INTERNATIONAL ENERGY AGENCY

China's Worldwide Quest for Energy Security

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FOREWORD

The IEA and China:
Partners in Energy Co-operation and Policy Dialogue

Formal contacts between the International Energy Agency and China began in 1994. The relationship has developed over the years, to the mutual benefit of both parties. Within the framework of the IEA-China Memorandum of Policy Understandings, signed on 29 October 1996 in Beijing, the IEA maintains technical contacts and pursues an active dialogue with those responsible for Chinese energy policy.

China's growing importance in the world energy market and the global environmental system require that the world pay close attention. The Agency's expertise and the experience of its Member countries are at China's disposal to help answer critical questions about energy policy.

The study benefited from exchanges of information and ideas with a number of Chinese scholars and officials including in particular Mr. Yan Peng Gui of the Shenhua Corporation, Mr. Liu Ren of the State Development Planning Commission, Professor Liu Deshun of Tsinghua University, Professor Zhou Fengqi of the Energy Research Institute, Professor Yang Guang of the Institute of West Asian and African Studies and Mr. Xu Xiaojie of the China National Petroleum Corporation, Dr. Keun-Wook Paik of the Royal Institute of International Affairs, Mr. Jeffrey Logan of the US Pacific Northwest National Laboratory, and Mr. Philip Andrews-Speed of the University of Dundee also contributed to the study at various stages.

This study presents the IEA's analysis of China's growing energy linkages with major petroleum producing countries. Mr. Mehmet Ögütçü is the principal author and the coordinator of the study. Mr. Robert Cornell, Mr. Scott Sullivan and Ms. Christine Andaya significantly contributed to, and edited, the final text. This study is published on my responsibility as the Executive Director of the IEA and does not necessarily reflect the views or positions of the IEA, its Member countries or any official Chinese body.

Robert Priddle
Executive Director

List of Abbreviations and Acronyms Used in the Text

ADB	Asian Development Bank
ASEAN	Association of South East Asian Nations
CNODC	China National Oil and Gas Exploration and Development Corporation
CNOOC	China National Offshore Petroleum Corporation
CNPCC	hina National Petroleum Corporation
DWT	Dead Weight Tonnage
FOB	Free-on-board
GDP	Gross Domestic Production
JNOC	Japan National Oil Corporation
LNG	Liquified Natural Gas
LPG	Liquified Petroleum Gas
MIST	Ministry of Science and Technology
MOFTEC	Ministry of Foreign Trade and Economic Cooperation
MRC	Mekong River Commission
MWR	Ministry of Water Resources
PLA	People's Liberation Army
PSC	Production Sharing Contract
RMB	Ren Min Bi (Chinese currency)
SACI	State Administration of Coal Industry
SAPCI	State Administration of Petroleum and Chemical Industries
SC	State Council
SETC	State Economic and Trade Commission
SINOCHEM	China National Chemical Import and Export Corporation
SINOPEC	China National Petrochemical Corporation
SOE	State-owned enterprise
SPC (SDPC)	State (Development) Planning Commission
SPCC	State Power Corporation of China
UNCLOS	United Nations Convention on Law of Sea
UNIPEC	China International United Petroleum and Petrochemical Corporation
USGS	United States Geological Survey

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Map 1

Map of China Indicating Major Provinces and Oil Fields

Source: China OGP, 1999, Vol. 2

EXECUTIVE SUMMARY

China is the newest major player in the global energy system. It became a net importer of oil in 1993. Within the next decade, China's imports will outstrip those of many OECD countries as well. The 1998 edition of the IEA's World Energy Outlook shows that oil, which made up 20 per cent of China's final commercial energy consumption in 1996, is set to rise to almost 26 per cent by 2020, with imports at 8 million barrels a day. This makes about 400 million tonnes a year, more than the projected net imports of the OECD Pacific countries (Japan, Korea, Australia and New Zealand) combined.

China's rapid growth since market reforms began twenty years ago has sparked a surging demand for energy to serve an expanding industrial and commercial structure as well as households with rapidly rising living standards. The nation's vast energy resources lie far from the most populous, fastest-growing regions; an inconvenient circumstance that stretched the inadequate domestic energy-delivery infrastructure from the start. So imported energy, notably oil, has become an attractive alternative in precisely those parts of China which need it most and have had the greatest access to it as the economy opened. The nation made considerable efforts to exploit its domestic resources, but growth eventually overwhelmed them and led – two decades after the reforms began – to rising net oil imports. Continued dependence on imports is now irreversible unless new, economically exploitable, reserves of domestic oil can be found.

Certain policy steps augmented and reinforced these trends, perhaps unintentionally. Turning the economy outward was bound to affect the energy sector profoundly. Insufficient investment in transport and energy infrastructure, plus relative slowness in shedding the sector's command-economy characteristics, inhibited the availability of domestic oil and raised its real cost. This cautious approach to reform in a sector considered « strategic » hastened China's loss of self-sufficiency in oil by sending confused price signals. The Chinese energy industry might have developed faster if it had been plunged directly into the high-price international environment that has prevailed since the late 1970s. The low-price environment of 1998 and early 1999 reinforced domestic pressures to import and dealt a severe blow to hopes for exploiting the relatively high-cost Tarim basin as an alternative to growing net imports.

While reform fostered the Chinese boom of the past 20 years, it left the energy sector mostly unaffected. Despite much churning, scant results have come forth. Little evidence appears of a unified domestic energy strategy. Coherent price signals work their way only slowly into the system. Most of the energy sector remains in the hands of state-owned enterprises (SOEs), which grow larger, more powerful and more unwieldy rather than more efficient. Regulation is in disarray. China has difficulty articulating how it weights the basic elements of an energy policy : development of indigenous oil and gas, diversification of energy sources and imported energy supplies, energy conservation and energy efficiency, and the environmental friendly components of all these elements. So the government is slow and awkward in translating them into official programmes. Many policies co-exist, sometimes as complements, sometimes in competition, but their interrelationships have poor definition. There are several strategies rather than a single one, and many actions which may or may not reflect policy. Policy drift persists despite a great deal of apparent activity.

Drift, however, is not the same thing as paralysis. China still stresses the need for an independent energy supply in the short run, accompanied by an ambitious and costly energy development plan. The plan covers oil and natural gas, coal, eight new nuclear plants, ten or a dozen new hydroelectric facilities and over 30 thermal power plants. At the same time China has aggressive trade and investment strategies to position China for energy security in a longer-term scenario in which much energy is imported. Official rhetoric manages both to stress energy independence and to leave ample room for substantial imports. Notwithstanding an ongoing debate about the directions of policy, China has moved quickly to forge a credible set of linkages with international energy markets.

Actions to mitigate the liabilities of import dependence cover all the standard fields : creation of a strategic oil reserve; pursuit of diversified, secure import sources; more receptive policies toward foreign investment in Chinese energy activities; and Chinese investment in foreign production facilities, developing oil and gas pipelines within producing countries or from the producers to China. All these actions show dual motivations. Aware of its growing dependency on imported energy, China seeks a more prominent position in the existing global system of energy production and trade but, where it can, it tries to open *new* connections in the global markets. Increasingly – as in all heavily import-dependent countries – external energy policies come to form a subset of foreign economic and security policies in general.

Policy makers abroad have noted the rapid shifts in oil trade patterns with which their Chinese colleagues have had to cope in recent years. In 1990, China exported almost five times as much crude oil and products as it imported. In 1997, its imports had swelled to twice the size of its exports. In those seven years, the comfortable patterns of self-sufficiency known since the Daqing fields of northeastern China came into production in the 1960s vanished.

Policy reactions have occurred swiftly. While, some policy lines reflecting the days of energy self-sufficiency still persist in Beijing, Chinese leaders have quickly and effectively grasped the essentials of dealing with energy-security issues in an import-dependent environment. Their basic strategies are maximum development of domestic resources, creation of strategic reserves, seeking foreign technology and investment, establishing reliable and secure oil trading channels, and making strategic investments in upstream production facilities abroad. All these approaches mirror the classic moves of nations which found themselves in import dependency in the past. In fact, China has already moved farther and faster to take advantage of inward investment in its energy industries than did Japan at an analogous stage of development.

Chinese oil trade policy still shows signs of the *dirigiste* and protectionist tendencies of a command economy. The government still imposes draconian measures by decree–the import ban in 1998 is one unfortunate example. Incomplete domestic price reforms create disequilibria, and trade is still viewed as a « swing » variable that can be manipulated at will to restore domestic balance. Such aberrations of trade policy disrupt markets and retard the development of reliable and secure supply relationships. They also create new imbalances, such as the rampant smuggling in 1998.

Until the 1990s, China obtained most of its oil imports from Asia. Perhaps the most visible early effect of its rising import dependence lies in shifts in these trading patterns. Exports have more or less stagnated or begun to decline. On the import side, the combination of Chinese oil requirements, growth-led increases in oil demand in the economies of Southeast Asia and slowing growth of Asian oil resources, has impelled both China and other Asian countries to import crude oil from other sources, notably the Middle East. China has taken steps to diversify its import sources to Africa and other parts of the world as well, but it is now turning, like everyone else to the one region with the most abundant supplies.

In the oil industry, trading and investment relationships are often closely linked. China desperately needs foreign capital to develop its energy sector. The

pace of such investment, especially in relation to China's needs, still does not match the rapid rages seen elsewhere in the economy. But change is coming. Realistically, however, much more must occur if China is to meet the financing and technology requirements of its domestic energy investment targets.

With its entry into the global oil bazaar as a major importer, China quickly learned the hazards of relying solely on purchase policies in the open markets. The more aggressive recent foreign investments of its state owned enterprises, notably China National Petroleum Corporation (CNPC) and China National Offshore Oil Company (CNOOC), stem directly from a May 1997 policy paper in which former Premier Li Peng blessed Chinese involvement in the exploration and development of international oil and gas resources. He also tied such projects specifically to the objective of stable, long-term supplies of oil and gas. Some Chinese officials foresee half of China's crude imports coming directly or indirectly from Chinese-owned overseas fields by 2000.

China's overseas investment has gone, so far, to several Middle Eastern countries, plus Argentina, Bangladesh, Canada, Colombia, Ecuador, Indonesia, Kazakhstan, Malaysia, Mexico, Mongolia, Nigeria, Pakistan, Papua New Guinea, Peru, Russia, Thailand, Turkmenistan, Venezuela and the United States. CNOOC has investments in Indonesia and the Gulf of Mexico, and plans new ventures in the Middle East (especially Iran), Central Asia, Myanmar and other parts of Asia. CNPC has been even more active, with exploration and production contracts signed or under negotiation in at least 20 countries. By the end of 1997, CNPC had pledged more than $8 billion for oil concessions in Sudan, Venezuela, Iraq and Kazakhstan, plus—at least notionally—another $12.5 billion to lay four immense (but still far from real) oil and gas pipelines from Russia and Central Asia to China. The oil projects in Iraq, Kazakhstan and Venezuela are large-scale. CNPC's entry into Kazakhstan laid down a Chinese marker in oil-rich Central Asia, a key area where a Chinese presence had previously been minimal.

Energy issues have clearly taken a higher priority in Chinese foreign policy. This represents a constraint as much as an opportunity because the drive for reliable energy supplies, now a national imperative, increasingly limits the use of energy policy as a means to other policy objectives. Every evidence points to China's rising awareness that its diplomatic goals with respect to energy, primarily oil and gas, must aim toward participation in the global energy system in a way that maximises domestic energy security.

The position of this vast nation in the global energy markets can only grow stronger as time passes. For other energy importers, two points have become

clear. First, China's *manner* of entry into the global energy markets carries no surprises. Its strategies bear strong similarities to those of other players. Second, that China requires *a strong place* in the system. Other players will need to make room for it. China is asserting itself as a powerful new force in the international energy markets.

China is creating energy relationships all across the Middle East, Southeast Asia, Russia, Central Asia and Africa, giving every indication of fitting itself into established patterns of energy trade and investment. At the same time, it does not ignore other potential sources of long-term supply throughout the world. Trade and investment are the main elements in China's energy co-operation with the rest of the world today. Joint energy-resource management may come tomorrow. It has carved out a significant position in Central Asia. It is there to stay, whether or not the oil and gas eventually flow through CNPC's visionary but still-uneconomic pipelines. It has formed oil trading or investment links with Russia, Africa, Latin America and North America. Natural gas links with Russia will likely become stronger. All can be expected to develop further.

CHAPTER ONE

DOMESTIC ORIGINS OF CHINA'S SEARCH FOR ENERGY ABROAD

China is rapidly becoming a force to reckon with in the global energy system. It became a net importer of oil products in 1992 and of crude oil in 1993. It cannot return to the era of energy self-reliance and net exports. Chinese leaders were untroubled by energy-security concerns for nearly three decades after the discovery of sizeable oil reserves in Daqing in 1960. That era is gone. Both Chinese and non-Chinese forecasts agree that within a decade or less China will be a major oil-importing force in world energy markets, with greater demand than many OECD countries.

This chapter describes how China's oil-import dependency came about and assesses its potential effects on worldwide energy markets. It particularly stresses Beijing's emerging energy-security policies. It traces the energy-related economic relations which China has begun to establish with others in the system, in its search for some certainty of long-term supply and reasonable protection against market volatility.

China's growing dependence on imported oil stems from domestic causes. The long period of growth generated by the economic reforms of the late 1970s sharply increased China's need for energy, especially and specifically for oil. In this immense and heavily populated land, the economic geography has favoured industrial and commercial growth in the East and South, far from China's main reserves of coal, oil and hydropower in the North and West. Furthermore, China was ill-served by an energy-delivery infrastructure that could not keep up with burgeoning demand. Imported oil increasingly fed economic development in the East and South, even when China remained a net oil exporter. Fast-growing oil imports eventually gained the upper hand in the first half of the 1990s, almost a quarter century after the reforms began.

Policy unintentionally reinforced these trends. Investment in infrastructure, especially for transport and energy, lagged far behind economic growth. China began its economic liberalisation with vast experiments, all of them focused on

coastal zones, before they were applied in the rest of the country.[1] Consequently, the East and South not only developed relatively great requirements for energy – especially for oil to feed their industry and transport systems – they naturally found it easier to seek supplies abroad as the economy opened. The development path turned China outward, and energy did not escape the trend. Meanwhile, hesitant and incomplete reforms in the energy sector have prevented it from boosting domestic energy output and distribution fast enough to meet growing demand. The economy has now developed so far and so fast that, barring discovery of vast new energy resources, even complete rationalisation and development of the energy sector could only limit, but not reverse, the dependence on imported oil.

A Perspective on the Chinese Economy

Many factors explain China's rising importance in global economic, energy and environmental affairs (Table 1.1). It has the world's largest population (over 1.2 billion) and the second largest economy after the United States in purchasing

Table 1.1: The Importance of China in the World
(China's shares of world totals, in per cent)

	1971	1995	2010	2020
GDP in PPP Terms	3	12	17	20
Population	23	21	20	19
Primary Energy Demand *(excluding combustible renewables and waste)*	5	11	14	16
Primary Energy Demand *(including combustible renewables and waste)*	n.a.	12	14	16
Coal	13	28	33	36
Oil	2	5	8	10
Power Generation	3	9	13	15
CO_2 Emissions	6	14	17	19

Source: IEA : World Energy Outlook, 1998

1. Agriculture was one outstanding exception. The first nationwide reforms were in farming and led very quickly to surges in output. China can now feed itself. This success, important in itself, helped set the stage for the realisation of further reforms.

power parity (PPP) terms[2]. As a trading nation, it ranks fifth after the European Union (EU), the United States, Japan and Canada. Its primary energy consumption is now equivalent to a fifth of the OECD total (second behind the United States) and at a tenth of the world's. IEA projections show China, including Hong Kong, accounting for 23 per cent of world primary energy demand *increase* between 1995 and 2020, the same as the OECD area, leaving about half (54 per cent) for the rest of the world. China already accounts for more than a tenth of world carbon emissions; it is the largest potential market for energy products, services and technology; how it supplies its growing energy needs will critically affect its own and the global environment in coming decades.

China's growth has been led, on the supply side, by huge increases in industrial production and, on the demand side, by rapid growth in personal consumption and consistently high rates of fixed investment. Very high domestic savings have been placed largely with the formal banking sector and used to keep state-owned industry afloat.

How fast has China's economy expanded? Very fast – but not as much as official data would indicate. Experts widely agree[3] that the figures published by China's statistical authorities underestimate the GDP level and inflation, and overestimate the real growth rate.[4] Six often-cited PPP estimates of the size of the GDP (at 1990 U.S. dollar values) range from $1,286 billion to $4,834 billion; they average $2.65 billion, well above the $1.83 billion derived from official statistics.[5]

Two recent studies, both launched by the OECD Development Centre, have produced new estimates of China's GDP and its growth, using internationally accepted methodologies approaches. The approaches differ, but the findings are

2. Using market exchange rates significantly changes – and distorts – the China picture. GDP calculated on a PPP basis is six times that based on exchange rates.

3. See, for example, Maddison (1997), Ren (1997), World Bank (1992) and Wu (1993).

4. The national accounts retain a mixture of the old Material Product System (MPS) and the UN System of National Accounts (SNA). They understate value added in agriculture and provide incomplete coverage of the economy. Until 1978, the system did not include "non-productive" services, such as banking, insurance and passenger transport. Service-sector statistics remain weak. Although the accounts have included some "non-material-product" services since 1987, the notion of "comparable prices", which understates inflation, remains in use as the deflator of national income in money terms to calculate growth rates in real terms.

5. Summers and Heston (1993), Ren and Kai (1993), Ren and Kai (1994), Taylor (1991) and Maddison (1997). The per capita values, in order of the GDP figures cited in the text are $1,135, $4,834, $4,264, $2,342 and $1,614.

similar. Maddison (1997) re-estimates Chinese GDP with a measurement technique closer to Western national accounting practice, using 1987 weights. He concludes that GDP grew at 4.4 per cent a year from 1952 to 1978 and 7.4 per cent annually from 1978 to 1994, well under the official figures of 6 per cent and 9.8 per cent. Ren (1997) found that applying a producer-price index to official GDP for the period 1986 to 1994 produced a 6 per cent growth instead of the official 9.8 per cent. Alternatively, applying ICP (United Nations International Comparison Project) techniques, he estimated GDP growth at 8.4 per cent for the same period. A similar exercise with the ICOP (International Comparison of Output and Productivity) methodology yielded 7.3 per cent. While all of these estimates fall significantly below the official figures, they do not change the fact that China's economy has developed very rapidly indeed.

Industrial activity holds a high and constant share of GDP – 48 per cent, the same as in 1978[6] – probably a legacy of the policy emphasis on heavy industry that persisted until 1980. As the economy has grown since 1978, however, the share of agriculture dropped significantly, from 28 per cent to about 20 per cent in 1995, and that of services jumped from 24 per cent to 31 per cent.[7] China's rural areas were the first to see substantial change after market reforms began in the late 1970s. In most of them, the 1980s marked a major shift away from subsistence farming toward a more commercialised and industrialised rural economy.

Energy and the Economy

Based on official figures, China's primary energy demand grew at over 5 per cent a year between 1981 and 1995, significantly less than the economy as a whole, implying an annual average *decline* in commercial energy intensity of 5.6 per cent. Many analysts are unwilling to believe this spectacular achievement, practically never seen in developing countries. The trend contrasts starkly with average annual *increases* of 1.4 per cent per year in India and 1.2 per cent in all of East Asia as a whole (including China). Typically, a developing country's energy-intensity curve rises with economic growth, peaks at a certain level of development, and only then begins to fall.

6. For comparison, industry's share in the GDP of OECD countries, around 40 per cent on average in 1960, declined to about 30 per cent in 1995.

7. *China Statistical Yearbook, 1996*.

Because "intensity" measures energy use per unit of GDP, the understatement of GDP and the overstatement of growth in the Chinese national accounts clearly affect the size of the estimate. Using Maddison's (1997) GDP estimates reduces the average commercial energy-intensity decline in 1981-1995 to a still-strong 3.4 per cent a year, leaving no question that China has indeed lowered its intensity of energy use in relation to output over the course of its sustained expansion.

This Chinese accomplishment in the midst of full-bore economic development has yet to receive a completely satisfactory explanation. One element is a combination of conservation measures, energy-sector reforms (mainly reduced subsidies) and fuel-switching (Zhong, 1998). Improving efficiency of energy use has also played a key role. The IEA has found in other countries (see, for example, OECD/IEA, 1997) that, because capital stock embodies patterns of energy use, new buildings, infrastructure, machinery or processes to deliver energy services present opportunities to enhance efficiency. To the degree that two decades of investment have embedded improved energy-service technologies and processes in the economy, efficiency gains have resulted.

Steadily improving energy efficiency does not change the deep need for further gains. Energy use in China is still highly *in*efficient, with huge possibilities to improve in almost every sector. Energy consumption per unit of GDP stands at five times US levels and 12 times those of Japan. Industrial processes still require large amounts of fuel relative to output, and motor vehicles burn excessively large amounts of gasoline or diesel fuel relative to their size, power and capacity. A study by China's Energy Research Institute indicates that China has the potential to achieve a further 30 per cent to 50 per cent reduction in energy consumption by raising its industrial energy efficiency to international standards.

The income elasticity of energy demand is the main parameter determining long-term energy demand projections – which are important for the analysis in this book – and it is subject to the same measurement problems as growth and GDP. Official Chinese statistics yield an income elasticity of roughly 0.5 (a one per cent rise in GDP brings a half-per cent rise in energy demand); the expected value for a developing country is about 1. The true value probably lies somewhere between the two. Barring adverse structural changes, therefore, China will continue to show slower growth in energy demand than in GDP.

The Energy System: History and Projections

A handy way to grasp a national energy system and the forces which animate it is to develop a coherent analytical scheme which explains past developments and forms a basis for looking at the future, not primarily as a set of (risky) forecasts but to identify the underlying uncertainties. The IEA presents such a structure for China in its latest World Energy Outlook 1998.

The model traces China's continuing transition from the past, when energy was allocated by the state, to a future involving more consumer choice. It assumes that policy reforms will continue over the long term, with deregulation steadily introducing more market elements. It covers an outlook period stretching to 2020. Since state-owned enterprises still dominate the Chinese economy and the energy sector, problems in transforming them into market-oriented institutions, plus bottlenecks in many critical sectors, could dampen the basic growth assumption. Table 1.2 shows the model's main assumptions. Table 1.3 presents the main projections.

Table 1.2: Main Assumptions for Projections of the Chinese Energy System

	1971	1995	2010	2020	1995-2000[1]
GDP[2] in PPP terms	484	3,404	8,426	13,123	5.5
Population (millions)	845	1,206	1,372	1,469	0.8
GDP per capita[3]	0.57	2.82	6.14	8.93	4.7
Coal Price (per tonne)[4]	44	40	42	46	0.5
Oil Price (per barrel)[4]	6	15	17	25	2.1
Liquefied Natural Gas Price (per toe)[4]	n.a.	126	141	210	2.1

Notes:
1. Average annual change, in per cent.
2. Billions of 1990 US dollars.
3. Thousands of 1990 US dollars.
4. 1990 US dollars. « Toe » stands for tonne, oil-equivalent.
Source: IEA : World Energy Outlook 1998

Energy Demand

Because economic growth is expected to slow down, primary energy demand will expand more slowly over the outlook period. As in the past, energy demand growth keeps well below the pace of economic development; there is a

Table 1.3: Projections for the Chinese Energy System
[millions of tonnes, oil-equivalent (Mtoe)]

	1971	1995	2010	2020	1995-2020[1]
Total Primary Energy Demand					
Solid Fuels	190	664	1 087	1 416	3.1
Oil	43	164	355	506	4.6
Gas	3	17	57	81	6.5
Nuclear	0	3	19	33	9.6
Hydro	3	16	39	62	5.5
Other Renewables	0	0	2	3	– –
Total	239	864	1 539	2 101	3.6
Total Final Consumption					
Solid Fuels	147	416	617	755	2.4
Oil	37	132	280	395	4.5
Gas	1	13	36	47	5.2
Electricity	10	68	165	255	5.4
Heat (including other renewables)	0	19	46	71	5.3
Total (including non-energy consumption of energy)	195	649	1 145	1 524	3.5
Energy Use in Stationary Services, by Fuel					
Solid Fuels	147	409	610	748	2.4
Oil	31	80	157	213	4.0
Gas	1	13	36	47	5.2
Heat	0	19	46	71	5.3
Power Generation	12	89	215	332	5.4
Total	191	610	1 064	1 411	3.4
Energy Use for Mobility (mainly oil products)					
Total	6	59	130	190	4.8

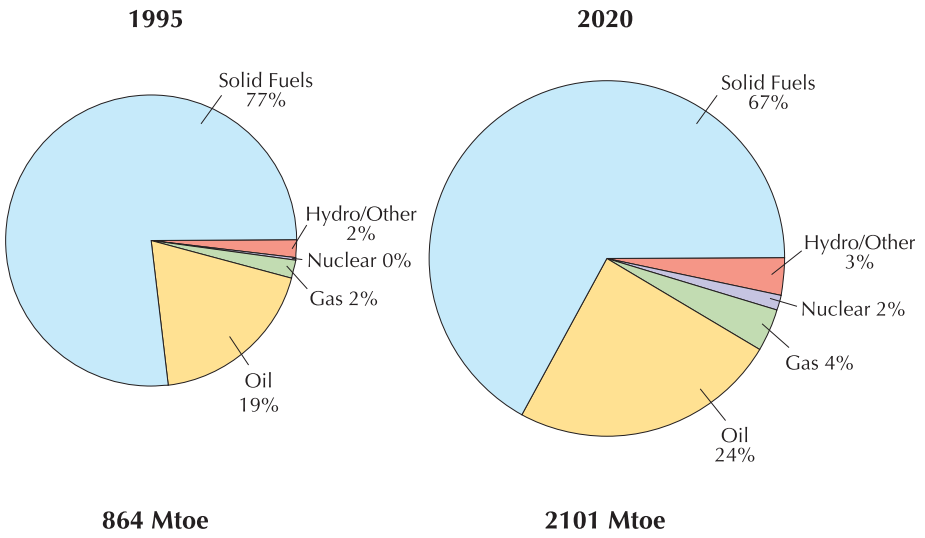
Notes: 1. Average annual change, in per cent
Source: IEA

further long-term decline in energy intensity, averaging 1.8 per cent a year. Moreover, fuel prices gradually begin to play a role in energy consumption decisions, augmenting the forces which slow energy demand growth.

Fuel shifts are likely to occur. Solid fuels, mainly for power generation, will retain their dominance, but their share drops by about ten percentage points (Figure 1.1), with significant losses in the industrial, residential and commercial sectors. Oil, gas, nuclear and hydro all grow faster than the market as a whole.

Gas, used mostly in chemicals and fertilizers, holds a very limited share of final consumption, but will grow stronger in the future. Nuclear and hydropower may expand to meet high electricity demand growth.

Figure 1.1: Total Primary Energy Demand



The projections show stationary uses of fossil fuels more than doubling over the outlook period. Because industry contributes such a large share of economic activity in China, it accounted for about two-thirds of total final energy consumption in 1995, mostly for heat – an unusually high share in comparison with, for example, 47 per cent in Korea and an average of 31 per cent in the OECD countries. Patterns of technological development will have a large effect on future industrial heat demand. Oil and gas will replace coal in significant amounts. Iron, steel and chemicals alone make up about half of total industrial fuel demand. Some 85 per cent of energy consumption in iron and steel involves coal and oven coke. China has one of the most steel-intensive economies in the world, and its steelmakers use on average a third more energy per tonne of output than their US counterparts. In chemicals, the use of coal in small-scale plants produces large inefficiencies. Chinese industry has ample scope for improving its energy efficiency.

Oil and gas are also likely to penetrate the residential/commercial fuel mix, displacing coal – although not in rural areas, where coal will continue to

dominate and substitute increasingly for non-commercial biomass (wood and straw). Partly for environmental reasons, official policy encourages the use of gas in urban residential areas. Gas networks already exist in many large cities, although much of the gas now comes from coal. Emerging patterns of residential and commercial energy demand (including electricity as well as coal, oil and gas) will depend largely on how fast commercial energy replaces non-commercial fuels, the pace of construction and the energy efficiencies that get built into new spaces as well as the appliances they contain. Along with appliance efficiency, the rate of home-appliance ownership will reflect growth in household disposable income.

China shows extremely low energy demand for transport – about 9 per cent of total final energy demand in 1995[8], compared with 33 per cent in OECD countries and 23 per cent in developing countries. Private automobile ownership, a key uncertainty in the projections and one in which official policies may play a part, currently stands at around three per thousand people, versus 27 in Thailand and 498 in Germany (IRF, 1998). Projections posit that energy demand for mobility will grow at about 4.8 per cent a year in China, more than tripling by 2020.

China's electricity demand has more than doubled in the last decade and will probably almost quadruple by 2020. Electricity will substitute for coal in many industries, both because of technological innovation and as the industrial structure becomes less energy-intensive. In the residential sector, as Table 1.4 shows, appliance-penetration rates are surging forward; they will continue to do so with strong growth in per capita incomes. Moreover, only about 80 per cent of the population is now connected to China's electrical grid; continued rural electrification will add still another force for high electricity demand growth.

Table 1.4: Ownership of Appliances per 100 Households

	Urban			Rural		
	1985	1990	1995	1985	1990	1995
Washing Machines	48.3	78.4	89.0	1.9	9.1	16.9
Refrigerators	6.6	42.3	66.2	0.1	1.2	5.2
Television Sets	84.6	111.1	117.8	11.3	44.4	80.7
Electric Fans		135.5	167.4	9.7	41.4	89.0

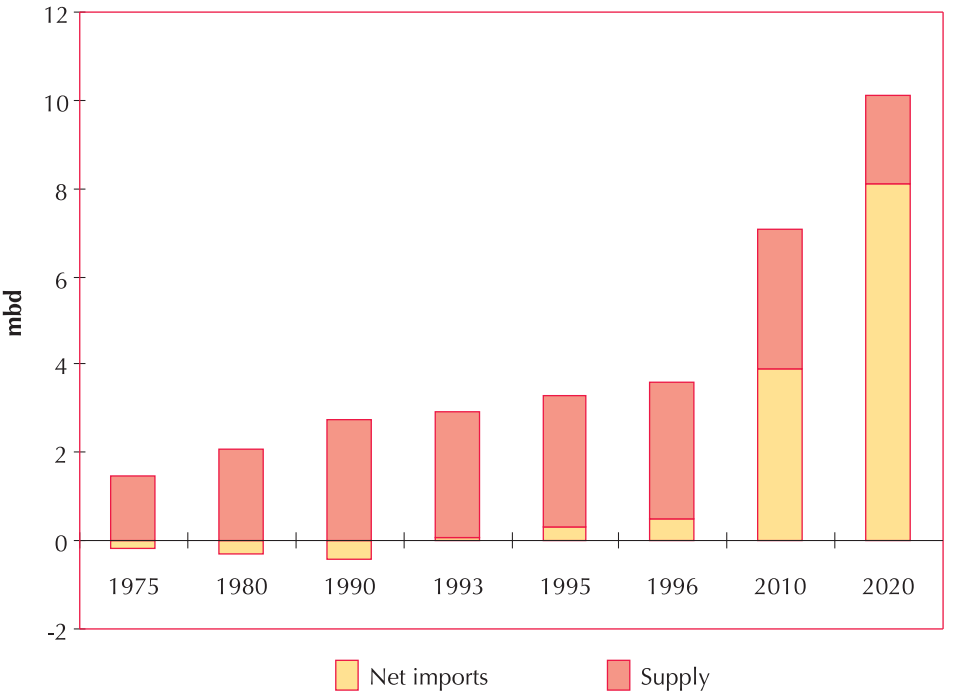
Source: State Statistical Bureau, PRC (1996).

8. Official figures on oil consumption by the transport sector, also reported in IEA data, probably are underestimated due to the methodology of data collection in China.

Energy Supply

Oil and Gas. Figure 1.2 tells much of the story of China's growing dependence on imported oil, with a widening gap between domestic production and demand. Oil accounted for about 20 per cent of final commercial energy consumption in 1996. Projections in the IEA's World Energy Outlook 1998 show that share rising to almost 26 per cent by 2020, with imports at 8 million barrels a day, four times projected domestic output in that year, and more than the projected net imports of 7.6 mb/d of the OECD Pacific countries (Japan, Australia and New Zealand) combined.

Figure 1.2: Domestic Supply and Net Imports of Oil



China became a major oil producer only relatively recently, with output rising from about 0.5 mb/d in 1970 to 3.2 million in 1997. Almost 90 per cent is produced onshore and a third of that amount comes from the Daqing field in the far northeast. Daqing was discovered in 1959, and it kept China self-sufficient in oil for a generation. The most developed offshore field is in Bohai Bay, an

eastern arm of the Yellow Sea, east of Tianjin and west of Dalian, a major tanker terminal. Zhujiang Mouth and Beibu Bay in the north China Sea are set to become significant gas producing fields.

The country has many unexplored areas, both onshore and offshore, but the longer-term outlook and Chinese hopes depend largely on the geologic potential and development of the remote, inhospitable Tarim basin in the northwest. The "Tarim" or "Far Western Basin" is actually three separate basins – the Tarim, Junggar and Turpan-Hami – in the huge Xinjiang Uygur Autonomous Region. The region's western borders touch Kazakhstan, Kyrgystan and Tajikistan (see map). Exploration and development there have been slow, with not very encouraging initial results for foreign oil companies at work in the basin. Estimates of its potential reserves still vary from as little as a few billion barrels to upwards of 80 billion (See Box 1.1). Indeed, Chinese reserve estimates remain extremely uncertain in general. The oil supply projections used here are based on a national reserve estimate of 29.5 billion barrels. Under this assumption, production rises until about 2010, then declines to around 2 mb/d by 2020.

Box 1.1
Hopes for Onshore Production: The Tarim Basin

Experts once suggested that this, the most promising of all China's hydrocarbon resources, could have reserves topping the proven reserves of Saudi Arabia – but Chinese estimates have dropped steadily, although they remain high. A recent survey by the China National Petroleum Corporation[1] reports that the Xinjiang region holds 30 per cent of China's total oil resources and 34 per cent of its gas (*Xinhua*, 1997). CNPC expects its oil reserves to total 3 billion tonnes by 2000, with gas reserves at 510 billion cubic metres (bcm). In 1997, the region produced 16.47 million tonnes (Mt) of crude oil and 2.1 bcm of gas; the oil output included 4.4 Mt from Tarim itself, up 42 per cent from 1996; 8.7 Mt from the Karamay field in the Junggar basin; and 3 Mt from the Turpan-Hami basin. Xinjiang's annual oil output now accounts for 11 per cent of China's total production, and is projected to rise to 20 per cent by 2000. CNPC plans to produce 30 Mt annually in the region by 2005.

1. CNPC is one of China's two largest oil SOEs. See Figure 1.3 (p. 21) and p. 23 for a description.

Chinese geologists believe that the Tarim contains mainly small– and medium-scale reservoirs rather than large, massive fields. In 1998, CNPC authorised a three-year exploration project to calculate reserves more precisely. China currently lacks both the technology and the capital to develop this vast and complex terrain. Several obstacles impede exploration and development : deep pay zones, high drilling costs, complex geology, high subsurface pressures and temperatures, a harsh climate and a lack of infrastructure in this extremely remote area.

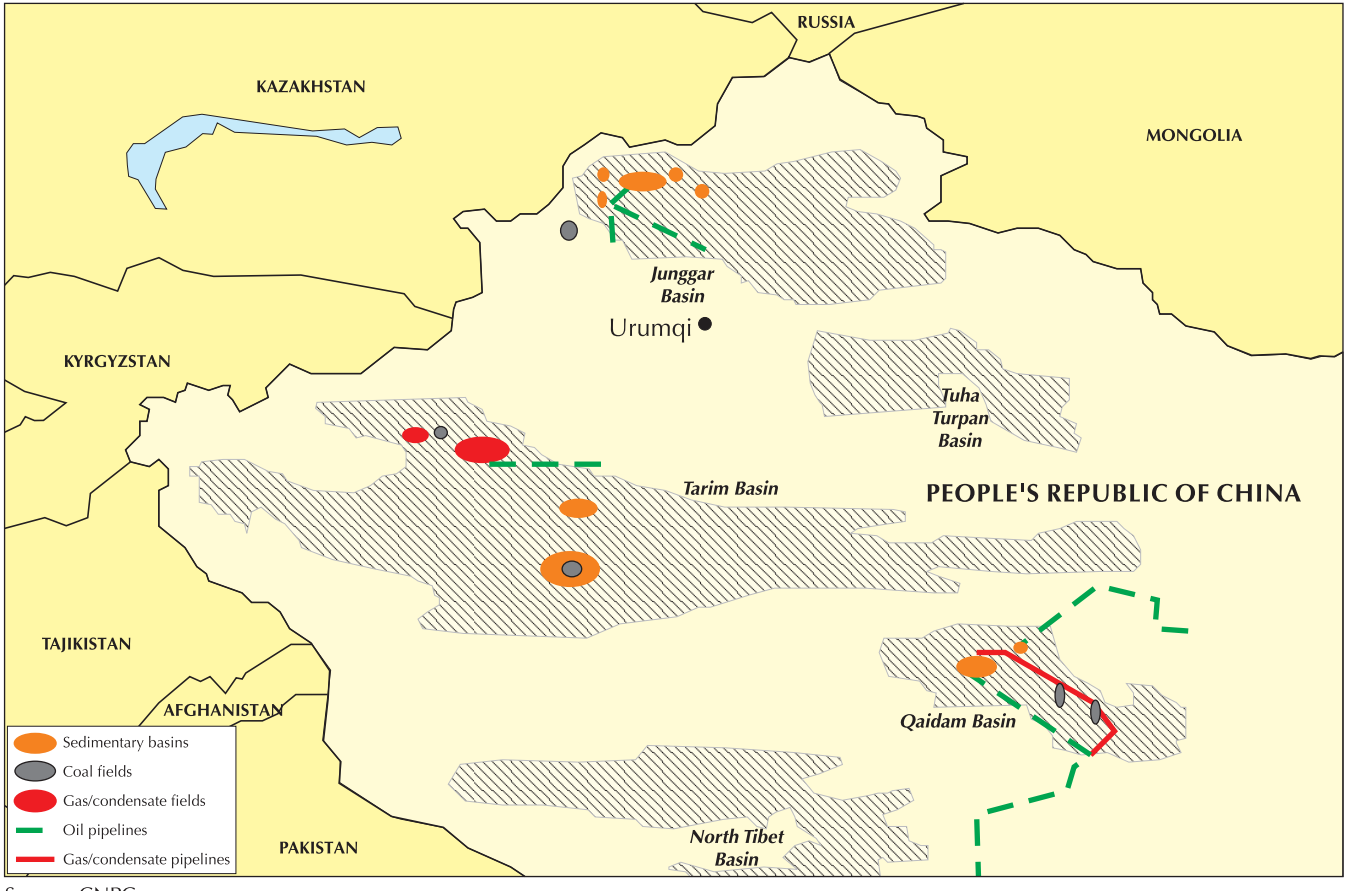
China opened sections of the Tarim basin to foreign investment in February 1994. The five blocks up for international bidding covered 72,730 km^2, an area larger than the Netherlands and Belgium combined but only about an eighth of the basin's total. Reacting to reports that these blocks are the most difficult to explore and potentially the least profitable, China offered another eight blocks in June 1995 and gave foreign interests access to some of the better blocks in 1997.

To get oil out of Tarim and into domestic markets, CNPC envisions a 4,200 km pipeline system, capable of delivering 20 Mt annually from Xinjiang to southwestern and eastern China. With estimated construction costs exceeding $1.2 billion and Tarim's output growing more slowly than expected, this remains a vision. Undaunted, and perhaps hoping that smaller, sunk investments will render the entire project unstoppable, CNPC has started to build pieces of the network. The first, a 480-km stretch within the region from Korla to the Shansan oilfield near Turpan, opened in late 1997 and can handle up to 10 Mt of oil a year, for transshipment by rail some 1,900 km farther to refinery facilities in Lanzhou, Gansu province.

Natural gas production grew strongly in the 1960s and 1970s after the discovery of large fields in Sichuan Province, but it remains a marginal fuel within the vast Chinese energy system, used mostly as a feedstock for the fertilizer industry and currently satisfying only about 2 per cent of energy demand, much lower than the world average of 23.6 percent. This will change, with gas becoming much more widely used. But for now current production is low relative to reserves. Proven reserves amount to over 1.5 trillion cubic metres (tcm), less than 4 per cent of the estimated potential. The current Five-Year Plan foresees annual production of 25 billion cubic metres (bcm) by 2000 from 22.3

Map 2

China's Tarim, Junggar and Turpan Basins



Source: CNPC

bcm in 1997 and almost 30 bcm by 2005. Official targets suggest output of 72 bcm in 2010 (IEA figure: 68 bcm) and 95 bcm (IEA figure: 99 bcm) in 2020[9].

An acceleration of gas production, if it comes, would represent a policy suitable by Beijing to switch to clean-burning fuels, both on environmental grounds (see Box 1.2) and to tap domestic gas resources in substitution for domestic coal and imported oil. The Chinese are also expected to decide soon whether to build the required terminals and other facilities to begin importing liquefied natural gas (LNG), primarily from Indonesia but also from the Middle East. A full-fledged fuel-switching policy could boost demand to 95 bcm as early as 2010 and to 140 bcm in 2020, with 75 bcm going into power generation, 30 bcm consumed in the chemical sector and 35 bcm used as city fuel[10]. LNG and compressed natural gas (CNG) are under consideration as transport fuels in taxis and buses. The key element in these fuel switches would be massive infrastructure requirements: trunk pipelines, storage facilities, city distribution networks (to the extent they are not already in place for coal gas) and the necessary LNG and CNG facilities.

Box 1.2
Switching to Gas

That China is even considering a fuel-switching policy as massive as the potential shift to natural gas indicates that environmental and climate-change concerns are gaining strength. Indeed, the current Municipal Plan for the city of Beijing gives top priority to fuel-switching to reduce the city's atmospheric pollution to "national standards". Shanghai explains its fuel switches on economic grounds, but it does have a target to reduce emissions of the main pollutants by from 2 to 10 per cent between 1995 and 2000. Nationally, a big push is on to promote coal washing, which reduces ash; this in turn reduces the extent to which coal-burning emissions produce acid rain.

9. Lan Quan and Keun-Wook Paik, *China Natural Gas Report*, Xinhua News Agency, Beijing and Royal Institute of International Affairs, London, 1998.

10. *Ibid*.

The national government does not trumpet its environmental concerns in its dialogue with the outside world. Yet national standards and a fair amount of environmental legislation do exist, and the government is well aware that pollution levels in Chinese cities approach crisis proportions. Beijing is sensitive to foreign criticism of its environmental policies. China is receptive to Japanese offers of money and assistance to counter Chinese-generated acid rain, which falls on the Japanese archipelago. Official pronouncements and documents on energy policy now almost always contain some words about environmental impacts. The main problem is changing, throughout the population and within the bureaucracy, the ingrained environmentally-unsound habits of the former command economy.

China will probably become the world's largest greenhouse gas producer by 2020, elevating concerns over China's energy policy beyond the local and regional level. While China currently spends less than 1 percent of its GDP on environmental protection, both Chinese government officials and foreign experts alike acknowledge that pollution may be costing the country 10 times that much. A total of 450 billion yuan will be spent on environmental protection between 1996 and 2000. Of the total, 182 billion yuan will be spent on water-treatment facilities, 208 billion yuan on the control of air pollution, and 50 billion yuan on solid-waste treatment.

China's heavy and rising energy consumption, its low levels of energy efficiency and its fuel mix based largely on coal all raise concerns about the nation's present and future CO_2 emissions and their contribution to global climate change. As noted in Table 1.1, China already accounts for 14 per cent of global emissions and its current and future policies have the potential deeply to affect the global totals. Chinese officials argue that emission control is primarily the responsibility of the industrial countries themselves and that those countries should bear much of the cost of emissions reductions in the developing world. Evidence indicates however, that the Chinese authorities have considerable awareness of China's own role. When circumstances permit, they will opt for fuel choices, technologies and energy efficiency measures which have emissions-reduction potential. The IEA believes that China can be receptive to advice and counsel in this respect, based on the wide experience of its Member countries in trying to solve the same problems.

Coal. China is a world coal power, and an extreme dependence on coal is the most striking feature of Chinese energy. In 1998, coal accounted for more than three-quarters of primary energy supply and around two-thirds of final commercial energy consumption. Various estimates put coal resources at one to 4 trillion tonnes, second only to Russia's. Proven, recoverable reserves stand at 115 billion tonnes – 11 per cent of world reserves and third-largest after those of the United States and Russia. Most coal ore is in relatively remote areas in the north-central part of eastern China, especially in Shaanxi, Shanxi, Henan and Shandong provinces. Already the world's largest producer, China accounts for steadily growing shares of global coal output; it passed through 1.4 billion tonnes (over twice its 1980 production) and 37 per cent of world production in 1996. In 1998, the total coal production declined to 1.2 billion tonnes largely because of the closure of unauthorised pits.

China exported 29 million tonnes of coal in 1996, or about 6 per cent of world exports. North Asia was the principal market, with Japan and Korea each taking a quarter of the total. Japan and China have a long-term agreement for trade in steam and coking coal. The outlook for future coal exports is uncertain, the best assumptions for the moment being that export capacity could indeed increase, but that strong domestic demand, poor coal quality and the already overburdened transportation network will keep net shipments from rising substantially in the next two decades. (See IEA/CIAB report *Coal in the Energy Supply of China,* 1999.)

Electricity. China is the world's second largest producer of electricity. At the end of 1998, installed capacity reached 270 million kW. Total power generation was 1,160 TWh[11], nearly three-quarters from coal-fired plants; it should attain 3,857 TWh in 2020. That represents a trebling of per capita generation, from 858 kilowatt hours (kWh) to 2,625 kWh, still well below today's average OECD per capita figure of 7,635 kWh. In 1995, heat took almost a quarter of the combined output of electricity and CHP (combined heat and power) plants, a proportion likely to remain essentially unchanged. Table 1.5 provides an overview of the expected growth in electricity generation and the fuel mix feeding it.

Coal-fired plants accounted for 70 per cent of the 227 gigawatts (GW) of installed generating capacity in 1995; hydro installations for 23 per cent; and oil-fired plants for 6 per cent. Gas, nuclear and renewables split the last percent-

11. Presentation by Mr. Xu Guanhua, Chinese Vice-Minister of Science and Technology, EU-China Energy Co-operation Conference, 4-5 March 1999, Brussels.

Table 1.5: Electricity Generation
(TWh, per cent of total)

	1995		2020	
	TWh	Per cent	TWh	Per cent
Solid Fuels	767	74.0	2,612	67.7
Hydro	191	18.4	726	18.8
Oil	63	6.1	257	6.7
Nuclear	13	1.3	127	3.3
Gas	2	0.2	123	3.2
Other Renewables	0	– –	11	0.3
Total	1 036	100	3,857	100

Source: IEA World Energy Outlook 1998.

age point. Over the past six years, annual additions to capacity have amounted to about 16 GW. By 2020, installed capacity could reach 757 GW, with the share of coal-fired plants dropping to a still-dominant 62 per cent, with hydro's rising to 26 per cent, with oil's holding steady or slightly increasing and with nuclear's rising to 3 per cent. Renewables other than hydro will see strong absolute capacity increases, but their share in the total will stay low, rising to only 0.6 per cent in 2020 from 0.1 per cent in 1995.

Coal, therefore, will meet the lion's share of the enormous expected growth in electricity demand, even though its weight in the electricity-generation mix will fall. While power generated from coal will increase at 5 per cent per year, efficiency improvements could hold the growth rate of coal inputs to power plants to 4 per cent annually. Many problems, such as small scale, inconsistent coal quality and low load factors, have kept the average thermal efficiency of fossil-fuel plants between 27 per cent and 29 per cent, compared to around 38 per cent in OECD countries. Most coal plants have less than 300 megawatts (MW) of capacity, but construction of 300 MW units and others of double that size should eventually result in efficiency increases_– as will the retrofitting or phasing-out of some inefficient, small plants. Nevertheless, acute electricity shortages and demand pressures work in the opposite direction, to keep older plants in service and to encourage building smaller, less efficient ones. If efficiency remains at present levels, coal consumption by 2020 would be 25 per cent higher and CO_2 emissions 10 per cent higher than projected.

China's hydro-electric resources rank first in the world, with at least 290 GW economically exploitable. This is mostly located in south-west and south-

central China. In 1996, hydro capacity stood at only 56 GW; it should reach 200 GW by 2020. The most significant hydro project, Three Gorges, will have a capacity of 18,200 MW, from 26 generators of 700 MW each, if completed.

As oil-fired generation roughly maintains or somewhat increases its share in the electricity-generation mix, it will quadruple in absolute terms between 1995 and 2020. This will add to pressures to find and tap more domestic resources as well as to secure reliable oil imports. Oil is the preferred fuel for power generation in some cases, especially in coastal areas, where imported oil is more accessible and often cheaper than domestic coal. The oil-fired Zhenhai combined-cycle power plant near Shanghai provides an example.

The country's first nuclear plant (300 MW) became operational in 1991, and the development of nuclear power proceeds rapidly. Official plans call for 20 GW of nuclear capacity by 2010 and 40 GW to 50 GW by 2020. Given that nuclear power is a capital-intensive option – costs per KW are triple those of a Chinese-manufactured coal plant – IEA projections show nuclear capacity in China falling way behind official goals, reaching 11 GW in 2010 and 20 GW in 2020. The Chinese see nuclear power as suitable, despite its higher costs, for provinces such as Guangdong and Zhejiang, where a severe lack of energy resources would otherwise slow economic growth. In 1999, China announced that no new conventional power plants would be approved for construction until 1 January 2002 because of the recent oversupply of power capacity as well as the slowing economic growth.

China also has renewable energy resources whose exploitation can be economic in some areas, especially remote, off-grid locations. Many provinces give priority to renewable energy development and include it in rural electrification programmes. Wind power has the largest potential both in areas where medium– to large-scale generators have grid connections, and in areas of low population density where emphasis is placed on domestic use of small-scale wind turbines. Grid-connected capacity rose to 223 MW in 1998[12] from 32 MW in 1994; off-grid capacity was 17 MW in 1994. Reasonable projections would place wind capacity at 2 GW in 2010 and 4 GW in 2020.

Coalbed methane, a gas formed and stored in coal seams, can be an important source of clean gas energy for China. The country's coalbed methane resources are around 30,000-35,000 bcm to a depth of 2,000 meters below the

12. "Development of China's Wind Energy", Xu Hongliang, China Fulin Windpower Development Corporation, presentation at EU-China Energy Co-operation Conference, 4-5 March 1999, Brussels.

surface, almost equal to that of conventional natural gas and ranking third in the world. By 2000, the annual production of coalbed methane could reach 10 bcm, according to the recently established China United Coalbed Methane Co. Ltd.

Biomass persists as an important form of non-commercial energy in rural China. China accounts for 20 per cent of the world's and 36 per cent of Asia's biomass primary energy supply. About 800 million people, largely in rural households, and half a million rural enterprises use biomass energy (Zhen, 1994). In 1995, biomass consumption reached an estimated 206 million tonnes of oil equivalent (Mtoe), or 19 per cent of China's primary energy consumption. Despite substantial programmes aimed at promoting the efficient and sustainable use of biomass, increasing urbanisation, rising incomes and more efficient technologies will all restrain its growth. Its projected share in primary demand will drop by almost half, to 10 per cent.

The Energy Delivery Infrastructure

Insufficient investment in the past, combined with inadequate project planning, management and co-ordination, has held the expansion of China's energy infrastructure to half the rate of demand growth over the past decade. The transport and power sectors have the most serious shortfalls. The World Bank has estimated the cost of demand infrastructure over the ten-year period to 2004 at $1.5 trillion, of which transport accounts for $600 billion and energy for $490 billion (World Bank, 1997). After many years of neglect, however, China's recent infrastructure investment performance has improved. Across the economy, it averages around 6.5 per cent of GDP, well above the developing-country average of 4 per cent and not far from the World Bank's recommended level of 7 per cent. In March, 1999, Finance Minister Xiang Huaicheng announced to the National People's Congress a 14.7 per cent rise in budget expenditures, largely on infrastructure, and a 57 per cent jump in the fiscal deficit (though it will still be only 1.7 per cent of anticipated GDP). The deficit spending was designed to reach Beijing's 7 per cent economic growth target for the year.

Within the energy sector, *coal* finds its way from remote mining locations to its markets on the clogged, overstretched rail network. *Electric power* flows to consumers through six large – and largely unconnected – regional power grids and several unconnected provincial grids. China loses about 20 per cent of its power generation through frequent power outages caused by inefficiencies on the grids. Planned upgrading and interconnections to create a national grid will

probably not occur until 2009, when the Three Gorges plant is scheduled to go into operation.

Crude oil moves chiefly by pipeline, although the network is not complete, and crude must often be switched to overcrowded, relatively inefficient and expensive rail transport to reach refineries. Generally speaking, crude oil flows from north to south and from east to west. Unless or until the northwestern Tarim basin becomes more important, the key centres of domestic production will remain in the northeast. China had in place some 19,340 km of pipelines in 1997 (see map), about 90 per cent more than the 10,800 km of 1983 – but traffic through them rose by only about 10 per cent, to 59 billion ton/km from 53.4 billion ton/km, probably because of bottlenecks at either end. Some crude (including offshore production in Bohai Bay) also moves south by maritime and river transport, from three main pipeline and tanker terminals in Dalian, Port Qinhuangdao (near Huangdao) and Qingdao. Small tankers carry crude to refineries on the Yangtze River.

Chinese planners' hopes for expansion from the Tarim basin and the northwest in general become clear in Table 1.6. This is one official view of the main directions in which crude oil will flow in 2020, and it provides some clues about current planning. The "production" and "supply" figures more or less balance, at 200 Mt and 194 Mt respectively, leaving little room for exports. Note that, in this view, imports (additional supply to most regions) through the East, South and Northeast will total 120 Mt – 60 per cent of total production and 38 per cent of total supply.

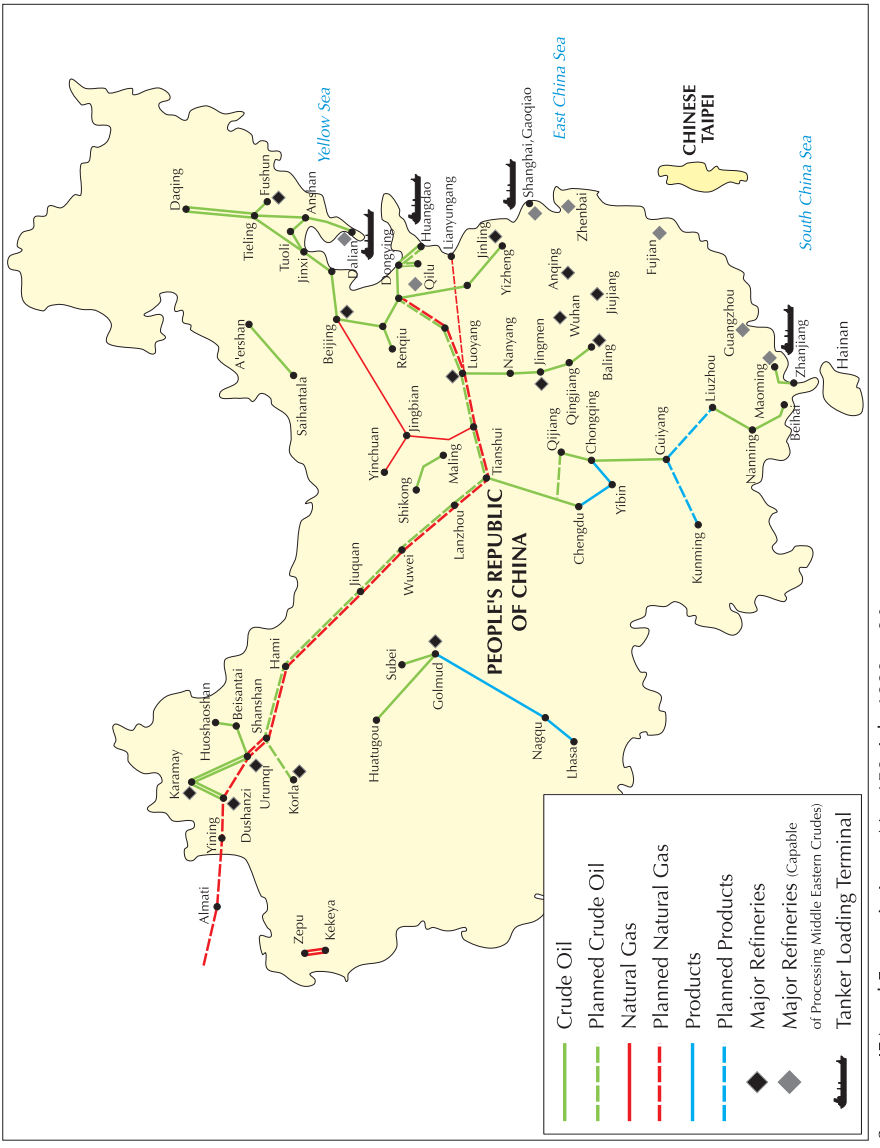
Table 1.6: A Scenario of Oil Production and Supply in 2020
(Mt)

Production Base	Production	Areas of Supply	Quantity Supplied	Imports
Northwest	96.5	Northwest	35.7	
		Southwest	22	
		Central and North	41	
North	31	Beijing	10	
		Tianjin	8	
		Others	13	
Northeast	16.5	Northeast	15	30
East/Offshore	56	East and South	49.3	90

Source: PRC (1996) *China Energy Strategy Study (2000-2050)*, Beijing (in Chinese)

Map 3

China's Oil, Gas and Products Pipelines



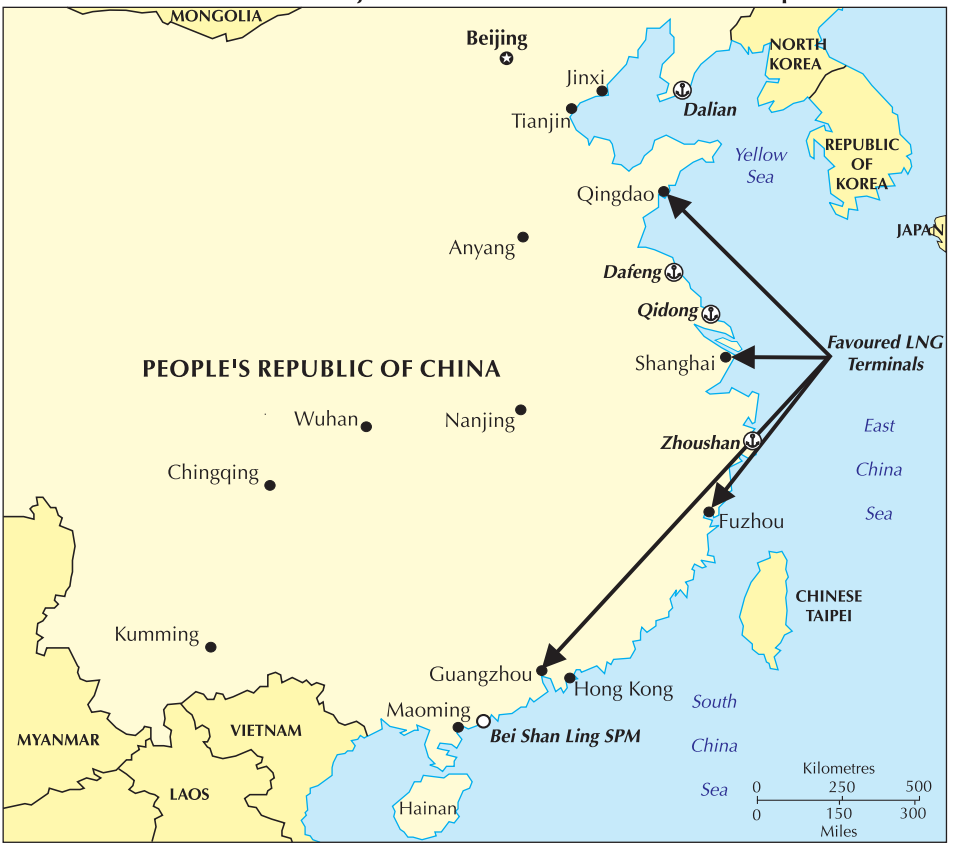
Sources: IEA and Energy in Japan No. 158, July 1999, p.26

Considerable crude-oil traffic, including imports, moves by sea to coastal areas in the South and East, and there are shortages of receiving terminals, ports, storage facilities and tankers (see map). By 2000, traffic to the main southern ports is expected to reach 52.2 Mt, but port handling capacity will probably fall well short of that, at 40.5 Mt. By 2020, total import and domestic flows could reach 150 Mt along the entire coast from Northeast to Southwest, requiring

further port expansion and investment in an estimated 70-80 large tankers at a cost of $6 billion.

Map 4

Ports and Terminals Projected for China's Crude Oil and LNG Imports



Source: CNPC

Oil products move mainly by rail, with some coastal shipping as well. Although refineries are going up rapidly in the East and South, regional imbalances remain in the refining industry. Earlier, most of the refineries were built near the northeastern oilfields, far from the regions of high demand. Many locally-owned refineries as well as some owned by CNPC and other oil state-owned enterprises are located in areas not connected to pipelines.

China is planning the construction of two long-distance refined oil pipelines through its northern regions. One is to run approximately 1,000 kilometres

from Daqing in Hebei. The other will run about 900 kilometres through Northwest China from Lanzhou or Wuwei in Gansu to Chengdu in Sichuan.

Poor *natural gas* infrastructure remains a critical issue in China. Development of a comprehensive transportation and distribution network is a necessity in view of China's increased gas use. Pipeline construction and downstream projects are at present lagging behind upstream progress. China aims to develop a national grid capable of transporting 150bcm/year of gas. Several new pipelines, including one from Xinjiang's Shanshan field to Urumqi and another from Shaanxi to Beijing, are already in operation. Preliminary feasibility studies are under way on the construction of a national gas pipeline system – a main line delivering gas from western to eastern China and to associated local networks. The country also intends to develop gathering centers and storage capacity of 15-17 bcm. Central planning and industrial policy are needed to promote natural gas development. Planners need to focus on building a reliable and efficient natural gas delivery system, gas-fuelled power generation, industrial use and distribution for residential use.

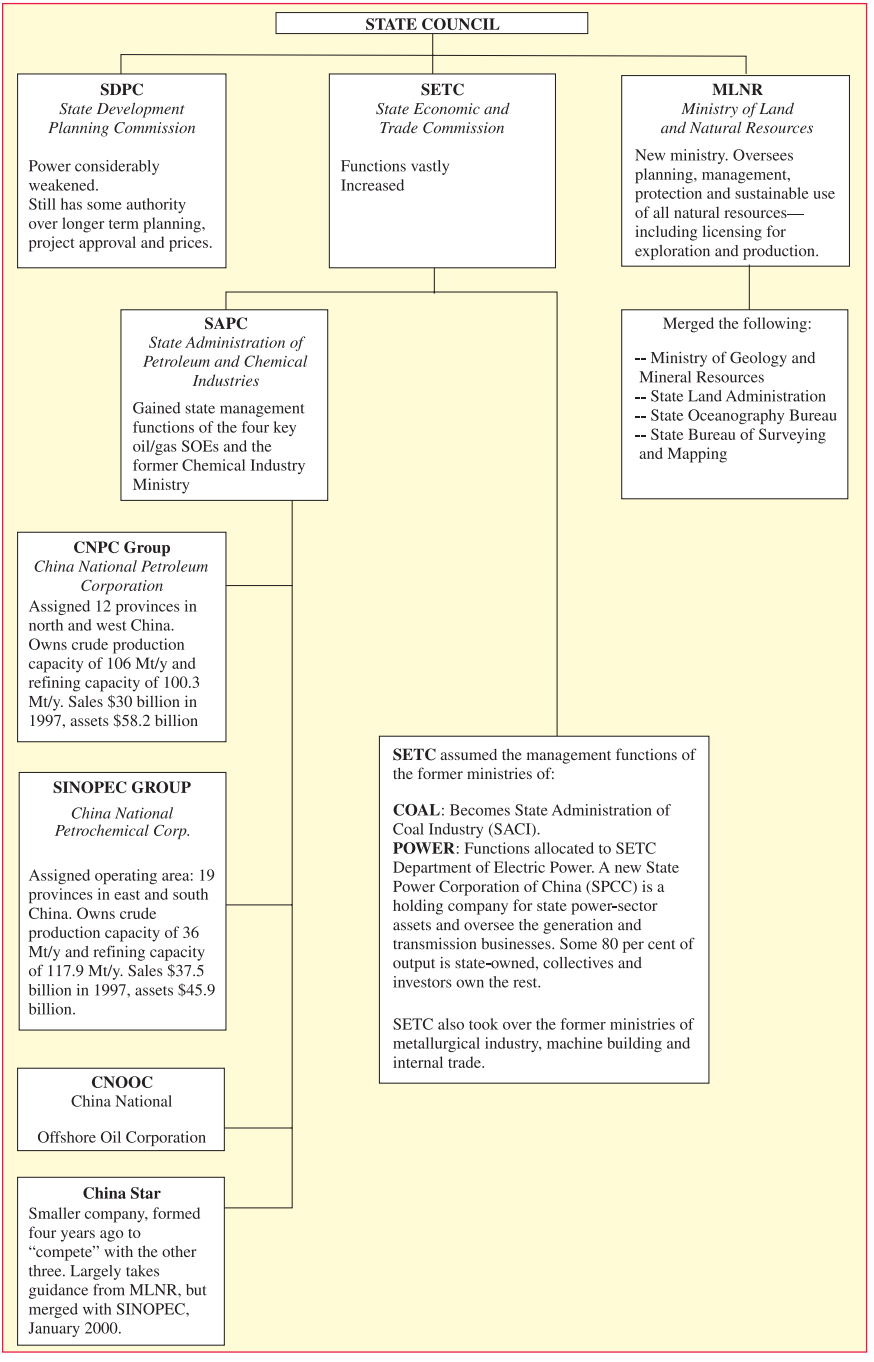
The New Institutional Setting

Characteristics typical of "command and control" systems still dominate the energy sector. In March 1998, the government announced a radical reorganisation and streamlining of government, and the restructuring of certain state companies. This move seeks to streamline, simplify and further centralise the apparatus of control in parts of the energy industry (Figure 1.3). On paper, it does appear that the Beijing government has wrested management of different parts of the energy system from competing ministries and agencies. The Decree places them under the sort of unified direction essential for any sort of comprehensive strategy. One objective – to introduce competition by separating the commercial operators from the policy makers and regulators – shows few signs, so far, of realisation.

The unification of control remains incomplete, with forceful management by the State Power Corporation of China (SPCC) operating more as a regulator than as a monopolistic holding company.

In the *oil and gas sector* (including petrochemicals), an oligopolistic structure has emerged. This structure will have a decisive impact on China's growing energy interface with the rest of the world. In principle, the four oil and gas state-owned enterprises grouped under the State Administration of

Figure 1.3: China's Re-Organised Energy Sector



Petroleum and Chemical Industries, a newly created regulatory body, may compete freely, both domestically and internationally, and across the spectrum of exploration, production, refining and marketing. Although some see them as modelled on the Korean *chaebols*, they do not have the *chaebols'* cross-industry conglomerate characteristics. If one ignores that they are state-owned enterprises, they look more like big oil and gas firms on the western model.

Each of the four came out of the restructuring with a particular "territory". CNOOC and China Star saw the least change, the former because its offshore operations were already clearly defined and the latter because – although created four years ago specifically to compete with the others – it remained marginal, more or less subordinate to the Ministry of Land and Natural Resources[13]. The China National Petroleum Corporation and the China National Petro-Chemical Corporation (SINOPEC), by far the two largest and most important firms, essentially divide mainland China between them: CNPC (with the most domestic crude oil resources) in the North and West and SINOPEC (with the most developed markets and access to foreign oil) in the South and East. This arrangement could easily turn into a cartel, with state– controlled trading between territories to relieve local imbalances in production and consumption. Whether it does so, or not, will depend on whether real competition occurs. No signs of that presently exist.

CNPC completed the first step of corporate restructuring by establishing a share holding company named PetroChina in early November 1999. CNPC is preparing for its first initial public offers, valued at a range between $7 and $10 billion for early 2000.

The restructuring put the lion's share of oil trading into the hands of CNPC and SINOPEC, more or less ending the independence of three of the four state-owned enterprises which previously had managed China's oil imports and exports.[14] Chinaoil, originally created as a crude oil exporter for CNPC, has now become CNPC's main oil-trading entity. SINOPEC, for its part, has absorbed the nation's top crude importer, UNIPEC (China International United Petroleum

13. SINOPEC took over China Star in January 2000, but this will not add much to SINOPEC's weight in the upstream oil sector because China Star accounts for less than 1 per cent of the crude output and 4 per cent of natural gas production.

14. The exception is Zhenrong Corporation, an oil-trading firm under the Ministry of Defense; it may well become extinct too, as the military follows government directives to shed its business operations.

and Petrochemical Corporation). SINOCHEM (China National Chemicals Import and Export Corporation), once China's oil trading monopolist, has had to surrender its 50 per cent equity shares in Chinaoil and UNIPEC to their new owners; it now operates on a much-reduced basis. On balance, these shifts favoured SINOPEC, which had lobbied for control of the crude oil import market.

Box 1.3
China's WTO Accession and Petroleum Industry

Under the US-China agreement on China's accession to the World Trade Organization concluded in November 1999, China assumes a substantial set of commitments. These commitments deeply involve state oil monopolies like CNPC and SINOPEC, as well as multinationals waiting to sell their energy products, services and technology to Chinese customers.

The contemplated tariff cuts mean that Chinese companies will have to reduce production costs to compete with imports. Current trade barriers include a quota system for certain oil products. China will have to increase its imports by 15 percent a year.

If China enters WTO in 2000, 19.8 Mt of oil product imports will be allowed for 2000, 22.7 Mt in 2001 and the amount will increase until 2004, when the quota system ceases to be a meaningful restriction on imports.

Under WTO rules, China will have to lift restrictions on distribution. The United States is pressing for retail rights for US firms in 2002 and wholesale rights in 2003.

The keys to success in a freely competitive market are quality and cost-effectiveness. In both areas, Chinese oil monopolies are a long way behing their international competitors.

Energy Prices: A Key to Reform

In many countries with long traditions of officially controlled prices, energy tariffs are among the last elements of the energy structure to be reformed, partly because governments see energy utilities as natural monopolies needing controls, and partly because almost everywhere they consider energy products as strategic commodities[15]. Moreover, the introduction of competition – market pricing – in energy presupposes effective regulatory systems and institutions, which do not yet exist in China. China's leaders have struggled to introduce a semblance of market pricing into the energy system; but they have moved cautiously and progress has occurred faster in some parts of the energy sector than in others.

Before 1980, the central government set all energy prices, usually at very low levels, a pattern which heavily subsidised energy consumption and required offsetting subsidies to producers, whose revenues did not recoup real costs. Low prices also worked as a powerful disincentive to greater energy efficiency, a goal that has moved up on the scale of policy priorities. It now functions as one strong motivation for moves toward market pricing of all types of energy. Until about the end of 1997, hesitant moves toward price rationalisation took place against a backdrop of relatively high world oil prices and a booming domestic economy which generated buoyant energy demand. The year 1998 brought shocks to this environment, however, in the form of severe declines in oil prices and a relative cooling of economic growth. Both have spotlighted distortions inherent in the Chinese system and probably speeded price reforms, which nevertheless remain incomplete.

Government control continues in varying degrees, but it tends increasingly to be shared between the central government and provincial authorities, which have gained power relative to the centre as reforms have swept through the Chinese economic system. In an environment of sagging coal demand, the reforms of the *coal* industry in 1998 aim partly to balance demand and supply so that prices will firm and generate some profits for the loss-making, high-cost, state-owned enterprises. Weak demand for coal stems chiefly from a corresponding weakness in *electricity* markets, whose growth has nearly stalled and where some regional surpluses of generating capacity have appeared. Once

15. See the IEA Study *Looking at Energy Subsidies: Getting the Prices Right*, Paris, 1999, which contains a chapter on China's energy price structure and policies (p 91-111).

again, central and local governments share in a labyrinthine system for fixing electricity prices. Fairly considerable price increases until 1998 (when there were none) still did not fully match the rate of inflation, and all sorts of subsidies still permeate the system.(Andrews-Speed *et al.*, 1998a).

The new State Power Corporation of China (SPCC) plays a strong but confused role as both regulator and holding company for electricity operators.[16] On the one hand, it is accelerating closures of small, relatively inefficient and polluting power stations.[17] These tend to be old plants with fully amortised costs that can sell power at lower prices than larger, newer establishments. Counties and cities own many of the old plants, while the provincial power companies (the SPCC's main "clients") own the newer ones. On the other hand, the SPCC sees an opportunity in the disturbed market to introduce more competition in power generation (but not in transmission and distribution, which are regarded as natural monopolies). One idea, mooted for Shandong Province, would consolidate plants into generating companies that would vie with each other in selling to a power pool.[18]

The oil industry has seen the most progress on prices. This has taken some time and a series of stages since 1980. In the early 1980s, China instituted a two-tier system; one heavily controlled price for sales of production within the state Plan and another, freer one for direct sales of above-plan output. These two tiers persisted in a progressively attenuated form until the 1998 reforms. With further but incomplete liberalisation of controls in 1992-94, a market price for refined products gradually emerged. Distribution-system reforms in 1994 removed certain price controls to generate more oil-company revenues. They also eliminated enough intermediary links in distribution to hold domestic retail prices steady despite significantly higher crude oil prices at the time. Finally, a probably quite decisive step came in 1998, toward full linking of domestic and international prices.

The June 1998 oil price reforms are not fully operational. They remain in a transitional period of indeterminate length as the government worries about its vulnerability to international price instability just when the parallel reforms of

16. The apparent source of government policy for the electricity industry, the Electric Power Department of SETC, is too small and weak to do much more than rely on the SPCC.

17. One sign of market weakness : a widespread move to cancel power purchase agreements (PPAs), under which generators sell power at fixed prices, usually to the provincial power companies.

18. See also Andrews-Speed *et al.* (1998b) and Ögütçü (1998a).

the institutional structure are getting digested[19]. Nevertheless, domestic prices have held only slightly above international levels since the summer of 1998. It surprised Chinese industry and probably demonstrated to policy makers that China's petroleum sector is more porous – more linked with the international industry – than they had hitherto realised. The first half of 1998 saw a surge in legal and illegal imports of both crude oil and refined products as the gap yawned between low international prices and high domestic ones. Domestic oil stocks rose, onshore production cutbacks ensued and the oil companies' financial performance plummeted. Initially, the government tried to crack down on smuggling and imposed temporary import bans. But these measures could not fully insulate the Chinese oil sector, and the price reforms followed quickly.

The new regulatory structure for the oil industry involves three main entities: the SDPC, through its Price Administrative Department and Transport and Energy Department; the SETC, through its administrative control over the oil/gas and chemicals companies; and the Ministry of Land and Natural Resources through its licensing machinery. In addition, CNPC and SINOPEC have both gained pricing powers and freedoms. They fix ex-refinery prices for their own refineries. They can set final retail prices for the main refined products within a 10 per cent band around baseline prices set by the SDPC (5 per cent above or below). Their subsidiary oil companies have control over the entire wholesale business and can fix the differentials between wholesale and retail prices for their provincial and local companies. Thus, the price administrators in the SDPC and the big oil companies themselves represent the key players in a system which, if fully implemented, will operate as follows:

- All vestiges of two-tier pricing for onshore oil will disappear. (Chinese refineries treat offshore crudes, already priced from the international market, as imports.)
- The SDPC will set and announce the baseline prices monthly, but its formula will hold rigidly to the average of daily Singapore FOB (free-on-board) prices for a calendar month, plus import tariffs. Hence, unless the formula changes or tariffs become a pricing-policy tool (the import tariff on crude oil has held steady at 16 yuan per tonne since 1 July 1997, and tariffs on products remain steady or are coming down), the SDPC's role appears in fact to be rather mechanical. The SDPC's regulatory power to enforce the prices that it does set also remains in question.

19. "The New Oil Price Reform in China : Moving Toward Market Deregulation ?", Kang Wu, 24 August 1998, FACTS Inc., Honolulu.

- Onshore oil prices in the domestic market should consist of the baseline prices, plus premiums or minus discounts. CNPC and SINOPEC fix the premiums and discounts within or between themselves, based on transport costs, quality differentials and "market conditions". They must both set and publish final retail prices for the main cities within their jurisdictions.

Knotty problems remain for making this new system operational. It almost certainly will not produce uniform pricing of petroleum products throughout the country. The main problem concerns economic geography, which requires that CNPC and SINOPEC clash or co-operate. CNPC controls the bulk of production resources for onshore oil and refined products, but SINOPEC controls the high-consumption markets in the south and east. Moreover, both face significant retail competition in local southern markets from small, township refineries and a collection of retail outlets far larger than their own networks.[20] The provincial authorities side with these local enterprises rather than with CNPC and SINOPEC because they furnish an essential source of provincial tax revenues.

Local oil companies (and SINOPEC) can hardly justify buying high-priced CNPC domestic products when foreign oil undersells them. As a result, through late 1998, neither CNPC nor SINOPEC has observed the SDPC's baseline retail prices (or the premium/discount band) since they first were set in June 1998 at $24 to $28 (200 to 400 yuan) per tonne higher than those posted at non-CNPC, non-SINOPEC gas stations. Both SINOPEC and CNPC have chosen to price for market share, but neither has resolved whether or how to co-operate with the other. On balance, a significant degree of market competition does exist in some localities at the retail level, thanks to cheap imports and the small operators, but it may not last long. The chief, unresolved question concerns whether CNPC and SINOPEC will collude or do competitive battle in the future and thus determine whether competitive market pricing pervades the entire national oil economy, especially if or when international oil prices firm and rise again.

A Summing Up

This chapter began with the assertion that China's growing dependence on imported oil has its causes in conditions and developments within China itself. We now can see how it came about.

20. China has 90,000 gas stations but only 8,000 belong to SINOPEC and 4,270 to CNPC. These "independents" thus rule the markets in their localities.

China's rapid development and growth since broad economic reforms began twenty years ago has sparked a surging demand for energy in forms that can serve an expanding, modernising industrial and commercial structure as well as the needs of households with rapidly rising living standards. The nation has vast energy resources of all types, but they tend to lie far from the most populated, fastest-growing regions. This has stretched the inadequate domestic energy-delivery infrastructure from the start. It has made imported energy, notably oil, an attractive alternative in precisely those parts of China which need it most. As the economy opened, these areas took advantage of their easy access to foreign oil. The nation has made large strides in exploiting its domestic resources, but the effects of growth have outstripped those resources and led to rising net oil imports. The trend has probably become irreversible, unless large new reserves of economically-exploitable oil can be found.

Certain policy steps augmented and reinforced these trends, perhaps unintentionally. A policy of fast export-led growth was bound to affect the energy sector as well as the rest of the economy. Insufficient investment in transport and energy infrastructure, plus relative slowness in reforming the command-economy characteristics of the energy sector, inhibited the availability of domestic oil and raised its real cost. Paradoxically, this cautious conservatism in pursuing reform of a sector considered "strategic" probably hastened the loss of self-sufficiency in oil. It sent confused and even perverse price signals to an industry that might have developed faster in the high-price international environment that prevailed over most of the period since the late 1970s. The current, low-price environment, a completely exogenous development, has reinforced domestic pressures to import and dealt a severe blow to hopes for exploiting the relatively high-cost Tarim basin.

CHAPTER TWO

CHINA'S SHIFTING TIES IN THE ENERGY WORLD

Introduction: Whither Chinese Policy?

Two central points of view contend within China's energy policy establishment. The first, perfectly understandable because the country has only recently lost its autonomy in oil, would seek to restore self-sufficiency. Proponents of this view can reasonably point to still-high estimates of unproven reserves, as well as the potentials for technical advances, fuel switching and energy-efficiency gains, to make their case for energy autonomy. They can also point to events within living memory, such as Western embargoes and the chaos in the energy sector, which followed the breakdown of Soviet-Chinese relations in the 1960s, as demonstrating the risks of international energy interdependence. In every country where it is even remotely possible to envisage it, self-sufficiency always has appeal on strategic and security grounds.

This view – and the "command economy" bias which accompany it – go far to explain why Beijing has moved slowly to reform its energy sector in comparison with other parts of the economy. A drive toward self sufficiency in a closed system invites reliance on state-owned enterprises almost indistinguishable from government itself, non-market pricing, heavy subsidies and a reluctance to accept foreign investment. That reforms in all these aspects are now taking place relatively faster than they were just five years ago attests to the pressures that rapid economic growth, surging oil demand and mounting net oil imports have placed on the system.

The second viewpoint urges a different allocation of effort, with more emphasis on seeking reliable and secure supplies of imported energy. It accepts oil-imports as an inevitable consequence of economic success and uses China's growing influence in international energy markets to ensure that imported energy is available when and where needed. It also appeals to the commercial interests of the big state-owned enterprises whose business and policy roles are so closely commingled. To some extent, the state-owned enterprises' forays into international markets as traders and investors have already established China's presence and given their viewpoint a solid place in Chinese policy. Yet one can

never be entirely sure whether a move by CNPC, SINOPEC or CNOOC – an investment in a foreign oil field, for example – has commercial motivations, policy impetus, or both.

Nevertheless, as long as the debate continues and reform remains incomplete, China will continue to have difficulty in articulating how it weights the elements of its energy policy: development of indigenous oil and gas, diversification of energy sources and imported energy supplies, and the encouragement of energy conservation and efficient energy use. Many policies co-exist, sometimes as complements, sometimes in competition, but their interrelationships have poor definition. There are several strategies rather than a single one, and many actions, which may or may not reflect policy[21]. So policy drift persists.

Yet "drift" is not the same thing as "paralysis". Government and the state-owned enterprises in fact show highly activist tendencies. The two basic points of view get accommodated in:

- an approach that still stresses a goal of independent domestic primary energy supply in the long run, accompanied by an ambitious energy development plan. Along with oil, natural gas and coal facilities, it calls for eight new nuclear plants, ten to a dozen hydroelectric facilities and over 30 thermal power plants;
- aggressive trade and investment strategies that stress positioning China for energy security in a longer-term scenario of dependence on imported energy. Much official rhetoric manages both to highlight energy independence and to leave ample room for international action. Notwithstanding the ongoing debate, therefore, China has reacted with alacrity, after just a few years of rising net imports, to begin forging a credible set of linkages with international energy markets.

Covering All Possibilities

Table 2.1, which reproduces Chinese figures rather than IEA projections, lays out some official premises under which China pursues its place in international energy markets. Beijing policy makers believe that, as petroleum demand jumps by a factor of 2.6 between 2000 and 2050, fully 87.5 per cent of

21. The first half of 1999 witnessed a series of high-profile meetings on energy policies, which highlighted the rising energy consciousness amongst the country's senior policy-makers.

the increment can be met by substitution of gas, hydro, nuclear, or renewables for oil, most of it in the 30 years between 2020 and 2050. Yet that still leaves large volumes of rising imports to find and manage in both the short and the long term – 22.5 per cent of total demand in 2000, 28 per cent in 2020 and 31 per cent

Table 2.1: Chinese Estimates of Future Petroleum Imports
(millions of tonnes)

	2000	2010	2020	2050
Demand	200	260	320	520
Domestic Supply	155	165	180	80
Deficit	45	95	140	440
Deficit met by:				
Substitution Fuels	– –	10	51	280
Oil Imports				
*Projections 1996**	45	85	89	160
*Projections 1999***	35	60-75	130	– –

Source: * PRC (1996) *China Energy Strategy Study (2000-2050)*, Beijing (in Chinese)
** *China Oil, Gas and Petrochemicals Newsletter*, Vol. 7, NO. 24, 15 December 1999, p.1

in 2050.

These numbers reflect a very positive view on the country's ability to provide itself with domestic oil. They fall well below non-Chinese estimates of oil import demand in roughly the next two decades. The IEA projections[22], for example, suggest that import requirements could reach 200 Mt (4 mb/d) in 2010 and twice that much in 2020. (Chinese experts find these figures too high.)

Actions to deal with import dependence cover all the standard fields: creation of a strategic oil reserve; pursuit of diversified, secure import sources; more receptive policies toward foreign investment in Chinese energy; and Chinese investment in foreign production facilities, plus (possibly) investment in oil and gas pipelines in producing countries or from them to China. All these actions show dual motivations. Aware of its growing dependency on imported energy, China seeks a more prominent position in the existing global system of energy production and trade. Where it can, it also seeks to open new connections in global *markets*. Increasingly – as in all heavily import-dependent countries –

22. See Chapter One, Figure 1.2.

external energy policies form a subset of foreign economic and security policies in general.

Strategic Reserves

Standard thinking on energy supply security in general and strategic reserves in particular involves relatively new concepts for Chinese energy policy makers, who look for guidance in the energy security policies of other importing countries, especially those of the OECD. The *China Energy Strategy Study (2000-2050)* (PRC, 1996) mentions the strategic oil reserves of the United States and Japan, and suggests that China should consider establishing a 15 Mt reserve (about a month's consumption) in 2000 and expand it to 64 Mt (three months' consumption) in 2010. The Chinese government announced in December 1999 its intention to keep crude stocks equivalent of 60 days of net imports and products stocks equivalent of 30 days of consumption by 2020. The amounts include China's commercial stocks, but exclude its production inventory[23].

CNPC has begun to develop a strategic oil supply system, to include oil reserves as well as seaport expansions the better handle to and store imports. A gas-oil reserve system is also under development. The research institutes of both the SDPC and CNPC have publicly suggested slower production in some fields to leave reserves in the ground, an attractive proposition when imported oil has lower real cost than some domestic output and above-ground storage infrastructure is scarce.

The present, limited storage facilities in China date from the era of self-sufficiency in oil. Small and scattered around the country at oilfields, transport hubs, refineries and ports, they are geared toward traditional demand and supply patterns. The system groans under infrastructure inadequacies, which require storage facilities to compensate for transport bottlenecks. A programme to build facilities for a strategic reserve would compete for scarce resources with the pressing infrastructure requirements already discussed in Chapter One and thus represent a quite significant policy decision.

Detailed information on China's strategic reserve plans remains scarce; the evidence available could suggest that at least some "strategic" oil storage and port handling capacity must piggyback on primarily commercial projects. Press

23. *China Oil, Gas and Petrochemicals Newsletter,* Vol. 7, NO. 24, 15 December 1999, p.1

reports in 1997 (*IHT*, 1997; *China OGP Newsletter*, 1997), one of which is at least semi-official, indicated that a decision on strategic reserves had been considered and made, and that some new national oil storage facilities might be completed before 2000. In January 1998 (a few months before the energy-industry re-organisation took place), the SDPC unveiled details of some proposed storage locations.

The potential sites include several deep-water ports – Huangdao in Shandong, Aoshan Island in Zhejiang, Maoming in Guangdong and Dalian in Liaoning. An oil product terminal is under construction in Qinzhou. The Guangzhou Petrochemical works operates a new terminal in Huizhou Daya Bay, capable of handling ships up to 250,000 DWT. A preliminary calculation by CNPC estimates that these projects will cost 30.2 billion yuan ($3.64 billion) to realise.

Evolving Oil Trade Patterns: The Search for Secure Supply

Table 2.2: China : From Oil Supplier to Oil Customer
(millions of tonnes)

	Crude	Products
Imports		
1990	2.92	3.12
1993	15.67	17.39
1997	35.33	23.20
Exports		
1990	23.99	5.42
1993	19.44	3.71
1997	19.83	5.56

Source: Tables A-1 and A-2 in the Appendix which, together with Table A-3, provide a detailed picture of China's changing oil trade patterns in relation to overall trade in goods. They are drawn from the FACTS, Inc.

Policy makers never like surprises, and the Chinese have had more than their share in recent years. Between 1990, when China exported almost five times as much crude oil and products as it imported, and 1997, when imports doubled

exports, the self-sufficiency known since the Daqing fields came into production in the 1960s became a wistful memory (Table 2.2).

Evidence of declining self-sufficiency appeared as early as 1985, but it gathered real force in the 1990s; the turning point from net exports to net imports came in 1993. Although 1998 saw a drop in imports as slower economic growth cooled demand, this represented a cyclical phenomenon, unlikely to persist. There is no reason to alter the projections of a steady increase in import dependence over the years and decades to come.

Chinese leaders and the big oil state-owned enterprises have reacted swiftly to the changes. A policy view on energy-supply security has developed, which combines a drive for diversification of import sources and a search for reliable suppliers, with "reliability" defined in terms of suppliers' political friendliness and a capacity to ship plenty of oil, especially crude. In practical terms, these considerations have pushed China's oil trade in the same directions as they have pushed other nations: toward the Middle East.

As Table 2.3 shows, that region has displaced the Asia-Pacific area as

Table 2.3: Diversification of Chinese Oil Import Sources, 1990-97
(per cent of total imports)

Region	Crude		Products	
	1990	1997	1990	1997
Middle East	39.4	47.5	1.2	1.8
Asia-Pacific	60.6	26.2	85.5	81.6
Africa	0	16.7	0	0.4
Others	0	9.6	13.3	16.2

Source: FACTS, Inc.

China's principal source of crude oil, but China also has made major strides toward diversification elsewhere. Asia-Pacific countries remain overwhelmingly the main sources for oil products, imports of which are far from negligible because China itself has a chronic shortage of refinery capacity relative to demand. These products, of course, can be and often are the output of Asian refineries using feedstocks from the Middle East.

In 1990, just three countries merited breakout in the data as key suppliers of crude oil: Indonesia, Oman and Iran. By 1997, the list included ten, far more

widely spread around the world: Oman (which had displaced Indonesia as principal supplier, shipping three times as much crude as China's total imports in 1990), Yemen, Iran and Saudi Arabia in the Middle East; Indonesia in Asia; Angola and Congo in Africa; and Argentina, the United States and Russia among the "others". (See Table A-1 in the Appendix for a detailed listing; the Appendix tables provide the empirical basis for this discussion.)

The concentration on Oman and Yemen in the Middle East derives in part from a technical factor. Chinese refineries, originally built to process sweet domestic crude oil, can readily use Omani and Yemeni crudes, but have difficulty with the sour crudes from elsewhere in the region. Refinery conversions and upgradings now under way will in time allow far greater diversification of import supplies among the Middle Eastern countries. Oman and Yemen may lose market share but not necessarily volume as Chinese crude imports mount in absolute terms over the long term.

Increasing Chinese crude imports from the Middle East do not imply any withdrawal from traditional Asia-Pacific suppliers. China imported more than five times as much crude from them in 1997 as in 1990. It reflects, instead, a region-wide trend toward heavier imports from outside the region as economic growth boosts demand beyond the capacity of Southeast Asian suppliers. (Even Indonesia is expected to become a net importer.) Oil dependence in Asia-Pacific countries reached 61 per cent in 1997 and is forecast to rise to 66 per cent in 2005 (Fesharaki, 1998) Somewhat dampened by the softer demand created by the Asian crisis (dependence fell to 58 per cent in 1998), these trends will re-establish themselves as the financial crisis and its repercussions wane.

The chief implication for China lies in the general shift toward the Middle East. It is part of a region-wide, indeed global development. To satisfy its own rising demand, China must, along with others, enhance its role as a player in those markets. While it has had some success in diversifying elsewhere, it must turn like everyone else to the region with the most abundant supplies, and it is doing so. The implication for other players – both suppliers and importers – lies in China's entry as a competitive buyer into the global system.

By 1997, China had already become an important customer for several countries (Table 2.4). Such relationships represent linkages already forged. They give some sense of how similar developments will proceed elsewhere, reinforced by exploration and production investments from the large Chinese oil state-owned enterprises in supplier countries discussed later in this chapter.

Table 2.4: Countries from which China Took More Than Ten Per Cent of Their Global Oil Exports in 1997
(percentages of total exports of crude or products)

Country	Crude	Products
Yemen	25.3	
Oman	21.8	
Indonesia	16.7	
United States	13.9	
Angola	11.3	
Japan		28.4
Singapore		17.5
Korea		17.4

Source: Table A-1 in the Appendix.

Significantly, many of these investment forays have occurred in countries other than those on the "principal supplier" list in 1997.

From the supplier side, Middle Eastern countries also have active interest in developing the Chinese market. Saudi Arabia represents a good example, Kuwait another. The Saudis see China as a lucrative market for crude oil and investment in the petrochemical sector. Saudi Aramco has already negotiated the main terms of a $1.5 billion deal to expand and upgrade two refineries in China in return for a long-term Chinese commitment to import Saudi crude. If China wants more Saudi investment as well as more Saudi oil, it will need to agree to more such deals. As China entwines itself ever more closely with the global system, the close intermingling of trade and investment flows into and out of its oil and gas industry will become increasingly apparent and important. The global industry offers a paramount example of how investment and trade move together.

Another measure of "linkage" concerns the degree to which oil imports become embedded in broader trading relationships. China tries hard to establish such links and has had some success. Among its main suppliers of crude and products in 1997, in only four did oil trade amount to the lion's share of total exchanges (the sum of exports and imports in Chinese data): Oman (100 per cent), Angola (93 per cent), Congo (92 per cent) and Yemen (83 per cent). All others had shares well under 50 per cent. Among the Middle Eastern countries, Saudi Arabia and the United Arab Emirates are China's principal overall trade partners.

Iran is significant, too, with over $1 billion in total trade, of which 41 per cent was Chinese crude imports. With the recent swap arrangement between China and Iran and a $250 million Iranian investment in a Chinese refinery upgrade to accommodate Iranian sour crude, Iran will rise in importance as a crude supplier to China. The Chinese-Iranian relationship has developed and changed over at least three decades, raising concerns within the international community in the mid to late 1980s that China was using arms exports and nuclear co-operation as building blocks to bolster it. Since the US-China Summit of 1997, China appears to be curtailing sensitive nuclear transfers to Iran as part of a wider and more positive trend in Chinese non-proliferation policy. Arms sales may be falling as well. The Sino-Iranian ties are steadily moving to more substantive economic and trade relationship.

At one time, evidence pointed toward a trend in Chinese foreign policy that involved developing economic relations with not only politically-friendly countries but politically– distant countries as well. Even in the 1970's and 1980's oil trade operated more as a tool of that policy than as a driver of it. Current Chinese activity in Iran, Iraq and Sudan all point to continuation of that policy, but it has taken on a very different guise, with the oil element playing a much more prominent role in purely political adventures. Like all countries, China seeks niches where it can function as a major player rather than just as one among many. Yet the field for such initiatives narrows steadily relative to the growing oil import needs which propel China into the global oil production and trading system and require that it adapt – as a fierce competitor – to it. From the evidence of China's oil trade and investment relationships so far, the adaptation appears well under way.

Chinese oil trade policy in general, more than its overall trade policy, still shows signs of the *dirigiste* and sometimes protectionist tendencies associated with command-economies. The government remains all too ready to impose draconian measures by decree – the import ban in 1998 provides a good example – in part because incomplete domestic price reform creates disequilibria and a tendency continues to view trade as a "swing" variable that can be manipulated at will to restore domestic balance. Such uses of trade policy disrupt markets and do not help the development of reliable and secure supply relationships in the long run. They also create new imbalances, such as the rampant smuggling

problem with which the Chinese had to cope in 1998, and they illustrate the close interconnections between domestic reform and trade liberalisation.

There is recognition that the next steps of the reform process and the date of the WTO membership are closely linked. WTO membership will call for delicate policy decisions in the energy sector. China appears aware of the need to overhaul its energy industries before dropping tariffs and opening up to less expensive imports.

Foreign Investment: In and Out

Investment flows, especially foreign direct investment, create links between a nation's energy sector and the international energy system as firmly and surely as do the patterns of energy trade. China faces two urgent pressures: to develop its domestic energy system rapidly and massively as demand swells with growth; and to establish secure access to oil from abroad to satisfy rising import demand. The first goal will be impossible to achieve without heavy private foreign investment[24]. The second can be helped along significantly by judicious Chinese investment in energy assets outside its own borders. Both have begun to occur.

Inward Investment

Before 1990, China's public utilities and energy sector made no effort to attract foreign investors. This is in contrast to the rest of the China's economy, which has become the world's second largest destination for direct investment inflows since reforms began two decades ago. Official hesitation to open the sector manifested itself in heavy state intervention, long and complicated approval processes and the lack of an institutional and legal framework comfortable for investors. All is not yet well, from the investors' point of view. They continue to criticise this lack, especially the ambiguous separation of institutional responsibilities between the central and lower-level governments.

24. Between 1979 and the end of 1997, China cumulatively approved 304,866 foreign-invested enterprises, with contracted foreign investment valued at $521.1 billion and paid-in investment at $221.8 billion, according to MOFTEC (Ministry of Foreign Trade and Economic Co-operation) official statistics. Foreign direct investment increased from $2.3 billion in 1987 (and $41.7 billion in 1996) to $45.3 billion in 1997 and $35.6 billion in 1999. Hong Kong, Japan, Chinese Taipei, the US and Singapore are the top five investors in China, accounting for about 83 percent of China's total FDI in 1997.

They also find difficult the incomplete moves toward market pricing. Permission to invest still requires approval from both the government authorities and the state-owned enterprises involved; the state-owned enterprises can face a clear conflict of interest as they seek to protect their own market positions.

Since 1990, nevertheless, the system clearly has loosened and changed its stance. Chinese authorities have overcome much of their reluctance to accept a foreign presence in the sector. Recent energy-market reforms, expanded capital markets, the deregulation that has occurred and state-sponsored initiatives have all spurred both foreign direct investment and foreign portfolio financing in Chinese energy (Gan, 1998). The state-owned enterprises themselves participate in and seek ventures with foreign investors much more frequently than before. The pace of foreign investment in the energy sector, especially in relation to China's needs, still does not match its buoyancy elsewhere in the economy, but much change has occurred. Much more must occur if China wishes to meet the financing and technology requirements of its domestic energy investment targets. China desperately needs foreign capital to develop its energy sector.

Foreign investment in the *power industry* now represents about 10 per cent of the total, and the government seeks to increase that share to 20 per cent. Up to 1997, foreign funding for the grid system of the State Power Corporation reached 96 projects with 62.34 GW totally. The foreign funds, agreed by contracts, amounted to $23.7 billion, of which $15.1 billion was transferred. Among those projects, 12 projects are FDI with 9.65 GW of capacity and $7.3 billion of investment. China awarded its first Build-Operate-Transfer (BOT) thermal project, the Guangxi Laibin B plant, to GEC Alsthom and Electricité de France in 1996. Both COFACE, the French authority which insures foreign trade and investment, and commercial banks are now active in this relationship.[25] Russian, French and Canadian firms participate in Chinese nuclear power projects, and the Clinton-Jiang summit meeting in 1997 produced an agreement which facilitates sales of US nuclear technology to China.

With the exception of Occidental's ill-fated Antaibao mine from which they withdrew in 1990, substantial funds have yet to flow into *coal mining*, though such investments are now permitted. China wants to attract more foreign investment nonetheless, particularly for large-scale open-cast mines and for

25. *COFACE* is the French export credit bank.

26. This information precedes the recent energy-sector re-organisation. The regulations may change to conform with the new structure, but CNPC is not likely to lose much of its commanding position.

high-yield and high-efficiency underground mines. Foreign investors will be encouraged to invest in building coal slurry pipelines, tapping coal bed methane, building pit-head thermal plants and developing clean coal technology.

For *onshore oil*, China opened exploration and development to joint ventures in 1985. Foreign companies may operate only in specific regions approved by the State Council in conjunction with CNPC, which has exclusive charge of the activities.[26] Policy favours the central and western regions with concrete improvements in their investment climate, including recent removal of mandatory export performance requirements, so that foreigners may now sell their energy products without hindrance in the domestic market. By the end of 1997, CNPC had signed 37 contracts with foreign partners, worth about $1 billion in foreign investment; it has opened for foreign exploration about 2.5 million km^2, mostly in western China. A geological survey agreement between CNPC and a Japanese group led by Japan National Oil Corporation (JNOC) was a major breakthrough in 1997, giving foreign interests access to some of the better blocks in the Tarim basin. Other examples include:

- A production-sharing contract (August 1997) between CNPC and Enron Oil and Gas to develop oil reserves in Sichuan province in the Southwest. This follows a 1996 agreement, Enron's first in China. Enron will bring advanced technologies and also contribute to study of CNPC's envisioned gas pipeline from the Tarim basin to the east coast.
- A September 1997 CNPC contract with Canada's Pan-China Resources Ltd. to develop oil reserves in Hebei Province, a key move to stabilise output in one of China's northeastern oilfields. China needs advanced foreign technology and equipment to maintain production in these aging fields, which also include Daqing, Shengli and Liaohe.
- The US's Chevron began to drill three fields in 1999 as part of the $60 million oil and gas exploration and development projects in China over the next two years, in the Bohai Sea. Chevron has already invested $90 million in a polystyrene plant with an annual capacity of 100,000 tonnes.

For *downstream operations* – refining and petrochemicals – the focus shifts from CNPC to SINOPEC and CNOOC as the chief dealmakers with foreign investors, although CNPC is not absent from these businesses. In mid-1997, SINOPEC announced a moratorium on building new refineries for at least three years, apparently to reduce its total investment under the current Plan (1996-2000) by about $4 billion, to a still-sizeable $18 billion. This could boost Chinese

imports of oil products, in which SINOPEC also has a large interest. The company will go ahead with upgrading existing refineries (foreigners welcome), and it has allowed Total of France to finish its new Dalian refinery, with projected production of 100,000 b/d; it will sell 85 per cent of its output in the domestic market rather than exporting 70 per cent as originally intended. Plans for several foreign and joint-venture refinery projects linked with SINOPEC, however, have gone on ice.

Shell was and is the first and biggest foreign investor in Chinese energy. In early 1998, Shell Chemicals and CNOOC signed a framework agreement for the next phase of a $4.5 billion joint-venture petrochemicals complex – the largest of its type in China – in the Daya Bay Economic and Technical Development Zone in Guangdong Province. The project has a complex history, illustrative of the long lead times of such investments. Project conception goes back to the late 1980s; China approved its registration in 1991; the feasibility study came forth in 1994, for a combined refinery and petrochemical complex. In 1997 the partners (a Shell China subsidiary and three Chinese entities, with Shell and CNOOC holding 50 per cent and 40 per cent, respectively) submitted an amendment to the SDPC that proposed constructing the petrochemicals complex before the refinery. The joint venture was actually to come together before the end of 1998 and physical operations would begin in 2003.

Shell has other ventures as well. They include a petrochemical plant in Hainan; a possible pipeline between Guangzhou and Hainan; a lubricant blender under construction in Zhejiang's Zhapu port; and a recently agreed petrochemical joint venture with a SINOPEC company in Nanjing, Jiangsu Province, to which Shell will bring advanced technology and in which it will hold 60 per cent of the equity.

Mobil is China's leading international lubricant supplier, with over 20 offices in cities across the country. Mobil has three lubricant plants positioned in northern, southern and central China: one in Tianjin, one in Hong Kong, and the latest and largest, which opened in 1997 in Taicang (Jiangsu Province) on the Yangtze River some 45 km north of Shanghai. With an annual production capacity of half a million barrels, it brings advanced technology; has facilities to handle 25,000 DWT (dead weight tonnage) vessels and supply bulk marine lubricants; and includes a training centre, an LPG (liquified petroleum gas) depot and a joint-venture plastic bottling facility.

Exxon's China activities include exploration, refining, marketing (of lubricants nationwide and a range of products through Esso service stations in

the Pearl River Delta), chemicals and power. It opened a lubricant-additive blender in Jinzhou in 1996 (a joint venture with SINOPEC Jinzhou), and started turning out lubricant blenders in Tianjin and Ningbo in 1997. In another joint venture, it will expand output of a multi-billion-dollar refinery and petrochemical project in Meizhou Bay (Fujian Province) from 4 Mt to 12 Mt per year, build an ethylene steam cracker and install production lines for polyethylene and polypropylene.

It is settled policy in many countries of the Middle East to seek to invest in downstream facilities of their import customers in return for long-term import contracts or investment in their own crude oil production development. This is *quid pro quo*, which China must sometimes offer in order to gain access to secure oil supplies. It also cements international relationships on a long-term basis. A good example is the $1.5 billion deal under negotiation with Saudi Aramco, in which the Saudi company would invest in and supply oil to joint-venture refineries in China that would both sell their output domestically and export it. The talks centre on expanding and upgrading the Thalin refinery at Qindao (Shandong) as well as some Saudi presence at the Maoming refinery in Guangdong. Reports indicate that Thalin would receive 10 Mt of Saudi oil a year for 50 years. Other foreign investors can also be involved in such deals.

As China continues to import increasing quantities of Middle Eastern crude oil, it must modify and upgrade its refineries to deal with it. This falls under refinery investments, which SINOPEC will continue to make, and sometimes involves joint ventures with its Middle Eastern crude oil suppliers.

Offshore Oil

A discussion of offshore oil production belongs in this chapter on China's links with the international energy system because its development has depended from the start on heavy participation of foreign companies in exploration and development. In fact, the offshore subsector offers the notable exception to China's reluctance until the present decade to open its territory to international investment. China opened the South China Sea to foreign firms in 1980 and the East China Sea (including Bohai Bay) in 1992. CNOOC, the leader in the field among the Chinese state-owned enterprises, has tried hard to adopt standard international investment practices, and it has benefitted greatly from an array of

27. China National Offshore Oil Corporation (CNOOC), Annual Report, January 1999, Beijing.

joint-venture operations.

CNOOC produced 15/16.3 Mt of crude oil and 2.6/4bcm of natural gas in 1997/1998[27]. China will probably generate the largest increase – over 200,000 b/d – in offshore production in East Asia over the next five years. Proven reserves have jumped recently by 1.1 billion barrels, to 10.7 billion, in twenty offshore

Box 3.1
The South China Sea

The hydrocarbon resources of the South China Sea are little known. Several unconfirmed Chinese reports place potential oil reserves at 213 billion barrels, while the US Geological Survey (USGS) estimated reserves in 1994 at 28 billion. Such reserves could support production of from 140,000 b/d to 370,000 b/d_similar to the current capacity of Brunei and Vietnam but significantly less than China's projected import requirements. Some experts believe that natural gas comprises the largest component of the South China Sea's hydrocarbon deposits, but estimates of this resource vary widely as well; the USGS estimate is 266 trillion cubic feet.

The area's potential has produced numerous territorial disputes and sovereignty claims, most importantly in the Spratly and Paracel Islands. China, Vietnam, Chinese Taipei, Malaysia, the Philippines and Indonesia all have some involvement in them. The disputes have rendered infeasible any resource exploration and development in the contested areas, an outcome which is in no country's interest from the point of view of access to new oil and/or gas supplies. Any successful exploitation of these areas would require not only a stable political environment among the countries concerned but also much joint venturing, with high levels of international co-operation and foreign investment. Such investment has come only to those areas where China's claims are uncontested.

China's claims practically blanket the South China Sea. It has shown no tendency to relax them and prefers to offer bilateral negotiations with the other claimants rather than seek a multilateral solution. It also is a party in periodic flare-ups, with military overtones, over one claim or another. Two recent developments may or may not signal a bit of political movement : (1) China has now ratified the United Nations Convention on Law of the Sea (UNCLOS), although this does not nullify prior territorial claims; and (2) CNOOC has revived a long-dormant agreement with Chinese Taipei's China

Corporation to explore and develop some 15,400 km^2 between the Pearl River delta and the Taiwan Strait, which gets rather close to the Paracels. Nevertheless, much more will have to occur in the direction of peace and stability before any serious hydrocarbon resource development in the most promising parts of the South China Sea can begin.

oil and gas fields. Most of the increase has come from new fields in the South China Sea (see Box 3.1), but the Beibu Gulf northwest of Hainan Island and new discoveries in Bohai Bay have contributed as well. Offshore production roughly quadrupled between mid-1994 and mid-1996, to 380,000 b/d from under 100,000 b/d. Forecasts suggest it may go to over 630,000 b/d (25 Mt per year) by 2000. CNOOC wants to produce by 2005 10 Mt of oil from South China Sea, 10 Mt from Bohai and natural gas equivalent to 10 Mt from its offshore areas.

As a result, offshore work has gained a much higher profile, as the older onshore fields demand ever-increasing effort to maintain production, and as the Chinese Far West, in Xinjiang and especially the Tarim basin, continues to produce disappointing results. CNOOC recently reported 126 contracts and agreements with 67 companies from 18 countries and areas. They involve $5.38 billion in foreign capital, some 58 per cent of the total investment in offshore oil exploration and development. The situation continues to evolve, and reports of new ventures appear regularly in the trade press.

In mid-October 1999, CNOOC floated $2 billion in stocks on the Hong Kong and New York stock markets. The attempt, however, failed. Adverse market conditions appeared to be a major reason for the failure. Lack of careful planning and CNOOC's internal problems have also been blamed.

The joint statement issued by China and Vietnam in early March 1999 will promote oil and gas development in the Beibu Gulf by the two neighbouring countries[28]. Both sides agreed to resolve the existing border and territorial issues

28. *China Daily*, 7 March 1999, Xiao Zhao, p.1.

29. *People's Daily* (Overseas edition), 30 May 1997.

and plan to resolve the issue of the demarcation of the Beibu Gulf before the end of 2000.

Investing in Foreign Energy

With its entry into the volatile global oil bazaar as an importer, China quickly learned the hazards of relying solely on purchase policies in open markets. The more aggressive recent foreign investments of its state-owned enterprises, notably CNPC and CNOOC, stem directly from a policy paper produced in May 1997[29] in which former Premier Li Peng blessed Chinese involvement in the exploration and development of international oil and gas resources and tied such projects specifically to the objective of stable, long-term supplies of oil and gas. Some Chinese foresee half of China's crude imports coming directly or indirectly from Chinese-owned fields by 2000.

China's overseas investment forays include, so far, several Middle Eastern countries, plus Argentina, Bangladesh, Canada, Colombia, Ecuador, Indonesia, Kazakhstan, Malaysia, Mexico, Mongolia, Nigeria, Pakistan, Papua New Guinea, Peru, Russia, Iran, Sudan, Thailand, Turkmenistan, Venezuela and the United States[30]. CNOOC has investments in Indonesia and the Gulf of Mexico, and plans new ventures in the Middle East (especially Iran), Central Asia, Myanmar and other parts of Asia. CNPC has been the most active, however, with exploration and production contracts (sometimes for petrochemicals) signed or under negotiation in at least 20 countries. By the end of 1997, it had pledged more than $8 billion for oil concessions in Sudan, Venezuela, Iraq and Kazakhstan, plus another $12.5 billion to lay four immense (but still far from real) oil and gas pipelines from Russia and Central Asia to China. The oil projects in Iraq, Kazakhstan, Sudan and Venezuela are large-scale.

CNPC's entry into Kazakhstan laid down a Chinese marker of some importance in oil-rich Central Asia, where Chinese presence had previously been minimal. The solid parts of this activity involve an investment of $4.3 billion over 20 years in Kazakhstan's state-owned Aktyubinsk oil company, plus a 60 per cent stake, worth $1.3 billion to be invested through 2002, in a joint venture with the Kazakh firm Uzenmunigas, to develop Kazakhstan's Uzen field on the east Caspian Sea coast. Uzen is estimated to hold 130 Mt to 200 Mt of oil, with near-term production at 8 Mt per year through 2002. Under a separate 1997

30. For a brief overview of China' s overseas petroleum investments see *China Economic Review*, July 1998, p.36.

oil-swap deal with Iran, Uzen oil produced by CNPC will move across the Caspian and to a refinery near Teheran, with China receiving an equivalent amount of Iranian crude exported from Iran's Gulf coast.

Beyond that, two pipelines would carry oil and gas eastward into Xinjiang and the Tarim basin. The oil line (3,000 km) would connect Kazakhstan's western producing regions with refineries in its north and south, then extend into western China. The extension would make little sense unless CNPC can use it to revive official interest in a long, internal pipeline from Tarim to the markets in central and eastern China. The whole would constitute what has been dubbed the "Energy Silk Route" (see map). With Tarim showing less than its original promise, and given the likely high real cost of its oil, formidable economic arguments, as well as severe funding problems, now impede the entire affair. The gas line (5,800 km from eastern Turkmenistan through China) faces similar objections and represents an even more distant prospect. The Chinese enthusiasm for a "Continental Bridge" for petroleum supplies from Central Asia seems to have cooled down recently. Senior leaders have realised that this project would be uneconomical, at least in present circumstances.

All told, CNPC, CNOOC and the other state-owned enterprises have a target of 100,000 b/d to 150,000 b/d for shared oil from their foreign ventures by 2000, and that could rise to 400,000 b/d to 600,000 b/d by 2010. While significant, such amounts of oil will make only a dent in China's import requirements, accounting for perhaps 20 per cent of total imports, including products. China will have to continue to rely on traded oil, primarily from the Middle East. The state-owned enterprises' investment activity, however, has an importance beyond its quantitative impact on the composition of imports. It will strengthen the state-owned enterprises' financial positions and provide them with a presence in the global energy markets (as well as status in the eyes of supplier-country governments) that can pay off in terms of future import reliability.

Trade, Investment and Diplomacy in the Search for Energy Security

Energy issues have clearly taken a higher priority in Chinese foreign policy. This represents a constraint as much as an opportunity because the drive for reliable energy supplies, now a national imperative, limits the use of energy policy elements as instruments for other policy objectives. Every evidence points

Map 5

Energy "Silk Route" from Central Asia

Source: IEA and National Pipeline Research Society of Japan

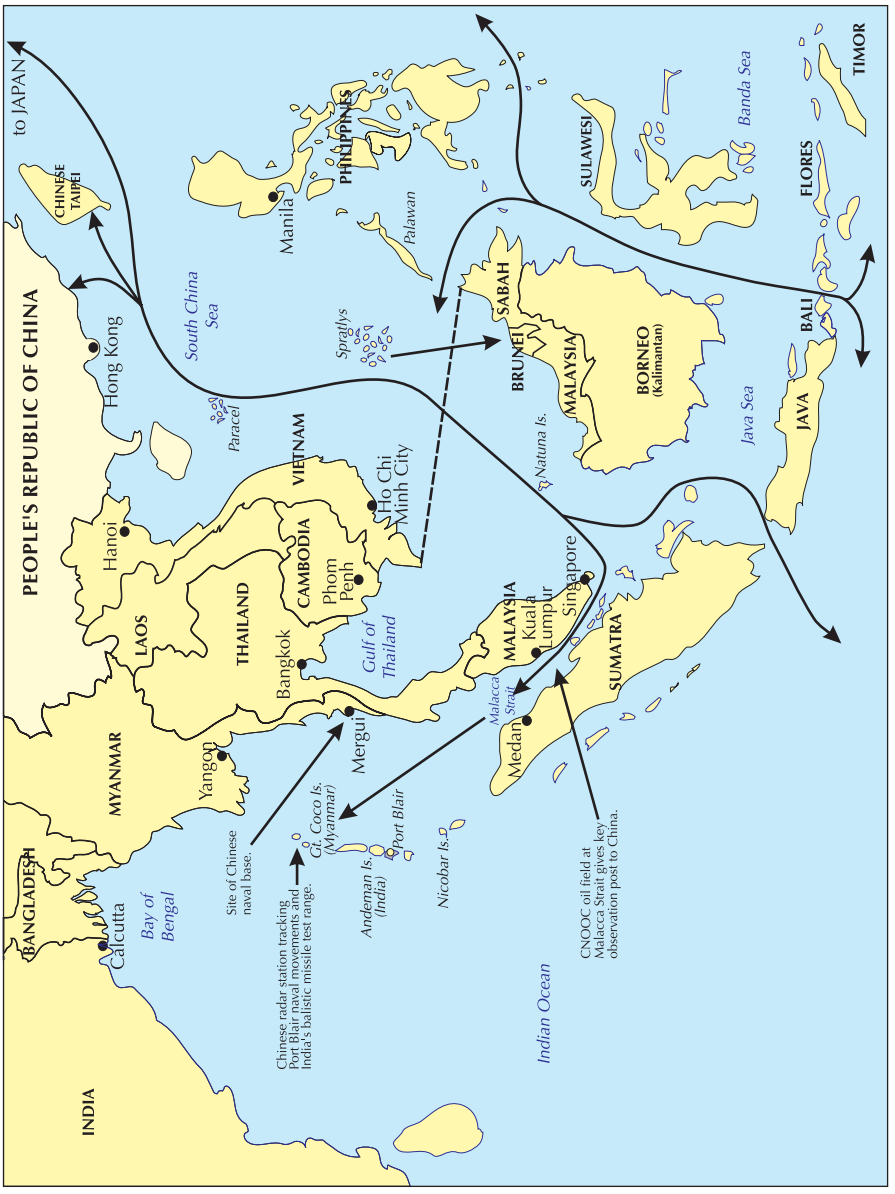
to China's rising awareness that its diplomatic goals with respect to energy, primarily oil and gas, must aim toward participation in the global energy system in a way that maximises domestic energy security.

Given the world's petroleum geography, the first requisite lies in the development of enduring relations with all potential oil suppliers in the *Middle East*. In the coming decades, China can perhaps moderate, but will not escape, the common international dependence on crude oil from that region. Despite the disapproval of some countries, Chinese investment in upstream facilities will continue in places like Iraq, Iran and Sudan, where China perceives open niches which it can enter without much competition. China has already given evidence, however, that it sees how the need to establish reliable supply channels throughout the region can limit on disruptive action. For example, it has accompanied decisive moves to invest in Iraqi oil fields with great care to avoid violating the UN sanctions, delaying actions which would be in violation until after the sanctions are lifted. In pursuing its interests, China will face two broad, moderating forces in its Middle Eastern oil policies_the need for a region-wide focus and the need for global acceptance as a responsible competitor for Middle Eastern oil supplies.

China has entered into production-sharing agreements with Iraq and Sudan. It may further increase its purchase of crude oil from Saudi Arabia and the United Arab Emirates for processing in the southern and eastern coastal refineries. It develops its support to Iran as enhancing its presence in the Gulf region and helping to ensure access to a key source of oil essential to China's expanding economy. Iran has been wooing Beijing with the prospect of crude oil being transported by pipeline from CNPC's Uzen Caspian concession in western Kazakhstan, southward into Iran and down to the Gulf ports for shipment to China. This would replace the costly and increasingly unattractive construction of a pipeline running from Uzen all the way east across the length of Kazakhstan and then into and through Xianjiang.

Like all its Asian neighbors, China worries about the security of transport corridors, chiefly the Malacca Strait, through which all Middle Eastern oil reaches its Asian customers (see map). This concern is legitimate. It may lie behind China's recent policy reversal in ratifying the UN Convention on Law of the Sea (UNCLOS). The Convention's guarantees of safe passage have great value in this respect. Moreover, in an almost perfect illustration of how policy interconnections work in a globalised world, the ratification also makes immensely more difficult any Chinese move to deny safe passage for oil and

Map 6
Security of Oil Shipping Routes



other trade through the South China Sea. This relieves to some extent a situation that Japan and Korea both fear.

This is a gain for all countries, although it in no way affects China's territorial claims in the South China Sea and over the mineral, oil and gas resources that may lie on and under the seabed. Those and conflicting claims of

neighbouring nations have created an impasse, which effectively blocks most exploration and development in this potentially oil– and gas-rich area. It is hard to see how any such activity can go forward to unlock those resources, which China and its Asian neighbors so badly need, unless or until co-operative international efforts create the stability which investors will require.

In *Central Asia* – which some see as a massive extension of the Middle East and others treat as a new oil and gas region rivaling it – China made a major coup with its investments in Kazakhstan. It both signaled and implemented its intention to function and be seen as a major player in the region's oil and gas development. The resources it has acquired and probably will acquire in the future, by whatever path they may reach China, will considerably help China's efforts to diversify import sources and bring them closer to home in a geopolitical sense. China has obvious foreign-policy interests in developing relations with the border countries of Central Asia, and they coincide with its oil-security interests.

As China becomes a major importer of oil and gas the Caspian region appears an attractive target in its search for security of petroleum supply. Until recently a passive observer of Central Asia's power plays, China has now thrust itself onto the center-stage of the region's energy geopolitics by winning several major oil and gas deals. Caspian oil may be considered a potential threat to Middle Eastern market share in the near to medium term as it could sharply reduce Asian demand for Persian Gulf products. Incremental output from Central Asia is expected to reach 2 mbd in the next ten years. The building of a pipeline to export this oil, through Iran or Afghanistan, or of a pipeline across China, could result in the bulk of Caspian oil going to Asia.

In *Southeast Asia*, aside from problems connected with the South China Sea, China has a web of energy and other trading relationships to manage. It will continue to import crude oil from Indonesia as a key customer, and to a lesser extent from Brunei. Singapore will remain a major products supplier, along with Japan and Korea, and a gateway for Middle Eastern crude and products. As China develops its gas distribution system and completes the necessary terminals, Indonesia, the world's largest LNG exporter, will probably become the first source to which China turns for LNG imports. These would come in part from the Natuna field now under development, which, ironically, has become part of the South China Sea imbroglio. As rising Asia-Pacific crude imports from the

31. 1,142 ships a day or 421,602 a year, pass through the Strait of Malacca at the southern entrance of the sea. (*Far Eastern Economic Review*, 25 February 1999, p.28)

Middle East further crowd the Malacca Strait[31], the involved countries, China included, may well find attractive and economic for investment an existing proposal for a trans-shipment pipeline across peninsular Malaysia to ease the pressure.

When the ASEAN countries emerge from their current economic slump, interest may revive in schemes to develop the Mekong River basin. This idea faces formidable economic, environmental and political obstacles. It does, however, enjoy a nascent institutional structure in the Mekong River Commission (MRC) composed of Thailand, Vietnam, Cambodia, Laos and Myanmar, and a 1996 co-operation framework agreement between ASEAN and the Mekong's riparian countries. China would have a deep involvement. The energy perspective mostly concerns hydropower for the markets of Thailand and China's coastal areas. The Asian Development Bank (ADB) estimates the generating potential at 58 GW and feasible installed capacity at 37 GW, mostly in China's Yunnan Province and Laos. On its own, China has developed ambitious hydropower plans on the Mekong (*Lancang*, in China) for Yunnan, with the Thai and Guangdong power markets in mind. But the multilateral development banks show caution in providing finance, for environmental and other reasons. If a Mekong development project ever reaches fruition, it can happen only with unprecedented international co-operation among a group of countries not accustomed to it in the past[32].

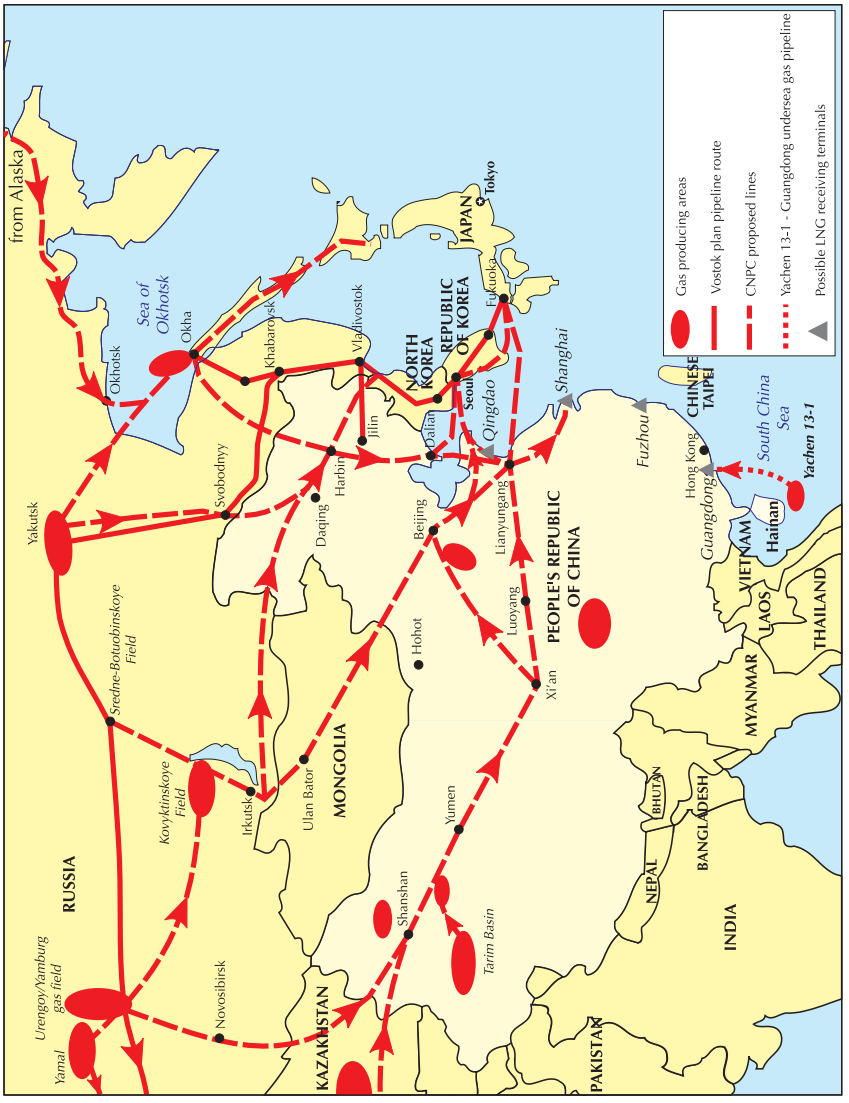
China's energy interests also extend beyond its northern borders to *North-east Asia*. Chinese-Russian ties have warmed considerably (to the chagrin of the Chinese military, which still harbours doubts), with a plethora of "agreements" and solemn declarations of intent about hitting a bilateral trade target of $20 billion by 2000 (from the current $6 billion) and increasing energy co-operation. Pieces of paper to this effect always get produced whenever high-level bilateral meetings take place. Russian energy firms as well as their western and eastern partners are also eager for some business to take place and to find some practical way to tap Russia's rich Siberian energy resources.

At the heart of it all lie various proposals to develop energy supplies, mainly gas, in the Russian Far East and to ship them south through pipelines (see map). Such a development would fit well with a Chinese decision to turn more decisively to gas as a clean-burning switch fuel, although problems of cost and

32. Ögütçü, *China's Outward-Looking Energy Linkages*, 1998.

financing continue to render the idea uneconomic in relation to alternatives, including development of China's relatively untapped domestic gas resources and LNG imports from Southeast Asia. CNPC's attitude to such a development will also play a role if it withdraws its support for one of the routes and becomes completely wedded to its competing proposal for an "Energy Silk Route" from Central Asia. The main obstacle, however, involves the multilateral nature of all such proposals. They would make even less economic sense and would not attract

Map 7
Proposed Pipeline Routes in Northeast Asia



Source: IEA, Gas and Oil in Northeast Asia, and CNPC, 1999.

sufficient financing if Japan and Korea were not involved[33]. These two countries would be needed to help build the infrastructure and also to take shares of the product. The product would transit Russian, Mongolian and Chinese territory in the most likely case and North Korea in the other. Putting any of these deals together would thus require international confidence and co-operation of a high order[34].

China has very substantial trading and energy relations with both Japan and Korea. It offers an important market for their refineries' exports of petroleum products. Both have long-standing deals to import Chinese crude oil; they date from before the onset of Chinese import dependence, however China will be reluctant to give up the waning policy-leverage rationale for originally entering into them; at the same time, all signs point to the gradual decline of these exports.[35] Japanese and to a lesser extent Korean firms are in the forefront of foreign participation in Chinese oil and gas development, onshore, offshore and in the refining industry. On balance, China can look upon the nexus of energy trading and investment relationships with Japan and Korea as solid and likely to continue so.

33. Japanese Prime Minister Hashimoto and Russian President Yeltsin announced on 10 April 1997, at the end of their informal talks, that both countries are determined to resolve their half-century territorial dispute over the Kuril islands and sign a peace treaty by 2000. This will clear most of the hurdles in the way of Japanese-Russian co-operation in the field of energy.

34. Russia and China signed an accord on 25 February 1999 on a feasibility study for the development of the East Siberian Kovykta gas field and the construction of a pipeline from the field to China. Both parties are expected to hold talks with Japan, South Korea and Mongolia on the prospects of these countries' joining the project.

35. The decline has already been evident for Japan since 1990 (See Appendix Table A-2). In February 1999, Chinaoil cancelled its cargoes to Japan for that month, leaving vague the prospects for future cargoes. Under the long-term China-Japan agreement, the Chinese are committed to ship about 6 Mt of crude oil per year; exports to Japan in 1997 amounted to 10.47 Mt, so there is room for a quite substantial reduction before China reaches that threshold. After protests from Japan, CNPC has agreed to continue supplies. The incident underlined the tension inherent in having state-owned firms operating with substantial independence — they still have to take the government's foreign policy concerns into account when making sales decisions.

CHAPTER THREE

WHAT IT ALL MEANS. WHAT NEXT?

China in the System

China crossed a threshold in 1993 when it became a net importer of oil. Just a few years thereafter, its policy makers and diplomats have learned rapidly and well both the constraints and the opportunities that accompany a presence in the international energy system.

The position of this vast nation in global energy markets can only grow stronger as time passes. Neither Chinese forecasts nor estimates made outside China suggest any scenario other than one in which, in a decade or two at most, China will be one of the world's great importers of petroleum and its products. At the least, China will import more oil than the OECD Pacific Region countries (Japan, Australia and New Zealand) together.

Estimating the extent of China's future oil import needs remains fraught with uncertainties. To some degree, today's import volumes reflect a certain disequilibrium in the country's outward-oriented development path. Forced-draft economic growth since economic reforms began in the late 1970s has favoured the eastern and southern provinces, which have become the great centres of energy demand. The loosening of the political centre's *dirigiste* economic grip and its positive encouragement of growth through trade have turned that demand toward international markets. At the same time, the domestic petroleum geography has placed oil resources, for the most part, far from these demand centres, in the northeast and potentially in the far-western basins of Xinjiang. Construction of the necessary energy delivery infrastructure has lagged however, and this too has stimulated imports. Inadequate infrastructure not only created physical constraints on getting domestic oil to domestic markets but also raised its real cost, notwithstanding that the pricing regime kept this cost hidden.

Thus, better delivery infrastructure – and indications are that China is investing more to create it – would better link domestic markets with domestic resources and discourage imports. On the other hand, much infrastructure (refineries, petrochemical plants, local delivery facilities) has already gone up

in the coastal regions specifically to handle imports. More is coming. This strengthens the import-oriented bias. An institutional factor enters here as well : much depends on the future behaviour and interaction of China's two giant oil state-owned enterprises, SINOPEC and CNPC. Head-to-head competition, or some simulation of it, would rationalise the domestic energy markets and subject imports to a strictly economic calculus for the nation as a whole. More collusive behaviour would block such rationalisation, with imports higher than they otherwise would be. In the interest of keeping its oil imports as low as possible, China needs to improve the efficiency of its domestic energy markets by accelerating pricing, regulatory and other reforms.

The ultimate constraint on self-sufficiency in oil, however, is the extent of China's own resources. Present prospects are not particularly encouraging. Offshore oil, the most promising source in the short term, will not satisfy more than 10per cent of demand. The most reliable onshore fields in the northeast are aging and their output will, at best, stabilise. That leaves Xinjiang and its Tarim basin, which is believed to have very large reserves but has not yet lived up to its promise. It is fairly clear that, given the difficulty of finding oil and then extracting it in that inhospitable terrain, plus the need to construct thousands of kilometres of pipeline to deliver it cost effectively to market, Tarim will produce very high-cost oil.

"High cost" is, of course, a relative term. It depends on international oil prices which, if high, could render Tarim oil competitive with imports. Presently low international prices could rise. Yet their effect in the short term has been to delay CNPC's grand pipeline vision. This will delay the arrival of Tarim oil on the markets in the longer term, or raise its cost relative to imports if rail transport has to be used. Official forecasts of oil supply for the coming decades do not factor in massive quantities of Tarim oil. On the other hand, there are no signs of China's slowing its efforts to explore and develop the Tarim basin. If anything, CNPC pushes them harder. This suggests a policy decision, *de facto* or explicit, to develop Tarim as a long-term energy security measure but hold back on the pipeline investment until its economics improve. Oil in the ground but available is high-quality energy security.

In addition to the *amount* of domestic resources, the ways in which they will be used will be critical to the implementation of demand side and technology deployment policies. Some of the most important energy issues for China over the coming three decades include continued advances in end-use technologies, advanced renewable technologies, fuel cells, gas-to-liquid conversion, further

developments in clean-coal technologies, and gas turbines, carbon capture and sequestration processes, and perhaps, hydrogen technologies.

Natural gas offers another option. It remains a marginal fuel in the Chinese system, although as long ago as 1990 CNPC estimated reserves, mainly in Sichuan Province, at about 60 trillion cubic metres. Its use will increase, but once again infrastructure problems intervene. Pipeline construction and downstream facilities lag behind upstream progress. Largely because of these infrastructure obstacles and the insufficient development of market, the IEA's scenario holds increased gas production to about half the official Chinese forecasts. China might also turn in the direction of imported LNG from Indonesia and/or the Middle East. It has yet to decide definitively whether to facilitate such imports by investing in a large network of LNG terminals and delivery systems in the East and South of the country. Faced with mounting environmental problems and starkly rising oil imports China could well decide to accelerate building up both its domestic gas delivery system and its gas imports, in a grand national switch toward clean-burning fuels. That case is, of course, the opposite of the IEA's scenario.

A qualitative change is starting to take hold in China with respect to the uses of renewable energy, which until recently has been viewed as highly peripheral. China plans to invest up to $35 billion in renewable energy equipment development and manufacturing from now to 2009.

A word is in order about the effects of the current economic crisis in Asia on China and its burgeoning energy demand. There is no question that in 1998-99 China experienced a *relative* slowing in economic growth. Pressures on domestic energy supplies have eased somewhat, and energy imports have receded from 1997 levels in part because of the oil import ban imposed with partial effect early in 1998. This study takes a long-term view, however, and makes no adjustment for the crisis. In effect, it assumes that the impacts on China will be short-lived and not of sufficient magnitude to alter substantially the prospective import scenario. Similarly, it assumes that the Asian countries chiefly affected by the crisis, although in the throes of great cyclical economic distress, will escape any long-term decline. Their economies will rebound as will their energy demand. The assumptions thus posit that the general trend to growing oil import dependence in Asia will resume. The implications for these countries, for China and for the global energy system are analysed from that perspective.

Is China Different?

China's emergence as a major oil importer has occurred both relatively recently and quite rapidly. It testifies to the nation's success in growth and development. Quite naturally, the habits of thought inherited from the recent era of energy self sufficiency still persist in Beijing, Chinese leaders have quickly and effectively grasped the essentials of dealing with energy-security issues in an import-dependent environment. Their basic strategies have been developing domestic resources to the maximum possible, creating strategic reserves, seeking foreign technology and investment, establishing reliable and secure oil trading channels, and making strategic investments in upstream production facilities abroad. These are the classic moves of nations which found themselves in a position of import dependency in the past. In fact, one can argue that China already has moved farther and faster to take advantage of inward investment in its energy industries than did Japan for its energy sector at an analogous stage of development.

For other major energy importers, two messages have become clear. First, China's manner of entry into the global energy markets carries no surprises. Its strategies bear strong similarities to others' and they are equally aggressive. Therefore, and second, it has become clear that China requires a strong place in the system. Other players must make room for it. China is not a marginal player but a powerful new force in the international energy markets.

Some Implications for Linkage Patterns

China's increased dependence on overseas petroleum and its growing investments in overseas resources are bound to affect the government's attitude and behaviour in international politics, especially in the Middle East, Central Asia, Russia and ASEAN region.

Until the 1990s, China obtained most of its oil imports from Asia and sent most of its exports to Asia. Perhaps the most visible and important early effect of its rising import dependency lies in shifts in these trading patterns. Exports have more or less stagnated, but China will try very hard to continue the energy relationships they have created (with Japan and Korea, for example), because they contribute to the development of other energy ties, such as the inward investment and technology flows that China needs in its drive for energy security.

On the import side, the conjunction of Chinese oil requirements, growth-led increases in oil demand in the economies of Southeast Asia and slowing growth of Asian oil resources have tended to shift both Chinese and other Asian crude oil imports to sources in other parts of the world, notably the Middle East. With its own refinery capacity continually stretched and perennially lagging behind fast domestic demand growth, China does conduct and is likely to maintain a healthy trade in oil products with the rest of Asia, especially with entrepôt refineries such as those in Singapore which process Middle Eastern crude. Such imports have also become a mainstay in Chinese energy trade with Japan and Korea.

China thus participates in an Asia-wide trend in turning toward the Middle East for rising supplies of imported oil. It competes for those supplies, but more in attempting to make them secure on a long-term basis than in the sense of vying for a scarce resource. International oil prices now are low because oil is abundant globally and especially in the Middle East. Neither Chinese nor other Asian demand is likely to affect them significantly anytime soon.

The Chinese have a natural security concern to ensure that the long shipping lanes from the Middle East to East Asia remain open. Beijing's recent ratification of the Law of the Sea Treaty has a bearing here. Observers have preoccupied themselves with what this gesture may or may not mean with respect to China's pursuit of its territorial claims in the South China Sea, forgetting that the Treaty's guarantees of safe passage through crowded channels, such as the Malacca Strait, was the primary reason why the world's navies supported its negotiation. This alone would have justified ratification of the Treaty from China's point of view, notwithstanding that it implies Chinese commitment to guarantee safe passage through the South China Sea.

As its Middle Eastern oil trade has developed by necessity, China has striven hard to put its many trading relationships with the countries concerned on a sound, long-term basis, through reciprocal investment and non-oil trade. Its forays into Iran (with arms trade), Iraq and Sudan have raised both eyebrows and concerns in other oil-importing capitals, notably Washington. The U.S. has energy-security interests as well, and fears that China's efforts may be destabilising for the region as a whole. In terms of timing, China made its oil-related, politically oriented trading overtures to these countries at times when it thought it could exploit political and economic gaps while other oil importers held back. More significantly, they came, at least in Iran, before China fully realised the breadth of its own energy-security concerns and their relation to its

foreign policy in general. Recently, China has tended to stress energy security more and diplomatic adventure less. It now deals with and invests in a host of countries in the region; in managing its oilfield development deal in Iraq it takes care to do so in ways which do not violate the UN sanctions. In Iran the arms trade is losing emphasis while straightforward economic dealings continue to advance.

China is creating energy relationships all across the Middle Eastern region, giving every indication of fitting itself into established patterns of energy trade and investment. At the same time, it does not ignore other potential sources of long-term supply throughout the world. It has carved out a significant position in Central Asia and is there to stay as this region develops. This will hold true whether oil and gas eventually flow through CNPC's visionary but still-uneconomic pipelines or move to China *via* the Middle East. It has at least nascent and sometimes major oil trading or investment links with Russia (natural gas, too), Africa, Latin America and North America. All can be expected to develop further.

In the longer term, talks of participating one day in several proposed Asian energy projects, still far from realisation and indeed often in doubt for economic reasons. Practically all of them have common characteristics : they will involve strong international co-operation, including financing from around the globe and heavy international sharing of the output. Exploitation of the hydrocarbons beneath the South China Sea hardly seems feasible except in a multilateral context because investors will demand stability before they commit themselves. The Mekong River development scheme, mostly for electric power, inherently involves a jointly owned, multilateral resource. Siberian gas cannot flow southward unless or until China, Japan and Korea can agree on jointly sharing the output and jointly building the pipelines with Russia, which must be pleased with the terms. Bringing such schemes to reality will draw China ever more tightly into the international energy system.

Both the short and the long views of China's energy relations with the rest of the world, therefore, demonstrate the importance of international co-operation to China. China's energy security policies are a kind of developing synthesis between the drive for a respected place in the system and a growing willingness to cooperate internationally. Trade and investment are the main elements in cooperation today. Joint energy-resource management may come tomorrow.

APPENDIX

DATA ON CHINA'S OIL AND OVERALL TRADE

Table A-1: China as an Oil Customer
(millions of tonnes)

Supplier Countries to China	China's Oil Imports								Supplier Countries' Total Oil Exports							
	Crude				Products				Crude				Products			
	1990	1993	1996	1997	1990	1993	1996	1997	1990	1993	1996	1997	1990	1993	1996	1997
Middle East	1.15	6.60	12.04	16.78	0.04	0.10	0.33	0.45								
Oman	0.85	4.09	5.66	9.03		0.01	0.01		30.12	35.94	40.60	41.40	1.60	2.27	1.70	1.65
Yemen		1.66	3.77	4.06				0.03	6.00	6.73	14.79	16.00	0.75	1.59	0.90	0.95
Iran	0.30	0.07	2.31	2.76		0.01		0.05	116.30	124.90	130.00	125.80	1.34	5.17	7.95	10.65
Saudi Arabia		0.22	0.30	0.50		0.06	0.18	0.17	234.10	320.50	346.20	360.20	38.49	57.46	42.40	41.95
Others		0.56		0.43	0.04	0.02	0.14	0.20								
Asia-Pacific	1.77	6.53	8.21	9.27	2.67	13.59	13.91	18.96								
Singapore					2.28	9.40	9.18	9.56					42.59	47.20	50.35	54.55
Indonesia	1.23	4.02	6.30	6.59		0.09		0.18	39.50	38.81	38.87	39.55	7.27	7.50	12.90	14.60
Korea						2.19	2.61	5.50					3.72	14.25	21.89	31.52
Japan					0.23	0.93	1.27	2.50					3.74	3.86	7.60	8.80
Others	0.54	2.51	1.91	2.68	0.16	0.98	0.85	1.22								
Africa		2.13	1.93	5.91		0.02	0.01	0.01								
Angola		1.23	1.66	3.84			0.01		17.31	25.31	32.45	33.85	0.12	0.09	0.16	0.17
Congo				0.98					n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
S. Africa								0.01					0.02	0.04	3.35	3.48
Others		0.90	0.27	1.09		0.02										
Others		0.41	0.51	3.37	0.42	3.69	1.58	3.78								
Russia		0.01	0.32	0.48	0.18	1.27	1.24	3.45	98.83	126.10	130.20	133.90	37.52	37.95	54.83	56.03
Argentina		0.20		1.11		0.02	0.01		0.05	6.84	18.12	19.34	1.72	4.29	2.85	3.15
United States		0.01	0.11	0.75	0.11	1.61	0.23	0.27	5.45	4.90	5.50	5.40	37.40	45.20	43.55	44.80
Others		0.19	0.08	1.03	0.14	0.79	0.11	0.06								
Total	2.92	15.67	22.70	35.33	3.12	17.39	15.83	23.20								

Sources: East-West Center Energy Program Database
Notes: A blank space indicates a value that is negligible, equal to zero or not relevant. n.a. = not available.

Table A-2: China as an Oil Supplier
(millions of tonnes)

China's Customer Countries	China's Oil Exports								Customer Countries' Total Oil Imports							
	Crude				Products				Crude				Products			
	1990	1993	1996	1997	1990	1993	1996	1997	1990	1993	1996	1997	1990	1993	1996	1997
Asia-Pacific	19.38	16.54	17.67	17.50	5.19	3.66	3.74	4.73								
Japan	13.67	12.70	11.58	10.47	1.63	0.41	0.55	0.40	190.20	219.80	227.30	234.00	45.56	31.56	42.35	37.65
Hong Kong					1.09	0.46	1.59	1.70					6.96	8.72	10.21	9.92
Korea	1.00	1.61	3.16	4.53	0.06		1.07	0.64	42.24	76.79	98.89	119.60	13.87	23.76	29.48	25.45
Indonesia		0.37	1.15	1.11			0.01	0.08	6.26	7.70	9.53	9.25	3.32	5.65	10.10	16.60
Others	4.71	1.86	1.78	1.39	2.41	2.79	0.52	1.91								
Others	4.60	2.89	2.65	2.33	0.23	0.05	0.44	0.83								
United States	4.01	2.78	2.65	2.31	0.13	0.05	0.44	0.83	294.70	339.40	375.40	411.30	106.20	91.65	98.55	96.80
Panama							0.11	0.19	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Others	0.60	0.12		0.02	0.10		0.31	0.57								
Total	23.99	19.44	20.32	19.83	5.42	3.71	4.18	5.56								

Source: East-West Center Energy Program Database.
Notes: A blank cell indicates a value that is negligible, equal to zero or not relevant. n.a. = not available.

Table A-3: China's Overall Trade in Goods with its Oil-Trade Partners
(millions of US dollars)

Oil-Trade Partners[1]	Chinese Exports (fob)				Chinese Imports (cif)				Trade Balance			
	1990	1993	1996	1997	1990	1993	1996	1997	1990	1993	1996	1997
Japan	9,011	15,77	30,88	31,82	7,588	23,25	29,18	28,99	1,423	-7,474	1,705	2,827
Hong Kong[2]	26,65	22,06	32,90	43,78	14,25	10,47	7,82	6,990	12,39	11,59	25,07	36,79
United States	5,179	16,964	26,683	32,695	6,588	10,688	16,155	16,298	-1,409	6,276	10,528	16,397
Korea	1,259	2,860	7,500	9,116	684	5,360	12,482	14,929	575	-2,500	-4,982	-5,813
Singapore	1,97	2,245	3,749	4,319	858	2,646	3,601	4,465	1,117	-401	148	-145
Russia	2,239	2,692	1,693	2,033	2,140	4,987	5,152	4,08	99	-2-	-3,459	-2,053
Indonesia	379	692	1,428	1,841	803	1,451	2,280	2,674	-424	-760	-853	-833
Saudi Arabia	337	579	749	854	81	119	829	826	256	460	81	28
South Africa	n.a.	246	683	784	n.a.	412	664	790	n.a.	-166	19	-5
Oman	8	11	12	17	125	561	811	1,346	118	550	-799	-1,329
Argentina	12	248	337	465	318	220	518	722	-306	28	-181	-257
Iran	318	403	395	496	44	310	386	536	275	93	8	-39
Panama	95	350	488	1,010		10	2	2	95	340	486	1,008
Yemen	72	112	106	100	2	255	570	651	70	-143	-464	-551
Angola	29	11	29	29	1	181	244	604	28	-170	-215	-574
Congo	1	8	8	12		6	18	152	1	1	-9	-140

Source: East-West Center Energy Program Database.
Note: A blank cell indicates a value that is negligible or equal to zero. n.a. = not available.
1. Countries are listed in rank order of total trade (exports plus imports).
2. These figures reflect large amounts of trade (especially exports) passing through Hong Kong and counted as trade with it, but destined for or coming from other countries.

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