

Coal in China: current status and outlook

Coal is making a much-noticed comeback to the forefront of the energy scene, primarily due to the preponderant role that it plays in supplying energy to the Chinese economy. With demand very high and increasing fast, several challenges have appeared. The first is industrial: domestic production will have to work very hard to keep up with demand. The second is economic: judging by consumption forecasts, the slightest misalignment of supply and demand will have repercussions on world prices. The last, but certainly not least, is the environmental challenge, which is major in that massive investments in modern technology are required to lower the environmental impact of coal.

China ranks Number Two worldwide in terms of primary energy consumption (1,698 Mtoe in 2006). Since the beginning of this century, the rate of increase in consumption has become significantly steeper, averaging 12.5% a year since 2002, compared to 3.5% between 1992 and 2002. Given the demographics, energy consumption per capita is still fairly low (1.1 toe per capita in 2003¹), but it is rapidly increasing.

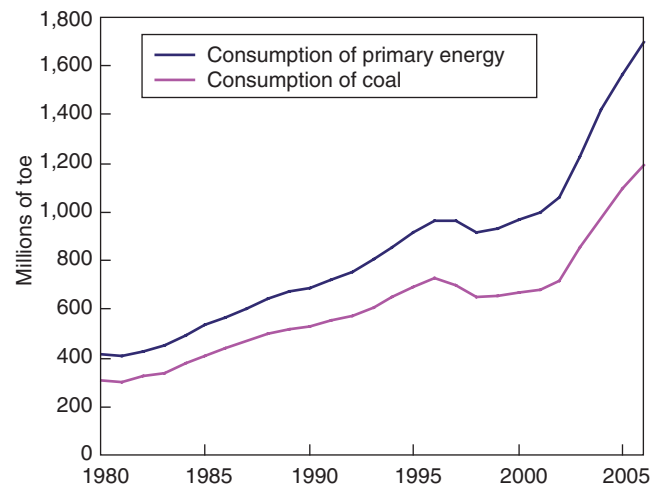
Coal consumption in China

The fuel of choice for the Chinese economy

With nearly 1,200 Mtoe in 2006, China consumes more coal than the United States, Europe and Japan combined. It accounts for more than 38% of the coal consumed worldwide and domestic consumption doubled between 2000 and 2006.

Coal is preponderant in the Chinese energy portfolio: in 2006, it represented 70% of primary energy consumption. Although its share tended to fall between 1994 and 2002 (decreasing from 76% to 67.4%), it has been steadily rising since 2003, which illustrates the key role that coal plays in meeting the energy needs generated by the tremendous economic boom of recent years (Figure 1).

Fig. 1 - Trends in the consumption of commercial primary energy and coal in China



Source: BP Statistical Review 2007

Several factors, such as the abundance of Chinese reserves, account for the dominance of coal. Some of these factors are economic in nature, including a low labor cost that helps make this energy competitive. The biggest factor is political: coal has enabled China to preserve a certain degree of energy independence².

(1) This statistic is comparable to the average noted in South American countries.

(2) To make the comparison with oil, it should be noted that China ceased to be self-sufficient in 1997 and imports now represent 47% of domestic oil consumption.

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Not surprisingly, all forecasts suggest that Chinese coal consumption will keep rising. According to the reference scenario published by the International Energy Agency (IEA)³, it will grow at an average rate of 5.5% a year until 2015, then more slowly (1.7% a year) from 2015 through 2030. This forecast of 2.4 billion toe for 2030 corresponds to an increase in annual consumption of 119% compared to 2005.

Sustained development of the electricity sector

The power sector absorbs about 55% of the coal consumed in China and about 78% of its power (2,544 TWh in 2005) is generated using coal.

Following the large-scale programs launched in the 1980s, the "electrification battle" has been won: 99% of the Chinese population now have access to electric power. The growth prospects for this industry are impressive, because consumption per capita is still fairly low (about one-fifth of the average for OECD countries). In its reference scenario, the IEA estimates that electricity production will grow by 7.8% a year between 2005 and 2015, then by 3.1% between 2015 and 2030. This trajectory corresponds to consumption of 8,472 TWh by 2030. As a result, decisions to invest heavily to boost production and reinforce power transmission networks must be made. In addition to a large-scale nuclear power program, China will need to expand its fossil power capacity to meet electricity demand.

In 2006, Chinese power plants totaled 622 GW of installed capacity; coal-fired plants accounted for 484 GW. In the IEA reference scenario, an extra 1,312 GW will be added by 2030, a number that exceeds current installed capacity in the United States. New coal-fired power stations will represent 70% of new capacity.

Given the bright prospects of the power sector, coal consumption is expected to achieve high growth. According to the IEA, the power sector could absorb 1,073 Mtoe by 2015 and 1,487 Mtoe by 2030, in which case electricity would account for 61% of Chinese coal consumption by 2030.

High industrial demand

In 2005, Chinese industry used the equivalent of 280 Mtoe of coal, and steel, construction and chemicals accounted for 75% of its consumption. Owing to the especially rapid development of the industrial component of the Chinese economy, consumption forecasts are up significantly: the IEA reference scenario estimates that annual consumption will reach 443 Mtoe by 2015 (i.e. average growth of 4.7% a year).

The issues involved

The trend is clear and indicates that coal consumption will continue to rise, but we might focus on a few of the factors likely to be involved.

The energy efficiency challenge

After improving steadily for a decade⁴, the energy intensity has clearly deteriorated since 2002⁵. Since coal is preponderant in China's energy portfolio, the size of the increase in coal consumption will obviously depend on how this ratio evolves. The government knows this and has undertaken strong commitments. It made improving energy efficiency a national priority in the eleventh five-year plan, whose objectives for 2020 (compared to 2000) are:

- Keep GDP growing fast (a fourfold increase compared to 2000, in constant money terms).
- Limit the growth of energy consumption (a twofold increase).

Recently, the authorities have taken several measures⁶, but whether or not these goals can be achieved is open to debate. The IEA stresses that, in order to reach these goals, it would be necessary to invest massively in modern technologies able to boost the energy efficiency.

On paper, some margin for maneuver does exist, especially in the electricity sector. Even without taking line losses into account, the example offered by the modernization of coal-fired capacity is interesting. The IEA estimates the energy efficiency of Chinese coal-fired plants to be 33.2%, versus 36.7% for plants operated in OECD countries and 45% for cutting-edge facilities. The technology choices made for future power plants will have a crucial impact. In this respect, Chinese public authorities have shown real determination: since 2004, more than half of all new power plant orders are for supercritical units with an efficiency of about 41%. Furthermore, four 1,000-MW thermal power plants using a Siemens ultra-supercritical technology are under construction.

To give another example, China can also achieve efficiency gains in energy-intensive industries. Comparisons at the international level indicate that the processes used to manufacture steel, cement and chemicals can be improved. The speed and efficiency with which best practices are propagated will have a non-negligible influence on consumption forecasts.

(4) In 2000, the Chinese economy consumed 243 toe per USD million of GDP, exactly two times less than it did in 1990 (in constant money terms).

(5) Since that date, domestic energy demand has tended to grow faster than energy savings. This has led to a steady deterioration of the energy efficiency (in 2006, it marked an upturn, increasing by 0.8%).

(6) The most recent, launched by the Ministry of Science and Technology in September 2007, aims to promote household energy savings.

[3] Source: IEA (2007), "World Energy Outlook".

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The deployment of Coal to Liquid technology

China is considering the production of synfuel from coal on a massive scale. It is true that the foreseeable expansion of the domestic automobile fleet (currently only 25 cars per 1,000 inhabitants) will keep domestic demand for motor fuel surging. With these prospects in mind, several companies including Shell and Sasol are thinking about projects in northern China. Sasol is involved in discussions concerning two projects (with the Chinese companies Shenhua and Ningxia Industry), one located in Yulin (Shaanxi Province in northwestern China) and the other in the autonomous region of Ningxia. Each of these facilities would be able to produce the equivalent of 80,000 bbl/d of synfuel by 2012-2013.

The Chinese government had initially planned capacity of more than 1 Mbbbl/d by 2020. At national level, that would mean additional consumption of about 220 Mt of coal per year, or nearly 9% of the consumption reported for 2004. But there is still a great deal of uncertainty associated with the environmental⁷ and financial risks. For one thing, each plant may cost more than USD 5 billion.

Environmental issues

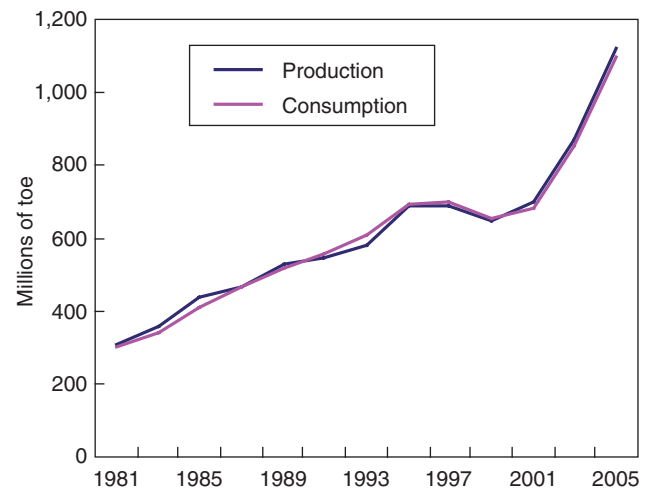
China ratified the Kyoto Protocol in 2002. But, since it is not listed in Annex 1, it is not subject to GHG emissions reduction commitments for the first Commitment Period (through 2012). Although its CO₂ emissions "only" grew by 33% between 1992 and 2002 (source: World Bank), the high growth of coal consumption gives observers cause for concern. The Netherlands Environmental Assessment Agency recently put China at the top of the list of countries generating the most CO₂ and coal is responsible for three-quarters of China's CO₂ emissions. Given this situation, it is clear that future political choices (e.g. regarding the possibility of China joining a post-Kyoto agreement) will not be neutral as far as the coal sector is concerned, unless the energy situation changes radically as a result of research on clean coal and CO₂ capture/storage technologies.

What will the consequences on the Chinese coal industry be?

In light of these considerations, questions about the future domestic coal supply of China are justified. China's proved reserves have been estimated to be 114 Gt. At the current rate of extraction, they are

⁽⁷⁾ In addition to air, soil and water pollution, these projects may cause water shortages. The problem is that the provinces most likely to be chosen for this type of installation (those with the largest coal reserves) are among the most arid in the country.

Fig. 2 - Trends in coal production and consumption in China



Source: BP Statistical Review 2007

thought to represent 48 years of production and, at first glance, appear adequate to cover future domestic demand. This impression is reinforced when one realizes how immense the country's coal resources are. The General Geological Bureau of China has estimated them to be 5,570 Gt. This number suggests that reserves likely to be recoverable under existing technological and economic conditions are higher than anticipated. Even leaving aside the problem of reserves, the domestic industry must still show that it is able to cover this rapid increase in demand in timely fashion.

Sharp uptrend in production

In 2006, China, the world's Number One coal producer, extracted 2.38 Gt of coal (1,212 Mtoe) or 39.4% of world production. Since 2002, the growth rate for Chinese coal production has shot up to average 13.8% a year—and this includes 2006, when output "only" increased by 8.4%! During the decade 1992-2002, it averaged 2.7% a year...

A heterogeneous industrial structure

The structure of the Chinese coal industry is heterogeneous, characterized by two types of companies:

- State-owned companies directly controlled by the central government. These very large firms (Shenhua, China Coal) operate very productive modern mines whose output, in some instances, exceeds 10 Mt/year. They benefited from policies implemented between 1950 and 1980, when the development of domestic coal production was one of the strategic priorities set by the young Communist

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nation. Under the master development scheme, the Chinese economy was methodically planned to promote development of heavy industry.

- Companies controlled by local governments, local public authorities or private-sector companies.

The second category contains many small business enterprises (more than 20,000) whose legal status is often unclear, to the point where some might be called illegal^[8]. These mining operations, which currently represent production of close to 1 Gt, emerged between 1980 and 1990, when the planned-economy approach to policy could no longer cover rapidly increasing consumption. The public authorities in Beijing tolerated the emergence of these new market players, provided that they were small operators. From a strictly economic perspective, this policy was a success, enabling a gradual phasing-out of rationing where it existed. In the late 1990s, however, the rapid proliferation of such small mines coincided with lower growth in domestic demand, which led mechanically to surplus capacity and fierce competition. The small mines were the hardest hit. Beijing opted for a policy in favor of closing these operations, which had a poor safety record. They were among the most hazardous in the world: in 2006, two out of three of the 4,746 fatal accidents reported at Chinese coal mines occurred at small mines. Since 2002, energy demand has soared and small operations, which play the role of adjustment variable on the Chinese coal market, are being redeveloped. Nonetheless, Beijing is implementing a strict policy of closure and/or consolidation that should result in the closure of 10,000 small mines by 2010^[9].

China, a net importer of coal

China has been a leading coal exporter despite the fact that the bulk of its production serves to cover domestic demand. With exports of 72 Mt in 2005 (about 9% of the coal traded worldwide), it ranked Number 6 in the

world. Now recent statistics show a steep uptrend in imports, up by nearly 50% in 2006. At the same time, exported volumes have declined steadily since 2003. During the first quarter of 2007, China imported more coal than it exported and imports were up by 44% for the first ten months of 2007 compared to 2006.

It is still too early to say that China no longer enjoys self-sufficiency. After all, imports only corresponded to 2% of Chinese demand. Yet the situation clearly reveals that certain factors are inhibiting a rapid expansion of supply. One is the current saturation of production and transport capacity. Time and investment are needed to create extra capacity and relieve this saturation, e.g. by building rail infrastructure from production areas in the northwest provinces to major consuming areas in the eastern and southern parts of the country. Purchasing from external suppliers is sometimes a more economical solution, especially in the dynamic southeastern provinces, where the risks of an energy supply shortage militate in favor of importing steam coal from Vietnam, Australia and Indonesia. Aware of the situation, the public authorities have recently amended the customs regulations concerning coal. Since 1st June 2007, import taxes have been eliminated while export taxes have been multiplied by a factor of three, to 15%. It is probable therefore that the Chinese economy will have a growing influence on the international coal market in the medium term. The first signs of this change were visible in 2007: a drop in Chinese exports, along with a sharp increase in exports and logistics problems in major exporting countries, led to an imbalance between the supply and demand of coal. Prices climbed to new records (USD 130/t CIF). According to a recent estimate by the China Coal Industry Association, net import demand will be situated between 150 and 210 Mt by 2010. This would be enough to completely destabilize the narrow international coal market.

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[8] Source: B. Wang (2007), "An imbalanced development of coal and electricity industries in China", *Energy Policy*, Volume 35 (10).

[9] Source: AIE (2007), "World Energy Outlook", p. 338.