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COAL AND OIL IN CHINA'S ENERGY SECTOR

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INTRODUCTORY NOTE

The following comments are based on John H. Lichtblau's recent visit to China to participate in a Chinese-American Symposium entitled "Energy Markets and the Future of Energy Demand," sponsored by the U.S. Department of Energy and the State Planning Commission of the People's Republic of China. The symposium was held at the Johns Hopkins University-Nanjing University Center for Chinese and American Studies in Nanjing. The Chinese participants at the symposium presented 18 papers on various aspects of the Chinese energy sector. Further information and views were gathered in Beijing in discussion with Chinese government officials and resident representatives of foreign oil companies.

I. CHINA'S ECONOMIC REFORM

China's economy is in the process of moving from a strictly Marxist economic system based on production allocations and fixed prices set by government agencies to a partially market-oriented economy. In the words of one speaker from the State Planning Commission, China's current economic reform "marks the conversion from the strictly planned product economic management model to the planned commodity economic model." The purpose of the reform is the "creation of a socialist commodity market which will lead to more effective distribution of resources." Most sectors of the economy, including the energy sector, are still largely price-controlled at levels substantially below market values. This is due in part to bureaucratic turf protection but more so to the fear of accelerating the existing inflation rate which has already entered the double-digit range.

Meanwhile the country's economy continues to grow at staggering rates. There is now official recognition that the 11% annual growth rate for total output achieved in the last 5-Year Plan (1981-85) was excessive. However, in the first two years of the current 5-Year Plan (1986-90) the targeted annual rate of 6.7% has been substantially exceeded in both years.

With a population of 1.1 billion, growing at 1.5% a year, an annual per capita income of still only about $500, rapid urbanization and a state-fostered public attitude of rising expectations for material goods, China's principal economic problem in the foreseeable future will be to keep the intrinsic growth in domestic demand from outrunning that of economically available supplies, without causing too many distortions. As we shall discuss in the following pages, this problem applies very much to the Chinese energy sector.

II. THE ROLE OF COAL

China's energy sector is dominated by coal. Last year coal accounted for at least 72% of total primary energy production (including hydropower) and 75% of primary energy consumption. Ten years ago coal's shares were slightly lower, 70% for both production and consumption. Volumetrically, coal production amounted to about 660 million tons of coal equivalent and consumption to 635 million tons in 1987, putting China among the world's three largest coal nations (the two others are the U.S. and the USSR). Coal's dominance is not expected to decline during the remainder of this century. Chinese forecasts project an annual growth rate in total primary energy production of 3.5% between now and the year 2000, while coal production is projected to grow at 4-4.5%. Some of the increase may go into export which last year reached a record level of about 11.5 million tons. But domestic coal demand is projected to rise at least as fast as total energy.

China has of course sufficient coal reserves to meet any of these supply and demand forecasts. However, an energy system of China's size based primarily on coal creates major air pollution problems. The Chinese energy planners are aware of this. In fact, the problem already exists. In South China, for instance, pollution from coal burning is causing recurrent crop damages, according to one paper. But so far very little has been done to contain it. China's electric power stations do not have scrubbers for removing sulfur oxides from flue gases and most raw coal is used directly without processing or cleaning. The pollution is aggravated during the winter by direct combustion of coal in urban areas, the principal urban heating fuel. With the country's growing urbanization, this seasonal pollution source is likely to increase. China is now building its first two nuclear power plants which will be operative by the early 1990's. But by the end of the century nuclear power is projected to account for only 2.5%-3.0% of electricity generation or less than 1% of total domestic energy supply.

One reason for the almost assured increase in domestic coal demand is the rapid growth in electric power demand. A very substantial annual growth rate of 6.7% in electric power generation was achieved in the 6th 5-Year Plan (1981-85) and a just slightly lower rate (6.3%) has been targeted in the current 7th 5-Year Plan. Yet, electric power supply at slightly over 500 billion KWH this year (equal to one-fifth of U.S. generation) remains insufficient to meet actual demand, causing substantial power shortages. According to a non-Chinese analysis, these shortages idled nearly one fifth of the country's industrial capacity in 1987. A Chinese estimate puts the power shortage at 50 billion KWH annually, equal to about 10% of total electric power output in 1987. Thus, if China's economy is to grow at anywhere near the foreseen rates, electric power generation will have to keep pace, and with it will the growth in coal burning for this purpose. Hydropower which currently accounts for 20% of total power generation is not expected to increase its share between now and the year 2000.

To comprehend the full magnitude of coal in China's energy supply it must be kept in mind that while coal is, by far, the principal source of electric power generation, this market accounts for less than 25% of China's total coal consumption. Coal is a major energy supplier to every sector of the Chinese economy, even transportation (coal supplies 80% of railroad fuels). Thus, increased air pollution and its environmental consequences may be part of the price the country has to pay for the remarkable speed of its industrialization and rise in living standards.

Natural gas is unlikely to alleviate this situation significantly over the next 12 years. China's proved natural gas reserves are relatively small, about 31 TCF, while current annual production of 0.5 TCF supplies only 2% of total energy requirements. By 2000 gas production may have risen to 1.5-1.8 TCF, according to a macro-economic energy forecast presented at

the symposium. While this would be a large percentage increase, the additional gas would displace only about 50 million tons of coal out of a total of perhaps 1 billion tons burned by then.

III. THE OIL SECTOR

In the oil sector both supply and demand are expected to grow throughout the remainder of the century. But under the existing price policy, potential demand will rise more rapidly than physical output. Thus, the country will either experience oil shortages or it will have to raise its domestic price substantially above the current artificially low level (relative to world prices), or it will have to reduce its oil exports to supply the domestic market. Most likely, we will see a combination of all of these means to balance domestic supply and demand.

The 7th 5-Year Plan (1986-90) shows clear signs of the oil dilemma facing China's economic policy makers. Unlike in the 6th Plan when the growth rate in production run substantially ahead of that in demand, in the current Plan production is now expected to rise by only 3.1% annually, or by a total of 400 MB/D during the 5-Year period, while consumption is expected to rise by nearly 5.5% annually, or by a total of 560 MB/D. This would leave about 500 MB/D for exports in 1990, compared to 730,000 B/D in 1985. The 130 MB/D decline in oil exports between 1985 and 1987 and the apparent further decline this year reflects the reality of these trends.

A. Oil Supplies

In the 7th 5-Year Plan Chinese oil production was initially projected to grow at 3.7% annually to 3 million B/D by 1990. This target has now semi-officially been reduced to 2.9 million B/D, which would imply a growth rate of only 3.1% over the 5-Year period (or a 2.5% rate from last year's level of 2.68 MB/D). A major reason for the slower growth rate is the leveling off in production of China's aging major field, Daqing, which had reached its peak of 1 million B/D about seven years ago. In fact, unless substantial investments in secondary recovery techniques are made, Daqing production is likely to start declining in the near future. According to one resident foreign oil expert in Beijing, the decline has already begun as a consequence of previous overproduction, with current output below 900,000 B/D. China's second largest field, Shengli, is currently producing 700,000 B/D and apparently has the potential to increase to 1 million B/D. However, Shengli crude is heavier than Daqing crude and therefore less suited to meet the rapid growth in domestic light products demand, discussed in the next section.

A major complaint of the Chinese National Petroleum Company is that it receives only $26/ton ($3.50-4.00/bbl) for the first 100 million tons (2 million B/D) of its production from Sinochem, the state refining company. Production above that level is sold at higher but still controlled prices if used domestically and at world prices if exported. Thus, currently some 70% of China's crude production is transferred from producer to refiner at a fraction of its world market value. The National Petroleum Company argues that with higher revenue it could engage in more secondary recovery, exploration activities, etc. The argument is reminiscent of that made by U.S. oil producers in the 1970's when prices for old oil were frozen at their historical level while newly discovered oil carried no price restrictions. The National Petroleum Company believes that as part of the general economic reform which is trying to relate prices to market value, this system of crude pricing will be gradually modified.

According to various Chinese projections, production by the year 2000 will range between 3.7 and 5.5 million B/D, with 4 million B/D the most widely quoted and accepted forecast figure. The 4 million B/D would mean an annual growth rate of about 3.3% from 1990 to 2000. This is considered feasible but would require considerable effort, particularly if Daqing production declines during this period, as is likely.

One area of growth, offshore production, has so far yielded relatively little new oil despite intensive exploration activities first by China alone and since 1979 in cooperation with a substantial number of foreign companies (45 companies from 12 countries, including geophysical survey agreements). Despite a good success ratio in exploratory drilling -- 33 oil and gas discoveries on 106 geological structures tested -- total production this year will be only about 16-18,000 B/D from two fields in the Bohai Sea. During 1989 offshore production could reach 25,000 B/D and by 1991-92 60,000-65,000 B/D. While this is of course a welcome development for China, most foreign oil companies operating in the offshore area appear to be less than enthusiastic about the economics of their prospects, at least so far. The decisions to explore were made before 1986 and assumed prices closer to the $25 area than the current $15 area. Also, some of the finds consist of relatively low-value heavy crude (17-22 API gravity) and have low reservoir pressure.

The steady reduction in offshore exploration investments by foreign companies -- from $500 million a year in 1984 and 1985 to $270 million in 1986, $200 million in 1987 and perhaps even less this year -- reflects the reduced economic attraction of Chinese offshore exploration. However, an interesting discovery has recently been made in the Pearl River Mouth basin in the South China Sea, suggesting a relatively large potential in this region, according to Chinese oil officials. The third round of offshore bidding for foreign companies which will get under way later this year will give an indication of the degree of continuing foreign interest in China's offshore area. The new bidding terms are more attractive and flexible than the previous

ones, reflecting China's recognition of the reasons for the decline in foreign investment.

The biggest potential for new production appears to lie in the Northwest in the Basins of Tarim-North and Junggar. According to private industry comments as well as unofficial government estimates, the region has a gigantic oil potential. Reportedly, one or two wells with very large initial flow rates have already been drilled. So far, the project is entirely in the hands of the National Petroleum Corporation, with no foreign participation, as are most other onshore projects.

The principal and perhaps insurmountable problem of developing the production potential in the Northwest is transportation. To transport the oil to the eastern markets or seaports would require a large-diameter pipeline of more than 3,000 miles, an undertaking far beyond the technical and financial capability of the Chinese economy for at least the remainder of this century. Up to 8-9 million tons (160-180,000 B/D) of production could be carried to markets in tank cars by the existing railroad system, according to China oil company officials. But if the current very preliminary estimates prove correct, the region's ultimate production would be a multiple of this volume. Clearly, a project of this size could only be undertaken with a consortium of foreign oil companies and some international guarantee, perhaps through World Bank participation, of the pipeline's long-term profitability. Several government speakers recommended foreign participation in developing the Northwestern oil potential. Some consideration is also being given to building the pipeline through Pakistan which would be a considerably shorter distance to the sa. But there may be political risks in going this route.

B. Oil Demand

Chinese oil demand by the year 2000 is projected at about 4 million B/D by the Institute of Nuclear Technology's mid-range forecast. This would reflect an annual growth rate of 5% from 1987 on, or about the same as the 4.9% rate during the most recent 5-Year period (1982-87). Some other forecasts are lower but a growth rate of 4% would appear to be minimum, given the expected 7-8% growth rate of the economy during this period. The major factor in the growth of oil demand is the transportation sector which is targeted to rise at 7.7% annually for freight traffic and 9.9% annually for passenger traffic during the current 5-Year Plan. For the period 1985-2000, the State Planning Commission projects a growth in the oil demand for transportation of 7.1% annually, or from 392,000 B/D to 1.1 million B/D. This would raise the transportation share of total oil consumption from 21% in 1985 to 27-28% by 2000. Since coal and waterpower will approximately maintain their current share of total energy demand between now and the end of the century and natural gas's share is expected to increase only modestly (from 2.3% in 1987 to 5% in 2000), oil consumption for purposes other

than transportation will continue to grow along with total energy demand. Thus, by 2000 domestic oil demand and supply will be approximately in balance, leaving almost no surplus for exports, unless a change in government domestic pricing and allocation policy reduces the foreseen demand growth rate in order to maintain a significant export market.

C. Oil Exports/Imports

Most observers agree that some oil exports will be maintained at the expense of the domestic market because of the priority of foreign exchange requirements. (Last year's $3.7 billion of oil exports accounted for 9% of China's total merchandise export). However, while several government officials have expressed the view that exports would be stabilized near 500,000 B/D in the 1990's, or about 75,000-100,000 B/D below this year's level, informed foreign observers believe exports will steadily decline to half that rate or less by the end of the century. This year's export level of about 580,000 B/D is 20% below the 1985 peak, with a decline registered every year.

Within the total export volume, refined products which accounted for over 100,000 B/D in the 1980-85 period, will be largely phased out, since China will need all domestically produced light and middle distillate products to meet its internal requirements. China is currently importing some 40,000 B/D of light products under a processing agreement for its crude with Singapore refiners. This is approximately equal to half its exports of these products. In the 1990's China is likely to become a net importer of light and middle distillate products.

The level of these product imports will depend on the size of the distillation and conversion facilities of the country's refining industry. Current distillation capacity is about 2.1 million B/D and fuel oil upgrading capability is estimated at 35%-40% of distillation capacity. Under existing expansion plans both are to be raised by about 450 MB/D by 1990.

If demand is to rise to 3.7-4.0 million B/D by 2000, with all of the increase in light and middle distillate products, the current expansions will be insufficient by the mid-1990's. Given the high foreign exchange capital cost of further expansions, an increase in processing arrangements with Singapore and other refineries in the Pacific region can be expected. However, since all Pacific markets are registering sharp increases in the demand for light and middle distillate products, along with declines in residual fuel oil demand, the cost of these processing arrangements may rise in the future.

Table I

CHINA'S ENERGY PRODUCTION AND CONSUMPTION AND STRUCTURE

	Energy Production					Energy Consumption				
Year	Total (MTCE)*	Raw Coal (Shares %)	Crude Oil (Shares %)	Natural Gas (Shares %)	Hydro Power (Shares %)	Total (MTCE)*	Raw Coal (Shares %)	Crude Oil (Shares %)	Natural Gas (Shares %)	Hydro Power (Shares %)
1970	309.9	81.6	14.1	1.2	3.1	292.9	80.9	14.7	0.9	3.5
1975	487.5	70.6	22.6	2.4	4.1	454.3	71.9	21.1	2.5	4.6
1980	637.4	69.5	23.7	3.0	3.8	602.8	72.2	20.8	3.1	4.0
1985	855.5	72.8	20.9	2.0	4.3	770.2	75.2	17.0	2.2	4.8
1987	910.0	72.2	21.0	2.2	4.6	845.0	75.1	17.6	2.3	5.0

* million tons of coal equivalent

Table II

CHINA'S OIL CONSUMPTION AND PRODUCTION

(million B/D)

	Consumption	Growth * (%)	Production	Growth * (%)
1975	1.34		1.54	
1980	1.75	5.5	2.12	6.5
1985	1.83	0.9	2.49	3.3
1987	2.08	6.6	2.68	3.7
1990(gov't forecast)	2.39	4.8	2.89	2.5

* Average annual growth rate from previous year shown.

Table III

CHINA'S NET OIL EXPORTS

(Thousand B/D)

	Crude	Product	Total
1983	297	108	405
1984	440	125	565
1985	600	133	733
1986	570	70	640
1987	545	59	604
1988 est'd	530	48	578