

China 's Coal Demand Outlook for 2020 and Analysis of Coal Supply Capacity

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1. Coal Consumption

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. Domestic coal demand in China in 2002 reached 1370Mt, accounting for 66% of the total primary energy consumption (1480Mtce) in China. If the exported coal is included, the total coal 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, product structure and coal industry structure, coal consumption decreased a lot since 1997, decreasing by 37Mt (or 2.7%)

comparing with 1996, and 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 actual coal production was estimated at over 1450Mt), 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. It is predicted that coal production in 2003 could reach about 1600Mt.

China is a major energy consumer with coal as the dominant energy, coal always plays dominant role in primary energy consumption. In 1950s, coal accounted for more than 93% of the energy consumption; after 1960s, with the increase of oil production, the proportion of oil in energy consumption increased rapidly, while the proportion of coal in energy consumption was decreased from 93.9% in 1960 to 72.15% in 1980; after 1980s, the proportion of coal in energy consumption rebounded again, which was increased from 72.15% in 1980 to 76.20% in 1990; after entering 1990s, China has adjusted the previous self-balanced energy policy, and actively joined the international energy market, a great amount of high quality energy such as oil and natural gas has been imported, and coal export is encouraged, it starts the prelude of the structure optimization of China's energy consumption, the proportion of coal in primary energy consumption has been decreased remarkably, which has been decreased from 75.8% in 1990 to 66.10% in 2002. For details, please see Table 1.

Coal consumption tends to be concentrated in four industries including power generation, building material, metallurgy and chemical production, the coal for

power and heat generation is the main factor stimulating the coal demand. The four industries consumed 1149Mt coal in total in 2002, increasing by 764Mt comparing with 1985 (385Mt), and 1.38 times the national coal consumption increase (553Mt) in the same period; the share in the national coal consumption was increased from 47% in 1985 to 80% in 2002, especially the coal consumption for power and heat generation increased a lot, which was increased from 123Mt in 1980 to 733Mt in 2002, with an annual average increase rate of 8.45%, and its share in the national coal consumption also went up from 20.3% in 1980 to 53.5% in 2002. The coal consumption for residential use represented a decrease trend, which was decreased from the highest 175Mt in 1988 to 79Mt in 2000, and its share in the national coal consumption was decreased from 20.7% in 1980 to 6.4% in 2000. In addition, coal export was increased from 6.44Mt in 1982 to 83.90Mt in 2002, with annual increase rate of 13.7%, and becoming the second largest coal exporter in the world.

2. Coal demand prediction of major coal consuming industries

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, of which, the United States used 80% of coal for power generation in 2000, 42.7% higher than that in China, it suggests that there is a great potential for coal to be used for power generation in China. 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; comparing with gas fueled power generation, the unit investment increases by less than 10%, but when the fuel

cost in East China is 0.15yuan/kWh, even if the desulfurization system is installed, the fuel cost is only 0.17yuan/kWh, however, the fuel cost of gas fired power generation amounts to 0.30 yuan/kWh. Therefore, the coal-fired power generation will be increased remarkably in the foreseeable future, it is predicted that coal for power and heat generation will be increased from 732Mt in 2002 to 1500Mt in 2020, with an 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 decreased 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 the peak in 2010, and may decrease later on. Coal demand of other end coal users such as residential users will continue to decrease. Considering the side effect resulted from the environmental impact due to coal mining, the coal export should not be increased too much, the net coal export can be controlled within 100Mt or so. By 2002, 2010 and 2020, total coal demand in China is expected to reach 1650Mt, 1800Mt and 2050-2200Mt respectively, of which, the domestic coal demand is 1580Mt, 1720Mt and 1950-2100Mt respectively. The status and development trend prediction of coal demand by power and heat generation, metallurgical, building material and chemical and other main coal consuming industries is described below:

Power and heat generation

The electricity generated in 2002 in China amounted to 1654.2 TWh ($T = 10^{12}$), of which, the thermal power reached 1352.2 billion kWh, consuming 655.95Mt coal, together with the 76.89Mt coal for heat generation, the coal for power and heat generation totaled 732.85Mt. The thermal power generated during

January to July 2003 increased by 16% comparing with the same period last year, the coal consumption for power and heat generation increased by 65.50Mt, it is predicted that coal consumption for power and heat generation in 2003 could reach 826.00Mt. It is predicted that the installed capacity in China in 2005, 2010 and 2020 will amount to 430GW ($G=10^9$), 580GW and 820-900GW respectively; and the electricity generated will reach 1690TWh, 2760TWh and 2860-3217.5GW respectively. With large generating sets being adopted, the coal consumption per kWh will be decreased gradually, it is predicted that specific coal consumption for power generation will be 350gce/kWh, 330gce/kWh and 310gce/kWh. The coal consumption for power and heat generation is expected to reach 917Mt in 2005, 1090Mt in 2010 and 1350-1500Mt in 2020 respectively, of which, the coal consumption for power generation is 820Mt, 988Mt and 1240-1390Mt respectively.

Metallurgical industry

Among the energy consumption of metallurgical industry, coal accounts for about 70%, mainly including coking coal, fuel coal and coal injected into blast furnace. In 2002, metallurgical industry consumed 176Mt coal. The pig iron production in 2002 reached 170.75Mt, consuming coke of 93Mt (including metallurgical coke), equal to coal 130Mt; fuel coal and coal injected into blast furnace was about 20Mt respectively. During January to July 2003, comparing with the same period last year, the pig iron production increased by 18.1%, and coke production by 20.6%, it is expected that coal consumption by metallurgical industry in 2003 will increase by about 10Mt comparing with last year, and the total coal consumption would reach 186Mt. It is predicted that the pig iron production in China would reach 230Mt in 2005, 270Mt in 2010 and 300Mt in 2020, the coke ratio will be decreased from current 450kg/t (of pig iron) to 410kg/t in 2005, and 390kg/t after 2010, the coke demand would reach 145Mt, 155Mt and 155Mt respectively, the coal injected into blast furnace and fuel coal is expected to reach 50Mt, 60Mt and 65Mt respectively. Therefore, the coal

demand by metallurgical industry is expected to reach 195Mt in 2005, 215Mt in 2010 and 220Mt in 2020.

Chemical industry

Coal demand by chemical industry includes lump anthracite for nitrogen fertilizer and fuel coal for heat supply etc.. Over recent years, the annual coal consumption of chemical industry remained at 80Mt. It is predicted that the nitrogen fertilizer production with coal as raw material will increase slowly, taking into consideration the energy saving, coal demand will not increase. With the increase of use of boiler steam, the fuel coal demand will also not increase. The alternative liquid fuel such as coal liquefaction and coal derived methanol etc will become the growth point of coal demand for chemical production, however there are many uncertainties. Considering these uncertainties, the coal demand for chemical industry would reach 80Mt in 2005, 90Mt in 2010, and 100Mt in 2020 respectively.

Building material industry

Coal consumption by building material industry amounted to 160Mt in 2002, of which 110Mt for cement production, 37.80Mt for clay brick production (the coal has an average heating value of 5000kcal/kg), the total of above two items accounted for 92% of the total coal consumption by building material industry. During January to July 2003, cement production increased by 15.6% comparing with the same period last year, it is expected that coal consumption by building material industry in 2003 will increase by 6Mt comparing with last year, and reaching 166Mt. It is predicted that coal demand by building material industry would reach 170Mt in 2005, 150Mt in 2010, and 130Mt in 2020.

Other industries

Coal demand by other industries shows a downward trend. The coal

consumption by other industries amounted to 225Mt in 2002, it is predicted that coal demand by other industries would amount to 213Mt in 2005, 170Mt in 2010, and 158Mt in 2020.

Coal export

It is predicted that coal export would reach 85Mt in 2005, 90Mt in 2010, and 100Mt in 2020. The annual coal import will be controlled around 10Mt.

3. Analysis of coal supply capacity

Currently, the production capacity of coal mines in China is estimated at about 1500Mt, including State-owned mines 1000Mt (100Mt higher than the designed capacity), township mines about 500Mt. Considering the mine closing due to resource depletion and the operation of new mines, it is predicted that the coal supply capacity would reach 1530Mt/a in 2005, 1550Mt in 2010, and 1430Mt in 2020 respectively. Therefore, the shortage of coal supply would reach 120Mt in 2005, 250Mt in 2010, and 620-770 in 2020 respectively.

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 the production conditions are poor.

For the purpose of meeting the coal demand, new coal mines with a total capacity of 900Mt/a need to be constructed during 2003-2020, with annual construction scale of 50Mt. 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, the shortage of reserves with detailed exploration would reach 30 billion tons.

4. Recommendations

(1) Adjusting coal industry industry, “ constructing large coal producing base, establishing large enterprise group, promoting the joint operation of coal and electricity”

At the beginning of 21st century, China coal industry should develop with aim of “ constructing large coal producing base, establishing large enterprise group, and promoting joint operation of coal and electricity”, 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”. We should begin with the national energy supply security, coal and electricity should establish a long-term and stable joint venture relationship with win-win strategic partnership and with assets as the bridge. Several 100Mt level coal group should be established as soon as possible, and new mines should be dominated by large and middle modern ones, so as to promote the sustainable and healthy development of coal industry.

(2) Enhancing the combination and upgrading of the township mines, fully improving their whole quality, realizing the ultimate improvement of coal mine safety

Township mine is the group in coal industry, which is of the most laggard productive force and outstanding safety accident , the ultimate cause lies in the laggard productive force, we must 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.

(3) Enhancing the development and popularization of clean coal technology

The coal dominated energy production and consumption structure in China is determined by the resource conditions and economic development, it is improper and impossible to change it, thereby, the damage of environment is also severe. The State should begin with the strategy , take effective measures, enhance the development and popularization of clean coal technology.