

CHAPTER 2

CHINA'S ENERGY DEMAND

2.1 China Economic Growth during 1992 – 2006

In 1978, the government of China embarked on a major program of economic reform. In an effort to awaken a dormant economic giant, it encouraged the formation of rural enterprises and private businesses, relaxed state control over some prices, and invested in industrial production and the education of its workforce. One major feature of the 1978 reforms was the liberalized foreign trade and investment - the policy increasing contact with the outside world. Since 1978, external trade has increased several-fold and investment from foreign countries has been encouraged as part of the 'open door' policy.

This 'reform and opening up' policy has sustained high growth. China's foreign trade has developed rapidly. The 1990s saw a thorough change in both the scale and patterns of FDI in China. The relative scale of FDI greatly increased, and what is more important, it began to be gradually integrated into the local economy.

Figure 1: China Growth Rate during 1992 – 2006

Year	GDP Index in real terms	GDP Rmb billion at current prices	GDP per head Rmb	Real annual growth rate (%)
1992	1,660.00	2663.8	2,287	14.2
1993	1,877.50	3,463.40	2,939	13.5
1994	2,114.00	4,675.90	3,923	12.6
1995	2,304.30	5,847.80	4,854	10.5
1996	2,530.10	6,788.50	5,576	9.6
1997	2,745.20	7,446.30	6,054	8.8
1998	2,959.30	7,834.50	6,038	7.8
1999	3,169.40	8,206.80	6,551	7.1
2000	3,422.90	8,946.80	7,086	8
2001		10,965.50		8.3
2002		12,033.30		9.1
2003		13,582.30		10
2004		15,987.80		10.1
2005		18,232.10		9.9
2006		14,147.70		10.7

Source: National Bureau of Statistics, China Statistical Yearbook 2004; National Bureau of Statistics plan report.

As shown in the table, China's high GDP resulted from Deng Xiaoping's Southern Tour at the beginning of the year 1992 which massively boosted foreign direct investment inflows into coastal areas and started a wave of government investment in Shanghai. In 1993 Zhu Rongji appointed to rein in the overheating economy, this time more selectively than in 1989-1991. Growth rates subsided gradually in subsequent years, producing a so-called "soft landing". During the 1990s, living standards continued to rise, as evidenced by the proliferation of consumer durables, especially among the urban population. Continuing FDI inflows helped boost foreign exchange reserves to record heights in the late 1990s.

China's economy has expanded rapidly in recent years. Nowadays China is the world's most populous country and has a rapidly growing economy. In 2005, China's rate of economic growth is estimated to have been 9.9 percent in real terms, following average annual growth of 9.2 percent from 2000 to 2004. In 2006, statistic

of customs showed, China's total value of import and export in the first 5 months hit US\$ 647.85bln, up by 23.9% year-on-year. China's real gross domestic product (GDP) has grown at 10.7 percent in 2006, fueled by strong investment. Inflows of foreign direct investment (FDI) into China totaled \$86.1 billion in 2005, a new record and roughly double the level of 2001. Measured on a purchasing power parity (PPP) basis, China in 2005 stood as the second-largest economy in the world after the US, although in per capita terms the country is still lower middle-income and 150 million Chinese fall below international poverty lines.¹

It can be said that industrial production has been the major contributor to the expansion in China's gross domestic production, underpinned by strong growth in consumption both in China and in China's major trading partners. The growth in industrial production has been driven largely by increasing investment across all sectors, with particularly strong output expansion in energy intensive industries, including iron and steel, cement, plate glass and chemicals.

According to a report offered by the Organization for Economic Co-operation and Development (OECD) during an ongoing anti-corruption conference in Beijing, China's rapid economic growth, brought about by the adoption of market mechanisms, is quite likely to continue in the coming years. In the past more than two decades, China's economic growth has averaged 9.5 percent, a rapid pace which is likely to be sustained for some time, according to the Economic Survey of China in 2005.

¹ Lai Pingyao, "China's Economic Growth: New Trends and Implications," in *China & World Economy*, (November 2003), by the Institute of World Economics and Politics, Chinese Academy of Social Sciences (State : Blackwell Publishing, 2003)

2.2 Energy Consumption in China

China's two decades of rapid economic growth have fueled a demand for energy that has outstripped domestic sources of supply especially oil, natural gas and coal which are the major forms of energy consumed.

Energy is used in an economy to supply a service or to perform a certain activity. The level of demand is determined by a complex set of factors. These include the size and structure of economies, the distribution of income, consumption patterns, the degree and character of urbanization, and the performance of available technology. The stage of economic development is also a major factor shaping the energy intensity of a country. For example, during a country's infrastructure-intensive basic materials often grows faster than GDP. This situation tends to increase energy intensity.

China is now the world's second largest consumer of energy, accounting for some 12% of global energy demand, but its rate of increase of demand is some four to five times that for the rest of the world. Rapid economic growth in China resulting in a rising demand for energy resources, particularly oil and gas, poses energy demand challenges. China's spectacular economic growth is largely responsible for its rising energy demand, and projections assume that fairly rapid growth will continue. Unlike most developed countries, energy use in China is still dominated by industry, which accounts for 70% of final demand.

Total primary energy consumption in 2005 rose to 1234 million tonnes of oil equivalent. This rapid expansion in industrial energy use has outweighed efficiency gains in energy production and energy conservation measures such as those that contributed to the slowdown in China's energy consumption in the late 1990s.

The industrial sector is the largest user of energy in China. China known as 'the World's Factory' is a major player in product lines that are still mass produced in many countries. The shift toward China-based manufacturing is also underpinned by impressive advances in global supply chains. As a result, the continuation of China's

export drives energy demand. As China's GDP grew at a rate of 9.8 percent per year during the period 1985 - 1995 and expected to average 6.6 percent per year until 2020, rapid economic growth has boosted oil and natural consumption remarkably.

China's Oil Consumption

China's demand for crude oil has been growing over the past decade, and in 2003 and 2004, the country's demand for oil increased dramatically. China's changing petroleum requirements are closely related to its high rates of growth in economic output and personal incomes. The growth in incomes and the accompanying changes in petroleum demand are themselves driven by an ongoing population shift from rural to urban areas. That growing urban population is demanding new vehicles and new roads, raising the demand for energy in the transportation sector. Separately, the growth in output in industrial sector is driving the high demand for petrochemical feedstocks, including naphtha-based petrochemicals, which are similar in composition to motor gasoline.

Those underlying factors suggest a significant momentum in China's demand for petroleum. A key concern in this analysis is not whether China's demand for petroleum will continue to grow but how fast it will grow over the next five to ten years.

China's petroleum markets have undergone profound changes in the past decade as demand for a wide range of petroleum products has grown much more rapidly than many analysts expected and as growth in the country's domestic oil production has slowed sharply. The increase in demand for oil has been greatest in the country's transportation and industrial sectors, causing the mix of products demanded in China to shift away from heavy fuel oil and toward lighter fuels – diesel, gasoline and petrochemical feedstocks. Demand in the transportation sector in particular has been pushed by high growth in incomes and demographic changes that are expanding the potential population of drivers. Along with high levels of motor vehicle sales and

highway construction, those changes are laying groundwork for future demand growth. To help manage those changes, while complying with national policies to preserve energy independence and protect the environment, the Chinese government is restructuring its oil industry.

China's Total Petroleum Use

In 2004, China became the second largest consumer of petroleum, behind the United States. In that year, world wide petroleum demand increased by 3.3 percent, more than twice the annual rate of increase over the past decade.² Nearly 30 percent of that additional demand originated in China, where demand grew at an annual rate of 15 percent.

China first emerged as a net importer of crude oil in the early 1990s. The country was largely self-sufficient in oil resources until 1992. Utilizing the resources of its western regions and coastal waters, China's state-owned oil businesses had been able for many years to boost production in line with growing demand. But production growth slowed in the mid-1990s, and came close to a halt in 2004, with output at about 3.5 million barrels a day. By 2004, in little more than a decade, China's net imports of petroleum had increased to about 3.0 million barrels a day.

Much of the growth in petroleum consumption and the relative growth of particular fuels can be traced directly to growth in output of the major sectors of the Chinese economy – industrial, transportation, residential, and commercial. Changes in the efficiency of energy use in different sectors, which also can help to explain consumption trends, are less important than total economic activity in the short run.

² Changes calculated from data on world oil consumption and prices reported in Department of Energy, Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0025 (July 2005).

Activity in the industrial and transportation sectors, which together account for over 80 percent of all petroleum use in China, explains much of the increase in demand for diesel fuel and gasoline. In 2002, the industrial sector accounted for over half of China's total demand for petroleum. That sector includes manufacturing, agriculture, and energy conservation activities, such as petroleum refining and electricity production. Manufacturing concerns – many of them involving foreign investors from the United States, Japan and South Asia – use refined petroleum products such as heavy oil and diesel fuel to operate equipment and the heat and cool their facilities and use products such as naphtha and liquefied petroleum gases to produce petrochemicals.

In agriculture, petroleum demand is strongest for diesel fuel, which is used to power China's 15 million tractors and 22 million small rural vehicles. The bulk of China's electricity comes from coal, hydroelectric power, and nuclear power, but limits on the ability to rapidly expand that capacity in the face of recent growth in electricity demand have steered increased usage to older power plants burning heavy fuel oil and newer small-scale generators burning diesel fuel. As with petroleum demand in general, industrial demand is growing fastest in China's urban centers.

About 25 percent of China's petroleum consumption is for transportation, including moving passengers and freight by road, water, rail and air. The growing demand in the transportation sector reflects the new personal wealth in China, as well as the transport requirements of industrial and commercial activity in the urban centers of the eastern provinces. The major fuels for transport are diesel, gasoline, heavy oil, and jet fuel. Diesel is by far the most important, accounting for nearly twice as much consumption as gasoline.

Today, China, which consumes 7 million barrels per day, half of which is imported, is the world's second-largest oil consumer (behind the United States). China's future trends are even more dramatic than those of the past. Following the recent surge in China's demand for petroleum, its per capita consumption of oil is still less than 8 percent of America's. Adding 5 million cars per

year, China expects its auto fleet to increase from less than 25 million today to more than 125 million within 25 years. As a result, the EIA projects that China's demand for oil will more than double by 2025, reaching 14.2 million barrels per day, and more than 10.9 million barrels will be imported. As a result, China's net imports will have increased by 8 million barrels per day since 2004. Until President Bush recently joined his six immediate predecessors by promising that America's addiction to oil would end, the EIA had been projecting that U.S. net petroleum imports, which averaged 4.2 million barrels as recently as 1985 (when China was East Asia's largest oil exporter), would exceed 19 million barrels a day in 2025, reflecting an increase of more than 7 million barrels since 2004.

China's Natural Gas Consumption

China's energy needs are growing with incredible speed, and the Chinese government knows it. By 2030 natural gas will surpass oil to become the world's number one energy resource, especially in the power generation industry. According to government forecasts, China will need to invest over 220 billion RMB in natural gas infrastructure, pipelines, and liquefied natural gas (LNG) facilities between 2002 and 2020. Opportunities will be created in the reconstruction and expansion of old power plants as well as in refitting existing power generation equipment. In coal bed gas exploration, foreign investment and advanced technologies will be key. Natural gas in China offers attractive prospects for investment. In the near future, it will become one of the most vibrant areas of cooperation between China and foreign countries.

The demand for natural gas, as a clean and efficient fuel, is expected to reach 200 billion cubic meters by 2020. With demand growth outpacing supply, China will have a supply gap of about 80 billion cubic meters by 2020. The Chinese government is currently drafting plans for the mid to long-term development of the natural gas industry. Objectives include the further acceleration of exploration,

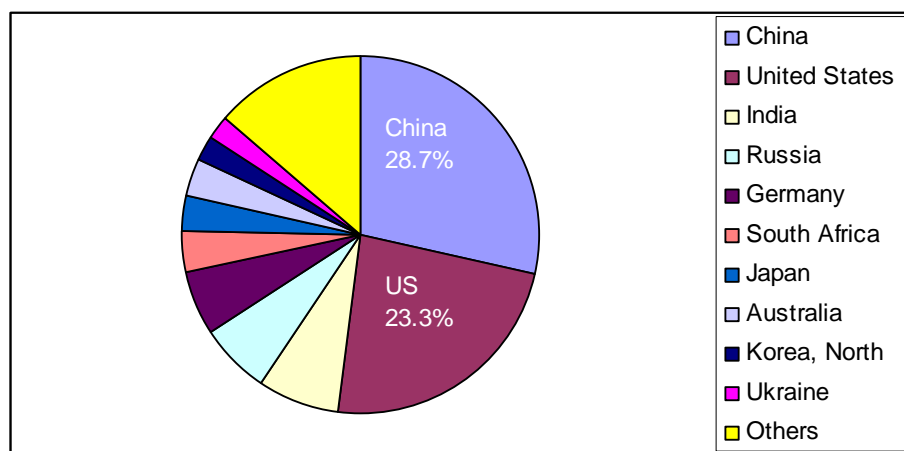
development and use, optimization of energy supply structures and enhancing national energy security.

One important issue for foreign companies interested in China's natural gas infrastructure is the level of openness to foreign businesses. The Chinese government encourages foreign companies to participate in the construction and operation of natural gas exploration, shipping, storage, power generation, urban use and related industries. A number of laws and regulations have been modified to relax restrictions on foreign investment. In fact, in recent years almost all major international petroleum and petrochemical companies have invested in development in China.

China's Coal Consumption

China's main energy consumption is coal. As indicated in the chart below, China is the largest coal consumer in the world. Its coal consumption accounts for one fourth of that of the world total, and half increase of the coal consumption of the world is contributed by China.

Figure 2: Coal Consumption by Country



Source: Energy Information Administration

Consumption of coal in China is driven to a large extent by the electricity generation sector. The expansion of the iron and steel industry, the building and construction industry, and the manufacture of durable consumer goods to meet increasing domestic and export demand has led to a rise in energy consumption of electricity in net terms after the United States. In 2004, the electricity and iron and steel industries are estimated to have accounted for around 50 percent and 13 percent respectively of total coal consumption in China.

Electricity generation capacity has increased substantially over the past few years, with electricity production capacity added to the network more than doubling between 2003 and 2005.

Domestic coal demand in China in 2002 reached 1370Mt accounting for 66% of the total primary energy consumption 91480Mtce in China.³ If the exported coal is included, the total demand was 1.44 billion tons. Among the domestic coal demand, coal for power and heat generation was 732 Mt, accounting for 53%; coal for building material industry 165Mt, accounting for 12.0%; coal for metallurgical industry 176Mt, accounting for 12.8%; coal for chemical industry 80Mt, accounting for 5.8%. It is predicted that the total coal demand could reach 1580Mt, of which, the domestic coal consumption is 1500Mt, and net coal export 80Mt; coal demand would increase by 136Mt comparing with 2002, of the increased coal demand, 90Mt for power generation, 30Mt for coke production, and 16Mt for cement production and blast furnace fuel except coke etc.

Since 1980s, coal consumption in China has experienced a rapid continuous increase; coal consumption was increased from 610Mt in 1980 to 1348Mt in 1996, with an annual average increase of 46.13Mt or annual average increase rate of 5.08%. Subject to the adjustment of national economic structure, energy consumption structure, production structure and coal industry structure, coal consumption decreased a lot since 1997, decreasing by 37Mt (or 2.7%) comparing with 1996, and

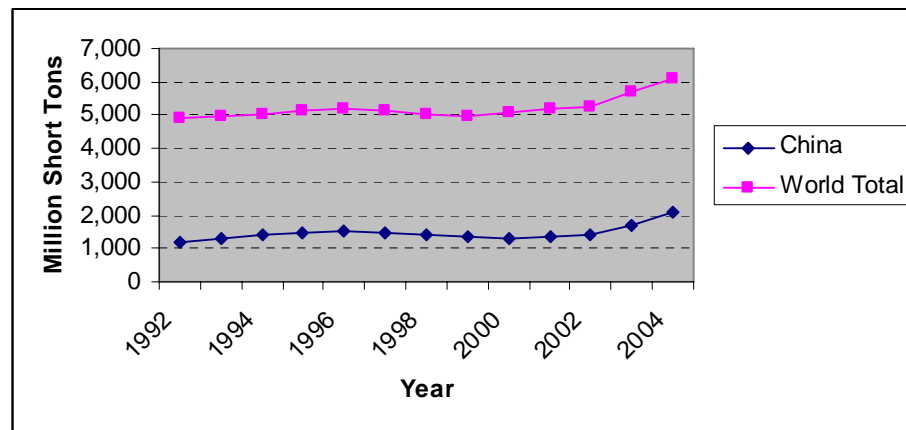
³ He Youguo, China's Coal Demand Outlook for 2020 and Analysis of Coal Supply Capacity. <http://www.iaea.org/Textbase/work/2003/beijing/4Youg.pdf>

further decreased to about 1200Mt in 1998, decreasing by about 100Mt comparing with 1997.

In 1999 and 2000, the coal consumption recovered slowly, driven by the growth of power generation coal and coal export in 2001 and 2002, coal production and consumption experienced a strong increase, the coal production in 2002 reached 1393Mt, the highest in history. Furthermore the coal quality was also greatly improved comparing with 1996, the average heating value of national thermal coal was increased by 700kcal/kg in 2002, increasing by 15.8%. Based on this data, we can infer that national coal consumption can be reduced by more than 150Mt.

China is a major energy consumer with coal as the dominant energy. Coal always plays dominant role in primary energy consumption. Coal consumption tends to be concentrated in four industries including power generation, building material, metallurgy and chemical production. The coal for power generation is the main factor stimulating the coal demand.

Figure 3: China's Coal Consumption during 1992 - 2004



Source: Energy Information Administration

The coal dominated energy consumption structure in China is determined by the energy resource characteristics of rich coal and poor oil and gas and the economic development stage, and it will remain unchanged in the foreseeable future. The domestic and foreign experiences with coal processing and utilization

demonstrate that coal fired power generation is the main contributor of coal consumption, which generally accounts for more than 80% of total coal consumption in developed countries. Comparing with hydropower and nuclear power, the coal fired power generation in China features low investment, short construction period, low electricity production cost and rich resources etc. It is predicted that coal for power and heat generation will be increased from 732Mt in 2002 to 1500Mt in 2020, with a annual increase of 40Mt. By 2020, the share of power generation coal in the national coal consumption will be increased from 56% in 2003 to 71% in 2020, but still lower than that in developed countries.

Coal demand by metallurgical and chemical industries will continue to increase, but their share in national coal consumption will be increased further. The main coal consuming products of building material industry have reached high production level. The growth space is quite limited, comparing with developed countries. There is a great potential for energy saving. The coal consumption will reach peak in 2010, and may decrease later on. Coal demand for other end coal users such as residential users will continue to decrease. Considering the side effect resulted from the environment impact due to coal mining, the coal export should not be increased too much.