Energy Strategies in China and India and Their Implications[1]

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Chapter 1 Energy Strategies in China

1-1. Highlights of recent trends in energy supply and demand

During the first half of the 1990s, China recorded consistently robust economic growth of over 10% a year. In the second half of the decade, the growth rate slowed down but the country still maintained high economic growth at around 7 – 9% per annum. Reflecting this strong economic growth, China's energy demand expanded in the early 1990s. BP Amoco's Statistical Review of World Energy (hereinafter referred to as BP Statistics) reported that China's primary energy consumption grew from 669 million tons oil equivalent (MTOE) in 1990 to 753 MTOE in 1999, up by an average of 1.3%/year. As of 1999, with its primary energy consumption accounting for some 9% of the world's total, China became the world's second largest energy consumer after the United States.

During the past few years, however, a noteworthy change has occurred in China's energy consumption trends: despite the continuing economic growth, primary energy consumption has been in continuous decline after peaking at 887 MTOE in 1996 (Fig. 1). Particularly in 1999, China registered a sharp fall of 10.7% from the previous year to 753 MTOE. This decoupling between economic growth and energy consumption is "directly" attributable to significant declines in coal consumption, the mainstream of energy use in China, during the period. In fact, China's coal consumption plunged by as much as 25% in three years from 677 MTOE in 1996 to 511 million tons in 1999.

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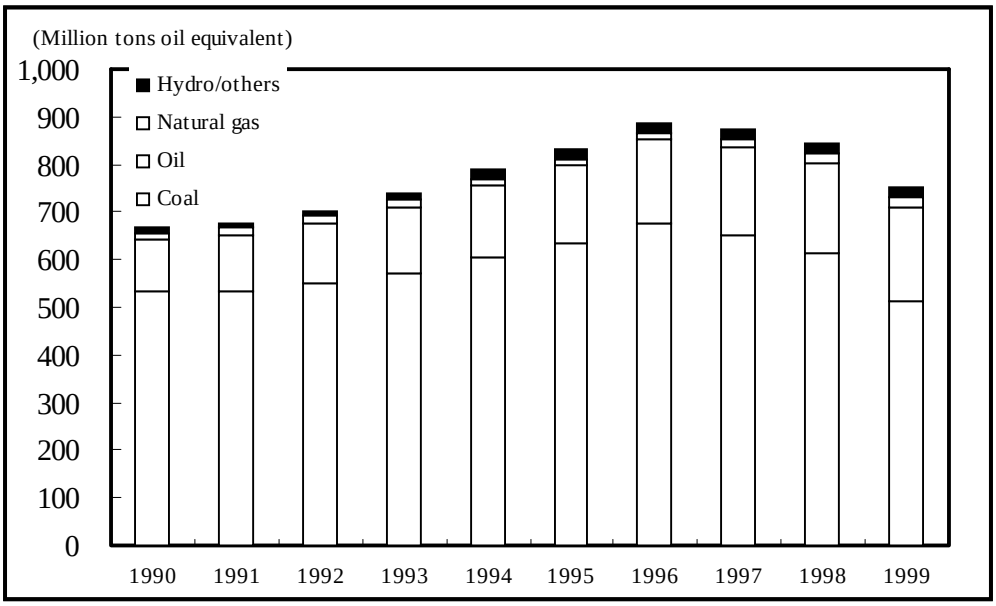
Fig.1 Primary Energy Consumption in China



(Source Prepared from BP Statistics)

A closer examination of the causes of this decline in coal consumption reveals several factors. These include: (1) As a result of the slowdown in Chin's economic growth, there was also a downturn in the growth of energy demand. (2) Under these circumstances, China has undergone structural industrial shifts that reduced the preponderance of coal-intensive industries (metallurgy, chemicals, construction, etc.). (3) The growing popularity of high-quality and high-calorie coal usage helped promote the trend toward conservation and more efficient use of coal. (4) A switch to alternative energy sources, notably oil, has also been in progress in the burgeoning commercial and residential sectors, among others. Also of significance is the fact that, since the second half of the 1990s, the Chinese government has created a coal-industry rationalization policy under which inefficient small and medium-sized mines were compulsorily closed down, resulting in the disappearance of their coal output[2].

[2] During our overseas interview survey conducted under this study project, some small/medium mines scheduled to be closed down continued production illegally and brought about significant coal supplies not counted in statistics. This was one of the principal causes of the decoupling between the economy and energy consumption.

Along with shrinking coal consumption, China's recent trends have included steady increases in alternative energy sources such as oil and natural gas. The strong economic growth resulted in higher income levels, triggered the advance of motorization, encouraged ownership and greater use of energy-consuming appliances, and promoted shifts to more convenient and higher-quality energy sources. As a result, China's oil demand has increased steadily from 110 million tons in 1990 to 200 million tons in 1999 (up by 6.1%/year on average). Natural gas consumption has also grown from 13.20 MTOE to 19.30 MTOE (up 3.9%/year) over the same period. These recent demand trends have caused a significant change in China's energy consumption mix: a shift from coal to oil and natural gas. The share of coal in primary energy consumption dropped by more than 10 points from 79.9% in 1990 to 67.9% in 1999, while oil and natural gas shares rose from 16.5% and 2.0% to 26.5% and 2.6%, respectively.

It can thus be seen that the demand for energy, particularly for oil, has grown along with the brisk economy. At the same time, significant differences are also apparent among energy sources on the supply side: China is self-sufficient in coal and natural gas, the former thanks to abundant domestic reserves and sufficient production capacity, and the latter owing to demand being restrained by limited supply. In the case of oil, however, domestic production has failed to keep up with the soaring demand. Since declining into a net oil importer in 1993, China has covered its domestic oil needs by increasing oil imports year by year. It thus appears possible to conclude that China's energy supply-demand gaps in the 1990s, which resulted from the country's strong economic growth, have basically been bridged by successive increases in oil imports[3].

1-2. Tenth five-year plan and energy policy-related topics

As mentioned above, despite the strong economy, China's energy demand has generally decreased during the past few years, reflecting the decline in coal consumption. However, from the

[3] Regarding the reasons why China's expanding energy supply-demand gaps have been mostly covered by larger oil imports, see Ken Koyama, "China's Energy Supply and Demand and Problems" (Kunio Kayahara ed., "China's Energy Strategies," Ashi Shobo, 1996).

medium- and long-term perspectives, the widely accepted view is that China's energy demand will resume its expansion, with the economic growth and energy demand returning to a normal positive interrelation[4].

Discussions have been under way in China concerning the tenth five-year plan (hereinafter referred to as 10.5 Plan), which laid out the foundation of its economic and social development programs and targets for the next five years (2001 – 2005). The fourth session of the National People's Congress (NPC), held from March 5 to 15, 2000, officially adopted the 10.5 Plan's main principles, among others. With the long-term target of doubling the GDP's 2000 level by 2010, the 10.5 Plan calls for average GDP growth of 7%/year throughout the period (until 2005).

The officially adopted 10.5 Plan revealed no specific numerical targets related to energy supply and demand, etc. However, according to our overseas interview surveys and various literature checks, it is highly likely that China will set GDP/energy elasticity at around 0.4 over the planned period. If this is so, the country's primary energy demand will keep growing by around 3%/year on average through 2005. This means China is likely to face a challenge in securing supplies to meet growing domestic energy needs and thus to achieve sustainable economic growth and development from the energy aspect.

Accordingly, the priorities of China's energy policy under the 10.5 Plan can be summarized as follows:

(1) Upgrading of energy supply and demand mix (shift to cleaner and higher-quality energies)

(2) Securing a stable energy supply (in response to rising dependence on energy imports)

(3) Aligning energy policy with matters such as environmental problems and social policy

(4) Rationalization of the energy industry, including enhancement of its management capability and international competitiveness.

From now on, the Chinese government will need to come up with an energy policy that can

[4] Regarding this point, the view is largely shared by the Chinese government officials and the National Oil Corporation whom we interviewed in China under this study project, as well as the opinions expressed by specialized research institutes, the International Energy Agency (IEA) and the Energy Information Administration of USDOE, among others.

help drive these priorities forward.

1-3. Promotion of natural gas development/use seen as increasingly important

Greater use of natural gas holds the key to achieving policy goals and at the same time establishing compatible, well-harmonized policy commitments. Judging from the low share it occupies in primary energy, natural gas has hitherto played a very limited role in China's energy supply and demand. Nevertheless, natural gas has the features of "clean energy," and China's gas reserves have been considerably increased by recent exploration/development activities. In the context of issues such as the deteriorating environment (air pollution) caused by coal burning, and mounting reliance on energy imports that need to be curbed by energy diversification and effective use of domestic resources, China is likely to place top priority on the promotion of natural gas development/use. Moreover, the country's inland and western regions, where vast natural gas reserves are believed to exist, have been left markedly behind in the economic development process, showing conspicuous economic gaps as compared with other regions of China. Accordingly, heavy investment paired with energy development and infrastructure projects in these regions can play a key role in social policy as well.

In this context, the "Western Gas to East" project is highly symbolic and offers effective response measures to such policy themes. The project will connect the gas-producing Western Tarim Basin with Shanghai, a major consuming area, by installing an approximately 4,200km-long trunk pipeline to move 13 billion cubic feet of gas, hopefully from 2007 onward. It is among the Chinese government's current top-priority projects. Including all works from upstream (development of gas fields) to middle & downstream (installation of pipeline networks), the project is reportedly expected to cost a total of about $18 billion. In view of the colossal cost and the need for adoption of advanced technology to ensure efficient implementation, among other things, foreign capital will inevitably be required. In this aspect also, the project has symbolic significance in the context of

China's future energy and market development[5].

This project has aroused considerable interest among foreign capital as well. Many firms have shown a strong desire to participate, and it was disclosed in March 2001 that, including majors, 19 international firms have been screened as qualified bidders and have already submitted their tenders for the project. China reportedly intends to narrow down these 19 firms to a short list of seven by May and by the end of June will select the final partners with whom a joint venture will be established for project implementation.

In the meantime, China is not only considering development and use of domestic natural gas resources, but also has import plans which are already partially in progress. One such plan is to develop the Kovykta gas fields in East Siberia, Russia, and install a long-distance pipeline to China through Mongolia or via a detoured route, and further to South Korea[6]. This pipeline project, though important for China's gas supply in the long run, has been positioned as the next in line after the more prioritized domestic gas use projects (e.g., the Western Gas to East plan) for the present (during the 10.5 Plan's period). However, in February 2001, South Korea's Korea Gas Corporation officially proposed to the Democratic People's Republic of Korea (North Korea) a scheme to interconnect the planned pipeline on a route through North Korea, thus revealing a significant initiative related to the pipeline project from Russia. Also, in March 2001, China announced new developments connected with realization of LNG import projects by settling BP's long-pending participation in the project to build an LNG terminal in Shenzhen, Guangdong[7]. China thus has a variety of large-scale projects under way in its efforts to increase natural gas development and use.

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[5] To promote the introduction of foreign capital, as far as this project is concerned, the Chinese government offers a wide range of investment incentives, from a majority equity acquisition to various tax incentives, and even permits foreign capital to participate in gas businesses in the cities located along the planned pipeline.

[6] This project is reportedly scheduled to start supplying 30 billion cubic feet/year of gas around 2008 – 2010. It is estimated that the pipeline will be 4,100km-long and will cost $11 billion in total.

[7] The Shenzhen LNG project is expected to construct a 3-million-ton LNG receiving terminal, a 300-km pipeline and a gas-fired power plant during the first phase, and expand the receiving capacity to 5 million tons in the second phase. This project allows foreign capital participation of up to 30%. As a result of an international bidding, four

1-4. Positioning of coal as the principal domestic energy source

Promotion of coal use will certainly be a big concern for China in its search for effective responses to its ever-greater reliance on imported energy, upgrading of supply and demand mix, and environmental problems. Namely if China, whose rich domestic coal resources are capable of relatively inexpensive development, could upgrade its use of coal while minimizing its environmental loads, the country could do much toward curbing its reliance on energy imports and the increasing cost of energy supply. Partly owing to high oil price levels worldwide since 1999, China is currently showing great interest in the application of clean coal technology to promote upgraded coal use, and is considering projects to build big coal liquefaction and gasification plants[8]. Of course, aside from these advanced technologies to upgrade coal use, application and more extensive use of well-established technologies, typically those enabling coal-fired power plants to increase generating efficiency and slash SOx and NOx emissions by retrofitting existing equipment, could also provide a way for China to succeed in its efforts toward greater use of coal. At the same time, now that China has committed itself to reorganization and streamlining of the coal industry by closing down inefficient small- and medium-sized mines yielding poor-grade coals, it can probably be assumed that the country is going ahead with its promotion of efficient and upgraded use of coal as a total system[9].

1-5. Composite effects expected from hydro-energy, new energies and energy conservation

With the aim of achieving all its energy-policy priorities, China is placing great hopes on the development and enhanced use of hydro-energy and new/renewable energies. This is because the

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consortiums remained on the short list.

[8] For example, the Chinese government approved in February 2001 a $3-billion project to construct in autonomous Nei Mongol a coal liquefaction plant capable of producing 5 million tons/year of petroleum products from 15 million tons/year of raw coal. Among others, various construction projects are under consideration and include a liquefaction plant in Yunnan, gasification plants in Yunnan, Hobei and other provinces, and a model plant for coal gasification combined power generation in Shandong.

[9] In regard to the promotion of coal use, greater use of the so-called coal bed methane is also attracting growing attention. While China's coal bed methane resources reportedly amount to 30 trillion cubic meters, in November 2000 China signed three production sharing agreements with Texaco, which called for joint exploration of coal bed methane in Nei Mongol, etc. Later, China signed more PS agreements on coal-bed methane exploration. There are 11 signed agreements as of February 2001.

special features of hydro-energy and new/renewable energies offer various specific advantages—for example, (1) they are basically indigenous energies, (2) they are less polluting, particularly at the consumption stage, and (3) distributed-type new/renewable energies in particular are expected to contribute to electrification in remote areas/frontier areas far from the existing power grids. As the existence in China of huge resource potentials for hydro-, wind, photovoltaic, biomass energy, etc.[10], becomes apparent, the country's future development moves are attracting keen attention.

Above all, on the hydro-energy front, China is carrying out a plan to increase its present generating capacity of about 70 GW (the world's third largest) to around 125 GW by 2010. Most of China's hydro resources are located in the economically least developed Western region. This is the rationale behind the "Western Power to East" project now being implemented to develop hydro-power plants in the Western region and supply electricity generated there to the Eastern coastal areas, where energy consumption is highest[11]. This project, which is also contributing effectively to development/infrastructure construction in the Western region, is currently positioned among China's national priorities. In addition to large-scale central power plant projects, the development of mini hydro-units (under 12 MW per unit) as distributed sources is under consideration, with some already implemented[12]. Meanwhile, though not falling in the new/renewable category, nuclear power generation is also being introduced and promoted as a domestic energy source. China at present has three reactors with a combined capacity of 2.1 GW in operation in Dayawan, Guangdong, and Taishan, Zhejiang. During the period of the 10.5 Plan, four plants (with eight reactors having a combined capacity of 6.6 GW) currently under construction are scheduled to be put on stream.

China also attaches great importance to energy conservation, because successful conservation efforts are expected to help the Chinese economy strengthen its international competitiveness in

[10] For potentials of new/renewable energies, etc., see Hisashi Miyamori, "Chugoku no enerugi shijo seisaku doko(IEEJ website homepage) "

[11] Under the "Western Power to East" scheme, four projects, including construction of the Xiaowan Plant (total output 4.2 GW) in Yunnan, is scheduled to start within 2001.

[12] China reportedly has about 7,000 mini-hydro units installed, which are supplying electricity to 300 million onsumers.

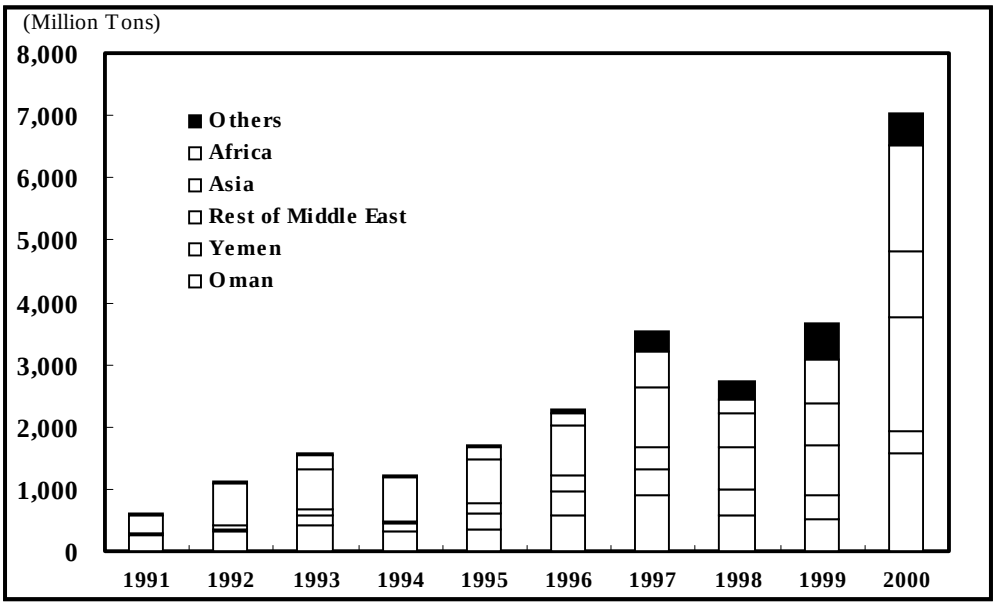
macro terms, in addition to its two principal effects of reducing energy imports and environmental loads. Since China adopted a policy of giving priority to energy conservation under the sixth five-year plan (1981 – 1985), commitments to improving energy efficiency have been emphasized in all subsequent five-year plans[13]. Under these circumstances, the trend of China's energy intensity (primary energy consumption/GDP) has been downward, thus showing progress in improving the efficiency of energy use[14]. Nevertheless, China's energy efficiency is still low by international standards[15], which means there is ample room for further improvement. Accordingly, the 10.5 Plan prioritizes energy conservation as did the preceding plans, and is likely to enhance the drive toward further efficiency improvement.

1-6. Efforts to secure oil as core of stable energy supply

For the Chinese, whose increasing reliance on imports appears inevitable in view of their ever-greater energy demand, establishment of a secure energy supply is an issue of extreme importance. The problem of rapidly increasing import reliance has become acute in the form of burgeoning oil imports. Particularly in 2000, China's crude oil imports, up by 90% over the previous year, passed the 70-million-ton mark (Fig. 2), attracting attention among energy circles not only in China but worldwide.

[13] China enacted its Energy Conservation Act in November 1997, and this took effect in January 1998. The Act contains provisions to encourage development of less energy-consuming technologies, ban inefficient energy projects, and establish efficiency standards for energy-consuming appliances, among others.
[14] China's energy intensity shrank more than 60% from 2,512 TOE/$ million in 1980 to 913 TOE/$ million in 1998.
[15] China's energy intensity of 913 TOE/$ million in 1998 is far above OECD's average (202 TOE) and Asia's average (258 TOE) in the same year.

Fig.2 Sources of Chinese Crude Oil Imports



(Source) Prepared from China OGP.

In order to reduce its reliance on oil imports, China, as already mentioned, is likely to take various measures ranging widely from greater use of natural gas to more effective use of coal, the principal domestic energy source, use of new and renewable energies, and promotion of energy conservation. Yet even assuming that such measures will be successful, expansion of oil imports into China appears to be unavoidable. The reason for this is that despite the constantly growing oil demand (largely attributable to surging transport demand caused by the spread of motorization) there appears to be little hope for substantial growth of domestic crude oil production from the maturing and aging principal oilfields of the eastern regions, notably Daqing[16].

In view of the expected massive expansion of oil imports, China is unrolling various policies and strategies to secure a stable oil supply. First, because significant increases in output are unlikely at home, China is aggressively launching into the upstream sectors abroad to gain access to

[16] During our overseas interview surveys conducted under this study project, some interviewees expressed the view that, while China's oil demand will probably be around 250 million tons in 2005, oil production is likely to end at around 160 million tons, more or less at its present level. If this is so, net oil imports will total 90 million tons. In comparison, actual net oil imports in 2000 are estimated to be about 47 million tons.

overseas resources. The best example is CNPC, a state-run oil company. Since the mid-1990s, CNPC has been negotiating with overseas countries including Iraq, Venezuela, Kazakhstan and Sudan. As of 2000, crude oil production capacities that CNPC acquired overseas totaled 13.5 million tons/year, together with 5.05 million tons of equity crude oil. During the period of the 10.5 Plan, CNPC intends to strengthen its overseas operations and cover 15 million tons of its crude oil production target for 2005 (set at 120 million tons) with output from its overseas fields. In addition to CNPC, CNOOC and SINOPEC are also taking very positive approaches to doing business abroad. SINOPEC in particular, whose core business was originally in the downstream sector, is endeavoring to catch up in the upstream sector too. To that end, SINOPEC has made various moves including the formation of a subsidiary specializing in overseas upstream business operations (International Oil Exploration and Development Corporation) and the decision to invest in Iran's upstream and downstream businesses[17]. Beside the objective of securing a stable oil supply through direct access to overseas resources, the companies' positive attitude toward overseas business operations may be motivated by an additional consideration. In order to diversify and strengthen its business management, they are hoping to make best use of the upstream sector's human and technical resources accumulated by a state-run oil company in Asia's largest oil-producing country.

Furthermore, in view of the clear inevitability of expanding imports, other measures are being directed toward securing stable imports. Aside from the activated overseas upstream investments, one such move is a plan to invite oil-producing countries to invest in China's downstream oil sector[18], and thus to establish broader political and economic ties with the Middle Eastern oil producers[19]. Also, in order to encourage steady imports of Middle Eastern crudes from a different standpoint, investments are under way in retrofit/upgrading of refining capacities. China's

[17] From late 2000 through early 2001, SINOPEC reached agreements with NIOC, Iran's state-run oil corporation on (1) projects to retrofit an Iranian refinery and construct a crude oil terminal, and (2) a contract to explore and develop Iran's Kashan oilfields, among others.

[18] Since the start of the 1990s, various investment projects in China's oil downstream (refining) sector have been under consideration. At present, Saudi ARAMCO and Exxon Mobil are considering whether or not to join investments in a refinery project in Fujian.

[19] 19Following President Jiang Zemin's visit to Saudi Arabia in November 1999 and President Khatami's visit to China in June 2000, among others, China has committed itself to strengthening its ties with Middle Eastern

refineries, originally designed for domestically produced low-sulfur crude oil, have encountered technical setbacks in processing crude oil from the Middle East[20]. Given the strong likelihood that further imports will consist largely of high-sulfur crude oil from Saudi Arabia and Iran, it is of crucial importance for the Chinese refineries in the coastal areas[21] to make high-sulfur crudes acceptable through capacity upgrading.

The issue of oil stockpiling is also included among oil security measures. China was for many years an oil producer/exporter and therefore hardly recognized the need for oil stockpiling. In fact, China had no government stockpiling system, nor did it require oil companies to have oil stockpiles, while oil companies held some 20 – 30-day commercial stocks necessary for their business operations[22]. However, since becoming a net oil importer in 1993, China has had a growing interest in oil stockpiling due both to the crude oil spikes since 1999 and its rapidly expanding oil imports. By 1999, China had reportedly authorized a study on oil stockpiling systems directed by top-level government agents, and initiated examination works. In fact, government organizations, state-run oil companies, think-tanks and others have conducted a series of joint studies to determine a government stockpiling system suited to China from various angles, including actual conditions of oil stockpiling in foreign countries and the cost-benefits of stockpiling. China now seems to be more keenly aware of the usefulness of oil stockpiling as a means of preparing for emergencies and for market stabilization. One problem, however, is that building and maintenance of stockpiles involve huge cost burdens, for which reason the matter is still under consideration. It is significant that Premier Zhu Rongji emphasized in his report on the 10.5 Plan's main principles that "a stockpiling system for strategic resources such as oil should be established as

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oil-producing countries.

[20] While Mideast crude oil imports have expanded since the 1990s, these have consisted for the most part of low-sulfur crudes from Oman, Yemen and others. Incidentally, in China, "high-sulfur crude oil" often means crude oil having a sulfur content of more than 1%.

[21] The most typical example is Zhenhai Refinery, the largest refinery in the SINOPEC group, which in 2000 processed 10.70 million tons of crude oil. Of this, 4.03 million tons consisted of high-sulfur crudes. The refinery stated that within three years it would have a system to process 14 million tons of high-sulfur crudes out of 20-million-ton crude oil throughputs.

[22] See Ken Koyama and Shinya Kawasaki, "Asia's Response to Growing Oil Dependence from Outside the Region and Japan's Role" (IEEJ, the 28th Summer Energy Seminar, July 21, 1999).

early as possible." The specific contents of this new policy remain uncertain. However, now that the establishment of an oil stockpiling system has been decided under the 10.5 Plan, it is almost certain that some policy actions will be taken.

1-7. Commitment to strengthening management capability and competitiveness of the oil industry

China's state-run oil companies—i.e., the country's oil industry—are responsible for the domestic supply of oil, a commodity of crucial importance in economic development, and have the task of securing stability of supply, including that of imports from overseas. Accordingly, since effective management and good competitiveness of the state-run oil companies at home and abroad play important roles in securing a favorable (low-cost) and constant oil supply to the Chinese market, such efforts by these companies are vital from energy-policy perspectives. For the companies themselves, strengthening of their corporate capability and competitiveness is essential to their survival and growth in the present environment of advancing globalization and market liberalization.

Under the circumstance, China has been committed to various organizational reforms in the industry, changes and reforms of market institutional design, etc. since the mid-1990s. In 1998, China scrapped the conventional horizontal-division system of upstream and downstream sectors and, through reallocation of assets, formed two big vertically integrated company groups: CNPC and SINOPEC. The Chinese oil industry was thus given a completely new industrial structure. Within the framework of this structure, China has since 1998 initiated a succession of new policies that have included regulation of petroleum product imports, tougher control of oil smuggling, closure of small refineries, and revision of the domestic oil pricing system. With these measures, China has attempted to strengthen the oil industry's management capability and improve its competitiveness.

With its WTO membership approaching, China is now being forced to improve the efficiency and competitiveness of its oil industry even more. For this reason, each of the state-run oil companies has embarked on restructuring measures such as massive personnel cuts, which they have

never attempted before[23], in order to prepare for the anticipated fiercer market/competitive environment. At the same time, they need to expand and upgrade investments in order to strengthen their commitment to priority growth fields. As a means to this end, the Chinese state-run oil companies have opted for public offering of stock (IPO) on overseas markets. CNPC executed IPO as early as April 2000, SINOPEC in October 2000 and CNOOC in March 2001. In this way, they are attempting to increase their competitiveness by raising funds and introducing advanced technologies and management know-how through strategic alliances with foreign capital[24].

While promoting rationalization and restructuring, CNPC, SINOPEC and CNOOC are thus constantly implementing strategies that will ensure their growth and survival in the future. These include commitments to domestic oil/gas development projects, expansion of overseas oil/gas businesses, upgrading of refining capacities to increase crude oil throughputs, and strengthening of the marketing sector by installing additional new SSs[25]. Competition to grab a piece of the "pie" on the expanding Chinese market is certain to become more severe among both new and old players, including China's state-run oil companies, the majors, other foreign firms, and local oil dealers other than big state-run enterprises. Recently, for example, competition has intensified to the extent of disrupting the business areas shared between CNPC and SINOPEC and divided when the two big groups were formed. It can thus be seen that new developments differing basically from the conventional market order are under way. Future changes in China's oil industry deserve to be watched with keen interest.

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[23] For example, in 2001 SINOPEC is aiming for $260-million-worth cost reductions through personnel cuts, energy conservation, etc. The company intends to cut its workforce by 100,000 jobs to 420,000 employees from 2001 to 2005. CNPC is also planning to slash 50,000 employees (including 35,000 jobs at PetroChina) within the next five years.

[24] Of $2,890-million-worth IPO provided by CNPC (PetroChina), BP invested $620 million. The $3,460-million-worth IPO of SINOPEC attracted $1,000 million from Exxon Mobil, $430 million from Shell, and $400 million from BP. When CNOOC entered with $1,430-million-worth IPO, Shell invested $200 million. Massive investments were thus made by majors in all cases.

[25] For details of individual companies' business strategies, see Hisashi Miyamori (Op.cit.).

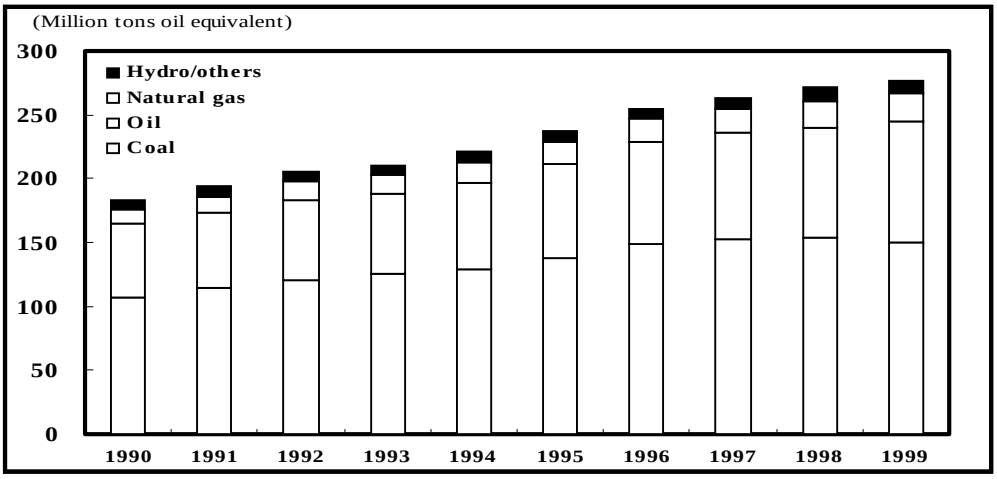
Chapter 2 Energy Strategies in India

2-1. Highlights of recent energy supply and demand trends

In the early 1990s, India embarked on full-scale introduction of economic liberalization policies, thus stimulating economic growth. The GDP growth, around 4%/year in the first half of the 1990s, stayed above 7% for three consecutive years from 1994 to 1996, accelerating economic expansion. In subsequent years, India has sustained a high growth rate of around 5 – 7%. Keeping step with the brisk economic trend, India's primary energy consumption has expanded considerably. BP Statistics report that India's primary energy consumption grew by 4.7%/year on average from 183 MTOE in 1990, reaching 276 MTOE in 1999 (Fig. 3).

By energy source, oil and natural gas during the period 1990 – 1999 posted annual average growths of 5.6% and 7.5%, respectively, which suggest that both these energy sources underwent significant demand increases. Coal, which forms the mainstream of India's energy mix, registered constant growth of 3.9% over the same period. However, the coal share in total primary energy declined from 58.2% in 1990 to 54.3% in 1999, while oil and natural gas increased their shares from 31.6% and 6.1% to 34.3% and 7.7%, respectively. Shifts in the energy mix can thus be seen to be under way.

Fig.3 Primary Energy Consumption in India



(Source) Prepared from BP Statistics

Focusing on the supply side, India in common with China is virtually self-sufficient in coal, with ample reserves and production capacity available, and in natural gas, the demand for which tends to be restrained by supply due to its characteristics. With regard to oil, however, India supplements the domestic supply with imports since domestic production is unable to keep up with the strong demand growth. Thus in India (as in China), the energy supply-demand gap, widened by strong economic growth in the 1990s, has been largely bridged by increased oil imports.

2-2. Promotion of domestic oil/gas development as top priority

In this energy supply-demand situation, India's energy policy currently gives top priority to the promotion of domestic oil (and natural gas) development. In the background, mounting oil imports resulting in ever-higher import costs (hard currency payments)[26] give cause for concern as a potential depressant in the Indian economy, while growing reliance on imports is also seen as a mounting threat to energy security. In particular, the oil price spikes in international oil markets since 1999 have had the effect of emphasizing the potential seriousness of these problems, and have stimulated interest in increasing energy self-sustaining rates at both government and private levels.

At present, the Indian government is unrolling the so-called New Exploration & Licensing Policy (NELP) designed to promote domestic oil development. Even before the NELP was introduced in 1997, the Indian government had committed itself to the introduction of foreign and private capital in support of efforts to advance domestic oil development. Up till now, the government has held a few rounds of bidding for exploration blocks, etc. and has adopted a policy of inviting foreign capital to EOR programs in combination with other efforts to stabilize oil flows from the Bombay High oil field, India's largest. However, foreign and private capital have so far not always shown great interest in India's international biddings, because they often involve time-consuming procedures and also for the reason that India's state-run upstream firms (e.g., ONGC) have been favored or their equity protection prioritized. Therefore, with the NELP, the

[26] As a result of growing oil imports and rising oil price, India's trade deficits soared from $6.48 billion in 1997 to $9.61 billion in 1999.

Indian government has hammered out a policy aiming to encourage introduction of foreign/private capital into the domestic upstream sector by eliminating favored treatment of the state-run upstream sector and setting fair competitive conditions[27].

The first round of bidding under the NELP was held and closed in August 1999. Its outcome revealed that tenders were submitted for 27 out of 48 blocks offered, and 25 blocks were ultimately awarded. Nine of these blocks were awarded to state-run firms (eight to ONGC) and the remainder to private/foreign enterprises. Preparation is now under way for the second round of bidding, slated for around the spring of 2001. As none of the first-round projects have yet started exploration & development, it is difficult at this moment to assess the impact on India's oil production. However, by making effective use of the NELP, the Indian government appears hopeful of boosting crude oil output from about 32 million tons at present to around 40 million tons before termination of the next (the tenth) five-year plan (2006)[28].

One problem is that even the currently functioning NELP is not always highly evaluated. Although in the first round of bidding various private/foreign enterprises won many blocks, no tenders were submitted by the majors. Moreover, roughly half of the blocks offered received no tenders at all, and in view of the small number of tenders overall, the closing day for bidding was extended[29]. India attributed the poor outcome primarily to flagging crude oil prices on the international market—but that was not the whole story. It appears, in fact, that problems exist that are inherent to India's resource potentials, and others related to the attractiveness of its blocks and contract terms. Particularly for majors, which are constantly reviewing a wide range of promising investment targets worldwide and take the approach of selecting the most attractive among newly proposed projects, investment terms that are slightly better than before are not alone sufficient to interest them in the Indian upstream sector. Unless investments in India's upstream sector become

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[27] An underlying factor in India's attempts to attract foreign/private capital under the NELP is the country's need for introduction of capital and advanced technology. In particular, introduction of foreign capital is considered to be a matter of crucial importance not only for new reserve additions but also to stabilize production and enhance the recovery rate (from 26-38% to 35-40%) of Bombay High, India's principal oil field.

[28] The information was gained by our overseas interview survey conducted under this study project.

[29] The first round of bidding, originally scheduled to be closed on May 18, 1999, received a poor response and was

significantly more attractive than comparable projects in other parts of the world, few majors are likely to make large investments. For these reasons alone, India cannot be too optimistic regarding any beneficial effects from the NELP on domestic output.

2-3. Moves in direction of overseas oil/gas development as a means of securing imports

While still hopeful of NELP-based domestic output increases in the future despite present sluggish production levels, India has lately begun adopting a new strategy of launching itself into overseas oil/gas upstream sectors. In terms of energy policy, it aims to secure a stable energy supply by strengthening direct access to overseas resources in response to growing oil imports. For the entities responsible for making upstream investments overseas, this policy provides opportunities to pursue business diversification and improve earnings, while putting their human resources, technologies and others to effective use. There is an additional reason why India has become involved in overseas upstream operations recently. Since the mid-1990s, state-run oil companies in Asia—notably Malaysia's PETRONAS and China's CNPC—have implemented upstream projects overseas[30] and built up a certain presence, which could have an influence on India's moves. China in particular, which has become rapidly and heavily dependent on oil imports after falling into the status of a net oil importer, engaged not only CNPC but also other state-run oil companies in overseas operations. It is likely that this move of China served as an incentive for India to follow suit.

In India, ONGC Videsh Limited, a subsidiary of ONGC, is responsible for overseas upstream operations. The company has started activities in various parts of the world, but cites priority areas such as Russia, the Middle East (e.g., Iraq, Iran), the countries around the Caspian Sea, Latin America (e.g., Venezuela), and Asia. To date, the following achievements have been announced[31]:

- In November 2000, a strategic partnership was concluded with Iraq, based on which the two

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extended three months to August 18, 1999.

[30] On this point, see Ken Koyama, "Oil Supply Security Policy Initiatives Taken by the Asian APEC Economies" (IEEJ, "Website Homepage).

[31] For details, see Yasuhiro Makino, "Indo no enerugi shijo-seisaku doko (IEEJ Website home Page) "

countries agreed to implement exploration in Block 8 near the borders of Kuwait.

- In November 2000, a memorandum of understanding (MOU) was signed with SONATRACH of Algeria, among others, on participation in bidding for the Iraqi Tuba oil field development.
- In November 2000, an MOU was signed with Indonesia's state-run oil company, PERTAMINA, on service cooperation. Based on the MOU, ONGC Videsh is expected to participate in oil/gas exploration in Indonesia.
- In November 2000, an agreement was reached with Venezuela's state-run PDVSA on making investments totaling $100 million in oil exploration/development within Venezuela.
- In February 2001, ONGC Videsh acquired 20% of interests in a Russian project, Sakhalin 1.
- ONGC Videsh participated in the Nam Con Son project in Vietnam jointly with BP and others (interests 45%).

It can be seen from the above that India has been playing an active role particularly since the second half of 2000, and its future moves will be watched with interest.

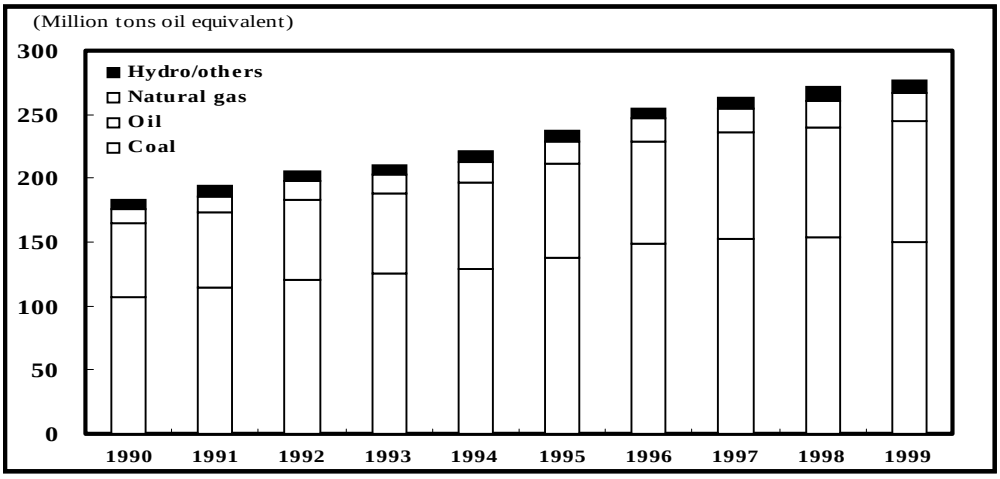
2-4. Reliance on crude oil imports from the Middle East

As already mentioned, India's oil demand has been growing rapidly as a result of its brisk economy. According to the BP Statistics, this growth averaged 5.6%/year from 57.90 million tons in 1990 to 94.80 million tons in 1999. On the other hand, crude oil production remained virtually unchanged, moving only from 34.80 million tons to 36.20 million tons over the same period. As a result, the oil supply-demand gap widened, and this in turn led to a sharp growth in imports. A breakdown of imports (crude oil, petroleum products) reveals conspicuous increases in crude oil imports since the mid-1990s[32]. At the same time, progress has been made in increasing India's refining capacity. Partly as a result of Reliance, a private company, having put its newly built giant refinery (capacity 27 million tons) on stream in July 1999, India's crude oil imports in FY1999

[32] In the mid-1990s, refining capacity failed to keep up with the growing oil demand, and petroleum product imports, particularly diesel, increased considerably. As a result, the share of crude oil imports in total oil imports had plunged to about 60% by FY1995.

reached some 45 million tons and occupied a high 77.5% of total oil imports (Fig. 4).

Fig.4 India's Oil Imports



(Source) Prepared from BP Statistics

Among the constituents of India's crude oil imports in recent years, an increasing share of African crude oil, particularly from Nigeria, has been noted. This is attributable to various factors. Firstly, in view of the greater preponderance of white oils in India's oil demand mix and upgraded specifications (lower sulfur contents) of petroleum products, the Indian refining sector is basically in need of low-sulfur crude oil. Among others, although African crude oil prices are primarily linked to North Sea Brent, the market's supply-demand relations have often made African crudes less expensive, so that crude oil imports from Africa make good sense economically. Nonetheless, although it is true that African crude oil imports have been growing rapidly, Mideast crudes at present still constitute the mainstream of India's crude oil imports. The background to this includes the following factors: (1) The short distance between the Middle East and India means that economic advantages exist in points such as transportation cost. (2) The Middle East has sufficient supply potential to cover India's import requirements. (3) India and the Middle East have long-standing economic/trade relations and have virtually formed a single "market zone." For these reasons, most of India's incremental crude oil requirements are likely to be met by imports from the Middle East.

On the basis of these projections, India has considered a number of projects to build new refineries in joint ventures with the Middle Eastern oil-producing countries[33]. Such projects are expected to be beneficial to both sides: introduction of capital from Middle Eastern oil producers will enable India to mitigate its financial burdens incurred in refinery construction, while stable crude oil supplies can be secured at the same time. The oil-producing countries for their part will be able to secure a stable outlet for their crude oil and gain a foothold in India's vast market place.

In reality, however, most of such refinery projects have been canceled, or have ended in pullouts by the Middle Eastern oil-producing countries. This outcome is the result of various factors. First, new refinery construction involves total investments on an enormous scale. Second, owing partly to the Asian economic crisis, refining margins remain sluggish in Asia, casting doubt on the economic viability of massive investments in the refining sector. Among others, India's moves to deregulate and free its oil downstream sector remain uncertain, as will be discussed later. In addition, it is significant that India, the host country of investments, failed to offer any specially favorable treatments/incentives to the joint venture projects with the Middle Eastern oil-producing countries in return for securing oil imports[34]. In fact, the decision whether or not to support a specific project appears to have been decided on the basis of the respective economics in each case. Basically, both the Middle Eastern oil-producing countries and the majors seem to be highly interested in the Indian market, in which expansion and liberalization are likely to be realized before long. The Middle Eastern oil-producing countries, with their massive crude oil production capacities and interest in acquiring security/expansion of outlets, are expected to continue searching for approaches to India's downstream oil sector while keeping a watchful eye on market trends[35].

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[33] For details, see Yasuhiro Makino (Op. cit.).

[34] As already mentioned, for India to receive oil supplies from the Middle East is sometimes viewed by Indians as being entirely natural. This derives from the concept that, as India is a "natural market" for Middle Eastern crudes, its security should involve no extra cost.

[35] Among recent moves, Kuwait (KPC) is reported considering equity participation in Reliance Refinery and Mangalore Refinery.

2-5. Effects of downstream sector's deregulation/liberalization attracting attention

The consequences of the moves to deregulate petroleum product pricing and free the market are seen as likely to have a powerful impact on the industrial structure of India's oil (downstream) market, and as such are attracting attention. Since the early 1990s, India has made steady progress in deregulation/liberalization of the oil sector by taking such steps as promoting introduction of foreign/private capital into the upstream sector, opening up the refining sector and introducing private investment, and freeing product imports.

Today, the most important regulation still remaining is an oil-pricing rule (subsidy policy) known as the Administered Pricing Mechanism (APM). The APM was originally applied to pricing on overall oil markets (the entire upstream and downstream), but its targets have since been narrowed down. At present, the APM is being applied to retail pricing of four principal products: gasoline, kerosene, LPG and aviation turbine fuel, with the aim of helping to stabilize the people's livelihood and conforming with social policy[36]. Under India's current APM system, state-run oil companies responsible for domestic distribution/marketing[37], among others, acquire the products at the price linked to the international market (Singapore) from the refining/wholesale stages, then sell them at the regulated price. Now however, as a result of the current policy of freeing the economy overall, combined with the need to mitigate financial burdens attributable to subsidization, complete removal of the APM has been called for, and the Indian government has decided to abolish it at the end of March, 2002. This decision results not only in the total elimination of regulated pricing but also in the liberalization of market entries.

Such elimination of regulated pricing and market entry rules in India, whose market is huge and still expanding, is basically a welcome development from the viewpoint of foreign/private capital considering the possibilities of investment/market participation in India. Indeed, the oil-producing countries, majors, India's private firms, etc. have recently started taking various

[36] Prices of gasoline and aviation turbine fuel are kept high, and the resultant revenues are used to fund subsidization of LPG and kerosene.
[37] The four companies primarily responsible for domestic marketing are IOC, HPCL, BPCL and IBP.

measures in preparation for abolition of the APM and market liberalization[38].

In India, however, where poverty is still rampant, cutting subsidies is socially and politically an extremely sensitive issue. Particularly, in the wake of the oil price rises on international oil markets since 1999, there are concerns regarding potentially negative impacts resulting from complete freeing of the market, which could cause domestic prices to become completely linked to international market prices. In view of these considerations, uncertainty is being expressed in certain quarters as to whether India's government actually abolish APM as scheduled[39].

Some have also pointed out that the Indian government may still impose conditions on the entry of would-be market players even if it abolishes the APM and frees the market as scheduled. Namely, the possibility remains that, in return for entry, new market players would be required to invest in the upstream sector and/or in infrastructure projects such as oil pipelines.

Abolition of the APM and market liberalization inherently have implications for oil security policy as well. A good example is the impact on the oil stockpiling policy. India at present depends on imports for more than half of its oil supply. Worse, despite its increasing reliance on imports, India has neither a national oil stockpile nor any stockpiling requirement for oil companies[40]. The reason for this—aside from cost burdens incurred in oil stockpiling—is perhaps that India has a "sense of security" based on the belief that the domestic supply/market is fully under government control, since it is state-run oil companies that are responsible for domestic supply. But once pricing/marketing rules have been completely repealed and various players are active in the market, India will have to examine its stockpiling policy. It is quite probable that market players will then be obliged to conduct stock control/monitoring as well as prescribed amounts of stockpiling in the course of response measures under examination by the government.

At any rate, the present situation does not allow us to predict the effects of abolition of the

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[38] Oil-producing countries and majors, like Saudi ARAMCO and Shell, as well as domestic firms, typically Reliance, are showing interest in market participation.

[39] Many people we interviewed overseas under this study project expressed worry that APM won't be abolished as scheduled.

[40] It is believed that India currently has only about 15 – 30-day commercial stockpiles held by oil companies as necessary stocks for their business operations.

APM and market liberalization. As these are capable of causing drastic changes in India's oil market structure, market players, etc., future developments must be carefully followed.

2-6. Natural gas import plans

Natural gas currently accounts for about 8% of India's total primary energy consumption and occupies the position of third energy source after coal and oil. Natural gas is principally used in power generation and fertilizer production. When combined, the two consuming sectors alone account for about 80% of the country's total natural gas consumption[41].

With these two sectors occupying center stage, India's natural gas consumption grew sharply by 7.5%/year from 12.70 MTOE (12.5 billion cubic meters) in 1990 to 21.40 MTOE (23.7 bcm) in 1999. During the period, natural gas production has grown favorably along with consumption[42], and the entire domestic demand has been met by domestic output. However, it is believed in some quarters that India's "potential demand" for natural gas is greater than its actual consumption, which has been regulated by supply restraints involved in domestic production[43].

The potential demand—i.e., the possibility of expanding consumption— is believed to originate from the two above-mentioned sectors of power generation and fertilizer production. India's basic electricity demand is on the rise in reflection of its economic development, and there is a constant demand for generating fuels. As will be discussed later, while the principal generating fuel is coal, from the viewpoints of environmental conservation in urban areas and accessibility to fuel coal (distance and transport cost from mines), in certain locations natural gas-fired power generation often proves superior. Furthermore, in agriculture-based India, expansion of the fertilizer supply is among top priorities in the country's efforts to increase output and self-sufficiency in foods. This means there is massive demand for fertilizer feedstock. Accordingly, it is considered that once the supply of natural gas becomes sufficiently available at affordable cost,

[41] As of 1998, the natural gas consumption mix consists of fertilizer production 39.4%, power production 38.7%, and other industrial uses 13.4%.
[42] India's natural gas production grew sharply from 11.80 MTOE in 1990 to 22.40 MTOE in 1999.
[43] This view was often expressed by people we interviewed at Indian government organizations, etc.

potential demand will be realized by the same margin as incremental supply, thus leading to expansion of actual consumption.

The first option in boosting the natural gas supply is to increase the domestic natural gas output. At present, India is giving clear-cut priority to this option of enhancing domestic gas production, and is implementing the (previously mentioned) NELP to that end. However, as hopes should not be pinned only on sharp domestic output increases, natural gas imports are under consideration as the second option for increasing supply. Natural gas imports are roughly divided into pipelined imports and LNG imports, and India appears basically to prefer the former. This is because, although distance from the supply source has to be taken into account, pipelined gas supply is considered to be economically advantageous if the other conditions remain constant.

At present, there are two pipeline gas supply projects to India. One is an export project from Bangladesh, and the other from Iran. However, owing to factors such as deviating policies and conflicts with the transit country (Pakistan)[44], neither of these projects stands much chance of realization for the time being. LNG projects have therefore been highlighted in recent years as being more feasible.

A succession of LNG import projects are being considered in major coastal and near-coastal cities from the point of view of favorable transport cost[45]. Particularly on the West Coast, large numbers of projects are being examined or are under way, assuming imports of LNG from the Middle East (Table 1). At present, there are reportedly more than 15 LNG projects targeting the Indian market. Regarding contents and actual states, however, many of these are still at the study stage. The few that are actually in progress include the Dabhol project, Petronet LNG project, Pipavav project and Trombey project.

The most advanced of these is the Dabhol project, which is being carried out under Enron's

[44] As Bangladesh gives top priority to domestic supply, a government permit for the export project is at present unlikely to be granted. The Iranian project also faces many difficulties at home and abroad as the pipeline runs through Pakistan, whose relations with India are tense due to the Kashmir dispute, etc. For details, see Yasuriho Makino (Op.cit.).

[45] For details, see Yasuriho Makino (Op.cit.).

leadership. This project, studies for which were started in the early 1990s, is designed to construct an LNG import terminal, build and operate a power plant, and supply natural gas to gas distribution business in Maharashtra Province[46]. Fueled by naphtha in its first phase, the power plant was commissioned as early as May 1999. The second phase of the power plant includes capacity expansion and fuel switching to LNG. Construction works, etc. at first made good progress toward the second-phase commission slated for November 2001[47].

Table 1 LNG Projects in India

Operators	Location	Province	Initial capacity (Mil. t/y)
DPC (Enron/GE Capital/Bectel/MSEB)	Dabhol	Maharashtra	5.0
PLL (GAIL/ONGC/IOC/BPCL/GDF/RasGas, etc.)	Dahej	Gujarat	5.0
	Cochin	Kerala	2.5
DBEC (Unocal/CMS Energy/Woodside Petroleum, etc.)	Ennore	Tamil-Nadu	2.5
GPLCL (BG/Sea King Engineers/Gujarat state gov., etc.)	Pipavav	Gujarat	5.0
Indigas (Total Fina Elf/TEC/GAIL)	Trombay	Maharashtra	3.0
Shell/Essar	Hazira	Gujarat	2.5
Reliance/TotalFinaElf/Tractebel	Jamnagar	Gujarat	5.0
PLL	Gopalpur	Orissa	5.0
	Mangalore	Karnataka	2.5
AMIG	Gopalpur	Orissa	5.0
KIOLC[48] (IOC/Petronas/Cocanada Port Company Ltd.)	Kakinada	Andhra Pradesh	2.5
Total fina Elf/HPCL	Vizag	Andhra Pradesh	2.5
Core Group	Indefinite	Orissa	7.5

(Source) Prepared from various reference materials.

(Note) Core Group consists of the Indian Farmers Fertilisers Cooperative, Tata Chemicals, GAIL and NTPC. AMIG stands for Al-Mnhal International Group (Abu Dhabi). KIOLC stands for Kakinada Indian Oil LNG Consortium. Beside those named in the table, there are a few projects whose locations and capacities remain indefinite.

[46] LNG receiving capacity is designed at 5.00 million tons. Of this, 2.20 million tons will be used by the power plant built under this project.

[47] With LNG supply scheduled to start in the fourth quarter of 2001, sales-purchase agreements (SPA) were concluded with Oman LNG (20 years, 1.60 million tons) and Adagas (20 years, 480,000 tons). Also, a letter of intent was signed with MLNG Tiga, from which India would buy 2.60 million tons of LNG for 20 years to be used for industrial use.

[48] BP Amoco also expressed its participation in this project (East & West Report, 2001-1-19).

Early in 2000, however, trouble broke out over purchase of electricity from the first-phase power production by the provincial electricity board (MSEB), the electricity buyer. Specifically, MSEB became unable to pay for electricity due to international oil price rises, etc. The incident led to criticism that the project's electricity sales price to MSEB was too high, and the situation deteriorated so much that prospects for the second phase appeared endangered. Enron, the prime organizer of the Dabhol project, decided on a price cut and MSEB agreed to pay part of its obligation, so moves toward a compromised settlement are hoped for. However, no definitive solution has so far been reached.

This serious difficulty for the Dabhol project, which had been seen as going ahead smoothly, plainly revealed the presence of fundamental problems and the magnitude of risks involved in LNG projects in India. These include (1) the fact that LNG is an internationally priced commodity. (2) It remains uncertain whether India, which still at the developing stage, is ready to accept the price determined by the international market. (3) In particular, electricity is at present subsidized primarily for agricultural use, and is therefore low-priced in India. (4) As a result, most of the provincial electricity boards responsible for electricity marketing and distribution are deeply in the red, and there is some doubt regarding their ability to pay for electricity from LNG or similar projects[49].

The outcome of negotiations on the Dabhol project between Enron and the Indian side is likely to have a massive impact not only on the Dabhol project itself but also on the fate of other LNG and energy-related projects. At any rate, although many LNG projects are under consideration, only a limited number of such projects can be realized[50]. The fact is that India can hardly afford the "high prices" of LNG imports conventionally paid by LNG importers in East Asia (Japan, South Korea and Taiwan). A view held by many is that expansion of LNG use in India is unlikely unless more

[49] For details of India's electricity rating problems and its debt-ridden provincial electricity boards, see Yasuriho Makino (Op.cit.).

[50] According to people interviewed under this study project, LNG projects actually starting up will very probably number 1 or 2 at best, with combined receiving capacity remaining at around 5 million tons at maximum for the next five years.

competitive LNG pricing can be achieved.

2-7. Importance of coal in the electricity sector and future challenges

As already mentioned, India has in policy terms committed itself above all to boosting domestic production of oil and natural gas. In the case of oil, however, mounting imports remain unavoidable due to the strong demand. This has led to many big projects for natural gas imports, some of which are under consideration and others already implemented. From this viewpoint, curbing India's rising reliance on energy imports will be no easy task.

From now on, promoting the development/exploitation of "indigenous" principal energies, notably coal and hydro-energy, will be central to solving the issue of increasing reliance on energy imports—i.e., how to maintain/increase self-sufficiency rates for India as a whole. In this context, a crucially important point is which power sources the Indian electricity sector will choose. Namely, as constant growth in India's electricity demand is likely in support of the brisk economy[51], there is an increasing need to secure electricity supply capacity and power development. Under these circumstances, the selection of power sources is expected to have a great impact on India's primary energy mix, supply and demand balances (import needs) by energy source, etc.

The Indian government is adopting the stance of emphasizing development of hydro-power generation, mainly on the grounds that: (1) Ample untapped hydro-potential is still available at home. (2) Hydro use causes less environmental pollution from emissions, etc. (3) With a 61% share held by coal, the present power mix is excessively coal-dominant. In reality, hydro-power development is not always easy, in part because of the long lead time involved. As a result, India currently has few alternatives but to place coal at the center of its power development, because coal resources are abundant and its cost is lower than that of rival fuels[52].

[51] The government outlook (16th Electricity Survey) expects India's electricity demand to soar from 529,013 GWh in 2001 to 1,318,644 GWh by 2010.

[52] According to the (original) power development plan under the ninth five-year plan, supply capacity additions will be made up of 29.5GW of fossil-fuel-fired power (mostly coal), 9.8 GW of hydro, and 0.88 GW of nuclear.

As coal reserves and principal producing areas are unevenly distributed[53], some consuming areas find the transportation and purchase costs of domestic coal high, and consequently choose alternative fuels (e.g., LNG). However, because greater LNG use is limited by the restraints described in the preceding section, LNG can hardly become India's principal generating fuel for the time being. This basically means that coal is likely to continue as India's primary generating fuel for some time to come. In its efforts to promote greater use of domestic coal in the power production sector and also to solve the coal transportation problems, India is planning to supply electricity by building power plants at mines and installing transmission networks[54].

Thus, with efforts to expand coal use concentrating on power production[55], coal will continue to form the mainstream of India's primary energy mix ahead as in the past. For the long term, the Indian government envisages a situation (Hydrocarbon Vision 2025) in which the coal share, though gradually declining, will remain above 50% for the next 25 years. However, there are still many issues to be solved in India's coal sector, including that of environmental conservation and coal grade. Various regulations and restraints are currently imposed on the burning of India's ash-rich coals[56]. As a result, some of the principal coal users/consuming industries (e.g., power producers, steelmakers, cement manufacturers) have initiated coal imports in the hope of procuring coal of the required grade at lower cost. Actually, India's coal imports, which account for a mere 5% or so of the total supply, have been on the rise, reaching 17.21 million tons in 1997. From now on, India's coal industry will need to accelerate the development of power production at mines, the shift in production to higher-grade coals, production cost cuts through rationalization, construction of infrastructure for transport/distribution, and investments in equipment to upgrade coals such as coal washing facilities, etc. Without such measures, even the coal sector is likely to become gradually

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[53] Of India's total coal reserves, 96% is concentrated in the five eastern provinces, including Bihar.

[54] Capacity expansion is not the only issue of importance for India's electricity sector. The problem of how to deal with sizeable transmission/distribution losses, averaging about 20% nationwide, is also crucially important. For details, see Yasuriho Makino (Op.cit.).

[55] The (original) ninth five-year plan stated that India's coal demand would expand from 412 million tons in 2001 to 775 million tons in 2005.

[56] For example, since 1997, power plants situated in urban areas, seriously air-polluted areas, and 1,000 km or more from coal-producing areas have not been allowed to burn coal with ash content of over 34%.

dominated by imports, with India facing the problems of a decline in the domestic coal sector, its principal energy industry, and increased reliance on imports from overseas[57].

Chapter 3 Implications for International Energy Markets and Japan

3-1. Impacts on international energy markets

Energy supply-demand trends in China and India, as well as the policies being applied by the two governments to best meet such trends, both of which have been discussed in the preceding chapters, are likely to produce various impacts on the world's energy markets. First, there will be an impact on international energy markets. This statement leads naturally to the question as to whether or not immense rises in energy consumption and imports by China and India, both already among the world's largest energy consumers, will contribute significantly to tightening future supply and demand in international markets.

Certainly the two countries' burgeoning energy demands will be responsible to a large extent for sharply increasing the world's energy demand from now on. For instance, in the case of oil, for which both China and India rely heavily on imports, the International Energy Agency (IEA) reports in its latest outlook[58] that from 1997 to 2020 the world's total oil demand is expected to increase by about 40 million B/D. Of the increments, about 30 million B/D will come from non-OECD areas, with China and India alone responsible for about one third of the incremental demand from non-OECD areas. It thus appears most likely that these two countries will constitute the prime force in pushing up the world's demand for oil.

However, even taking account of the predicted rises in demand by China and India, the IEA reports in its outlook that such massive rises are not expected to upset the world's oil supply and demand balance in the long run. Global oil demand is projected to soar to 114.7 million B/D by 2020, due largely to demand surges in the two countries. Despite this, the IEA believes it will

[57] Facing steadily increasing coal imports in recent years, the Indian government in May 2000 raised the tariff on coal imports from 15% to 25%.
[58] See IEA, "World Energy Outlook 2000."

basically be possible to expand production as much as is needed on the assumption that the crude oil price (in real terms) will stay moderate at $16.5/bbl in 2010 and $22.5/bbl in 2020. This assumption perhaps reflects the view that recent progress in advanced technology development/application in the oil upstream sector has facilitated production cost cuts, enhanced recovery rates at existing oil fields, and made possible new reserve additions, etc. Even more importantly, the assumption may derive from the view that, with foreign capital invited by the large producing countries including OPEC members, the conditions of supply-expansion investments are improving.

In sum, a study of the whole market in macro terms leads to the conclusion that large rises in the Chinese and Indian oil demand (and imports) are being absorbed by overall supply rises. Such a conclusion, however, does in fact refer to the image and average developments of markets in macro terms. It does not necessarily mean that problems are non-existent: in actual markets, the possibility of decoupling from average developments or occurrence of supply-demand squeezes in the short run cannot always be ruled out. In such an event, it is possible that import conditions or measures taken by China and India would lead to market instability.

In the background to these considerations, one noteworthy fact is that international oil markets today have fewer and fewer buffers that could help in supply-demand adjustments, and the market system itself is becoming increasingly vulnerable to supply-demand fluctuations in the short run. Conventional buffers include OPEC's surplus crude oil production capacity, oil companies' oil stockpiles, and IEA members' emergency oil reserves. More recently, it has been observed that OPEC's surplus capacity has dwindled sharply, oil companies have slimmed down their stockpiles as part of rationalization efforts, and the IEA reserves have become less influential on the world market due to the dwindling share held by IEA members in the world's oil consumption.

Under these circumstances, rapidly rising oil imports by China, India, etc., could place strong pressure on markets to move in the direction of tighter supply and demand and higher prices[59]. This is applicable to normal times also. In particular, such developments can lead to a serious

[59] Actually the surge in China's crude oil imports in 2000, up 90% over the previous year, is thought to have been one of the principal factors that tightened international crude oil markets.

situation if in combination with disruptions to international oil markets that have occurred for some reason or other. The reason for this is that if oil-thirsty countries act solely to satisfy their own import needs while ignoring the legitimate interests of others, this can seriously destabilize markets, particularly in emergencies[60]. Since neither China nor India were principal importers on international markets at the times of past oil crises, they are somewhat lacking in experience in such matters. In other words, as they do not yet have any response measures to demand-supply squeezes and are unprepared for such emergencies, the two countries just deal with such matters as and when they occur.

Accordingly, in order to stabilize international oil markets from now on, it will be essential to relieve and reduce as far as possible the pressures on oil markets exerted by growing Chinese and Indian consumption/imports. In this context, it is a matter of crucial concern that the Chinese and Indian governments should succeed in their policy goals, including energy diversification, development of domestic energy, enhanced energy conservation and construction of oil stockpiling system, all of which are currently under way. Japan for its part must pay sufficient attention to these trends and offer necessary assistance wherever possible.

3-2. Majors and producing countries strengthening commitments to greater investment opportunities

Meanwhile, trends in China and India such as soaring energy demands, policies of introducing foreign capital to facilitate domestic energy development, deregulation and liberalization of energy markets, and reorganization of energy industries, are providing the international energy industry with big investment opportunities. During the turbulent days of sluggish crude oil prices until early 1999 followed by skyrocketing crude oil prices, the international oil/energy industry has undergone a series of reorganization/restructuring moves. Amid the resultant turmoil, major players on the market have been under pressure to introduce streamlining/efficiency-improvement measures, while

[60] On this point, see Ken Koyama & Hitoshi Endo, “Current Situation of Oil Supply Security Problems and Response Measures of Asian Economies” (IEEJ, the 335th Regular Briefing of Research Results, October 31, 1997).

it has become a matter of vital importance to secure promising investment targets for the sake of growth and better earnings in the future. Accordingly, the leading market players—notably the majors and Middle Eastern producing countries (state-run oil companies)—currently appear to have China and India in their sights as priority investment targets.

In fact, the majors and Middle Eastern oil producers have made increasingly aggressive commitments to the Chinese and Indian markets in recent years, and various developments have been noted.

First, an examination of the majors' approaches to the Chinese market shows that, by taking advantage of listing (IPO) of the state-run oil companies (CNPC, SINOPEC, CNOOC), they have strengthened their strategic alliances with them and thus reinforced their commitments to the priority investment sector. Examples of principal investment plans and entries by three majors are outlined below.

a. Exxon Mobil: Invested $1 billion in IPO offered by SINOPEC; have plans to increase the petrochemical capacity of a refinery in Guangzhou, Guangdong, and sell fuels in Guangdong (jointly deploy 500 SSs within three years after formation of a JV); also, retrofitting/expansion of a refinery and construction of a large-scale petrochemical plant, both in Fujin, are under consideration jointly with Saudi ARAMCO (the petrochemical project has already been approved by the government).
b. Royal Dutch Shell: Invested $430 million in IPO offered by SINOPEC, and $200 million in IPO offered by CNOOC; agreed on construction of petrochemical plant in Huizhou, Guangdong; plans fuel marketing in Jiangsu (deploy 500 SSs on a joint venture basis); is participating in gas development in Zhangbei block, Shanxi, as well as construction of gas pipeline to Beijing.
c. BP: Invested $620 million in IPO offered by CNPC (PetroChina), and $400 million in IPO by SINOPEC; is participating in a LNG project in Guangdong; has joined a petrochemical plant project in Shanghai; plans fuel marketing in Zhejiang (deploy 500 SSs on a joint venture basis).

All the majors mentioned above submitted tenders for the "Western Gas to East" scheme, China's

top-priority project, thus revealing actual or planned massive investments largely in gas businesses and oil downstream operations.

In their approaches to India, the majors are also focusing on gas (LNG) businesses and oil downstream operations. Regarding the former, particularly because LNG supply from the Middle East is expected to become the nucleus, the majors are struggling to secure outlets and increase sales of specific LNG projects in which they have become involved[61]. Furthermore, in an effort to secure LNG marketing, moves are also being made toward participation in downstream operations (LNG terminal construction, gas marketing)[62]. Regarding the latter, while carefully watching moves to abolish the APM and liberalize the market as discussed in Chapter 2, the majors are seeking chances to enter downstream oil operations. By trying to establish their brand image through expansion of already freed lubricant marketing, among others, the majors are steadily preparing the ground for a rosy future.

The Middle Eastern oil producers, for their part, intend first to secure and increase sales of crude oil, their most important commodity, in both China and India. One reason for this is their expectation of an enlarging "pie": they feel that oil demand and imports by these countries are likely to keep growing in the long run. They also have other reasons that justify their approach, including the facts that (1) the European/American markets, important outlets so far, are now exposed to intensifying competition from the former Soviet republics, Africa, Latin America, etc., and do not allow easy market expansion, and (2) Asia-bound crude oil can be sold for higher prices than that destined for Europe/America[63].

Notable among their efforts to secure/increase crude oil sales in recent years has been the move to strengthen political/economic relations overall. Particularly with China, commitments to reinforce ties of investment/economic cooperation are noteworthy in having included reciprocal

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[61] For instance, Exxon Mobil is participating in Qatar Gas, Ras Rafan and Yemen Projects, RD Shell in Oman LNG, BP in Adgas, and Total Fina Elf in Qatar Gas, Yemen, Oman and Adgas.

[62] For example, Total Fina Elf is joining in the Trombey project, and RD Shell in the Hazira project. Also, in March 2001, RD Shell announced it had decided on $3-billion investments in gas projects (construction of pipeline and gas-fired power plant) in India.

[63] The so-called "Asia Premium." There was a premium of about $1 – 1.5/bbl on average in 1990 – 1999.

visits by top government officials that covered non-oil sectors as well[64]. Among China-related matters on the table in the past, Saudi ARAMCO considered participation in a joint venture refinery construction project in Shandong and a refinery capacity expansion project in Maoming, Guangdong. These projects in fact failed to reach the stage of agreement. At present, however, with Saudi ARAMCO considering participation in a Fujian refinery capacity expansion project jointly with Exxon Mobil, the Saudis are clearly continuing their aggressive approach.

On the Indian market, too, joint-venture refinery projects have since 1990 been under consideration between Middle Eastern national oil companies and their Indian counterparts. These have included Saudi ARAMCO and HPCL, Kuwait's KPC and IOC, Oman's OOC and BPCL, OOC and Essar Oil, OOC and HPCL, and the UAE's ANDOC and IOC. Although these JV projects have made little progress for reasons already cited[65], the producing countries' interest in the Indian market has basically remained high. More recently, as demonstrated by KPC's plans for equity participation in existing refineries as well as entries by establishing partnership with majors, tentative new approaches have been noted[66]. From now on, the Middle Eastern producing countries are likely to step up their commitments to India, while carefully watching the effects of product pricing deregulation and market liberalization slated for late March 2002. Incidentally, Iran's approach to planned pipeline gas exports now under negotiation is somewhat exceptional among attempts to tap into the Indian gas market, in that most such initiatives at present consist of efforts to increase LNG sales in partnership with majors.

It is thus clear that the majors and producing countries alike intend to conduct aggressive business operations and increase oil and natural gas outlets on the Chinese and Indian markets. Investment projects in China and India are certainly facing various problems and uncertainties,

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[64] When President Jiang Zemin visited Saudi Arabia in November 1999, he signed a MOU on China's increased purchases of Saudi crudes, a Fujin refinery retrofitting/expansion project by Saudi ARAMCO (plus Exxon Mobil), etc. Likewise, when President Khatami of Iran visited Beijing in June 2000, a protocol was signed on China's increased purchases of Iranian crudes and energy cooperation in such fields as LPG exports. In addition, China and Iran have drawn up economic cooperation schemes in non-oil sectors, such as participation by Chinese firms in a subway construction project in Teheran, and Chinese loans to a railway project, etc.

[65] See Chapter 2, 2-4 of this paper.

[66] Good examples are KPC's plans for equity participation in Reliance Refinery, etc., and an alliance between Saudi

including the instability inherent in the developing stage of any market, constantly changing political, economic and energy policies, etc., and risks as such as those that became apparent in India's Dabhol project. Despite such negative considerations, however, the majors and producing countries appear determined to stay with their commitments to entering these markets in pursuit of future growth and earnings.

3-3. Implications for Japan

Japan depends on imports for most of its energy, which forms the basis of the country's economic activity and the lives of its citizens. Accordingly, the trends of the international energy markets, where energy is procured, are of critical significance to Japan's energy security and economic well-being. China and India are in all likelihood about to increase their presence on these international energy markets, and consequently their energy-related trends and policies are of great concern to Japan.

As previously mentioned, China's and India's rising energy demands and imports are unlikely to cause such a serious situation as would result from extreme supply-demand squeezes on international energy markets in macro terms or on average, thanks to the increasing supply capacity. Nevertheless, in the process of market development, rapid expansion of demand and imports in these countries are capable of contributing to market destabilization. Also, in the event that their energy demand and imports expand to a significantly larger extent than currently projected, or that the supply capacity expansion is somehow restrained on international markets, the possibility cannot be ruled out that international supply and demand may start to tighten. From this viewpoint, Japan needs to remain watchful and pay particularly close attention to energy trends in China and India. This is because a constant supply-demand situation, if maintained by China and India without placing excessive pressure on international energy supply-demand or contributing to its destabilization thereof, will have great significance for Japan too.

ARAMCO and RD Shell in downstream operations in Asia region-wide, including India.

Viewed in this way, it would appear advantageous for Japan to offer all possible cooperation in helping to stabilize these countries' energy supply and demand situation. In particular, promotion of the currently highlighted development/utilization of domestic natural gas, more effective use of abundant coal resources, encouragement of energy conservation, and an oil stockpiling system to stabilize markets and strengthen emergency preparedness are now occupying the attention of both the Chinese and Indian governments. These policy goals, which can also be regarded as effective in curbing oil import rises, stabilizing oil markets, reducing environmental loads, etc., deserve to be seen as central themes of future cooperation. It is above all essential for Japan, a country rich in accumulated technology, know-how, knowledge, etc. and experienced in past oil crises as an energy consumer/importer, to extend cooperation in fields where it has comparative advantages by international standards[67].

China and India, where demand is expanding and markets are in the process of opening up to the rest of the world, might be seen by Japanese enterprises as offering ever-greater investment & business chances. In reality, however, it is impossible not to have the impression that Japanese firms are a step behind in approaching these markets. This can perhaps be explained by the facts that: (1) Japan's energy industry, facing an increasingly severe management environment that results from current market liberalization and deregulation, is for the moment giving top priority to improvement of rationalization/efficiency. (2) The industry can now no longer afford massive investments due to its squeezing surplus financial capacity. (3) From their experience of investment/business in non-energy sectors, Japanese enterprises have the general perception that investing in China is not easy. (4) Particularly in regard to upstream investments, Japanese enterprises are generally unable to keep ahead of the majors in terms of capital, technology, experience, etc.

The pursuit of rationalization/efficiency is certainly a matter of vital importance for any firm, but investment is also an imperative for future growth and earnings. For this reason, it is extremely

[67] For instance, cooperation in China's oil stockpiling system construction can be a key point. Indeed, China for its part appears very interested in Japan's experience, technology, know-how, etc. and has great expectations for Japan's cooperation in this field.

important for Japanese firms to create and implement strategies aimed at the Chinese and Indian markets in their efforts to secure a bright future. Recent moves[68] to participate in a Guangdong LNG project and the "Western Gas to East" scheme suggest that Japanese firms are now beginning to consider such commitments. In addition to the oil/gas sectors, investment projects related to energy conservation technologies, upgraded use of coal, etc. can also be promising fields of investment. From now on, based on the real needs of these countries, Japan should step up its commitments to the Chinese and Indian markets particularly in the fields where Japanese firms enjoy comparative superiority in technology, know-how, etc.

[68] With regard to a Guangdong LNG project, Sumitomo Corp./Chubu Electric Power paired with Exxon Mobil, as well as Marubeni/Osaka Gas coupled with Shell, remained on the short list. As for the Western Gas to East scheme, Japan's five leading trading houses passed qualification examinations and submitted tenders for the project.