

# China's Energy Resources: Now and the Future

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## Current State of Energy Resources in China

### *Energy Reserves in China*

The regular energy reserves in China account for 10.7 percent of the world's total amount, of which the hydropower resources ranks number one in the world, followed by coal number three, petroleum number 12, and natural gas number 22. Due to the large population, however, the exploitable energy reserves per capita in China is far below the world average. In 2000, the country's per capita oil reserves were 2.6 tons, per capita natural gas reserves were 1,074 cubic meters, and per capita coal reserves were 90 tons. These numbers are equivalent to 11.1 percent, 4.3 percent and 55.4 percent of the world averages, respectively. China has relatively rich deposits of coal, with the total reserves hitting 5.5697 trillion tons, confirmed reserves reaching 1.0421 trillion tons, and guaranteed reserves amounting to 1.0032 trillion tons. China's petroleum reserves total 102.1 billion tons, of which 22.56 billion tons are confirmed and between 14 and 16 billion tons are exploitable. China has 38 trillion cubic meters of natural gas reserves; the exploitable natural gas is between 7 and 10 trillion cubic meters and the confirmed exploitable natural gas amounts to 2.35 trillion cubic meters. China holds 676 million kilowatts of hydro energy in store, which could generate 5.92 trillion kilowatt-hours of electricity each year. The country's hydro resources boast the potential of an installed capacity of 378 million kilowatts and an annual generation of 1.92 trillion kilowatt-hours of hydropower. By the end of 2003, China had an installed hydropower capacity of 90 million kilowatt-hours. The total capacity at present has topped 100 million kilowatt-hours.

### *China's Energy Supply and Its Structure*

China's output of standard coal, in chronological order, was 637.35 million tons in 1980, 1.03922 billion tons in 1990, 1.06988 billion tons in 2000, and 1.603 billion tons in 2003. In terms of the supply of various energies, China produced 1.67 billion tons of raw coal in 2003, and the annual growth rate averaged 3.3 percent from 1990 to 2003 as well as from 1998 to 2003; the output of crude oil in 2003 was 1.696 billion tons, with the average yearly growth rate being 1.5 percent from 1990 to 2003, and 0.9 percent from 1998 to 2003; in 2003, China generated 1.9108 trillion kilowatt-hours of electric power, registering an average increase of 8.8 percent year on year from 1990 to 2003, and 9.1 percent from 1998 to 2003. Overall, in the year of 2003, raw coal took up 74.2 percent of China's energy production, crude oil 15.2 percent, natural gas 2.9 percent, and hydroelectricity 7.7 percent.

## *China's Energy Consumption and Its Structure*

China consumed 602.75 million tons of standard coal in 1980, 987.03 million tons in 1990, 1.30297 billion tons in 2000 and 1.678 billion tons in 2003. The proportions of various energy sources consumed in 2003 are: coal 67.1 percent, petroleum 22.7 percent, natural gas 2.8 percent, and hydro energy 7.4 percent.

### **Main Problems with China's Energy Exploitation and Utilization**

Some problems have manifested themselves in China's energy development: First, economic growth pattern is neither sophisticated nor cost-effective. In the past two decades, China has achieved substantially in energy conservation. According to estimates, in the 22 years between 1981 and 2002, China saved or could have consumed 1.26 billion more tons of standard coal. While the GDP registered an annual growth of 9.5 percent, energy consumption increased with an annual rate of 4.2 percent. That is to say, the doubled energy consumption has supported the quadrupled GDP. However, one fact that cannot be ignored is that the economic growth is obtained out of high input, high consumption, high exhaust, uncoordinated development, difficulty in recycling and low efficiency. Compared with the world's advanced economies, the energy consumption for one unit of product in China is apparently too high. For example, the consumption of coal for thermal power generation is 22.5 percent more than in developed countries, and energy consumption for steel making, cement production, ethylene production are 21 percent, 45 percent and 31 percent more, respectively, than in developed countries. In China, motor-driven vehicles consume 25 percent more of energy per one hundred kilometer than in Europe, 20 percent more than in Japan and 10 percent more than in the United States. Trucks use up one time more of gas per one hundred kilometer than in developed countries. And energy consumption for heating one unit of indoor area is two to three times more than in those developed countries in similar climate.

Secondly, China's energy structure is not satisfactory. At present, China relies mainly on the unsustainable energy sources such as coal and petroleum but much less on the renewable energies such as hydro, wind, solar and biomass energies. China's hydro resources rank number one in the world but lacks exploitation. So far only 15 percent of the hydro energy has been exploited, which accounts for less than 30 percent of the exploitable hydro energy. Meanwhile, an analysis shows that the wind can generate more than 1 billion kilowatts of electricity, of which over 500 million kilowatts can be generated by the wind at 50 meters above ground and an additional 500 million kilowatts comes from the wind offshore. The wind at 10 meters above ground can generate 253 million kilowatts of electric power, ranking number one in the world. There are wind resources in many areas of the country, including Xinjiang, Inner

Mongolia, Gansu, Tibet, Qinghai, Liaoning, Guangdong, Hainan, Fujian, Jiangsu and Zhejiang. At present there are over 40 wind power generation plants in China with an installed capacity of 567,000 kilowatts, accounting for only 0.14 percent of the total electric power generation. This is far behind the 6 million kilowatts of wind power in the U.S. and Spain, 2.11 million kilowatts in India and 14.6 million kilowatts in Germany. In terms of solar energy, the installed capacity of solar cells reached 50,000 kilowatts and solar water heaters had been used in buildings totaling 5.2 million square meters by the end of 2003. It is estimated that using solar water heaters for one square meter of area can save 120 kilograms of standard coal. Consumption of solar water heaters in China accounts for 40 percent of the total amount in the world, but it takes up only a small proportion of the total energy consumption in China. China also has rich biomass energy sources, such as residues from agriculture and forestry, wastes from grain processing and timber processing, and municipal and industrial wastes. Currently, there are about 600 million tons of grain stems produced in the country each year. These stems and other residues from agriculture and forestry can generate energy equivalent to that of 7.5 tons of standard coal. But they have barely been utilized and most has been squandered.

Thirdly, the energy management mechanism does not fit well with the market economy. On the domestic market, the production of major energy resources such as coal and petroleum and the generation of electric power are not in order. There are frenzied but disordered competition, such as in the coal production industry, where the competition among numerous scattered small mines has been detrimental to production safety and efficiency. Generally speaking, there is either a lack of competition – such as in the electric power generation and distribution industry, where low efficiency and repetitive construction are not rare, and the petroleum industry, where there are only a few oligopolies – or the production is still under strict planning of the government: for example, the government still intervenes in the pricing, export quantity and order method of coal products. From an international perspective, the Chinese energy enterprises have not yet adapted to international market. While China's crude oil price and refined oil price are gradually in tune with the international market, a price integration is yet to be realized.

Fourthly, many enterprises are engaged in the production and exploitation of energy resources in an unsophisticated way. This is manifested in three aspects. First, in the production of energy sources such as coal, too many small scattered coal mines compete despite a series of measures the government has adopted to restrain their development. Their existence results in a huge waste of coal deposits as only 40 percent has been truly collected. In China, the output of the top 10 coal mining enterprises only takes up 15 percent of the total coal output. This situation poses serious threat to production efficiency and safety. Second, the outdated management mechanism has directly affected production efficiency. The per capita coal output of the key mining enterprises is 3.4 tons per day, compared to 44 tons in the U.S., 11 tons in Germany, and 9 tons in Russia. Third, there is a shortage of talents and advanced technologies.

## Policy in Prospect

First, changing the economic growth pattern and improving the efficiency of energy exploitation and utilization. In recent years, the Chinese government has proposed to gradually change the mere pursuit of economic growth by focusing on economic growth rate and output quantity but ignoring output quality and production efficiency, thereby resulting in high consumption, high input, and low efficiency. For example, the government has requested to abolish conventional conception on development and put emphases on coordinated and sustainable development; meanwhile, the government is gradually enhancing the national economy evaluation system and plans not to use GDP estimate only to evaluate economic achievement but gradually replace GDP with green GDP estimate; moreover, the government is continually adjusting economic structure, encouraging the development of hi-tech industries and the abolishment of outdated equipment and technologies, and promoting technological progress, especially technologies for energy conservation and environment protection. In one word, the Chinese government is calling for adjustment of industrial structure, product structure, technology structure and enterprise structure so as to develop an energy-conservation economy through innovations in technology and management. At the same time, in order to change the economic growth pattern, the National Development and Reform Commission issued the *Interim Regulation on the Direction of Adjusting Industrial Structure and Content of Adjusting Industrial Structure*, which specify explicitly that the general direction and focus of adjusting industrial structure is “to support advanced products and equipment that help conserve energy, water and protect environment, and to forcefully abolish low-quality productions that incur high costs and generate severe pollution.” In short, the government requests to change economic growth pattern through a series of measures, thereby conserving energy and raising the efficiency of utilizing energy.

Secondly, the Chinese government attaches great importance to energy issues and is making progress in regulating the exploitation, utilization and conservation of energies. The National People’s Congress has unveiled several laws and regulations regarding energy resources, such as *The Electricity Law of the People’s Republic of China*, *The Coal Law of the People’s Republic of China*, *The Water Law of the People’s Republic of China*, and *The Interim Methods on Regulating the Refined oil Market*. Some local governments have also issued relevant rules accordingly, such as the *Methods on Regulating Geothermal Resources* by the Beijing municipal government. On February 28, 2005, the 14<sup>th</sup> session of the Standing Committee of the 10<sup>th</sup> National People’s Congress approved *The Renewable Energy Law of the People’s Republic of China*, which will take effect on June 1, 2006. The law lays a legal basis for encouraging the exploitation, utilization and protection of renewable resources, and for relevant technological and policy supports. It will play a positive role in improving China’s energy structure.

Thirdly, enhancing energy structure. First, the government will gradually change the structure of energy supply to one that focuses more on coal energy but also balances its development with that of petroleum and new energy resources, especially renewable resources. *The Renewable Energy Law of the People's Republic of China* encourages enterprises of all types to participate in the exploitation and utilization of renewable energies and provides priority tax treatment and financial support to renewable energy projects. Second, the government will gradually enhance the structure of demand for energy and has stipulated relevant policies encouraging rural areas and other areas where conditions allow to use new clean energy resources, such as biogas, solar water heaters and solar cells.

Fourthly, in the course of exploiting and using energy resources, the government will pay more attention to environment protection. The production and consumption of energy resources inevitably exert high pressure on the environment. For example, the burning of coal creates sulfur dioxide, which causes acid rain; the burning of fossil fuels emits carbon dioxide, which can bring changes to the global climate. The outdated technologies for energy production and utilization in China have generated pollution to a certain extent. In 2002, 19.27 million tons of sulfur dioxide was emitted nationwide, and acid rain was found at about one third of the land. In order to change this situation, the Chinese government is making an effort to tackle the environment problem arising from energy production and utilization and to develop clean energy resources and technologies for using them.

Fifthly, promoting recycling economy. The recycling economy will become a new model for China's economic development. Under this model, minimum amount of resources will be used for maximum economic growth. While existing resources are conserved, new resources will be regenerated.

Sixthly, actively seeking and corroborating international energy co-operation. China will use advanced technologies to develop new resources and conserve existing resources. In the meantime, the country will seek cooperation with other countries for mutual benefits.