China's Energy Policy: Energy and Economic Development

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Until the early 1970s China exported very little coal or oil. In 1978-79 decisions were made to modernize the economy by means of imported technology and capital goods and that meant China had to export more in order to pay for those imports. Energy exports, particularly oil, became an important source of foreign exchange. However, the increasing need for energy brought on by modernization has created a problem for China. With only limited amounts of oil available, it has been necessary to choose between meeting internal demand and exporting energy. In response China is, inter alia, *substituting coal for oil internally and also expanding its exports of coal. Until the Chinese are able to produce other goods for export, energy will continue to be an important source of foreign exchange.*

Avant le début des années 1970 la Chine a exporté très peu de charbon et de pétrole. En 1978-79 des décisions ont été prises en vue de moderniser l'économie du pays grâce à l'importation de technologie et de capitaux. Afin de financer cette importation la Chine a dû augmenter ses exportations et l'énergie, en particulier le pétrole, est devenue une source importante de devises étrangères. Cependant, à cause de la modernisation, les besoins croissants pour l'énergie ont créé un problème pour la Chine. Les quantités limitées de pétrole l'ont contrainte à choisir entre la demande interne et l'exportation de l'énergie. Par conséquent la Chine fait, entre autres, le remplacement du pétrole par le charbon en consommation domestique et augmente aussi ses exportations de charbon. Jusqu'à ce que la Chine puisse produire d'autres denrées pour l'exportation, la vente extérieure de l'énergie continuera à constituer une source importante de devises étrangères.

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In the space of a few years, China, the world's leading coal producer and the sixth largest oil producer, has become a significant force in international energy markets, particularly in Asia. The transition from self-sufficiency to the status of net exporter of coal, and more so of oil, is certainly a significant change. Moreover, with the "opening up" of the Chinese economy, exports in general, and energy exports in particular, have taken on a new, direct role in the country's economic development strategy.

The export program has introduced new constraints into China's energy system. They can be summed up with a question: what choice is to be made between production for export and production for domestic energy needs, which are enormous and far from totally satisfied? How are we to understand, furthermore, why China chose the route of oil exports at a time when it was importing substantial amounts of petrochemical products? There appears to be a paradox in Chinese energy policy. It can be understood only through an analysis of the logic

of those exports and their role in foreign trade.

Modernization of the economy will inevitably lead to increased energy consumption. Thus the constraints referred to above bear directly on any attempt to forecast the continuing role of China in international energy markets. Will China still be a significant exporter of hydrocarbons in 1990-1995? Will the Chinese sacrifice a tradition of internal self-sufficiency in energy to a strategy of accelerated development?

1. China's Entry into International Markets: 1978-1987

1.1 From Self-Sufficiency to Energy Exports

China became a significant force in international energy markets in the late 1970s and early 1980s, with nearly 40.4 million tonnes of oil equivalent (Mtoe) exported in 1985. Before 1973 China's oil and coal exports were relatively small (Tables 1 and 2). In large part this reflected a policy of self-sufficiency which was characteristic of China's economic strategy at that time. The years following the first oil shock saw a change in China's oil export policy and by 1985 the very high annual increases in volumes exported made China the leading oil exporter of East Asia. At the same time, coal exports (almost 10 million tonnes (Mt) in 1986) were far from neglected (Table 2). The Seventh Five-Year Plan (1986-1990) envisages exports of 30 Mt of coal in 1990 (*International Bulk Journal*, 1987).

Over 67% of China's crude oil exports and 95% of its coal exports went to Asian countries in 1985. As a leading trading partner, Japan occupies an important place, although a declining one, in China's oil and coal trade. In 1986, 37.8% of Chinese crude oil was bought by Japan. This figure was 75.9% in 1975 (Table 1). The importance of the region for China is also apparent from the level of its exports of oil products. Between 75% and 85% of its naphtha exports go to Japan (Fridley and Johnson, 1985). In the case of exports of oil products, it seems that each type of product is destined primarily for a specific market. For example, in 1982, 80% of its gasoline exports went to the United States (Fesharaki and Fridley, 1986).

China's coal exports are likewise characterized by dependence on certain countries and on trade focused on the Asian region. In 1985, 46.9% of its coal exports went to Japan. Two of China's main trading partners stand out: North Korea, which takes 23.1% of its coal exports, and Hong Kong, which takes 15.1% of its coal exports (Table 2). China certainly benefits from its very competitive position close to those consumption centres, for that keeps shipping costs very low (World Bank, 1985).

In recent years, however, China has pursued a policy of energy export diversification. This trend is clear in the case of crude oil, less so in the case of coal. Countries such as the United States, Brazil, and even Italy, are becoming energy export markets for China. In this context Singapore plays a special role in crude oil trade. This trade has grown constantly since 1981, for Singapore is one of the main refining points for China's crude (Table 1). Part of this refined crude (about 70%)[1] is bought back by Sinochem (National Chemical Import-Export Corporation), which handles China's petroleum exports and imports. It is significant that most of the refined products are destined for export (Fesharaki and Fridley, 1986, p.26). The recent five-year contracts for coal signed with the United Kingdom are certainly consistent with a diversification strategy. In short, China now plays a significant role in the international trade of energy, with the sole exception of natural gas.

1.2 New Characteristics of China's Energy Policy

The main features of China's energy policy were determined in 1979 (Bai Yiyuan, 1986). Following declines in oil and coal production during the period of "readjustment" (1980-1982), that policy was designed to satisfy domestic needs. But the choices that guided it suggested a possible

1 / Of the 160,000 b/d of crude exported to Singapore in 1986, 120,000 b/d were refined. Cited in *Petroleum Economist* (1987c).

According to *Bulletin de l'Industrie Pétrolière* (1987), 95,000 b/d of Chinese crude were refined in Singapore in 1987.

Table 1: Evolution of China's Crude Oil Exports from 1975 to 1988 (million toe)

	1975	1978	1979	1980	1981	1982	1983	1984	1985	1986	1897	1988
Japan	7.85	7.50	7.35	7.85	8.85	8.80	9.28	10.98	11.04	11.34		
North Korea	n.a.	n.a.	1.50	1.60	1.60	n.a.	n.a.	1.30	1.20	n.a.		
Philippines	0.40	1.15	1.00	0.90	0.60	0.65	0.40	0.75	1.25	n.a.		
Singapore	0.00	n.a.	0.00	0.02	0.29	0.50	0.18	3.08	8.30	8.00		
Thailand	0.00	n.a.	0.78	0.56	0.34	0.10	0.15	0.10	n.a.	n.a.		
United States	0.00	0.00	0.55	0.10	0.00	0.85	0.35	1.10	1.40	4.10		
Brazil	0.00	0.05	0.80	1.20	1.50	1.55	2.70	2.35	2.35	n.a.		
Italy	0.00	n.a.	0.41	0.16	0.00	0.00	0.00	0.22	0.22			
Romania	n.a.	n.a.	1.00	1.00	0.90	0.85	n.a.	0.63	0.52	n.a.		
Total exports:												
crude oil	9.88	11.30	13.40	13.40	14.00	15.20	15.19	22.29	30.03	28.05	27.20	26.05
crude & oil products	11.98	13.49	16.47	17.51	18.35	20.48	20.31	28.11	36.20	33.96	32.20	30.80

Sources:
Oil and Gas Journal (1988b) 'China's petroleum exports face slide,' (4 January).
Statistical Yearbook of China (1985; 1986).
Johnson, T. (1987) *China: Energy Sector Outlook ETU.*
Le Pétrole et le Gas Arabes (1987) No.432 (17 March).

Table 2: Evolution of China's Coal Exports (millions of tons)

	1970	1975	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Japan					2.10	2.79	3.72	3.41	3.85	3.55	3.60	4.26	4.60
North Korea								2.08	2.00	1.75	1.69	1.91	
Hong Kong								0.49	0.65	1.14	2.00	3.13	
Philippines									0.29	0.79	1.10	1.20	
Malaysia									0.01	0.05	0.19	0.10	
Singapore									0.02	0.06	0.07		
Thailand										0.00			
Belgium								0.13	0.14	0.14	0.20	0.13	
France										0.03	0.40	0.40	
Netherlands										0.05	0.14	0.23	
United Kingdom										0.02		0.21	
Total	2.27	3.00	3.12	4.63	6.32	6.57	6.44	6.56	6.96	7.60	9.90	13.50	15.60

Sources:
Coal Statistical Yearbook of China (various years)
Almanac of China's Foreign Relations
Statistical Yearbook of China (various years)
JETRO, *China Newsletter* No. 80, Mai-Juin 1989, p.28.

intention to export energy, for they were based on two main policies: development of supply and attempts to manage energy demand. The latter effort — involving fuel substitution and the promotion of more economical energy consumption — is rather innovative in the context of planned economies.

Those two policies enabled China to move rapidly from energy self-sufficiency to the status of a net energy exporter. Policies of energy de-

velopment and control are apparent in the Seventh Five-Year Plan (1986-1990), which is characterized by the desire to increase energy production but also to reduce energy consumption. (see Annex 1 and Chart 1, pp. 149-150.)

INCREASE IN ENERGY PRODUCTION

The increase in China's energy exports was made possible by large production increases, as shown in Table 3. From 1982 both coal and oil production recorded high growth rates, comparable to those of the 1960s and 1970s. The 1982-1988 production increases were 34.1% for oil and 44.1% for coal.

While the declines in energy production in the early 1980s marked the limits of a development mode characterized by centralized resource management, the recent increases have been due to the introduction of new economic arrangements. For both oil and coal, the production increases are connected with three main factors:

- price reforms;
- recourse to foreign technology and capital;
- modernization of existing production capacities.

The introduction of new price mechanisms, the "two-tier price system" (Citoleux, 1986), seems to have been a powerful factor in bringing about the production increase, especially for coal where output of 920 Mt was achieved in 1987. The two-tier price system allows enterprises, once they have achieved their production quotas, to sell their surplus on the open market at market-determined prices. The established state system is organized around prices, held very low for many years, which reflect the political desire to achieve rapid industrialization. For example, in some parts of the country the "market" price of coal in 1984 was eight times the price set by the state (Johnson, 1987, p.25). In the case of oil the market price was close to the international level, while the state price was only 100 yuan/t; i.e., $3.70/barrel (US dollars) at the official rate of exchange (Johnson, 1987, p.36).

The impact of price reform on the output of small local coal mines occurred rapidly. In 1985, 86% of increased coal production was due to increased output by these mines (China. Ministry of Coal Industry, 1987). Almost all of this higher output is traded at uncontrolled prices, for less than 13.5% of the coal produced by small local mines is marketed through the State distribution system (Johnson, 1987, p.25).

Price reform was accompanied by a policy of modernization of energy industries brought about with the help of foreign technology and capital. China faced technological problems because of its dependence on old equipment, unsuited to production conditions, and relatively few mines were mechanized. Only 45% of those run by the state were mechanized in 1985 (China. Ministry of Coal Industry, 1987, p.10). Thus China had to grapple with productivity problems due both to the technology it was using and to its dependence on centralized management in energy industries (World Bank, 1985, pp.88-124).

The Chinese government's modernization effort is very selective and focused on a few big projects. Where coal is concerned, for example, priority is given to the big state mines located in coal-rich Shanxi province. In the oil sector, the introduction of foreign technology and capital has aroused the most comment, especially with the opening up of China's offshore waters to international oil companies. Concessions to explore for oil offshore were obtained by 31 companies during the first invitation to tender in 1982, and by 20 companies during the second such exercise in 1985 (Johnson, 1987, pp.46-47). This new policy was extended to China's onshore in July 1985 with the opening up of 10 coastal provinces in the south of the country to international oil companies (*Bulletin de l'Industrie Pétrolière*, 1986). A third round of offshore exploration was opened in 1989 (*Petroleum Economist*, 1989).

Higher oil production since 1982 has, however, been due primarily to the efforts made in the modernization and maintenance of onshore oil fields. The increased production from the Daqing field, for example, stems from the introduction of new technology and equipment designed to increase the lifting rate (Fingar, 1986). Offshore production accounted for under 2% of total oil production in 1986 (*Petroleum Economist*, 1987a).

Table 3: Evolution of China's Oil and Coal Production from 1970 to 1988

	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Coal production															
Mt	354.0	482.0	483.0	550.0	618.0	635.0	620.0	622.0	666.0	715.0	789.0	872.0	883.0	920.0	960.0
Mtoe[1]	173.5	236.2	236.7	269.5	302.8	311.2	303.8	304.8	326.3	350.4	386.6	427.3	432.7	450.8	470.4
Oil production															
Mt	30.7	77.1	87.2	93.6	104.1	106.2	101.2	101.2	102.1	106.1	114.6	124.8	130.7	134.0	136.9

Sources:
Statistical Yearbook of China (various years)
Beijing Information (7 March 1988).
China Newsletter (1989) JETRO No. 79 (March-April), p.4.

Notes:
1/ The equivalence coefficient used is 1 tonne x 0.49 = 1 toe.

The new energy policy involved another important break with the past. In the 1960s and 1970s the Chinese mainly emphasized production, rather than exploration, modernization and maintenance (Fingar, 1986, p.2). The emphasis on production resulted in inadequate renewal of reserves and was largely responsible for the difficulties encountered in the energy sector at that time (Keith, 1986). This result demonstrates the influence of the organizational methods used in a centrally planned economy, in which quantitative production targets take priority over all other considerations.

With this strategy abandoned, major efforts are now being made with respect to exploration. Because energy has been designated a priority sector, the Seventh Five-year Plan provides for an investment in exploration of 117.7 billion yuan, as compared to 69.9 billion yuan in the Sixth Plan (1980-1985), and this despite very large increases in 1984 and 1985. In 1982, for which an estimate is available, 8.6 billion yuan were allocated to exploration. By comparison, the amount allocated to exploration was under 1.5 billion yuan in 1979, 1980 and 1981 (China. State Statistical Bureau, 1985).

MANAGING ENERGY CONSUMPTION

The amount of oil available for export has been affected by policy actions on the demand-side as well as by the supply-side policies referred to above. China's demand-side energy policy involves a search for more efficient energy consumption techniques and the substitution of coal for oil.

The potential for improved energy efficiency is large. Like other planned-economies, China is a big consumer of energy. Energy-intensive heavy industry accounted for 57% of industrial production in 1978. Wasted energy is easy to find in economies in which management methods offer little incentive for the economical use of inputs. Thus China's energy conservation policy has had some degree of success. As a rough evaluation, the energy intensity, calculated as the ratio of the consumption of primary commercial energy to national income, fell from 1.76 in 1978 to 1.50 in 1982.[2] According to Chinese estimates, energy savings of 90 Mtoe between 1979 and 1983 can be attributed to energy conservation policies (Cordes, 1984, p.21).

The second aim of China's demand management policy is coal-oil substitution. This is a dominant feature of the changing structure of China's energy consumption: coal accounted for 75.9% of the 405.8 Mtoe consumed in 1985, as against 69.9% in 1976 (China. State Statistical

2/ Own calculations based on data of the International Monetary Fund for national income and on data from *Statistical Yearbook of China 1986* (China. State Statistical Bureau, 1986) for energy consumption.

Annex 1: China's Energy Situation: Some Specifics

Coal predominates in China's production and consumption of primary energy. In 1985 it accounted for 75.1% of production and 78.7% of consumption and thus guaranteed the country's "energy independence." In contrast, at under 22%, oil plays a small part in consumption. Consumption of natural gas is negligible, at under 2%. The energy balance-sheet for 1985 records these features (see Chart 1).

Despite this independence, China has to cope with extremely restrictive geographical factors due to the location of its energy resources. The main deposits are far from consumption centres. For example, 70% of its coal reserves are in the North, including one-third in Shanxi province. The five oil fields which provide over 80% of its oil production (Daqing, Shengli, Huabei, Liahoe and Zongyuan), are all located in the North and North-East parts of the country.

In 1985 electricity production totalled 410.7 TWh (35.4 Mtoe), with 80% derived from the burning of coal. In addition to its thermal resources China has considerable hydraulic resources, in fact the largest potential resources in the world. But they are located in the South-West, again far from consumption centres, and therefore difficult to exploit.

China's energy consumption is heavily dominated by the industrial sector, which accounted for 60% of final energy consumption in 1985. In contrast, the share of the transport and residential-tertiary sectors remains low. Traditional sources of energy (vegetable wastes, wood, etc.) still have a large role in Chinese energy consumption. According to World Bank estimates, they accounted for at least 25% of consumption in 1980.

The energy production goals of the Seventh Five-Year Plan (1986-1990) ought not to bring about any fundamental changes in the established balances, except perhaps in the case of natural gas. Fairly rapid development of natural gas production is envisaged. The targets are as follows:

	1987	1990	2000
Oil production (Mt)	134	150	200
Coal production (Mt)	920	1000	1400
Gas production (billions of m^3)	12 [1]	17	25
Electricity production (billions of kWh)	496	570	1200
Refining capacity (Mt)	100 [2]	130	

Notes: 1/ 1985 value 2/ 1986 value

As well as the development of energy supplies, the above objectives reflect the intention to apply a demand management policy. According to the objectives of the Plan, the consumption of primary energy should be 694 Mtoe in 1990.

Despite the ambitious goals set out in the Plan, one of the main uncertainties facing China in the coming years is the increase in oil production. Variation in reserve estimates makes forecasting difficult and China does not publish official data on this topic. All that we have, therefore, are conflicting evaluations; for example, the following are estimates of proven reserves:

- 17.3 billion tonnes as of 1 January 1986, according to DOE/EIA
- 2.4 billion tonnes in 1986 according to BP
- 2.5 billion tonnes in 1987 according to CPDP
- 7.0 billion tonnes according to the Chinese sources cited by CPDP
- 5.5 billion tonnes in 1985 according to the World Bank

The estimates published by DOE in the US are thus very much higher than those of the majority of Western experts.

Chart 1: China's 1985 Energy Balance (Mtoe)

	Coal	Coke	Oil	Oil Products	Natural Gas	Hydro Electricity	Electricity	Total
Production	436.15		124.90		12.04	7.95		581.04
Import	1.66	0.01	1.27	0.32				3.26
Export	-3.89	-0.37	-30.03	-6.83				-41.12
Stock Variation	-15.12	-0.04	-1.04	3.84				-12.72
Primary Consumption	418.80	-0.76	95.10	-2.67	12.04	7.95		530.46
Supply	408.20	-0.76	95.10	-3.72	12.04	7.95		518.63
Coal Industry	-36.52	32.61						-3.91
Refining			-85.89	85.11				-0.78
Electricity	-87.95		-3.41	-10.75		-7.95	35.41	-74.65
Losses	-18.61		-0.24				-2.61	-21.46
Final Consumption	264.94	31.85	5.56	70.64	12.04		32.80	412.83
Agriculture	18.77	0.30	0.01	7.18			3.58	29.84
Industry	115.97	31.42	4.36	17.38	10.20		24.77	204.09
Transport	11.54	0.04	0.44	20.70	0.01		0.55	33.28
Households	101.64			2.15	0.42		1.91	106.12
Other Sectors	8.55	0.08	0.75	4.23	1.41		1.99	17.01
Non-energy uses	8.47			19.01				27.48

Source:
The Study of China's Energy Utilization and Policies for Comparison with India (1987) (Beijing: Institute of Nuclear Energy Technology; Institute for Techno-Economics and Energy System Analysis).

Note:
Losses and own-consumption of the energy sector are included in the industrial sector.

Bureau, 1986, p.249). This increase in coal consumption came about largely at the expense of oil, which accounted for only 20.9% of energy consumption in 1985, compared to 24.7% in 1976. It indicates an important change in China's energy policy, which in the 1970s was to replace coal with oil, particularly in thermal power stations. This "return to coal" is fundamental. It demonstrates China's determination to use less oil, and at least part of the oil saved is destined for export.

Savings in oil are being encouraged by measures which are an extension of broader economic reforms. In brief, they involve price increases imposed in conjunction with consumption regulation. Enterprises which exceed their consumption quotas have to obtain their supplies from the free market, where price rises have been very large. Specific taxes on oil were introduced in July 1982: 40 to 70 yuan/t on crude and 70 yuan/t on heavy fuel oil (Cordes, 1984, p.2). The energy conservation program has involved modernization (especially by means of imported technology), the merger of enterprises and the closure of many small enterprises, inherited from the Maoist period, which were heavy consumers of energy. Probably the most important factor, however, has been "economic restructuring", which explains some two-thirds of the energy savings, according to the official data (Brown, 1986). The restructuring has favoured faster growth of light over heavy industries, which should consume 4.5 times less energy per unit of value produced (World Bank, 1985, p.69). Light industry accounted for 51% of industrial production in 1981 as against 42% in 1978 (China. State Statistical Bureau, 1986).

Figure 1: Principal Coal Centres of China. (From map of CPDP.)

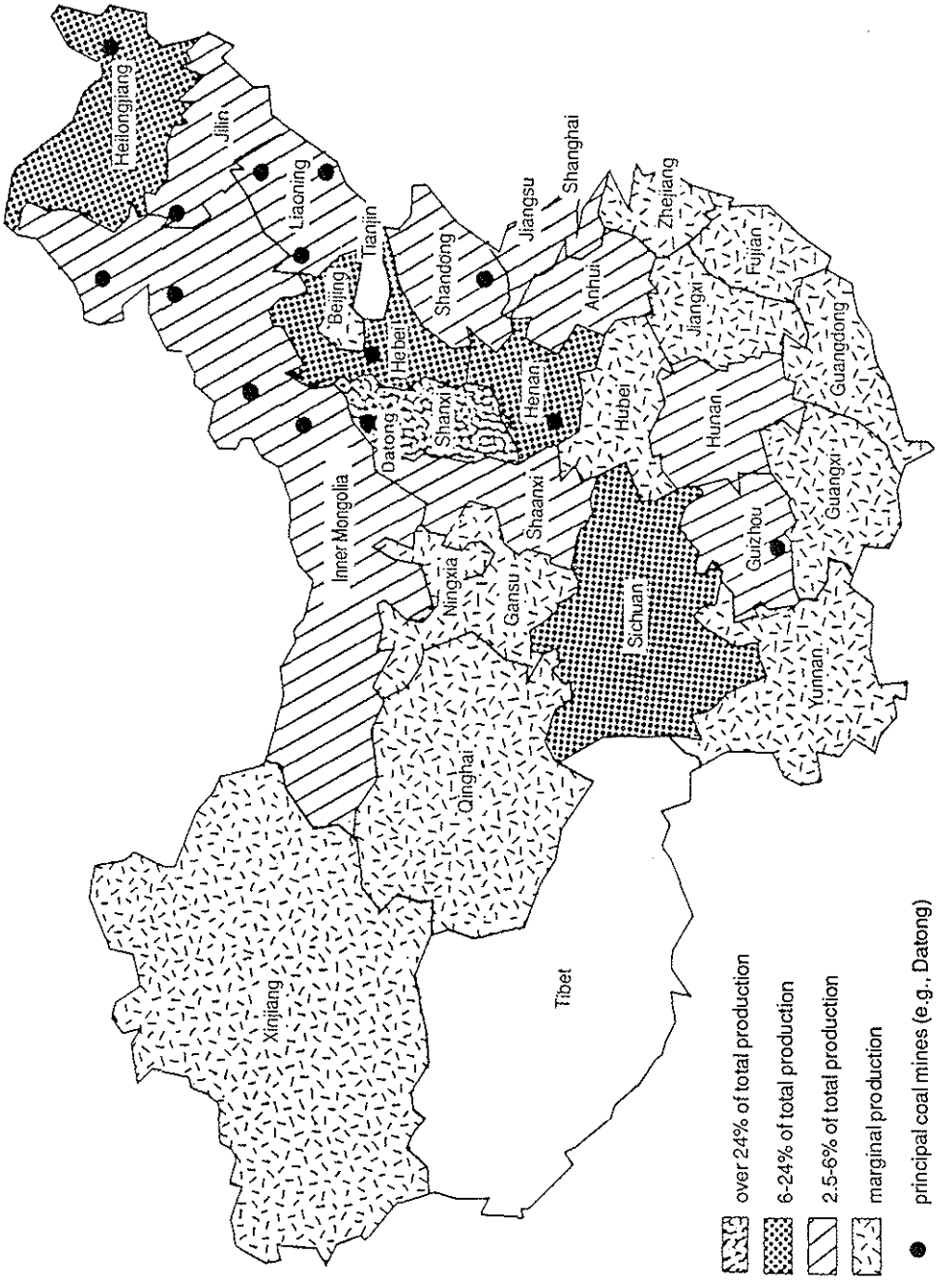
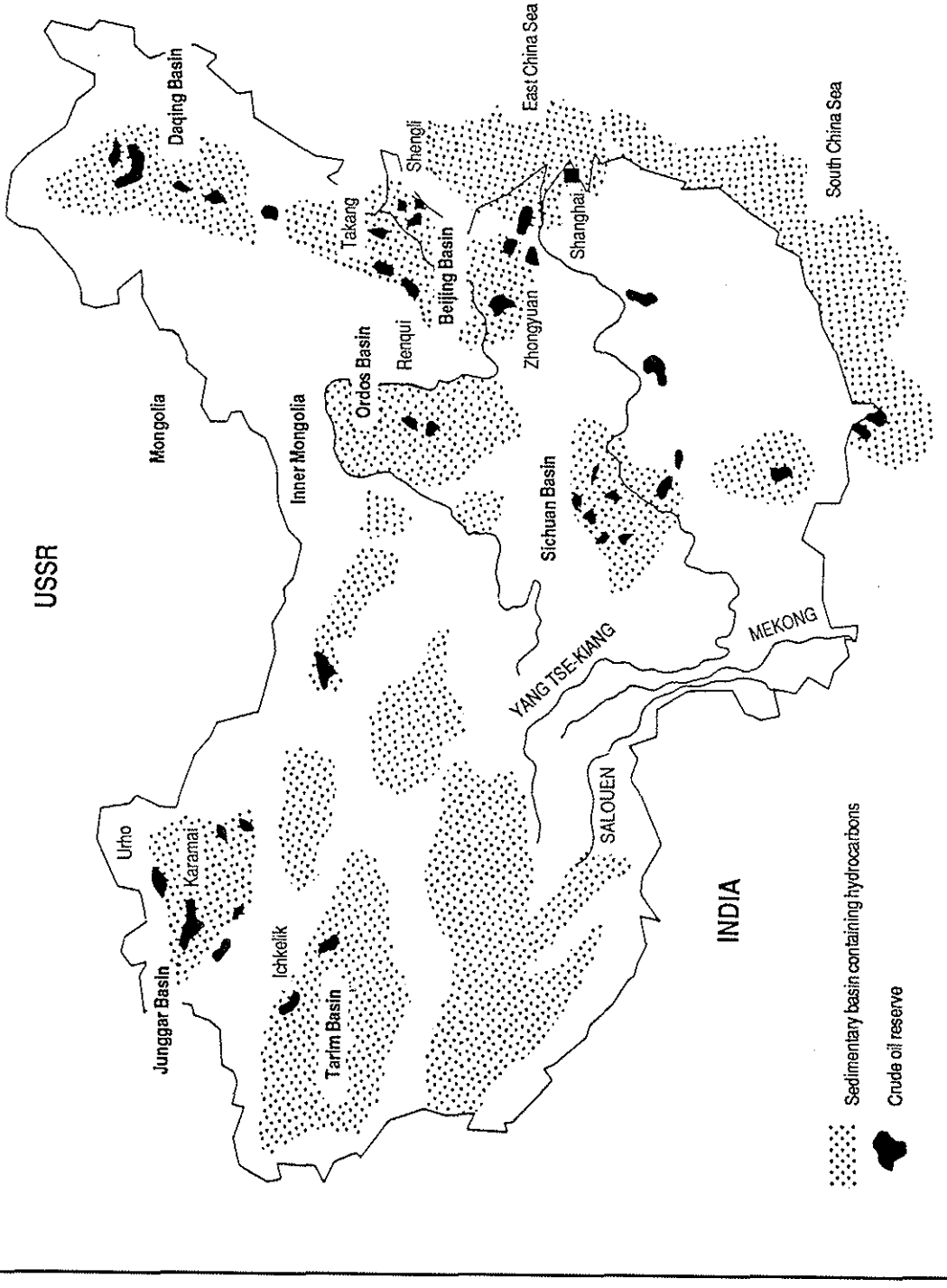


Figure 2: Principal Petroleum Reserves in China. (Source: *Petroleum Economist*)



2. The Logic of China's Energy Exports: Internal and External Constraints

It is apparent from the trends described above that energy available for export from China, especially oil, is a direct consequence of supply and demand policies. These policies reflect an adjustment between development priorities based primarily on domestic production and those which require imports. Increases in energy exports have undoubtedly created problems in a country where energy shortages persist and per capita energy consumption remains one of the lowest in the world. Why has China chosen this path? To respond one must consider the internal policy choices facing the Chinese against a background of their engagement in the international scene. The opening up of the Chinese economy to foreign trade has invested energy exports with a new function — as a source of foreign exchange they have an important role to play in the modernization of the economy.

2.1 The "External" Energy Issue

Since 1978 China has been increasing imports, especially of technology and capital goods, in an attempt to achieve a rapid modernization of its economy. Measured in current dollars, imports have quadrupled since 1978 and amounted to $42.25 billion in 1985. Between 26% and 40% of those imports were purchases of capital equipment, as against 17.5% in 1978 (see Table 4). In order to limit their foreign borrowing the Chinese have pursued a vigorous exports policy focused specifically on two items: textiles and energy. The energy component of exports accounted for more than 25% of foreign exchange earnings in 1985; energy exports brought China $7.05 billion in 1985, including $6.7 billion from oil exports alone. There is no doubt that energy exports helped China to keep its external deficit under $2 billion per year up to 1984.

With foreign trade integrated into the domestic reforms intended to accelerate the country's modernization, energy exports are vital for China. Several aspects of its energy policy confirm this. For instance, the way in which oil exports are marketed illustrates the special role that they have to play. Long-term state-to-state contracts, China's much-preferred selling method, are an excellent means of obtaining foreign exchange in a stable flow. This kind of relationship has been built, through Sinochem, with Japan in particular. An example is the contract, signed in January 1986 for five years, for the delivery of 8.9-9.3 Mt of crude oil per year (Fesharaki and Fridley, 1986, p.69). The terms are also special, for the final prices are determined retroactively (*Petroleum Intelligence Weekly*, 1986) and are negotiated on a quarterly basis. Up to the second quarter of 1987 the price was higher than the spot price of Daqing crude, conferring an additional advantage on China.

The special terms referred to above certainly do not mean that China has been unable to adjust rapidly to developments in the international oil market. Its adoption of the netback, or spot, price demonstrates this, as does its willingness to sell to international oil companies despite its traditional state-to-state links. It quickly adopted the netback price in order to carry out and augment its gasoline exports to the United States (*Petroleum Intelligence Weekly*, 1986). A.J. Troner views China's willingness to enter the US spot market in order to increase its sales as an integral part of its export policy (Hills and Bowie, 1987).

Moreover, the importance of energy exports, especially oil, is confirmed by domestic restrictions imposed in order to guarantee that crude oil will be available for export. The use of coupons for fuel purchases became a widespread practice in 1981 (Cordes, 1984, p.15), when oil exports amounted to 18% of production, a figure which had risen to 29.5% by 1985. Even during the periods of reduced oil production in 1980-1982 oil exports continued to grow, demonstrating the extent of restrictions imposed on domestic consumption.

In addition to those arrangements, one of the foundation stones of China's energy policy, the policy of self-sufficiency carried over from the earlier period, implicitly supports the option of energy exports. As an integral part of regional policy, various measures have been adopted to

Table 4: Evolution of China's Foreign Trade (billions of $US)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Imports	10.89	15.67	19.55	22.01	19.28	21.39	27.41	42.25	42.90	43.22	55.27
capital goods:											
according to MOFERT	1.90	3.96	5.38	5.11	3.39	3.25	5.20	10.97			
according to Customs						3.98	7.22	16.68	17.02		
Exports	9.75	13.66	18.27	22.01	23.35	22.23	26.14	27.36	30.94	33.44	47.52
crude oil				3.29	3.25		4.20	5.25	3.00	3.40	2.60
oil products				1.38	1.39		1.43	1.45	0.85	0.77	0.68
coal and coke				0.42	0.39		0.32	0.35	0.40	0.48	0.50

Sources:
Statistical Yearbook of China (various years).
China. Customs statistics (various years).

Note:
The series is interrupted between 1979 and 1980; not all of the data are entirely compatible.

insure that certain provinces, and especially their rural regions, supply their own energy needs. This has involved the development of contractual relations between producers and consumer regions and between producers and individual consumers. In the case of coal, energy-deficit provinces and communes have been encouraged to invest in the coal projects of regions rich in energy resources (World Bank, 1985, p.94). Similarly, enterprises and individuals have been authorized to invest in the construction of electric power stations, and thereby receive a portion of the electricity generated.[3]

In addition to mobilizing savings, produced in large part by the success of agricultural reform, this policy implicitly eases the constraint on exports by having some large consumers finance the development of the energy they need, thus leaving the government more room to manoeuvre with respect to the use of the energy produced by state industry. One of these "uses" so far has been exports and this policy is likely to continue in the medium term because it will be difficult to find other goods that can replace energy as saleable export commodities in large quantities.[4] The need to find substitutes for energy commodities is all the more crucial because the trade balance established in the past was seriously threatened by the fall in oil prices of the mid-1980s.

The effect of the price decline is evident in the data for 1986, when the decline in oil prices caused a drop in earnings from energy exports of $2.8 billion relative to 1985 (Table 4).[5] That shortfall was largely offset by the growth of textiles exports. Nevertheless, in view of the record 1985 trade deficit of more than $13 billion (FOB-FOB analysis), the Chinese government has had to pursue a selective imports policy. Imports have increased only slightly over previous years, by about 1.2% (Mommaels, 1987). China has already cut its purchases of oil equipment from the United States (*Petroleum Intelligence Weekly*, 1987a). In view of the strong growth of textiles exports, would the above adjustments have been necessary if oil revenues had remained unchanged?

The volume of Chinese petroleum exports has also fallen since 1986, to 26 Mtoe in 1988 (see

3/ See, in particular, Lewek (1986) and Fingar (1986).

4/ Gipouloux is informative about the prospects for change in the make-up of China's exports. "The structure of China's sales ... is changing shape slowly, with commodities and textiles still dominant.... The manufacture and export of goods with higher value added ... is obstructed by poor performance of an unsuitable and obsolete industrial apparatus." See Gipoloux (1986).

5/ In 1988, due to price changes alone, Chinese petroleum revenue is likely to be about $700 million less than had been earlier predicted.

Table 1). In the light of falling oil prices, the Chinese affirmed in August 1986 and again in 1988 their intention to reduce exports, by about 2.5 Mt in 1986 (Johnson, 1987, p.74) and about 1.6 Mt in the second quarter of 1988 (*Enerpresse*, 15 March 1989). But it remains that the export reductions are the result of the dynamics of internal supply and demand. Energy is just one example among many of the accommodations which China will have to make between internal constraints and external earnings, between internal balances and external markets.

2.2 The Future of China's Energy Exports

THE UNCERTAINTIES OF OIL SUPPLY

China's goal of quadrupling the value of industrial and agricultural output by the year 2000 entails increasing energy production twofold and electricity production fourfold (Fingar, 1986, p.10). Any increases, even small ones, in per capita energy consumption in a country with more than a billion inhabitants will result in large increases in total consumption. Chinese planners have set high oil and coal production targets for 1990 and 2000. But it is not certain that it will be easy to achieve oil production of 150 Mtoe in 1990 and 200 Mtoe in 2000 owing to uncertainties about the level of oil reserves (see Annex 1) and the development of offshore production. Temporary production crises due to management problems cannot be excluded in the short term. These problems have recently led Chinese planners to bring down their production targets for 1990 to 145 Mt (*Petroleum Intelligence Weekly*, 1988). But it is in the medium term that the central problem of the pace of renewal of oil reserves will arise for China's oil industry.

The main fields, including Daqing (42.4% of production in 1986), are reaching maturity. Their output, even with secondary recovery, should at most stabilize at the present level of 55.4 Mt. The main problem is that the exhaustion of the existing fields may virtually cancel out increased production from new fields. Of course there are areas with a potentially large output, for example, the Junggar and Tarim basins in Northwest China, but their contribution will probably not be significant in the early 1990s (*Petroleum Economist*, 1987b).

For this reason the development of offshore petroleum production becomes vital. The need for rapid development underlies the recourse to international oil companies. The results so far have been rather disappointing. No giant oil fields have been discovered. The title of a recent article on the offshore exploration — it refers to "Disappointed Dreams" (*Bulletin de l'Industrie Pétrolière*, 1986, p.1) — illustrates the disenchantment of foreign operators, and their experience has been worsened by the oil price decline. This is no doubt the reason why some Western experts forecast offshore production of only 100,000 b/d for 1990 instead of the official estimate of 200,000 b/d (Woodward, 1986). The recent discovery of a giant field with a production potential of 100,000 b/d should make it easier to attain the official production and export targets (*Petroleum Intelligence Weekly*, 1987b).

DEVELOPMENT AND GROWTH OF OIL CONSUMPTION

The future of oil exports is inextricably linked with the higher domestic consumption of oil products resulting from the internal dynamics of China's economic development. Some of these trends are already visible. The continued mechanization of farming, more or less inevitable if China intends to persist in its agricultural development, will generate increased consumption of oil products, especially for use in tractors and irrigation pumps. The 39% increase in the production of tractors in 1987 suggests the magnitude of the oil consumption which could result from their use (*Beijing Information*, 1988). Growth in the consumption of gas-oil for agriculture of at least 5% is expected in 1989 and 1990 (*Petroleum Intelligence Weekly*, 1989a). At the same time, improved living standards have resulted in larger numbers of automobiles and household electrical appliances, a development which is clearly demonstrated by the increased production of television sets (+132%) and vehicles (+123%) and by the very strong growth of vehicle imports in 1982-1985 (China. State Statistical Bureau, 1985; 1986). The Chinese forecast a total of 12 million vehicles by 2000, including 4 million

automobiles (*Beijing Information*, 1987). The increased use of petrochemicals envisaged in the Seventh Five-Year Plan, which is met at present mainly by imports, will entail higher domestic oil consumption (Annex 1) if imports are not to rise. Evidence that this is occurring is found in the notable increase in oil imports associated with the recent move to a greater autonomy of the provinces with respect to imports (*Petroleum Intelligence Weekly*, 1989a).

The main consumption increases will be of gasoline, diesel and raw materials for petrochemicals; large increases are expected between now and 1990. According to K. Woodward, the demand for oil products will rise by 6.8% per year between 1986 and 1990, including 8-10% for gasoline and diesel and 15-20% per year for raw materials for petrochemicals (*Oil and Gas Journal*, 1988). If economic advances continue, these developments should prove lasting, for the shares of transport (7.8%) and the residential-tertiary sector (19.7%) in commercial energy consumption are very small (World Bank, 1985, p.3).

Can these trends be offset by an energy conservation policy designed to save 70 Mtoe by 1990 (Yu Yehai, 1987)? Unless the existing tight restrictions on energy use are augmented, China's energy conservation policy would seem fragile. It depends on developments in a larger context than the energy system. Fundamentally, the major limiting factor lies in the logic of an economic system still based on quantitative targets, regardless of the cost of their attainment. As long as this logic persists and enterprises remain subject to "relaxed budgetary control,"[6] higher prices for energy consumption in excess of quotas may not offer any great incentive for energy savings. China's system of prices — both the prices controlled by the state and those established in free markets — still makes little sense. The sharp increases in free market prices have certainly not been due to energy costs, because only part of that energy supply passes through free markets. The recent decision (early 1988) to reintroduce price controls, with price ceilings for oil, natural gas, coal and electricity (*Bulletin de l'Industrie Pétrolière*, 1988), still leaves serious doubts about the continuation of price reform.

China's energy export policy faces another dilemma until such time as other exports become an important source of foreign exchange. On the one hand, modernization is supported by foreign exchange obtained from oil exports. On the other hand, modernization requires, and will increasingly require, oil to be allocated to domestic needs. The shortages of oil products in 1986 noted above were the first manifestation of this, despite massive imports. It is estimated that a third of the country's trucks were put out of commission in 1986 by the shortage of oil products. The most tangible manifestation of the Chinese oil dilemma is observed in 1988 and 1989. While production increased by only a small amount (2.2% in 1988), oil consumption grew by about 6-7% due to sustained economic growth. Paradoxically, the Beijing government has continued to reaffirm its intention to maintain oil exports. It seems, furthermore, to have imposed severe restrictions on the rights of provincial and municipal authorities to import (*Petroleum Intelligence Weekly*, 1989b).

COAL EXPORTS: A STRATEGY FOR THE FUTURE?

The Chinese may have chosen to deal with their oil export problems by turning to more coal exports. China's coal potential is enormous. An output of 1 billion tonnes in 1990 and then 1.4 billion tonnes in 1995 (China. State Statistical Bureau, 1986) is achievable in the light of 1988 output of 960 Mt. Given this situation, it should not be overly difficult to set aside 30 Mt for export in 1990, even if such a strategy causes temporary energy restrictions. Such exports would represent only 3% of the planned 1990 output. Nevertheless 1987 and 1988 have shown that growth in domestic consumption can involve severe constraints on the level of exports (13.5 Mt in 1987 instead of the 16 Mt that had been foreseen). This has, moreover, not prevented the appearance of numerous shortages, notably in electricity (*Beijing Information*, 1989). Thus there is some risk that the substitution of coal for oil in Chinese export policy will come up

6/ Term introduced by Kornai (1984).

against significant limits.

While production capacity could bear exports of 30 Mt, it is not clear whether China has sufficient means of transport to make such exports possible. As the main coal mines are located far from consumption centres and ports, the problem of transport, mainly by railroad, becomes one of the main variables in China's coal export policy. The stakes are high. In January and March 1986, 13 Mt of coal was unable to reach its place of consumption for lack of transport. Output levels in Shanxi province are already set in the light of transport capacity (Yu De Hui *et al*, 1987). Under these circumstances a recent JETRO report envisages a 1990 export volume of only 20 Mt, instead of the 30 Mt specified in the Seventh Five-Year Plan (Jones, 1987).

Major efforts are of course being made with respect to transport. But will they be enough? The required investment could be very large. There will be competition from other needs arising from the modernization of the industrial sector, and in 1984 energy investments already represented more than 40% of state investment in the industrial sector. Moreover the government, faced by ever stronger inflation, has formulated an austerity policy that will inevitably restrict capital investment. Thus the Chinese are left with the crucial issue of just where to invest.

Concluding Comments

Until now energy resources have played a large role in financing the modernization of the Chinese economy. The dynamics of internal demand associated with this development may, in time, reverse the situation. In particular, the consumption of oil products is likely to increase strongly. In view of the changes in oil production, and the problems of oil reserves and the mismatched refining structure, China may be forced to import large quantities of oil products between now and 1995. Some people confidently set the level of imports at 8.75 Mtoe for diesel and 6.25 Mtoe for gasoline by 1995 (*Petroleum Intelligence Weekly*, 1987c). Will China change from a net exporter into a net importer of oil? The answer depends on a key variable — China's borrowing policy. In the background looms the question of whether China is ready to accept energy imports if it has to borrow to finance them. For the moment, recent developments and import restrictions, with a policy of energy self-sufficiency still on the agenda, leave serious doubts about a borrowing strategy. Studies of this issue show clearly that the opening of China's economy to the outside world, dictated by the need for domestic modernization, has never prompted a questioning of the principle of self-sufficiency, which has long been part of China's economic development strategy.

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