Economic and Energy Outlook &*
Key Issues For Northeast Asia

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1. Regional Economics of Northeast Asia

The end of the Cold War has resulted in further economic globalization promoted by trends such as the transition to market economies and the spread of information technology (IT). Many developing countries in Asia have achieved an overall high rate of economic growth thanks to the fast-paced expansion of trade and foreign direct investment (FDI), close mutual economic ties and industrialization. In the process, they have made the region into the growth center for the entire world economy. Due to its economic advances, energy demand in Asia continues to expand much faster than in other parts of the world, having increased energy imports in recent years from outside the region, particularly from the Middle East.

While economic globalization has advanced, we have seen the expansion and formation of both new and existing regional economic blocks such as European Union (EU), North American Free Trade Agreement (NAFTA), Association of Southeast Asian Nations plus Japan, the Republic of Korea (ROK) and China (ASEAN + three) and the Asia Pacific Economic Council (APEC). In Northeast Asia, however, no such institutional framework has begun to take hold. Northeast Asia is normally defined as a natural economic region which includes Japan, Northeast China, ROK, the Democratic People's Republic of Korea (DPRK), Eastern Russia and Mongolia. Although the political events in the 20th century still overshadow the present in Northeast Asia, political and economic ties between the six different countries are moving in a positive direction, albeit rather belated.

If we look at Northeast Asia as an economic region, the most remarkable feature is its great diversity in terms of economic development stages, indigenous energy resources and energy requirements. For example, as shown in Table 1, GDP per capita is $32,610 for Japan, $8,930 for ROK, $2.140 for Russia, $910for China, and $440 for Mongolia in 2001. While Japan and ROK are very rich in capital and advanced technologies, China and DPRK have an abundant, high quality, low-cost labor force. In the energy sector, Japan and ROK have scarce domestic energy resources, and most of their energy needs are supplied via imports.

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	Population (millions)	GDP ($ billions)	GDP Per Capita ($)	Annual Growth 1990-2001 (%)
China	1271.8	1159.0	910	10.0
DPRK	22.4	n.a.	n.a.	n.a.
Japan	127.0	4141.4	32610	1.3
Mongolia	2.4	1.1	440	1.2
ROK	47.3	422.2	8930	5.7
Russia	144.8	310.0	2140	-3.7

Table 1. Key Economic Indicators of Northeast Asia (2001)

Source: The World Bank, "03 World Bank Atlas" 2003

China is also increasing oil imports in recent years as its oil consumption continues to out-pace domestic production. The DPRK is facing serious energy shortages due to economic and political difficulties. Japan and ROK are promoting energy policies to reduce dependency on Middle East oil by diversifying energy sources. In contrast, Eastern Russia including Sakhalin is very rich in undeveloped oil, natural gas and hydroelectric power energy resources.

On the whole, Northeast Asia has not only tremendous amounts of investment capital and advanced technologies, but also abundant energy resources and low-cost labor forces. Exploiting these advantages by deepening intra-regional economic relationships will help us to build a prosperous and peaceful Northeast Asia in the 21st century.

2. Economic Outlook for Northeast Asia

Economic Partnership Agreements (EPA) and other strong ties of interdependence among the economies in Asia are expected to develop further and keep the rates of economic growth at high levels in next several decades. According to projections from "Asia/World Energy Outlook, 2004" created by the Institute of Energy Economics, Japan (IEEJ), the world economy is expected to show moderate growth at an average rate of 2.7% from 2000-2020 driven by the Asian economy (Table 2). If we look at major energy importing countries in Northeast Asia, China, ROK and Japan are expected to show very different economic development as follows.

	1980–2000		2000–2020	
	Population	GDP	Population	GDP
World	1.6	2.7	1.1	2.7
N.E. Asia				
China	1.3	9.7	0.6	7.2
Japan	0.4	2.8	-0.1	1.3
Korea	1.1	7.4	0.4	4.3

Table 2. Projection of Annual Average Growth Rates of Population and GDP (%)

Source: The Institute of Energy Economics, Japan (IEEJ), "Asia/World Energy Outlook, 2004" March, 2004

The Chinese economy sustained high rates of growth throughout the 1990s with the support of its domestic demand, and stayed in the 7-9% range in recent years. It managed to record growth of 7.3% in 2001 in spite of the decelerating U.S. economy and slumping performance among Asia's newly industrializing economies (NIEs) and ASEAN countries. Furthermore, following its admission into the World Trade Organization (WTO) in 2002, China posted high rates of economic growth, at 8.0% in 2002 and 9.1% in 2003. Although it is saddled with an array of problems such as internal economic disparities, the need for state enterprise reform, unemployment, and bad debt, China should be able to achieve high growth at rates averaging 7.2% over the long term, provided that it continues to practice proper macroeconomic management.

The Japanese economy has stagnated for more than a decade mainly due to enormous bad loans in the banking sector after the burst of the "economic bubble" in the early 1990s. But the recent progress of economic reform in the corporate sectors has started to stimulate economic activity coupled with significant increases in exports to China and the US. The forecast for Japan is comparatively low growth at a rate of 1.3% owing to factors such as economic maturation and the decline in the labor population accompanying population decreases and aging.

The ROK economy continued to expand with growth rates of more than 7% by the late 1990s when the "Asian currency crisis" occurred in 1997 which seriously damaged its economy. Major economic reforms after the crisis have succeeded in bringing about a remarkable economic recovery aided by sharp increases in exports to China in recent years. The ROK economy is expected to expand with a moderate growth rate of 4.3% during next two decades due to rising labor costs and more fierce international competition from other Asian countries.

3. Global/Asian Energy Outlook

According to IEEJ projections, the world's primary energy consumption is expected to increase at an average annual rate of 2.1% during the years 2000-2020. The volume in 2020 is expected to reach 13.6 billion oil-equivalent tons (toe), a 1.5-fold increase from the 9.1 billion toe in 2000.

Roughly 70% of the increases in energy consumption will be derived from non-OECD countries (primarily developing countries). Non-OECD Asian countries will probably account for about two-thirds of the total, and China for about 30%.

Fossil fuels (coal, oil, and natural gas) are expected to contribute about 90% of the increases in primary energy consumption during the years 2000-2020, thus should continue to play a major role as an energy source. Oil consumption is expected to show the largest increases of all fossil fuels and account for 35% of the increase in primary energy consumption, followed by natural gas at 30% and coal at 26%.

	Total	Coal	Oil	N. Gas	Nuclear	Hydro Power etc.
2000						
World	9057	2325	3494	2107	676	455
Asia	2423	1049	938	237	132	67
2020						
World	13593	3489	5072	3490	781	761
Asia	4570	1811	1720	598	247	195

Table 3. World Primary Energy Consumption by Source (Million toe)

Note: Asia refers to China, Japan, Hong Kong, Taiwan, South Korea, Singapore, Brunei, Indonesia, Malaysia, Philippines, Thailand, Vietnam, India and other parts of Asia.
Source: IEEJ, "Asia/World Energy Outlook, 2004" March, 2004

World oil consumption is expected to rise from 70 million B/D (3.5 billion toe) in 2000 to 102 million B/D (5.1 billion toe) in 2020. Asia should account for about 50% of this increase. It is estimated that about 60% of oil demand will come from the transportation sector. The share of oil in primary energy consumption is expected to decline slightly, from 39% in 2000 to 37% in 2020, but oil would nevertheless remain the single largest energy source (Table 4).

Consumption of natural gas, which reached 2,341 billion m3 (2.1 billion toe) in 2000, is expected to hit 3,877 billion m3 (3.5 billion toe) in 2020, the highest increase among fossil fuels. The installation of combined-cycle power generation systems fueled with natural gas is steadily spreading due to advances in utilization technology and environmental compatibility considerations. About 60% of the increase in natural gas consumption should come from fuel put into the power sector. Expanded utilization led by this sector is expected to drive an increase in the natural gas share of primary consumption, from 23% in 2000 to 26% in 2020.

In oil-equivalent terms, world coal consumption is expected to rise from 2.3 billion toe in 2000 to 3.5 billion toe in 2020. Asia should account for about 70% of this increase, and China, about 40%. Roughly 90% of coal consumption demand will probably come from the power sector as the trend toward fuel for power generation deepens. The coal share of primary energy consumption should remain more or less unchanged at around 26% over the years 2000-2020.

	Coal	Oil	N. Gas	Nuclear	Hydro Power etc.
2000	26	39	23	8	5
2020	26	37	26	6	6

Table 4. World Primary Energy Consumption by Source(%)

Source: IEEJ, "Asia/World Energy Outlook, 2004" March, 2004

In oil-equivalent terms, the consumption of power generated by nuclear power plants is expected to rise from 676 million toe in 2000 to 781 million toe in 2020. The nuclear share of primary energy consumption is expected to decline from 8% in 2000 to 6% in 2020 due to the fast-paced expansion of natural gas utilization in the power sectors of developed countries in North America and Europe and their virtual lack of prospects for construction of additional nuclear power plants. The increase in generated output of nuclear power plants should be confined almost exclusively to a few countries in Asia. In East Asia, nuclear power will continue to play a vital role in Japan, South Korea, and Taiwan, which have few domestic energy resource reserves, and China, with its rapidly growing demand for electricity.

There are high hopes for the spread of renewable energy sources with little environmental impact such as hydroelectric power, geothermal energy, and new energy. Their share of primary energy consumption is expected to increase from 5% in 2000 to 6% in 2020. However, they will not rank on par with fossil resources as pillars of the base energy supply due to their high supply cost and unstable supply caused by natural influences such as the intermittent nature of photovoltaic and wind power.

4. Energy Outlook for Northeast Asia

4-1 China, Japan and ROK

Primary energy consumption in China Japan and ROK is expected to grow from 1648 million toe in 2000 to 2927million toe in 2020 (Table 5). China's primary energy consumption is projected to double from 932 million toe in 2000 to 2063 million toe in 2020, although ROK and Japan are expected to expand energy demand 1.6 and 1.1 times respectively. As a result, about 88% of consumption increases in Northeast Asia over forecast period is derived from expanded consumption in China, followed by Korea at about 9% and by Japan at about 3% only.

In Northeast Asia as is occurring globally, fossil fuels (coal, oil, and natural gas) are expected to continue to play a vital role as sources of energy, and account for about 90% of the increases in primary energy consumption over the forecast period. Coal is expected to have the largest share of the increase at 42%, followed by oil at 31% and natural gas at 14%. Annual average growth rates of fossil fuels are 2.6% for coal, 2.6% for oil and 5.0% for natural gas.

Consumption of oil, which was about 12 million B/D (591 million toe) in 2000, is expected to increase by an average annual rate of 3.1% and reach 20 million B/D (982 million toe) in 2020. China is expected to account for about 95% of the increase, ROK about 8%, but Japan is expected to decline about 3%. The greatest increases will come from transportation followed by the residential/commercial and industrial sectors. The oil share of primary energy consumption is

expected to dip from 36% in 2000 to 34% in 2020.

	Total	Coal	Oil	N. Gas	Nuclear	Hydro Power etc.
2000						
N.E. Asia	1648	789	591	110	116	43
China	932	656	222	28	4	23
Japan	525	94	265	65	84	17
ROK	191	39	104	17	28	3
2020						
N.E. Asia	2927	1325	982	290	217	114
China	2063	1158	592	162	61	90
Japan	561	101	253	84	104	19
ROK	303	66	137	44	52	5

Table 5. Primary Energy Consumption by Source (Million toe)

Source: IEEJ, "Asia/World Energy Outlook, 2004" March, 2004

	Coal	Oil	N. Gas	Nuclear	Hydro Power etc
2000	48	36	7	7	3
2020	45	34	10	7	4

Table 6. Northeast Asia's Primary Energy Consumption by Source (%)

Source: IEEJ, "Asia/World Energy Outlook, 2004" March, 2004

Consumption of natural gas is expected to undergo a 2.6-fold increase from 122 billion m3 (110 million toe) in 2000 to 322 billion m3 (290 million toe) in 2020, for growth at the highest rate of all fossil fuels. It is estimated that about 50% of the consumption increase will come from fuel use in the power sector. The natural gas share of Northeast Asian primary energy consumption is expected to grow from 7% in 2000 to 10% in 2020, yet shifts in natural gas should be slower than those in North America and Europe.

Consumption of coal is expected to rise from 789 million toe in 2000 to 1325 million toe in 2020. China will probably account for about 94% of the increase, while the ROK and Japan will probably account for about 5% and 1% respectively. About 90% of the increase will come from power generation, while the remaining 10% will come from industry. While the share of primary energy

consumption for coal is expected to slip from 48% in 2000 to 45% in 2020, it should retain the single largest share of the primary energy supply in Northeast Asia.

Consumption of power generated by nuclear power plants is expected to increase from 116 million toe in 2000 to 217 million toe in 2020. Almost all of the corresponding global increases should come from Northeast Asia. There are strong prospects for growth in China and in countries with few domestic energy resource reserves of such as Japan and Korea. China is expected to account for about 56% of the nuclear power increases in Northeast Asia. The nuclear share of primary energy consumption should stay at about 7% over the period to 2020.

The share of renewable energies (e.g., hydroelectric power, geothermal energy, new energy) is expected to increase from 3% in 2000 to 4% in 2020. It should be noted, that energy consumption is expected to expand rapidly in the region, thus requiring a rapid response to ensure a stable supply of energy. These circumstances will act to limit the utilization of renewable energies, whose supply tends to be unstable due to natural conditions (except hydroelectric power and geothermal energy). Nevertheless, the installation of new energy systems with low environmental loads will continue to play a key role.

The rate of oil dependence on the Middle East will deepen steadily in Japan, China, and ROK. It is expected to reach about 90% in Japan and 80% in ROK in 2020. It is also expected to jump from 15% in 2000 to about 50% in China in 2020 due to sharp increases in oil demand and the leveling o. of domestic production. The corresponding rate of dependence on the Middle East in Northeast Asia as a whole is expected to rise from 58% in 2000 to approximately 70% in 2020 with the quantitative expansion of consumption in China. If the three countries begin to import crude oil produced in Siberia (in quantities totaling about 100 million tons per year), the corresponding rate may be lowered by about 11%.

4-2 DPRK and Mongolia

According to projections from the Korea Energy Economics Institute (KEEI), DPRK's primary energy consumption is expected to increase from 15.69 million toe to 65.32 million toe, at an average annual rate of 7.4% over the years 2000-2020 (Table 6). The current energy consumption per capita of the DPRK is 0.17 toe/capita almost the same as that of China. Once foreign direct investments are introduced into the DPRK to revitalize its stagnant economy, demand for energy is expected to grow rapidly. In order to reach a stable supply of energy, the DPRK must make every e.ort not only to expand domestic coal energy production, hydroelectric power and other sources, but also increase oil and natural gas imports. The projections in Table 7 assume that the KEDO (Korean Peninsula Energy Development Organization) project will be completed by 2015, and also assumes that the Siberian gas pipeline would pass through DPRK territory from 2020. If not, alternative scenarios for energy supply sources will have to be examined. According to projections from the Korea Energy Economics Institute (KEEI), DPRK's primary energy consumption is expected to increase from 15.7 million toe to 65.3 million toe, at an average annual rate of 7.4% over the years 2000-2020.

	Total	Coal	Oil	N. Gas	Nuclear	Hydro Power etc.
2000	15.69	11.25	1.12	–	–	3.32
	(100)	(72)	(7)	–	–	(21)
2020	65.32	29.27	23.82	3.32	3.29	5.64
	(100)	(45)	(36)	(5)	(5)	(9)
00–20	7.4	4.9	16.5	–	–	2.7

Table 7. DPRK's Primary Energy Consumption by Source

(Million toe, %)
Note: * The projection assumes that the KEDO project will be completed by 2015.
** The projection also assumes that the Siberian gas pipeline will pass through DPRK territory from 2020.
Source: Korea Energy Economics Institute (KEEI), 2002

KEEI also projects that the primary energy consumption of Mongolia will increase from 2.6 million toe in 2000 to 3.7 million toe in 2020 at an annual growth rate of 0.1%. As its total amount of energy consumption will remain very small, the impact on Mongolia's energy balance will be minimal from a regional viewpoint of Northeast Asia for the foreseeable future.

4-3 Russia

The primary energy consumption of Russia is expected to increase from 612 million toe in 2000 to 841million toe in 2020 at an annual growth rate of 1.6%. Russia is the largest natural gas producer and exporter in the world as well as the second largest oil exporter after Saudi Arabia. Most exports of oil and gas have up to now been directed to European countries mainly through pipeline networks and oil tankers. As the Eastern regions of Russia depend almost entirely on extra-regional shipments of oil and the need for Northeast Asian countries to pursue a policy of diversification of their supply sources of oil and gas, it is quite rational for Russia to develop abundant energy resources in East Siberia and the Russian Far East, including Sakhalin. In terms of its resource base, it is estimated that the Eastern regions of Russia account for 45% of coal, 30% of natural gas and 18% of oil resources, over 80% of hydroelectric power for Russia as a whole.

	Proven Reserves	Global Share (%)	R/P Ratio
Oil (Billion toe)	9.5	6.0 %	22.2
Natural Gas (Trillion m^3)	47.0	26.7 %	81.2
Coal (Billion toe)	157.0	15.9 %	-

Table 8. Proven Russian Reserves of Oil, Natural Gas and Coal (at end of 2003)

Source: BP Statistical Review of World Energy, June 2004

Various oil and gas projects and their feasibility being considered depend on access to long distance, large capacity pipelines. The construction of mega-pipelines requires enormous capital funds and a long-term return-on-investment period. As the economic feasibility of the mega pipeline system

cannot be supported by limited domestic demand, most projects are expected to export oil or gas to neighboring markets. According to “Energy Strategy 2020” adopted in 2003, the Russian government promised state support for export pipelines, if these pipelines are built within Russian territory, as mega energy projects are expected to stimulate economic activities in the Eastern regions of Russia where economic development lags behind the rest of the country. Thus Russia and energy-importing countries in Northeast Asian have a common interest to cooperate to develop energy resources in the Eastern regions of Russia.

5. Key Issues for Northeast Asia

As Northeast Asia is expected to become further dependent on the Middle East for a long -term supply of oil, the region must have an ample supply capacity for natural gas and coal. The simultaneous realization of energy security, market rationalization, and environmental improvements in Northeast Asia demands the construction of the “best mix” of energy sources in each country that factor in the situation vis-à-vis the amount of energy reserves, geographical conditions, and stage of economic development. Furthermore, the formation of an analogous “best mix” in the region as a whole will require extensive utilization of coal and nuclear power alongside natural gas while assuring oil supply stability.

5-1 Ensuring energy security

Strong economic growth and progressive motorization are going to expand the demand for energy in Northeast Asia. As noted above, the dependency on the Middle East for supplies of oil should deepen, as regional oil supplies would not be able to keep pace with rapid demand expansion. While it is naturally important for individual countries to make efforts to secure their own energy supplies, there is also a possibility that an excessive pursuit of national interests by any single country could damage the energy security of the region as a whole. Thus it is becoming increasingly important for the issue to be treated as one in which all countries in the region have a common stake. To this end, Northeast Asian countries must cooperate to develop abundant undeveloped energy resources, including oil, natural gas, coal and hydroelectric power in the Eastern regions of Russia.

5-2 Pursuit of energy diversification and “best mix”

Pursuit of the best energy mix is another agenda item to be confronted by each country according to its circumstances vis-à-vis energy demand, the amount of resource reserves, technology level, and economic merit. However, it is also vital to retain the perspective of optimizing the mix in the region as a whole, based on cooperation between net consumers and net suppliers.

The use of natural gas in Northeast Asia is expected to grow in the future, driven by demand for diverse energy sources and environmental improvements. In order to promote this, natural gas must be economically competitive with other energy sources. The Asia-Pacific region has a fully sufficient long-term supply potential for LNG, while LNG importing countries must collaborate in efforts to raise their economic benefits by exercising stronger bargaining power against LNG suppliers. Thus it will be beneficial for Northeast Asian countries to cooperate to develop natural gas resources in the Eastern regions of Russia and have new supply sources of natural gas via cross -border pipelines.

Coal has superb economic benefits but also entails a high environmental load, thus its utilization in developed countries could stop growing as a result. In Northeast Asia, there are abundant reserves of coal in countries such as China and Russia, while the region‘s utilization of coal is expected to

grow, particularly in the power sector. This would further raise the importance of environment-friendly utilization harnessing high-efficiency technology. It is vital for Northeast Asia to make better use of its abundant coal deposits based on energy security and economic benefits.

In the developed countries of Europe and North America, construction of additional nuclear power plants has essentially been halted, while installed capacity is expected to decline. As a result, Northeast Asia should be the location of almost all additional nuclear power plants. Many Northeast Asian countries have a relatively low level of domestic natural resources, while nuclear power has a major role to play to ensure supply stability and overcome environmental concerns. There is also a need for interregional cooperation covering operations and management in this area. Thus it is important to have various options for energy supply sources. This would be linked not only to higher levels of energy security but also a stronger position in price negotiations for competing fuels.

5-3 Improvement of investment environment

A stable supply of energy is vital for sustainable economic development in Northeast Asia. In addition to securing crude oil, natural gas, coal, and other resources, enormous capital is needed to build infrastructure such as pipelines and transmission lines. Major financing of these mega-projects must rely heavily on both loans and direct investment from foreign private corporations as well as foreign governments, international organs, and other forms of public funding. Thus rules governing taxes, investments, and other systems must be defined in order to encourage development of energy resources and related infrastructure using foreign capital. Moreover, strong support by governments in the form of the financial assistance and investment insurance will play a vital role in promoting the participation of private enterprise in energy infrastructure projects.

5-4 Cooperation for environmental improvement

As the dominant energy sources will continue to be coal and oil in Northeast Asia in the foreseeable future, various environmental problems including current air pollution and CO2 emission will worsen due to rapid increases in coal and oil consumption. In order to deal with these problems, regional cooperation through technology transfer is extremely valuable and effective, particularly in the areas of energy conservation, clean coal technology and renewable energy development. China and other Northeast Asian countries have immense potential for energy conservation, and other enormous opportunities for technical assistance through the Clean Development Mechanism (CDM) and other schemes. As Japan ranks at the top worldwide in terms of energy conservation and environmental technologies, regional cooperation can contribute to a winwin situation in Northeast Asia.

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