the previous year in 1999 production there remained almost the same at 0.4%. The former Soviet Union having the most abundant reserves produced 590 million tons which accounted for 28.1% of world total. Production in the Asia-Pacific region in 1999 accounted for 11% of the whole, marking 229.4 million tons. This figure was up 5.1% from the previous year, achieving the second fastest growth rate after 6.7% of Central and South America. Future demand for less CO_x/SO_x-emission and environment-friendly natural gas is expected to increase. On the other hand, future trend of coal production may decrease with growing concern over the global environment conservation.

⁶ The Dubai Spot as a price index for Asia including Japan fell below 10 dollars per barrel twice in December, 1998 and February, 1999. Its causative factors include slowing demand due to the Asian currency crisis, an increase in production quota by OPEC in December, 1997, and expanded exports from Iraq.

(3) Consumption

The world trend of primary energy consumption shows a little slower increase in the 1990's than in the 1970's and 1980's. Primary energy consumption increased 30% between 1970 and 1980 and 20% between 1980 and 1990 while the rate of increase between 1990 and 1999 declined to 10%. In the 1990's, slowing consumption in the former Soviet Union due to sluggish economy and political instability in contrast with expanding consumption in the Asia-Pacific region led to a decline in the growth rate of world primary energy consumption. The region which consumed the largest amount in 1999 was North America, accounting for 30% of the whole. This was followed by 26% in the Asia-Pacific region, 21.1% in Europe, and 10.6% in the former Soviet Union in that order. In the Asia-Pacific region, consumption declined in both

1998 and 1999 under the influence of the Asian currency crisis (Fig 3).

In terms of world energy consumption by types, consumption of oil which boasts of its top share was on a moderate increase, with its share in total energy consumption in 1999 marking 40.5% against 39.9% in 1990. Coal tends to gradually decrease in and after 1990, with growing concern over environmental issues in the backgrounds, and the share decreased from 28.6% in 1990 to 25.0% in 1999. In contrast, consumption of natural gas followed a trend of increase and its share also expanded from 22.6% to 24.2%. Nuclear power also showed a moderate increase, with the share increasing from 6.6% to 7.6% (Fig. 4). Nuclear power is an influential source of energy for countries where energy resources are scarcely distributed while in developed nations, there is a remarkable decline in consumption as well as power plants in number or the pace of their new installation. In 1998, however, the world nuclear power generation reached 2,300 billion kilowatts in total, a level that daily requires about 9.50 million barrels of oil if by oil thermal power generation.⁷ In the future, nuclear power is likely to be an important source of energy in East Asia where a large amount of energy demand is expected from economic development.

⁷ Ginji Suzuki, "The basically more competitive world energy market," 'The World Economic Review,' The World Society of Economy, April, 2000, p. 34.

3 Energy Situation in East Asia

(1) World-third largest consuming region

It is East Asia that, as a region, the most greatly affected the recent-year's world energy situation.⁸ More specifically, it was East Asian countries' rapid economic development and resulting expansion of energy demand. As already reviewed, energy consumption of East Asia has expanded since 1990 in contrast with the suppressed growth of primary energy consumption due to shrunk energy consumption in the former Soviet Union and further promoted conservation of energy as well as development of new energy in developed nations. East Asian consumption of primary energy rebounded in 1999, reversing the previous year's decline, due to economic recovery from the second half of 1998. South Korea, Taiwan, and ASEAN also turned for an increase. This resulted in the same year's East Asian consumption of 276.4 million tons in terms of oil, accounting for 14.8% of the world primary energy consumption as the world-third largest consuming region after North America (with a share of 30.0%) and Europe (21.1%). The share was, if compared with 1990's, up 2.4 points from 12.4% that year. The share of East Asia including Japan is 20.8%. East Asia's share in the world primary energy consumption in 1990 was 12.4%, ranked fourth after North America, Europe, and the former Soviet Union. Between 1990 and 1999, however, a sizable decrease of 35.0% in consumption by the former Soviet Union, combinedly with expansion of East Asian consumption by as much as 31.8% during that period, raised the share of East Asia (Fig. 5).

⁸ For the purpose of this paper, East Asia means East Asian countries excluding Japan, that is, South Korea, Taiwan, China, and ASEAN countries.

This rapid expansion of consumption in East Asia gave rise to concern over possibilities of great influence on the world energy supply-demand situation. In terms of the contributing ratio to expansion of primary energy consumption by region and country between 1990 and 1999, however, it is North America that contributed the most greatly to such expansion and its contributing ratio reached 48.0%. The United States in particular contributed 40.4%, posting the world-highest single-country rate of contribution. The second-highest rate of contribution after North America's is 44.8% achieved by East Asia and, above all, China's contributing ratio was 12.5% only second to the United States'. If East Asia successfully get rid of its economic crisis to achieve economic recovery in earnest, its contributing ratio will continue to increase. On the other hand, if the by-country rate of contribution to expansion of East Asian consumption is reviewed, South Korea is found to have made the greatest contribution at the highest rate of 29.9%, though it consumed 182 million toe in 1999, accounting for only 2.1% of the world consumption. This was followed by 27.9% of China. China, with a share of 8.8% for its 753 million-toe consumption, is the world-third largest consuming country. Other than the above, Taiwan (10.6% contribution), Thailand (10.0%), and Indonesia (9.0%) are among those countries whose contributing ratio was high.

(2) Characteristics of consumption

East Asian primary energy consumption is characterized by the overwhelmingly large share of coal in primary energy consumption. The East Asian ratio of coal to primary energy consumption has decreased since 1990 from 61.2% that year but still remained high at 47.6% in 1999. By countries, China consumes much coal as the world-largest coal consumer, guzzling 24% of total world coal consumption. But coal consumption by China itself decreased from 533.6 million toe

in 1990 to 511 million toe. Meanwhile, despite a decrease in absolute coal consumption by East Asia between 1990 and 1999, the East Asian share in the world coal consumption grew from 26.1% in 1990 to 28.1% in 1999 due to a faster decrease in world coal consumption (Table 3). In East Asia thus dependent upon coal for considerable part of primary energy, there is a critical voice alleging that a large amount of CO₂ emission causes adverse effects including deterioration of the world environment and global warming.⁹

In the meantime, consumption of oil and natural gas has expanded. The share of oil and natural gas in primary energy consumption increased from 29.9% to 39.3% and from 5.0% to 8.2% respectively between 1990 and 1999. Natural gas marked a particularly large increase, a little more than trebling its consumption from 47.6 million toe to 135 million toe in the same period. Oil consumption was roughly doubled.

In 1999, 51% of Japanese primary energy consumption was oil, 13.2%, natural gas, and 18.0%, coal.

(3) Relatively energy resources-scarce region

The East Asian region, though ranked third in the world in terms of

⁹ According to the International Energy Agency (IEA), East Asian CO₂ emissions in 1997 amounted to 4,617 million tons, accounting for 20% of world total. (IEA, *World Energy Outlook 2000*)

consumption and world-second in the contributing ratio to consumption growth rates, reserves and production of oil, natural gas, and coal in a relatively small amount, justifying the reference of East Asia to as a relatively energy resources-scarce region. With the amount available within a country or region limited, East Asia is forced to depend upon imports from outside the region for considerable part of necessary energy.

In terms of East Asian oil reserves, East Asia has 35.2 billion barrels of oil reserves which makes up 3.4% share of 1,033.8 billion barrels as world total reserves in 1999. This means that East Asian reserves are, though larger than 2.0% of Europe, smaller for its consumption. Even reserves in China boasting of the East Asian-largest reserves are 24.0 billion barrels, accounting for only 2.3% of world total. Moreover, China, where domestic consumption of oil expanded due to its economic development, changed its status into a net importing country in 1993. A new production increase is also deemed difficult even at existing oil fields, inviting expectations on new oil field exploitation in western China. The second-largest reserves are 5.0 billion barrels of Indonesia, accounting for only 0.5% of world total. In Indonesia, it is also said that no production increase can be expected from existing oil fields. Reserves of Malaysia and Brunei also have the smaller world share of 0.4% and 0.1% respectively.

East Asian reserves of natural gas, though more abundant than oil, stand at 6,660 billion cubic meters, accounting for only 4.5% of world total. Malaysian and Indonesian reserves are large in East Asia. Coal is abundantly reserved in East Asia where 12.2% of the world reserves are distributed. The demand of coal will, however, be further shifted to natural gas or oil due to its slowing demand.

In East Asia, only natural gas has been produced faster than consumption. In 1999, 145.9 million toe of natural gas is produced while consuming 103.5 million toe and this is partly affected by presently less consumption in East Asian countries excluding Japan. But if Japan's natural gas consumption is added, the amount of consumption in East Asia becomes 170.6 million toe, exceeding production. In East Asia (excluding Japan), coal was overproduced in 1990. In 1999, however, the consumption exceeded the production due to a consumption increase in South Korea and Taiwan, while the consumption decreased in China. Oil is consumed in a much larger amount than produced, with the difference quickly widening from 32.9 million toe in 1990 to 201.9 million toe. Besides, Japan's 258.8 million-toe consumption (1999) is not included in this figure and if such consumption is added, the difference from production expands to 460.0 million toe. The gap must be covered by imports from outside the region, thus encouraging East Asia to be externally more and more dependent on imports.

External dependence of East Asia including Japan for oil reached 60.8% in 1995, with an increase (difference) in imports from outside the region between 1989 and 1998 amounting to 270.0 million tons. Imports of 239.0 million tons from the

Middle East (corresponding with a share of 88.5% in total increase) indicates extremely high dependence on the Middle East. Other than the above, imports from Africa increased by 28.0 million tons.¹⁰

4 East Asian Energy Outlook

(1) Growing consumption

According to IEA's *World Energy Outlook 2000*, the world primary energy consumption is projected to increase by 56.8% from 8,700 million toe in 1997 to 13,771.00 million toe in 2020.¹¹ During this period, it increases by 2.0% per annum. By regions, East Asia including China¹² is projected to increase to as large as 2.2 times throughout the same period from 1,460 million toe to 3,220 million toe. Its percentage share in total world consumption rises to 23.4% in 2020 from 16.7% in 1997,

¹⁰ Data from the General Conference of Comprehensive Energy Research Council of Ministry of International Trade and Industry, April, 2000.

¹¹ IEA, *World Energy Outlook 2000*, p.354.

¹² For the purpose of IEA, East Asia means East Asian developing countries excluding Japan and China. Japan is included in OECD.

which makes the region the world-largest consuming region. The annual average growth rate of the consumption projected during this forecast period is 3.4% by China and 3.7% by East Asia excluding China. A high growth potentials,¹³ consequent industrial development, and motorization in East Asia are contributing factors. On the other hand, the North America's share tends to shrink, from 27.5% in 1997 to estimated 21.6% in 2020 and West Europe's is also reduced from 19.6% to 15.6%. This is mainly due to much higher efficiency in energy utilization realized by technological progress and energy-saving efforts.

What should be noted, along with the East Asian growth, is an increase in consumption of India. Its primary energy consumption is likely to grow by 4.4% per annum between 1997 and 2020. This marks the expansion of 2.6 times compared to the level of 1997 to 720 million toe in 2020. Its share in world consumption increases from 3.1% to 5.2% which is comparable to Russia's. India's economic development and population increase are cited as main factors.¹⁴

Classifying energy by types, the share of coal in primary energy consumption is projected to decline from 26% to 24% between 1997 and 2020 while that of oil will remain almost unchanged at 40%. On the other hand, the share of natural gas increases from 22% in 1997 to 26% in 2020. Nuclear power declines from 7% to 5% and the new energy's share increases, though slightly, from 2% to 3%. In China, the share of coal declines from 73% to 62% during the same period while oil and natural gas increases from 22% to 28% and from 2% to 6% respectively. Nuclear power is also predicted to become 3% in 2020 compared with 2% in 2010. Other countries in East Asia are expected to follow a similar trend of decline in coal consumption and increase in oil as well as natural gas. India is featured by its share of oil remaining unchanged while observing an increase in the share of natural gas from 7% to 16%. This is due to the fact that India has larger surplus in reserves of natural gas than oil.¹⁵ It is, however, not enough for India's growing domestic demand to be met and India may also, like China, possibly be a major oil/natural gas importing country in the future.

The U.S. Department of Energy also released its outlook for primary energy consumption between 1996 and 2020 (US Department of Energy, *International Energy Outlook 2000*). It also predicts that energy consumption increases by 2.1% on an average each year for expansion of 1.6 times.¹⁶ By regions, the outlook projects

¹³ According to the IEA outlook, the annual average growth rate of China between 1997 and 2020 is 5.2%, down from 8.3% between 1971 and 1997. For China-excluded East Asia, it is estimated at 4.2%.

¹⁴ The rate of population increase between 1997 and 2020 is estimated at 0.7% for China, 1.1% for East Asia excluding China, and 1.2% for India on an average each year. Meanwhile, India's economic growth rate is expected to be 4.9% on an average.

¹⁵ In India, oil reserves stand at 4.80 million barrels at the end of 1999 with 17.8 minable years while natural gas is reserved by 650.0 billion cubic meters minable for 26 years.

¹⁶ DOE issued its energy outlook based on three scenarios of the highest, lowest, and intermediate world economic growth rates but here an intermediate rate-based outlook was employed.

developing countries in Asia (including South Asia) to become the largest energy consuming market. China is the world-second largest energy consuming country after the United States while India is expected to become the world-third largest energy consumer with its consumption exceeding that of Japan.¹⁷

Both IEA and the U.S. Department of Energy, predicting primary energy consumption to expand until 2020, concluded that since not only oil but also natural gas is sufficiently reserved for adequate supply, there can hardly occur a supply shortage or even supply disruption. According to IEA, oil prices remain constant at about 21 dollars per barrel until 2010 and, after that, increase to 28 dollars per barrel by 2020. It can be said that stable supply is expected for the time being.

¹⁷ Japanese energy consumption in 2020 will be 26,700 trillion Btu (the British unit of heat with about 250 calories as 1Btu) and India's is estimated at 28,200 trillion Btu.

(2) Growing external dependence

With increasing demand for energy, East Asian external dependence (ratio of net imports to consumption) for energy also grows. According to IEA outlook (Table 7), China's external dependence for oil greatly expands from 22.3% in 1997 to 76.9% in 2020 and similar expansion from 53.7% to 80.7% is also projected for other East Asian countries. In respect of natural gas, Asia which was a net exporter area in 1997 as a whole is likely to turn into an importing and 10% externally dependent area in 2020. Indian external dependence is also supposed to soar from 57.4% in 1997 to estimated 91.6% in 2020. The largest prospective source of imports is the Middle East but, more than this, imports from Africa as well as Central and South America are also deemed to increase.

On the other hand, the APEC Asia-Pacific Energy Research Center announced its supply-demand outlook down to 2010. According to this, Chinese external dependence for oil in 2010 reaches 42.8% after expanding from 5.2% in 1995 while external oil dependence of East Asia as a whole including China, Japan, South Korea, Hong Kong, Taiwan, and ASEAN 6 expands from 60.8% in 1995 to 67.9% in 2010.¹⁸ As for an increase in oil production in the whole of East Asia, production is also estimated to increase 2.7 times to 310.0 million tons between 1995 and 2010 but a supply-demand gap largely expands and external dependence soars (Tables 8 and 9).

¹⁸ The IEA outlook considerably differs from APERC's and according to the IEA outlook, China's external dependence could reach 61.0% in 2010.

5 Implication on Strategic Environment

One outlook for East Asian energy demand differs from another. It is apparent, however, that East Asian energy demand will grow substantially by 2010 and then by 2020 such as due to assumed quite likely future development, higher electrification, and further motorization in East Asian developing countries. External dependence for oil occupying the main part of energy will increase, assuring more oil exports from the Middle East.¹⁹ Particularly, a sizable increase in China's demand as well as in imports from the Gulf/Middle East countries is expected to greatly affect the world energy market. Despite its presently still small oil

¹⁹ According to the APEC outlook, Asian developing countries' imports are expected to be roughly trebled from 5.3 million barrels/day in 1995 to 15.2 million barrels/day in 2010.

consumption of 90 million tons, India may also possibly have great influence on the oil market if considering its future trend of increase is taken into consideration.

Japan is the fourth largest primary energy consumer in the world as of 1999, externally depending for about 80% of primary energy supply. Moreover, 51% of such dependence is accounted for by oil. Oil depends nearly 100% on imports, of which 86.2%, up from 78.1% in 1973, came from the Middle East (as of 1998). With Asian developing countries' demand for oil likely to grow and dependence upon imports from the Middle East also expected to increase in the future, what should be done to secure constant supply of oil and other energy will become a big issue for Japan.

(1) Energy security

In Japan, energy security has been considered much of as part of economic security or comprehensive security. Economic security means the "protection of national fundamental economic values (people's life and welfare/maintenance and development of normal economic activities) from external threat and, if exposed to such threat, prevention/control of its danger as well as confusion using every possible means." And energy security may well be said to "specify and eliminate such or external threats such as due to disruption of, substantial quantity reduction in, or other difficulties over assured availability/supply of energy, and then price hikes, thereby maintaining/developing people's life and welfare as well as normal economic activities".²⁰ At present, however, it is regarded as necessary to pursue not only a single country's but also the whole world's security since there is a growing perception that resources must be preserved for the future, bearing the global environment consideration and limitedness of resources in mind, not simply confined to assured availability of energy in quantities to earn national values. In other words, there is emerging an opinion that assured availability of energy for 'Globally Sustainable Development' is energy security in the true sense.

Energy security may also be roughly divided into conventional energy security and unconventional one. Among threats of conventional security are supply disruption and a sudden sharp rise in price while unconventional threats include environmental preservation-related problems of NO_x, SO_x, CO_x, and other emissions as well as acid rain and other living environment-related threats.

(2) Conventional threat

Factors for conventional threat include exhaustion of resources themselves,

²⁰ Hiroaki Fukami, "Studies of energy security redevelopment and foundations for policy deployment – Why is it a problem now?" *International Affairs* No. 476, the Japanese Institute for International Affairs, November, 1999, p.9.

political instability in supply countries, outbreak of a local war, embargo due to worsening diplomatic/economic relations between a supply and a consumer country, contingency, and a conflict or accident along the transport route. As far as exhaustion of resources themselves is concerned, as reviewed earlier, proven reserves are on a year-to-year increase and even oil has its over-40 minable years. In terms of ultimate reserves, minable years of oil become longer. Reserves also increase with increasing prices as well as with advancing mining/exploration technologies. Moreover, minable years of natural gas expected to be in growing demand in the future, though reserves are yet to be fully explored, is longer than oil's. New energy such as solar and wind will also hopefully be further developed, maybe contributing to less concern over supply due to exhaustion for the time being. What is more feasible will be limited-period/scale supply disruption or reduction due to a local war or conflict or other contingency.

In East Asia including Japan, the greatest concern is over its large dependence upon the Middle East where large oil reserves are lopsidedly distributed. There is vague concern over the possibility of a scramble for energy setting in when dependence upon the Middle East will further increase with growing economy in China and other East Asian developing countries and later in India in the future, allowing constant supply to Japan largely dependent on oil producing Gulf countries to be threatened by participation of China and other East Asian countries. For reference, APEC outlook predicts that Chinese imports will increase to 137.9 million tons to account for 50% or more of total Asian increments by 2010.²¹ Reserves, however, exist in a sufficient amount worldwide and oil producing Middle East countries can also afford to produce considerably more, fully absorbing a sharp increase in Asian demand. According to the IEA outlook, China and developing countries in Asia including South Asia will daily consume 30.8 million barrels in 2020 while oil producing Middle East countries are estimated to produce 61.8 million barrels in the same year, less likely inviting the situation where oil could be supplied short from the Middle East under normal conditions.

<Transport route>

What is important may be not the amount supplied but the problem of transport routes. Increasing East Asian dependence upon the Middle East means expanded imports from the Middle East, making it important to secure the safety of sea-lanes. Confusions in Indonesia located along an important route adversely affect energy supply to not only Japan but also East Asia as a whole. Particularly, oil transport through the Malacca Strait is about three times larger in volume than the Suez Canal. Approximately 80% of oil supply to Japan, South Korea, and Taiwan

²¹ According to the U.S. Department of Energy's *International Energy Outlook 2000*, China's oil consumption in 2010 amounts to 6.40 million barrels, exceeding Japanese 6 million barrels of the same year.

passes through this route. And oil carried via Malacca in 2000 amounts to 12.0 million barrels/day, which is expected to increase to 20.0 million barrels/day in 2020.²² The Malacca Strait is narrow and only 2.4 kilometers in width at its narrowest part. On top of it, since vessel traffic will become heavier, there are also possible temporary disruption due to an accident in the Malacca Strait.

There is another concern over heated disputes between China and ASEAN countries over possession of the Spratly Islands and the Paracel Islands to secure energy resources. It is also feared that China may attempt to increase its naval force to secure marine resources, thereby bringing a security dilemma to this region. The South China Sea rich in marine resources is also assumed to abound in energy resources endowed and it is alleged that, for this reason, China strongly claims its territorial rights to this region. How abundantly energy resources are distributed in the South China Sea has not yet been clearly identified. The estimated reserves made public on the side of China considerably differ from those by U.S. According to the publication on the side of China, oil reserves around the Spratly and the Paracel Islands are estimated at 105.0 billion barrels and those all over the South China Sea, at 213 billion barrels, of which profitable reserves all over the South China Sea are as small as about 10%, with 1.40 million to 1.90 million barrels supposed to be minable a day. 15 to 20 years will remain minable.²³ On the other hand, reserves published on the side of U.S. are estimated 10.0 billion barrels, with 137 to 183 thousand barrels deemed as minable a day even at peak times.²⁴ This is the level a little lower than that of proven reserves in Brunei and somewhat higher than that in Vietnam. Since off-shore oil field development requires technological capabilities and huge capital, development by China alone is more or less difficult and then it is questionable at present whether or not worthwhile reserves are available. Development is also not easy in view of environmental protection. It is, therefore, less necessary for China to increase naval force for the purpose of securing energy resources in the South China Sea.

East Asian developing countries have no or an extremely poor oil stockpiling system. Aside from Japan, a national stockpiling system is established by South Korea (some 60 days) and Indonesia (34 days) and a private stockpiling system is also available in South Korea (30 days), the Philippines (40 days), and Taiwan (60 days).²⁵ China has no such system but recently started to show a sign to have it. In coping with temporary supply disruption, it is necessary to establish a stockpiling system. Japan is probably required to design an East Asian-wide stockpiling system, taking

²² US Energy Information Administration, *South China Sea Region*, February 2001. (<http://www.eida.doe.gov/emeu/cabs/schina.html>)

²³ *Ibid.*

²⁴ *Ibid.*

²⁵ Ministry of International Trade and Industry, *Reviving Asia/Challenge to the 21st Century First for the Sector of Energy*, 1999, pp. 4-5.

into account future development of East Asian developing countries. East Asia will also be able to strengthen its regional power, through cooperation for East Asian stockpiling system establishment, for negotiations with the Middle East.

Natural gas hopeful as oil-alternative energy whose demand is likely to grow fastest is carried by sea in the form of liquefied natural gas (LNG) to East Asia, particularly, to South Korea, Japan, and Taiwan. So the safety of marine transport routes is more important. In recent years, there are a number of emerging projects for pipeline carriage from Russia and Central Asia.

The Trans-Asia Natural Gas Pipeline Network Project is a magnificent project to connect natural gas fields in the Far East Siberia, Sakhalin, China, Malaysia, Indonesia, Australia, Alaska, etc. as starting points with each of consumer places such as in Japan, China, Taiwan, Thailand, and the Philippines. Japan has a plan for carriage by overland pipeline from northern Sakhalin of the Far East to southern Sakhalin, then from southern Sakhalin by undersea pipeline through Hokkaido to Niigata. The pipeline will be as long as about 2,000 kilometers. In connection with China, there is a disclosed project to start the carriage from several gas fields including those in Sakhalin, Yakutsk, Irkutsk, and even Turkmenistan. Developmental situations over the Tarim Basin are to be noted.²⁶ A move is also witnessed among China, South Korea, and Russia toward cooperation to exploit a natural gas field in Irkutsk (Kovikchinskoye Gas Field with estimated reserves of 1,400 billion cubic meters) and pipeline construction, into which British Petroleum (BP) expresses its willingness to participate.²⁷ Most of these international pipeline projects, however, still remain under conceptual planning. The only international pipelines in operation in East Asia at present are Malaysia-Singapore and Thailand-Myanmar pipelines.²⁸ These natural gas supply projects are expected to be in further progress due to necessary decentralization of sources for energy resources procurement and environmental consideration. A problem is, however, the economy of natural gas development in terms of comparison with costs for oil imports.

International pipeline projects require huge capital, necessitating in due course many countries and private companies' participation and long-term involvement. On the other hand, natural gas is also major strategic goods, whose development are often pursued under the political leadership, inviting possible conflicts among state/corporate participants over interests. In addition, participation is often prevented for control in reality. Pipelines are laid over several countries and their territorial waters, therefore most likely causing conflicts over interests or disputes with countries en route and supply disruption such as due to

²⁶ *Nihon Keizai Shimbun*, September 21, 2000.

²⁷ *Nihon Keizai Shimbun*, November 3, 2000.

²⁸ Yasuhiro Koide, "Natural Gas Conditions and LNG Supply-Demand Trend in Asia-Pacific," *Energy Economy*, Vol. 26, No. 5, Summer, 2000, p. 96.

terrorism.

<Nuclear power>

In terms of nuclear power generation capacity, Western countries account for about two thirds of world total power output but nuclear power generation will probably tend to shrink in the future since it is now doubtful due to actual nuclear accidents whether or not management safety can be assured for nuclear reactors. On the other hand, in East Asia which now accounts for some 20% of the world power output, a trend of expansion partly for use as oil-alternative energy is assumed to be followed until the above ratio expectedly reaches 38% in 2020.

Security concern of nuclear power generation is over terrorism and nuclear proliferation. East Asian countries all signed the Non-Proliferation Treaty (NPT) and the issue of proliferation has tentatively been secured but since nuclear tests were carried out in May, 1998 by India and Pakistan, non-nuclear proliferation is becoming a more and more grave matter for Asia. India and Pakistan import nuclear reactors from Russia and China respectively. Their peaceful use and safety assurance have been serious concern of Asia as a whole. North Korea's nuclear development is also a problem which makes East Asia, particularly, Japan anxious. KEDO's light-water reactor project is expected to relieve Japanese concern and play an important role in stabilizing the Korean Peninsula. Asia has "ASIATOM" as its atomic energy-related cooperative organization. This is a regional organization for cooperation modelled after EURATOM of Europe. Its conceptual purpose is to cope with matters relating to non-nuclear proliferation, control/store spent fuel, and improve its safety. Nothing concrete has, however, so far been practiced.

(2) Unconventional threat

Unconventional security concern may be summarized into concern over the environment. East Asia quite characteristically depends much upon coal accounting for as large as about 40 percent of primary energy consumption and, above all, China is the world-largest coal consumer. Coal is assumed to be less consumed in OECD in the future due to its high rate of CO₂ emissions as a factor for environmental destruction and global warming while in China and India, coal consumption is likely to increase under their economic development-first policy and come to combinedly account for two thirds of world consumption in 2020.²⁹ In the environmental issue of East Asia as well, the China's trend serves as a substantial factor. Chinese CO₂ emissions account for about 14% of world total in 1997 as the largest emissions country only second to North America. A 1997-2020 outlook estimates an increase in world emissions of average 2.1% per year, indicating the faster-than-the-world

²⁹ IEA, *World Energy Outlook 2000*, p.23.

growth in China's emissions at the rate of average 3.1% per year.³⁰ CO₂ emissions in China cause not only global warming but also acid rain damages to Japan and South Korea. China itself is hit upon by serious environmental pollution due to increasing CO_x, NO_x, and SO_x emissions and the government takes measures such as for switching to oil or natural gas, desulfurization of coal, and improvement in combustion efficiency but no desired progress has come in sight, hampered partly by superannuated equipment.

In nuclear power generation, the issue of safety assurance is invariably important while problems with disposal of wastes and spent fuel will become more serious, heavily loading the global environment. Not only in Japan, but also in South Korea and Taiwan, such problems are already quite serious and a South Korean project to construct low/medium-level wastes disposal sites on Anmyeon Island and Kurop Island was abandoned in 1990 for the former due to residents' opposition and in 1995 for the latter because an active fault was found nearby. In Taiwan, an agreement was reached in 1997 to carry low-level wastes to North Korea for disposal but cancelled when opposed by South Korea.³¹

Economic development is in a trade-off with environmental protection as well as with energy security. Wide-spread disputes over trade-off problems are very likely between advanced nations crying for environmental protection and developing countries attempting their economic development.

6 Influence on Japan and response

The safest energy security lies in a high degree of self-sufficiency. In other words, it can be said that energy security depends upon whether energy resources may be procured within the region or must be imported.³² But resources-scarce Japan is forced to depend upon overseas for energy resources, mainly oil. Nuclear power generation as semi-domestically produced energy has also been able to only insufficiently contribute to better self-sufficiency in primary energy due to safety, wastes disposal, and other big problems. It is, therefore, an important task to secure constant energy supply from overseas at reasonable prices.

For oil as the most important primary energy, Japan depends nearly 100% upon imports and, what is more, about 90% upon Middle East. Toward the future, China, India, and even ASEAN countries where oil demand is likely to grow will expand imports from the Middle East to meet such a growth in demand for energy, possibly bringing a fear of possible scrambles with these countries for Middle East crude oil. As already reviewed, however, since supply of Middle East crude oil itself

³⁰ *Ibid.*, p.389.

³¹ *Nihon Keizai Shinbun*, September 22, 2000.

³² Paul B. Stares, "Introduction and Overview", *Rethinking Energy Security in East Asia*, (Paul S. Stares Edit.) Japan Center for International Exchange, 2000, pp.19-41.

will remain so ample in volume as not to be threatened by exhaustion, such scrambles are less likely to take place. A problem is rather the possibility of exports to Japan being reduced in volume if Japanese diplomatic and economic policies toward the Middle East failed, worsening its relation with Middle East countries, while Chinese and other active diplomacy with the Middle East takes effect, or of supply being temporarily disrupted due to political instability in Middle East countries. Nevertheless, Middle East countries' state finance largely depends upon earnings from oil exports and, therefore, it seems that a sharp reduction in supply or long-term embargo can hardly be resulted. And Japan's heavy dependence on the Middle East does not always mean that Japan is less capable to negotiate. Middle East countries are also dependent upon crude exports for large part of their national finance and, the more is exported to Japan from supply countries, the more difficult will it be for them to cut supplies to Japan. But since excessive dependence on specific region leads Japan to be more vulnerable, it is important to enhance development import scheme, seek alternative sources of supply such as in Central/South America and West Africa, and promote switching to natural gas. It is also required to develop new energy and enhance careful utilization of atomic energy in parallel.

Japanese energy imports including natural gas depend upon marine transport. Temporary disruption of supply is also conceivable such as due to a disaster, accident, piracy, and terrorism during marine transportation. Particularly, the Malacca Strait is narrow and has heavy vessel traffic, forming a choke point in northeast Asia. Possible choices in an attempt to maintain favorable relations with surrounding countries may also include efforts to stabilize such countries by developing a friendly diplomatic relationship through cooperation for their advancement, cooperate with them for a disaster and warning technologies, or give cooperative assistance to them in case of actual disaster. If natural gas pipeline projects should be realized, it will be necessary to exclude any accident, terrorism, and so on from pipeline routes. Pipelines involve many state governments and private companies and pass through multiple countries/territorial waters, making international relations more complex to invite more disputes over interests. It will be necessary to give further consideration to diplomatic/economic relations with countries concerned as well as to keep up closer cooperative relations such as with police and military force of the partner country.

For the issue of environment, it will be required to cooperate not only for worldwide regulations over emissions but also for China's improvement of energy efficiency in order to reduce its environmental pollution through technological cooperation measures including improvement of infrastructure and efficient utilization/desulfurization technology transfer to promote new energy exploitation. By doing so, damages such as due to acid rain may be reduced.

Energy security is no longer the issue of a single country. It is an issue required to be dealt with on a regional or global cooperation. There are, however,

disputes between developing countries and developed nations over whether development or environment. Within East Asia as well, there are both developing countries and developed nations and, in addition, China is emerging as a major energy consumer. Under the East Asian diversified and complex situation, Japan may also have to keep developing and leading a multi-lateral framework as well as promoting cooperative relationships within the region in an effort to secure constant supply of energy.

Table 1 Regional Distribution of Oil/Natural Gas/Coal Reserves

Oil

Natural Gas

Coal

1999 reserves

1,033.8 billion barrels

146.5 trillion cubic meters

984.2 billion toe

Production

3.45 billion tons

2.33 trillion cubic meters

2.1 billion toe

Regional distribution (%)

North America

Central and South America

West Europe

Middle East

Asia-Pacific

Africa

Former Soviet Union/East Europe

Mineable years

Source) BP Amoco, *Statistical Review of World Energy, June 2000* (hereinafter simply foot-noted as "BP Amoco")

Fig. 1 Trend of Oil/Natural Gas/Coal Production

Oil

Natural gas

Coal

Year

(Source) BP Amoco

Fig. 2 Trend of Spot Crude Oil Prices

US\$/barrel

Year

(Source) BP Amoco

(Note: Dubai Spot is the index price of crude oil for Asia including Japan while Brent, that for Europe)

Fig. 3 World Primary Energy Consumption

Asia-Pacific

Africa

Middle East

Former Soviet Union

Europe

Central and South America

North America

Year

(Source) BP Amoco

Fig. 4 World Trend of Energy Consumption

Oil

Natural gas

Coal

Nuclear power

Year

(Source) BP Amoco

Fig. 5 East Asian Energy Consumption

ASEAN 6

Taiwan
South Korea
Japan
India
China

Year

(Source) BP Amoco

Table 3 East Asian Primary Energy Consumption

(Unit: million toe)

1990
Share (%)
1999
Share (%)

World total
Japan
East Asia
China
South Korea
Hong Kong
Taiwan
Singapore
Indonesia
Malaysia
The Philippines
Thailand
India

(Source) BP Amoco

Table 4 East Asian Production and Consumption of Oil/Natural Gas/Coal (1999)

(Unit: million toe)

Oil
Natural gas
Coal

Production
Consumption
Production
Consumption
Production
Consumption

World
Japan
East Asia
China
South Korea
Taiwan
Hong Kong
Singapore
Brunei
Indonesia
Malaysia
The Philippines
Thailand
Vietnam
India

(Source) BP Amoco

Table 5 World Energy Consumption Trend and Outlook (by Region)

(Unit: million toe)

Consumption
Share (%)
Annual average rate (%)

World total
West Europe
North America

Russia
Japan/Australia/NZ
China
Other East Asia
India

(Source) IEA, *World Energy Outlook 2000*

Table 6 World Energy Consumption Trend and Outlook (by Types)

(Unit: million toe)

Consumption
Share (%)
Annual average rate (%)

World total
Coal
Oil
Natural gas
Nuclear power
Hydraulic power
Other

(Source) IEA, *World Energy Outlook 2000*

Table 7 Outlook for East Asia's External Oil Dependence (%)

China
East Asia excluding China
India
South Asia excluding India
OECD

(Source) IEA, *World Energy Outlook 2000*

Table 8 East Asian Oil Supply-Demand Outlook

(Unit: million tons)

Consumption

Production

Imports

External dependence (%)

(Note) East Asia consists of Japan, China, South Korea, Hong Kong, Taiwan, Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

(Source) APEC Asia Pacific Energy Research Center, *Energy Demand and Supply Outlook, 1998*

Table 9 East Asian Oil Supply-Demand Outlook (by Region)

(Unit: million tons)

China

Other areas of East Asia

ASEAN 6

Consumption

Production

Imports

External dependence (%)

(Notes) Other areas of East Asia include Japan, South Korea, Hong Kong, and Taiwan while ASEAN 6 is composed of Brunei, Indonesia, the Philippines, Malaysia, Singapore, and Thailand.

APEC's outlook has three scenarios; [1] Breakaway from economic crisis in 2000, [2] Prolonged economic crisis, and [3] Accelerated improvement in efficiency/switching to new energy due to technological progress but [1] was employed by this paper as its outlook scenario.

(Source) APEC Asia Pacific Energy Research Center, *Energy Demand and Supply Outlook, 1998*