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Production, Exports and Imports of Coal in China

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Abstract: The rapid emergence of China as a thermal coal exporter in the mid-1990s highlighted the extent to which changes in China's coal supply and demand balance can contribute to shifts in international coal trade and world energy prices. Since then the coal industry in China has undergone a process of significant realignment in response to capacity expansion by industry and the subsequent increase in demand for energy. China's National Development and Reform Commission (NDRC) have also reduced government intervention in the market. In 2003 and 2004 an increase in domestic demand for coal and infrastructure constraints led to a significant rise in coal prices in China. The increase in demand for both thermal and metallurgical coal in China has been largely met by domestic production. Policy measures by the Chinese Government to increase mine safety, reduce infrastructure bottlenecks and reform pricing mechanisms are aimed at maintaining the domestic coal demand and supply balance.

Key words: Coal export, coal import, coal production, coal market, energy, NDRC

INTRODUCTION

Coal energy is China's main resource energy. Among the out put of usable energy and its consumption, coal reaches more than 75%. At present, china meets the important strategically period when the economic is rapid developing, the demand of energy is increasing and the market of coal is surging. The coal production in 2004 targeted 190.56 trillion tons. It's estimated that the coal demand in china will be more than 250 trillion tons till 2020 (China Coal Expo, 2006). Therefore, there's a great potential development space for the Chinese coal industry. With the important support from the central government and the encouraging situation of building better society and fastering the space of development the national economic, china well speed efforts on building the large coal basses, reevaluating resources and reforming coal enterprises. A couples of large enterprises are being under construction coal mine safety is highly aimed by massive technology innovation which results the coming of second revolution in coal.

Over the past 25 years, china has undergone significant economic reform and has emerged as one of the world's fastest growing economies. Coal consumption in china has increased in response to a rapid expansion in industrial production and the consequent increased demand for electricity. Coal transport capacity constraints contributed to a substantial rise in domestic coal prices in 2003 and 2004 and an increase in power supply disruptions resulting from insufficient supplies of coal.

One of the challenges facing china's government has been to balance the pace of economic reforms and infrastructure developments with increased growth in domestic and foreign demand for consumer goods. Regulatory reform has contributed to maintaining the domestic coal demand and supply balance in the past few years.

Mineral sector has been playing an important role pushing forward china's national economy and social development. China's mining industry not only supports the rapid growth of the Chinese economy, but is also making great contribution to and exerting impact on the current development of the global mining industry. This has drawn tremendous attention from the world. With the prospect of china's mining industry is very broad. In 2004, china total import and export of mineral and related products exceeded US$ 215.544 billion (CNCPEC, 2005). The development research center of state council estimates that coal will account for 66% of primary energy consumption in 2010. Coal-based power generation will account for 65-70% of total generation for the next decades. Industry is the other major consumer of coal (The World Bank, 2004). The recent policy changes that could affect China's coal industry, particularly the impact of regulatory changes on demand and supply are examined.

Coalmines in China are traditionally classified in terms of size and ownership: Key (Large) State-owned Coal Mines (KSOCM); State-Owned Local Coal Mines (SOLCM) and small: scale Township and Village Coal

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Mines (TVCM). In 2002, there were 119 KSOCM each producing on average 598,300 tons annually ; nearly 2,000 SOLCM each producing on average 132,000 tons annually and 32,000 TVCM each producing on average13,000 tons of coal annually. In 2002, KSOCMs provided 51% of China's coal production, the SOLCM provided another 19% and the TVCM accounted for the remaining 30% of coal production (Creedy, 2006).

ECONOMIC GROWTH AND ENERGY CONSUMPTION IN CHINA

Energy consumption in China has shown growth, except in the 1995-2002, periods (Table 1) but, given the rapid growth of Gross Domestic Product (GDP), energy consumption growth has been surprisingly modest averaging 3% per year. The aggregate energy demand elasticity with respect to GDP was 0.34 until 1996 and averaged only 0.26 over the entire 1980-2002 period (Adams *et al*., 1996; Rawski, 2001). This contrasts sharply with the typical expectation that the energy elasticity in developing countries exceeds unity, in other words, energy consumption rises proportionately more rapid than GDP (Zilberfarb *et al*., 1981). This can be explained by changes in the composition of production and the energy intensity of production (Medlock *et al*., 1999; Brookes, 1972) and by substitution between fuels (Adams *et al*., 1968).

Government figures indicate that China's GDP has grown from US$ 148.8 billion in 1976 to US$ 935 billion in 1997, with an annual average growth rate over the past 10 years of 10.1%. The structure of China's economy is now diverse, with the industrial sector being the largest, accounting for 50.8% of GDP in 1997. Industrial growth over the past 10 years has averaged at 13.9% (World Bank county brief, 1998). However, there continues to be a major uncertainty over the quality of China's GDP statistics and widely agreed that the figures published by China's statistical authorities underestimate China's GDP level and overestimate the GDP growth, at least over the last two decades (IEA, 1998).

From 1978, the year that reforms and liberalization were initiated in the country, to 2001, China's economy grew at an average annual rate of 9.4%. Demand for primary sources of energy increased at an annual rate of 3.7% (IEEJ, 2003). However, the demand for primary energy changed in the latter half of the 1990s. While the economy grew at an annual rate of 7-8%, the demand for primary energy peaked at 1,380 million tce (tones coal equivalent) in 1996, declining thereafter up to 1999. Like wise, the proportion of coal constituting the primary source of energy in demand, which had formerly been constant at around 75% of total demand, declined from 74.7% in 1996 to 67.0% in 2001 (China Energy Statistical Yearbook, 2002).

The industrial sector is the largest user of energy in China. In 2003, it accounted for approximately 70% of total final consumption of coal. The rapid growth in the industrial sector has resulted in rising energy demand in China, particularly for coal fired generated electricity.

China's economy has expanded rapidly in recent years. In 2005, China's rate of economic growth estimated to have been 9.9% in real terms, following average annual growth of 9.2% from 2000-2004 (China Statistical Yearbook, 2005).

Industrial production has been the major contributor to the expansion in China's gross domestic product, underpinned by strong growth in consumption both in China and 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 (Melanie *et al*., 2006). The industrial sector is the largest user of energy in China. In 2003, it accounted for approximately 70% of total final consumption of coal.

Table 1: Energy intensity by GDP

Year	Total energy consumption (tce/10^4yuan)	Coal (tn/10^4yuan)	Coke (tn/10^4yuan)	Petroleum (tn/10^4yuan)	Crude Oil (tn/10^4yuan)	Fuel oil (tn/10^4yuan)	Electricity (10^4 Kw.h/10^4yuan)
1991	5.12	5.46	0.35	0.61	0.61	0.17	0.34
1992	4.72	4.94	0.34	0.58	0.57	0.15	0.33
1993	4.42	4.61	0.34	0.56	0.53	0.14	0.32
1994	4.18	4.38	0.31	0.51	0.48	0.12	0.32
1995	4.01	4.21	0.33	0.49	0.46	0.11	0.31
1996	3.88	4.04	0.30	0.49	0.44	0.10	0.30
1997	3.53	3.57	0.28	0.50	0.45	0.10	0.29
1998	3.15	3.08	0.26	0.47	0.41	0.09	0.28
1999	2.89	2.81	0.23	0.47	0.42	0.09	0.27
2000	1.46	1.39	0.12	0.25	0.24	0.04	0.15
2001	1.40	1.31	0.11	0.24	0.22	0.04	0.15
2002	1.42	1.31	0.12	0.24	0.22	0.04	0.16
2003	1.50	1.44	0.13	0.24	0.22	0.04	0.17

The rapid growth in the industrial sector has resulted in rising energy demand in China, particularly for coal fired generated electricity (China Statistical Yearbook, 2005 and IEA, 2005). The rapid rising energy demand had major implications for the coal industry. The share of coal in China's energy mix declined from 80% in 1990 to 70% in 2002. This downward trend reflected the government's long term policy to lower the use of coal through improved end use efficiency and substitution of alternative fuels, including natural gas. However, since 2002, rising demand for coal, particularly for electricity generation, has reversed the trend, with the share of coal estimated to have reached 73% in 2004 (IEA, 2006).

The distribution of coal resources varies widely from region to region, with nearly 67% of coal reserves situated in Northwestern China. Some 65% of all proven recoverable reserves occur in the provinces of Shanxi, shaanxi and Inner Mongolia, among which, Shanxi ranks No.1 in coal reserves (China Coal Industry Yearbook, 2000). Between 1970 and 1988, China's share of world energy consumption doubled from 4-8%. From 1980 to 1996, coal consumption increased in China at an average rate of 5.6% a year, faster than the average growth rate of 5.3% a year for total primary commercial energy consumption (Coal in the Energy Supply of China, 2000). It is now ranked the second largest energy consuming country in the world after the United States, with coal accounting for 68% of the total primary energy consumption and over 63% of the final commercial energy consumption in 2000. Coal consumption is expected to increase to 14% by the year 2010 and 16% by 2020, accounting for 67% of total primary energy demand in the year 2020 (Browne, 2000).

Total primary energy consumption in 2005 raised to 1234 million tones of oil equivalent an increase of 14% from 935 million tones of oil equivalent in 2004 (China Statistical Yearbook, 2005; IEA, 2005). This rapid expansion in industrial energy use has out weighed 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. In 2003, it accounted for approximately 70% of total final consumption of coal. The rapid growth in the industrial sector has resulted in rising energy demand in China, particularly for coal fired generated electricity.

Coal is one of the true measures of the energy strength of the United States. One quarter of the world's coal reserves are found within the United States and the energy content of those reserves exceed that of all the world's known recoverable oil. Coal is also the workhorse of the nation's electric power industry, supplying more than half the electricity consumed by Americans. Coal-fired electric generating plants are the cornerstone of America's central power system (Invest in China, 2007).

ANALYSIS OF COAL SUPPLY CAPACITY

According to an estimate by the authorities, China's total estimated coal resources within a depth of 2,000 meters total 5,570 tones (Jianping *et al*., 1998), although much of this total would not be economically recoverable. Currently, the production capacity of coal mines in China is estimated to be about 1500 Mt, including state-owned mines 1000 Mt (100 Mt higher than the designed capacity), township mines about 500 Mt. Considering the mine closing due to resource depletion and the operation of new mines, it is predicted that the coal supply capacity was reached 1530 Mt/a in 2005 and will reach 1550 Mt in 2010 and 1430 Mt in 2020, respectively. Therefore, the shortage of coal supply was reached 120 Mt in 2005 and will reach 250 Mt in 2010 and 620-770 Mt in 2020, respectively (Youguo, 2003).

At present, about one third of state-owned coal mines are suffering maladjustment between heading and mining and tense mining level continuity, one fifth of state-owned mines are suffering tense mine continuity or maladjustment. The state-owned mines are facing the problem with the serious aging of main production equipment; some equipment has exceeded the service life by 30-40%. Most equipment used in township mines are simple and production conditions.

For the purpose of meeting the coal demand, new coal mines with a total capacity of 900 Mt/a need to be constructed during 2003-2020, with annual construction scale of 50 Mt. However, due to less input in coal exploration, the preparatory work for mine development lags seriously, half of the planned new mines to be constructed during 2003-2010 fail to meet the requirement of coal exploration and the shortage of reserves with detailed exploration would reach 30 billion tons.

China's raw coal output in 2005 totaled at 2.198 billion tons with a year-on-year growth of 12.37%, which increased by double compared to 998 Mt in 2000. The annual compound growth was 17.10%. The output in 2004 was 1.956 billion tons with a year-on-year growth of 13.2%, up 228 Mt. However, coal shortage still exists (Research in China, 2006). According to the estimates, China's demand for coal was probably around 2.25 billion tons in 2006, including 2.17 billion tons for domestic demand and 80 Mt for export (People's Daily Online, 2006).

COAL CONSUMPTION IN CHINA

China is the world's second largest consumer of energy and a major energy producer. An overriding feature of China's energy system is the dominance of coal in both energy consumption and production. Coal accounts for more than two-thirds of China's total primary energy consumption and more than three-quarters of electricity generation is coal fired (Abareconomics, 2002). Growth in energy consumption has moderated significantly in recent years, primarily as a result of reduced coal consumption. Coal consumption in China fell by almost 12% between 1996 and 2000, from a peak of 1377 million tones in 1996, to 1215 million tones in 2000 (IEA, 2002a). Consumption of other fuels, including oil and natural gas, remained steady or grew over the same period. The relatively sudden and large fall in coal consumption is the result of several factors. A key driver has been the economy wide government reforms that have led to significant improvements in the efficiency of China's economy. Reforms has included the closure of some large and inefficient state owned enterprises, as well as the closure of small, less efficient plants in the coal (SETC, 2001).These reforms have resulted in notable efficiency improvements in major coal using industries.

The supply of higher quality coal, with a lower ash content and higher calorific value, has also been an important factor in reducing coal consumption. In addition to improvements in the quality of coal that is mined, an increase in the volume of coal that is washed has also improved coal quality. Around 25% of China's coal production was washed in 200, compared with 15% in 1996 (CCIPH, 2001). It is estimated that the use of higher quality coal reduced coal consumption by state owned electricity generators, for example, by over 70 million tones between 1996 and 1999 (Sinton *et al*., 2000). For the industrial sector as a whole, the share of coal fell from 71% in 1996 to58% in 2000 (IEA, 2002b).

In Tabel 1 economic growth and hence, output growth in key coal using industries also moderated over the 1990s, particularly in the second half of the decade, leading to lower growth in coal consumption. From almost 10% in 1996, China's official GDP growth rate slowed to 7% in 1999 (China Statistical Yearbook, 2001). The growth in coal consumption usually generated by economic growth has been outweighed in recent years by the factors described above.

China is the largest coal producer in the World (1.956 Mt in 2004) and was, until recent restrictions due to internal supply shortages, the second largest exporter of coal in the world (70.4 Mt in 2002 to Korea, Japan and Taipei). It is also the largest consumer of coal (1.531 Mt in 2003), accounting for approximately one third of the world's total annual consumption. More than half of china's coal is used to generate over three quarters of the national electricity supply. Clearly, the sustainable use of its coal resources is of vital importance not only for China, but also for the rest of the World.

COAL PRODUCTION IN CHINA

Between 1980 and 1996, production more than doubled from 620 million tones to 1,397 million tones, with annual growth rate of around 2.7% in the early 1990's peaking to a staggering 9.6% in 1995, before dropping back to 2.6% in 1996. However, since then production has declined, with total output in 1997 some 3.5% lower than the previous year, at 1,373 million tones and first estimates for 1998 some 11% lower at 1,213 million tones (Table 2). There are plans to reduce output by a further 100 million tones to less than 1,100 million tones in 1999 (China Daily, 1999).

Even with significant falls in production in the late 1990s, China has had a market oversupply of coal. The coal stockpile was estimated to be around 200 million tones in 1998 and was still around 140 million tones by the end of 2000 (Wang, 2000; Huang *et al*., 2001). This oversupply reduced domestic coal prices and severely affected the financial situation of state owned mines (Wright, 2000). In 1998, over 80% of key state owned coal enterprises were reported to have recorded a "severe economic loss", with losses amounting to 2.28 billion Yuan (US$275.4 million) (Huang *et al*., 2001). However,

Table 2: Coal production, import and export in China

Year	Coal import Mt	Coal export Mt	Coal production Mt
1990	2.1	17.3	1079.9
1991	1.4	20.1	1087.4
1992	1.23	19.7	1116.0
1993	1.43	19.9	1151.0
1994	1.2	24.2	1240.0
1995	1.6	28.7	1343.1
1996	3.2	36.5	1396.7
1997	2.13	35.4	1372.8
1998	1.6	32.2	1213.3
1999	1.7	37.5	1238.3
2000	2.2	55.1	1231.2
2001	2.7	90.2	1267.9
2002	11.8	85.8	1326.0
2005	26.2	72.0	2100.0

Table 3: Death on coal mining accidents person/Mt, (State Administration of Coalmine Safety, 2006)

Year	Total	Key State-owned	State-owned local	Township and village
1980	8.17	7.11	10.50	9.03
1995	4.86	1.43	9.06	12.07
2000	5.80	0.466	3.458	10.990
2001	5.13	1.880	4.231	15.438
2002	3.34	0.91	2.43	7.12
2003	4.17	1.08	3.13	9.62

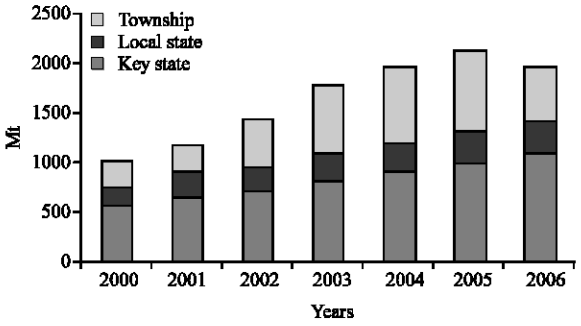

Fig. 1: Coal production, by mine type China, after McCloskey's(2005)

recent indications are that state owned mines are recording improvements in financial performance, with the proportion of mines running at a loss falling substantially in 2001-2002 (CIEC, 2002 and Xie, 2002).

Coal production in China doubled between 2000 and 2005 (Table 2), largely reflecting the reopening of many previously closed small mines at the township and village level as well as increase in the mechanization of coal mines. Township, village and local state mines tend to have a smaller production capacity ten key state mines.

In 2005, coal production in china increased by 8% to 2100 million tons. Production at local state mines is estimated to have declined by 3% in 2005 to 286 Mt but this was offset by production from key state coal mines and township coal mines, which increased by 10 and 9%, respectively (Fig. 1).

Coal is produced across china, with top six provinces accounting for 67% of production in 2005 (FACTS, 2006). The largest five coal producing companies last year were Shenhua, Zhongmei, Shanxi Coke, Datong and Longmei.

As china's coal production capacity will reach 2.26 billion tons in 2006, the supply will be a little more than demand (People's Daily Online, 2006). The fact that supply is a little more than demand is a good opportunity for the coal industry to integrate and upgrade.

Investment in the coal industry has increased significantly in the past 3 years. Fixed asset investment in 2005 increased by 66%, compared with an increase of 26% of total fixed investment across all sectors. This follows an increase in investment in the coal industry of 58% in 2004 and 52% in 2003 (China Statistical Yearbook, 2005). This investment has led to a substantial rise in production capacity and the supply of coal for domestic consumption in the past three years and has reduced upward pressure on prices.

In 2005, the industry was forced to reassess capacity utilization rates and mine safety after a number of serious mine accidents. The mortality rate as a percentage of coal produced is one of the highest in the world, with approximately three fatalities per million tones of coal extracted (Table 3). Common causes of coal mine accidents include methane gas explosions, flooding and mine collapses. In 2005, there were 5896 fatalities as a result of coal mine accidents mainly from gas explosions (Jonker, 2006).

Table 4: Coal production, import and export in United States (China Statistic Year Book, 2003)

Year	Coal import Mt	Coal export Mt	Coal production
1990	2.5	95.9	853.7
1995	6.5	80.3	858.6
1999	8.2	53.1	919.2
2000	11.3	53.1	895.2
2001	17.9	44.1	951.2
2002	14.1	34.6	916.7
2005	30	45.3	1027.9

From the first of January 2006, all coal mines will contribute a proportion of the output value of each mine to a fund to cover the cost of mine accidents, with small mines contributing the highest marginal rate. Funds not used in a particular year will carry over to the next year. The aim of the fund is to provide a financial incentive to coal mines to improve safety (Interfax, 2005). Unsafe mining practices can affect production through temporary closures enforced by safety inspectors. According to the National Development and Reform Commission, the central government agency that formulates policies for economic and social development, out of 5000 mines that breached safety standards, only 2157 were closed in 2005. However, the state Administration of work safety claims that 5290 small mines were closed in 2005 (Jonker, 2006). The difference in reported figures may be attributed to temporary mine closures. The National Development and Reform Commission (NDRC) has allocated US$ 750 million to improve mine safety, with the aim of reducing the number of coal mine accidents by 7% by 2007 (Interfax, 2006).

The closure of small coal mines does have an impact on coal production in the short term. However, increased mechanization and improvement in mining processes are expected to counteract any declines in production resulting from mine closures in the medium to long term.

In case of the United States, the coal production reached a record level in 2005, ending the year at 1027.9 million tons, accounting for 20.0% of corresponding global volume (Invest in China, 2007). Production in 2001 was 951.2 million tons higher than the 2000 level of 895.2 million tons and surpassed the prior record set in 1999 and 2002 by 919.2 million tons and 916.7 million tones, respectively (Table 4). Although total United States coal consumption rose in 2005, not all coal-consuming sectors had increased consumption for the year. Exclusive of refuse production, all three major coal-producing regions had an increase in their production levels in 2005,

something that had not happened since 2001. The percentage increases were 1.7% in Appalachia and 2.1% in both the Interior and Western Regions. The tonnage increase in coal production in the Western Region accounted for almost 56 percent of the total increase in the United States in 2005 (Freme, 2003).

The recurring problems that the coal industry typically deals with had varying impacts on coal production in 2005. Although many of these issues were the same as last year (weather, environmental, legal challenges and global economics), the overriding issue for the Unites States coal industry in 2005 was transportation of coal from mines to consumers.

INFRASTRUCTURE BOTTLENECKS IN CHINA

Mines are located in areas that require coal to be transported over significant distances to major industrial centers Transport links are vital to maintaining coal supplies to power plants these links account for approximately 60-70% of rail freight used. In 2005, coal transported by rail reached 1.1 billion tones, an increase of 8% over 2004 and coal handled at ports reached 370 Mt, an increase of 10% from 2004 (FACTS, 2006). Distribution constraints have led to major consumers of coal located in southern provinces of china purchasing imports, as well as mines in the north increasing exports. This situation has arisen from insufficient transport capacity in periods of peak electricity production. In 2005, coal prices stabilized as distribution constraints eased following substantial price rises in 2004 resulting from infrastructure bottlenecks.

The government has implemented a number of measures to address the shortfalls in rail capacity. One measure introduced was to prioritize freight carried on the network. In 2003, for example, shortages of food in Northern provinces resulted in the government reprioritizing rail freight for other products at the expense of coal. In 2003, the change in rail allocations resulted in a reduction in coal stocks at power plants and at ports. At least ten of the largest power plants in Shanghai, Guangdong, Zhejiang, Jiangsu and Fujian Provinces experienced coal shortages (Platts, 2003). Following the shortages, the government adjusted allocations for coal rail freight (Tian, 2004).

Currently, China has two coal rail transport links dedicated to coal the 600 Km track from Datong to Qinhuangdao and the 588 Km track from Shuozhou to Huanghua. The major capital projects that were completed in 2005 included upgrade the Daqin rail link and an increase in freight handling capacity at Qinhuangdao port (McCloskey, 2005). The Huaneng Group, Datong international, the State Development and Investment Corporation and the Ministry of railways are planning a third coal link. This 700 Km rail link, currently in the preliminary planning stages, has an estimated cost of RMB 20 billion (Interfax, 2006). A number of port projects are planned in the next five years, including the refurbishment of Qinhuangdao, Dangshan and Tianjing coal ports. Improvements to large scale container ports are also planned. These include Shanghai international port, Dalian, Tianjin, Qingdao, Xiamen, Shenzhen and Guangzhou (Interfax, 2006). The increase in capital expenditure on port and rail facilities should reduce coal transport capacity constraints and up ward pressure on domestic coal prices.

COAL CONTRACT AND SPOT PRICES

Coal contract negotiations between mines and major buyers have traditionally occurred at the annual coal conference, bringing together government authorities (National Development and Reform Commission and Ministry (NDRC) of Railways), major coal consumers and mining companies. In the past few years, there has been a growing trend for contract prices to be set out side the parameters of the conference. Contract prices negotiated at the coal conference are referred to as 'in-plan' prices. The difference between domestic thermal spot prices and contract prices in the past two years has led to increased investment by power companies in coal production.

In effective coal pricing mechanisms have led to a substantial widening of the gap between market prices for coal and contract prices in China in the past 2 years. The failure to reach an agreed outcome between coal producers and power companies exacerbated coal shortages in 2003 and 2004, with only half of all thermal coal delivered through conference contract in 2004. As a result, domestic coal prices in China have increased substantially in the past two years. The Qinhuangdao Datong premium blend coal price increased by 41% between December 2003 and December 2005, compared with an increase of almost 13% in the international benchmark price (Newcastle Fob coal price) over the same period. In 2005 and for the first half of 2006, the upward pressure on domestic coal prices eased, however, with prices stabilizing as transport constraints eased and production capacity came on line (Jonker, 2006). The average price in 2005 at Qinhuangdao port for thermal coals was RMB 388 a tone. In December 2005, prices of contracts for delivery in 2006 between mines and power plants were lower than market prices by RMB 80-100 a tone (McCloskey's, 2005).

In January 2006, at the opening of the coal conference, the NDRC announced that it would let the market determine contract prices within a reasonable range. By the end of the conference, 812 Mt of contracts had been settled, a reduction of 192 Mt from the 2005 conference (Jonker, 2006).

Key contracts (greater than 0.2 Mt) accounted for 583 Mt or 72% of the total contract volume. Contracts between coal mines and electricity companies accounted for 60% of key contracts, with other 235 Mt sold to other industries and designated export companies. In plan contracts receive priority rail transport allocation, which is also determined at the coal conference (Jonker, 2006). The delay in determining the prices of key contracts in 2003 and 2004 led to a sharp rise in thermal coal spot prices as well as increasing the need for imports. In 2005, coal contract negotiations were finalized in the two months following the conference, leading to a stabilization of thermal coal domestic spot prices. The increase in coal prices negotiated at the annual coal conference has led to an increase in electricity tariff rates. The NDRC has implemented a pricing mechanism that links coal prices to electricity charges. Prices negotiated at the conference (in plan prices) tend to be substantially lower than out of conference spot prices (Japan Electric Power Information Centre). The NDRC has also indicated that the difference between in -plan and spot market prices is likely to be lower in 2006. The NDRC is also attempting to reduce the number of relatively low trading volumes in the coal market by limiting trading by smaller coal companies. At the start of 2005, the NDRC issued new regulations that limit the number of coal trading organizations through a license system. A license can only be obtained if applicant companies have a capital base of US$ 6 million or greater. The aim is to limit the number of firms trading in the market (KPMG, 2005).

The link between coal costs and down stream product/service prices is also having an impact on the allocation of capital. Price signals provided by the market can have significant impacts on the level of investment in the coal industry. Over and underinvestment in coal mines increases the volatility of China's role in global coal markets.

COAL EXPORTS FROM CHINA

China's coal exports increased from 32 million tones in 1998, to 55 million tones in 2000 and to over 90 million tones in 2001 (Table 2), mostly to Korea, Japan and Chinese Taipei (IEA, 2002a). There are several plausible reasons for this rapid growth in coal exports: Large coalmines specifically designed for export, producing products such as Shenhua coal, began operating with an improved transportation infrastructure, enhancing their export capabilities; preferential treatment was implemented by the government to promote exports and sudden rise in global coal market prices in 2001 had a favorable affect on Chinese coal exports.

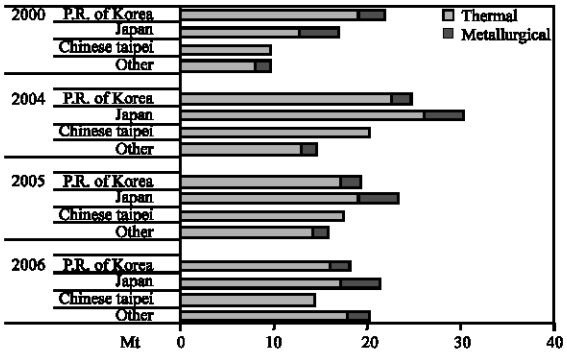

Fig. 2: Destination of China's coal exports, after Abare *et al.* (2006)

As a large consumer and producer of coal, China has the potential to have a significant impact on global coal trade. From 2000 to 2003, China expanded its exports of coal from 55.1 Mt to 93.8 Mt to become the world's third largest coal exporter. However, domestic demand pressures as well as infrastructure bottlenecks limited coal exports in 2003 and 2004. In 2005, the trend continued, with thermal and metallurgical coal exports declining by 17% and almost 8%, respectively. China's key exports markets are Japan, the Republic of Korea and Chinese Taipei. In 2005, China's thermal coal exports to these key markets declined by 20, 16 and 18%, respectively (Fig. 2).

In response to the supply constrained market in 2003, the coal export target in 2004 was reduced by 20 Mt to 80 Mt in January. Since then the export target has remained at 80 Mt (thermal coal 68 Mt and metallurgical coal 12 Mt) plus any unused allocation from the previous year. Exports in the past three years, have remained below the export target, inclusive of the carry over from the previous year, reflecting tightness in the domestic market.

Four state owned trading companies have licenses to export coal: China coal Group Corporation; Shenhua group Corporation; Shanxi import and export Group Corporation and Mine metals Group Corporation. Each company had an equal quota share in the past two years. Total exports in 2005 were 72 Mt, with 8 Mt of under utilized quota being carried over into 2006. A large proportion of the export quota for 2006 was allocated in December 2005, with 64 Mt of quota allocated to the four licensed export companies (Jonker, 2005). The quota is currently not under pressure, as rising domestic thermal coal prices have provided a disincentive to export, leading to a reduction in exports of coal to international markets. In 2006, the metallurgical coal export quota is 12 Mt, unchanged from 2005.

There has been a reduction in government assistance to coal exporters as domestic production is now being used to meet domestic demand. The most recent change to government policy affecting thermal coal exporters was in May 2005 when coal export rebates were cut from 11-8%. In 2004 the export tax rebate on coke and coking coal was lowered from 15-5% and from 13-5%, respectively (McCloskey's, 2006).

It is expected that the thermal coal export tax rebate may be reduced again in September (McCloskey's, 2006). The current situation of exports falling well short of the export target is expected to continue as domestic coal prices are expected to remain at current high levels in 2006.

U.S. coal exports increased for the third consecutive year in 2005, something not experienced by the U.S. coal industry since 1991. Total U.S. coal exports in 2002 were 34.6 million tons, an increase of 44.7 million tons over 2001. While total coal exports were up 53.1 million tones in 2000 and 1999, respectively (Table 4). Coal exports in the United States reached a record level in 1990 at 95.9 million tones (Invest in China, 2007); it is up to 45.3 million tons, accounting for 5.9% of corresponding global volume, the average price per ton increased by 24.0% as the tightening world coal market continued to push export prices to unprecedented highs (Freme, 2003).

IMPORT DEMAND FOR COAL IN CHINA

China's imports have increases since 2001. This is due to the narrow demand\supply environment created by the temporary stoppage of domestic production for securities inspections, which have been carried out as part of security enhancement measures implemented in response to the series of mine accidents that occurred in the midst of production adjustment measures and normalization of demand/supply balances. Coal imports increased 1.7 million tones in 1999, to 11, 8 million tones in 2002, primarily in southeastern coastal areas, such as Guangdong and Fujian provinces (Table 2).

Imports of both thermal and metallurgical coal account for approximately 1% of China's coal consumption. Total coal imports in 2005 reached 26.2 Mt, of which metallurgical coal imports accounted for 28%. In 2005, imports of thermal coal increased by 56% from 2004 (Fig. 3).

In April 2005, China's import tariff on steaming coal was reduced from 6-3%. The import tariff on coking coal was set at zero in January 2005, down from 3%. The reduction in import duties has encouraged increased imports of steaming and coking coal. However, the effect of the lowered tariffs is difficult to separate from the effects of differences between domestic and international coal prices (Jonker; 2005).

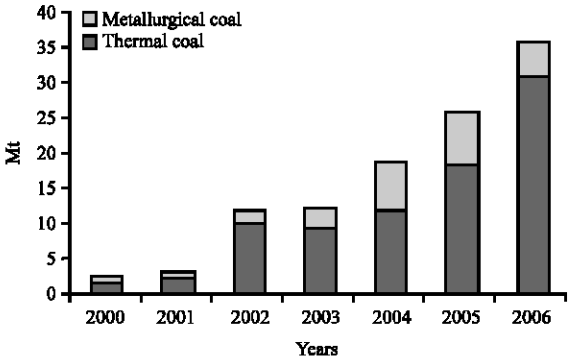

Fig. 3: Coal imports China, after Abare *et al.* (2006)

One factor that may limit coal exports and increase the demand for coal imports in the future is the development of coal liquefaction projects in China. The technology is being considered as one option to reduce China's growing oil and petroleum import dependence. China's first coal liquefaction project is scheduled to begin operating in 2007 and is located in Inner Mongolia. The Shenhua Group, one of China's largest coal producers, is financing the project. The take up rate of this technology is influenced by the relative coal cost of oil to coal and production costs. Production costs of the Shenhua project are expected to be approximately US$ 24 a barrel (Shenhua Group Corporation, 2004).

Imports of coal will continue to be needed to meet China's increasing demand for energy as infrastructure constraints limit the amount of coal that can be transported by rail. Domestic coal production is expected to supply the majority of the increase in coal demand. Imports will continue to account for a small proportion of total coal consumption but are expected to continue to increase in absolute terms.

The United States, coal imports set another record in 2001. Total coal imports were 17.9 million tons, an increase of 7.2% from 1999 were 2.5 million tones (Table 4). It is learned that imported coal covered 4% of the country's total consumption and annual import rose from 9 million tons six years ago to 30 million tons in 2005 and it was expected to exceed 40 million tons in 2006 (Invest in China, 2007). Some of the increase in imports is attributable to the internal coal transportation problems experienced during the year. Although imports represent less than 3% of total United States coal consumption, they are a factor in the supply balance, particularly for the coastal electric power producers. As all coal prices did in 2005, the average customs import price of coal increased. The average price of United States coal imports increased by 24.5% (Freme, 2003).

+Coal market: In 2005, again saw significant growth in world primary energy demand (2.4 %) and greater growth in world hard coal demand (7%), reinforcing the continuing role of coal in world energy markets. Although coal demand growth continues to be driven substantially by Chinese economic development and its need for electricity and steel, growth in coal demand was also apparent in many other countries, e.g., Australia, India, Korea and Russia.

International and domestic coal markets remain tight as growing demand meets constraints in the existing production and transportation capacity. Investment in coal production and port capacity in exporting countries has typically been made in response to identified increases in demand, rather than in anticipation of such increases, so there have been time lags in bringing new capacity to market (Heath, 2007).

Demand growth in Asian markets reflects commitments to coal in China (including Taiwan), Japan, Korea, Indonesia, India and other Asian markets and these commitments are likely to continue. The future of coal use in Europe is less predictable, with market volatility resulting from competition with gas for power generation and longer-term uncertainty regarding EU energy-environment policy, including concerns over energy security.

Australia remains by far the largest hard coal (thermal and coking coal) exporting country, followed by Indonesia and China. However, Indonesia now exports more thermal coal than Australia. Because the focus of growing demand is Asia, the transport cost advantage of Chinese producers is possibly the critical influence on the outlook for the pattern of future coal trade. Russia's proximity to Asian and European markets may become important if producers can overcome the disadvantage of domestic transport costs. European buyers increasingly value the lower sulphur content of Russian coals. In the second half of 2005, the price of coal began to decline on the international market and is now roughly equal to what it is on the domestic market; in some instances, it is even cheaper. The profits of coal enterprises are still on the low side. In the first half of 2006, national coal enterprises recorded a profit of 28.227 billion Yuan after state subsidies, a 13.15% increase from the previous year. Formerly state-owned coal enterprises made a profit of 7.191 billion Yuan, a slight increase of 0.11 % on last years earnings.

To avoid an imbalance in supply and demand and prevent a major downturn in the market, development and management must be improved; coal projects under construction must be abandoned and carefully inspected and checks and ratifications for coal production must be reinforced.

Problems of coal industry: The main work-safety indexes are accident and fatality rates per million tons. China has a poor safety record among coal-producing countries: in fact, it has the poorest safety record. The problems are exacerbated by a lack of practical guidance on safe working methods, lack of investment in safety equipment, resource waste, severe pollution and the failure to develop and impose a safety culture. Gas explosions and roof falls are the major causes of fatal accidents.

China produces plenty of coal beside oil and gas; it represents the main source of energy. In 2003, coal supplied 74% of total energy consumption. Over the next 20 years, coal will still account for about 70%. The greater is the production volume, the higher is the risk of accident. Some enterprises seek profits while ignoring safety.

The main reason is that China places too little emphasis on safety, which leads to poor training for the miners, outdated safety equipment and an obsolete management system. In a word, the applications of science and technology in this area lag too far behind.

Mechanized excavation accounts for only 75.4% overall, but in county-level coalmines the figure is zero. Mechanized excavation in develop countries is at 100%, or very close to it. When there is more mechanization, fewer miners are needed and so accident and casualty rates drop.

Science and technology contribute 40% to coal production in Shandong, compared with 60% or above in developed countries, there is little input into scientific research. Funding earmarked for this in Shandong is less than 1.5% of coal sales. In the United States, it is 3%.

The miners are poorly educated and trained and transient farmers account for a large portion of the total workforce. Many operators of small mines have poor safety awareness. In the United States, most miners are senior middle school graduates, management personnel are college graduates, safety-related technology, equipment and facilities need to be updated. Safety equipment is short in service life, poor in applicability and low in precision and unreliable in function. There is a dearth of special equipment to deal with accidents.

The main problem for the country's coal market is the gap developing between slow rise in demand and market acceleration in supply.

Underinvestment in coal industry in the 1980s is responsible for many of the economic and environmental problems in the industry today. The under investment is partly due to very low controlled coal prices. Controlled prices, lack of transportation and lack of economic incentives to mine coal efficiently contributed to coal shortages.

By closing most small coalmines and replacing them with more modern, large coal mines, expanding average scale of production and using intensive methods and a great deal of investment in manpower and materials, it has finally attained its goals. To solve the problems, the environmental pollution must be reduced by controlling earth subsidence in a timely way and underground water resources during the process of coal exploitation.

CONCLUSION

Coal contributes greatly to social and economic development. It triggered the industrial revolution and has driven industrialization in the past several centuries. At present, many developing countries are still heavily dependent on energy-intensive industries, such as metals and manufacturing.

Changes to China's economy, government policy, domestic coal demand and supply and infrastructure have all provided a base for China to increase coal exports rapidly in recent years, to become a major coal exporter with the ability to influence world coal markets. However, many commentators agree that such conditions and domestic coal surpluses are likely to continue to prevail in the short to medium term, enabling Chinese coal producers to continue to export at around current levels.

In the longer term, the extent to which this occurs will depend on the rate of growth of China's economy, which is likely to drive strong domestic coal demand; the expected continuing energy efficiency growth in coal using industries in China, which will exert downward pressure on domestic coal demand and the ability of China's coal industry to respond to these domestic trends.

The coal market in China has returned to a more sustainable position in 2006, compared with the supply constrained in 2003 and 2004.

Significant changes to electricity market regulation and the increase in generation capacity in the past three years has led to a subsequent rise in demand for thermal coal. The reduction in thermal coal exports has resulted from the widening gap between domestic coal prices and international benchmark prices. Demand for metallurgical coal also increased in the past 5 years in response to the capacity expansion in the iron and steel sector.

Increased investment in coal production and transport links has reduced upward pressure on coal prices in China. Despite these positive developments, the coal industry continues to face significant issues, including mine safety transport infrastructure constraints in periods of high demand and ineffective pricing mechanisms that distort price signals for both producers and consumers.

At the beginning of 21st century, China coal industry should develop with aim of "constructing large coal production base, establishing large enterprise group and promoting joint operation of coal " and thoroughly get rid of the past coal industry policy "simultaneously constructing and operating mine by state, the collective and the individual, simultaneously constructing small, middle and large mines".

Township mine is the group in coal industry, which is the most laggard productive force and outstanding safety accident, the ultimate cause lies in the laggard productive force, it should begin with the strategy for energy industry development and coal production in China, speed up the upgrading of the township mines, improve the mine operating level, so as to promote the ultimate improvement of coal mine safety.

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