

ISSUES ON CHINA'S ENERGY SECURITY

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ABSTRACT: For many years, China has made great strides in constructing a sizeable and stable energy supply system rooted mainly in domestic coal supply. That system, however, is subject to immense strain as a result of rapid economic growth, rising living standard, widespread environmental degradation, limited oil reserves and uneven resources distribution. Industrialization and urbanization since the early 1980s have imposed structural constraints on its traditional coal-based energy supply model. Eventually, China became a net oil-importer in 1993 when ten million tons of crude oil and petroleum products from abroad fed into the local economies of the coastal areas. Such a change meant that energy security has become an increasingly sensitive issue to the central government of China. This paper argues that China could benefit from a more open energy supply by striking to a balance of both domestic and international sources, rather than the traditional mode emphasized on a highly self-sufficiency rate.

KEY WORDS: national energy security; resources-internationalization; diversified energy supply; strategic oil stock-pile

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Energy supply is a determinant factor to the development and the prosperity of a modern society. China is one of the largest energy consumers and producers in the world, and energy supply and its security in the country are great issues concerned not only by the China itself but also by the whole world.

1 CONCEPT OF NATIONAL ENERGY SECURITY

The widely swing of fuel price and more reliance on fossil fuels have attracted more attention on energy insecurity recently, but most researches focused more on the energy supply (Compton's New Media, 1995; MAMDOUH, 2003). According to the common practice of the world's industrialization, the concept of national energy security seems to have two significant implications for China (Fig. 1). First, it suggests that a stability of energy supply for social production, people's daily life and military activity is a crucial factor that mainly emphasizes energy supplies in quantity. Second, it implies that a stability of energy supply for the whole society is a key element, which stresses on energy use in quality. In other

words, energy must be used in the way of environment-friendly. Unfortunately, an ever-growing energy consumption in the world during the past century caused a gigantic damage to man's living environment in general and to the atmosphere in particular, and among which, an increasing emission of CO₂ and SO₂ were the most common concerns of not only the public but also the governments.

National energy security had not become a significant phrase in the modern world before the 1980s. A very simple reason for that is the oil-crises occurred in the early 1970s in the Middle East when the oil price was doubled from US\$3.001 to US\$10.651 per barrel. As a result, major developed countries conducted International Energy Agency and a basic concept of energy supply policy aiming at stabilizing the oil prices was formally raised afterward (International Energy Agency, 2001).

Since the mid-1980s, a worsening situation of global warming has come into force when most developed countries began to review their original energy security policies (VOGELY, 1985). In the new round of strategic development of energy supply, the concept of usage safety addressed on environment protection was introduced

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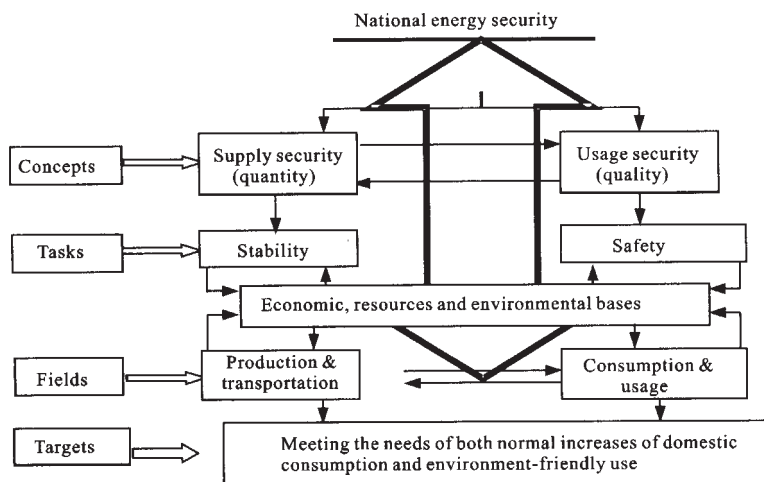


Fig. 1 Logical concept framework of the national energy security

widely to the national energy security (TILTON, 1990).

2 CHINA CONTEXTS: A BRIEF LOOK

2.1 Energy Consumption

Between 1952 and 2000 the primary energy consumption of China increased 27.8 times, while the GDP increased 34.4 times. Population, however, only doubled over this period. These indicate that energy consumption has close relationship with economic development and population growth.

Generally speaking, two stages are discernible in China's recent history of energy consumption. The first or initial stage prevailed before the late 1970s and was marked by consistent increase in the intensity of energy usage (Fig. 2). The driver for this state of affairs was the government's policy for developing heavy industries, which, in turn, imposed stringent demands on the suppliers of metallurgical as well as thermal coal. The second or stable stage followed in the wake of the adoption of Open Door policy in 1978, besides denoting China's turn

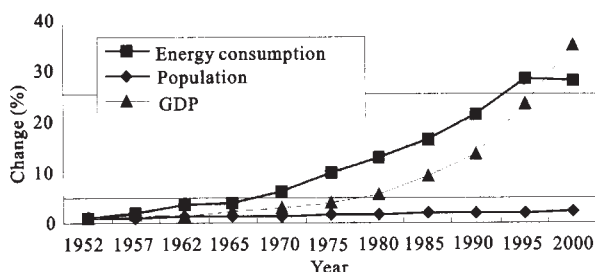


Fig. 2 Changing pattern of energy consumption, GDP and population increase in China

Sources: National Bureau of Statistics of China, 1991b, 1996b, 2001b

to export markets, embraces industrial diversification and absorption of foreign capital and technology (YAN, 1997). Since then the rate of growth in the intensity of energy usage reversed itself, exhibiting a slowing pattern.

In spite of the impressive increase in physical volume, the structural change of energy consumption in China is very stifling. A functional intensive analysis of energy consumption (FIAEC) shows that the index of FIAEC of the whole world between 1953 and 1995 reached 2.04, 6 times more than that of China (0.28). The higher index of FIAEC a country has, the slower increase of energy consumption in physical volume it would be (ZHANG, 2004).

This phenomenon can also be proved by the recent development of China itself. Between 1996 and 2000 the total energy consumption of China slipped from 1.389×10^9 t of SCE (Standard Coal Equivalent) to 1.220×10^9 t of SCE, or a reduction of 12.2% was achieved, while the index of FIAEC climbed up to 4.63. It can be argued that a reductive trend of energy consumption in volume could be continuing in the near future as the traditional coal-based structure of the country being diversified and advanced (Table 1).

2.2 Resources Base and Production

2.2.1 Resources base

The following four points can capture the characteristics of China's energy resources base. Firstly and most fundamentally, by now the three primary fossil fuels of coal, crude oil and natural gas, together with uranium, were all being tapped from domestic sources in China. Secondly, according to the Territory Resources Ministry of the central government, the density of energy reserves in China

Table 1 Primary energy consumption in the selected large developing countries, 1997

Country	Population ($\times 10^6$)	Energy consumption ($\times 10^8$ t of SCE)	Structure of energy consumption (%)			
			Coal	Oil	Gas	Electricity
China	1230.0	874.0	76.2	19.7	1.8	2.2
India	955.1	246.6	56.9	31.9	7.9	3.3
Indonesia	199.9	78.2	9.6	54.9	34.7	0.9
Brazil	159.6	112.9	9.5	65.7	4.2	20.6

Sources: ZHANG, 1995, 1997, 1998

exceeds 60% of the world average, a finding affirming the country's standing as an energy-rich place when its size is taken into account. Thirdly, the optimistic outlook attending the above point is diminished somewhat the proven reserve are related to population. The proven energy reserve per capita is about half of the world average. Fourthly, where the structure of proven energy reserves is concerned the devil in the details. Crude oil and natural gas together account for a meager 2.3% of the total proven energy reserves of China (ZHU, 1999).

2.2.2 Production

Grasping the basic facts of energy resources base promises to greatly assist understanding of the confronting China in terms of energy production. Generally, the energy production of China can be characterized as a great domination of coal, a highly dependency on domestic sources, production first and consumption second, and a chronic structural disadvantage.

China is the largest coal producer in the world. The absolute volume of coal produced in the country, while impressive (for instance, coal production reached to 1.397×10^8 t in 1996), hides the lack of energy supply mainly caused by uneven resource distribution, and this is particularly true in its east and south regions (WANG, 1997).

Furthermore, China appeared to be acceding to the global pattern, with coal giving ground to oil, after large oil reserves were proven and extracted in the northeast part of the country in the mid-1970s. A rapid growth of oil production makes coal's share fell from 88.0% of all primary energy production in China in 1965 to 69.4% in 1980, a very impressive decline. Unfortunately, however, the early-maturing oil industry had to give some ground back to coal. Production structure changed in tandem: coal's share of all primary energy produced in China turned up to 71.9% once more and more frequently stood at 74% before 1999 (Fig. 3).

2.3 Benefits and Effects

The benefits and effects of energy supply pattern mainly involve four fundamental areas, namely political, mili-

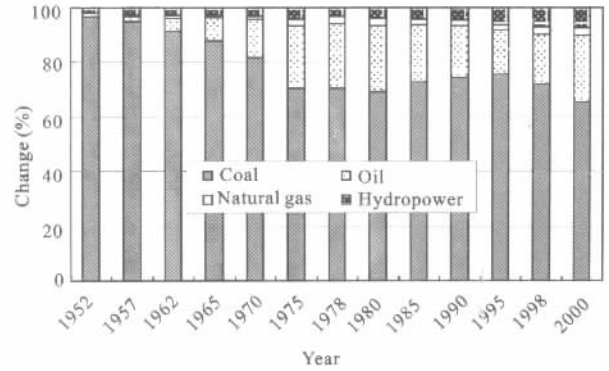


Fig. 3 Structural change of energy production in China, 1952–2000

Sources: National Bureau of Statistics of China, 1991b, 1996b, 2001b

tary, economic and environmental aspects. In political interests, low domestic energy prices and a highly self-sufficiency rate have played a key role that enable China to have a remarkable success in economic development. In the meantime, however, environment degradations have been widespread everywhere in the country. Certainly, the inverted pattern of energy intensity use, as mentioned above, indicates clearly a better result of the energy supply output in China. By a contrary, the overall situation of air pollution caused by energy consumption has been becoming worse and worse since the 1980s (Fig. 4).

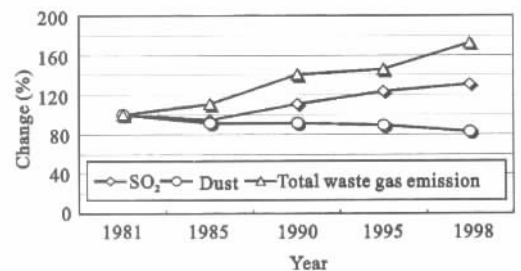


Fig. 4 Changing pattern of air pollution in China, 1981–1998

Sources: National Bureau of Statistics of China, 1991a, 1996a, 1999a

3 PROBLEMS FOR FUTURE DEVELOPMENT

3.1 Limited Resources

Apart from coal resources, limited resources of crude oil and natural gas in China could partially meet the needs of energy consumption requirement in 2010 (ZHANG, 1999). It is, therefore, that finding more proven reserves of oil and gas resources is the key element for China's energy supply.

Theoretically, there could have a large room for more reserves of crude oil and natural gas resources to be

proven because 60% of their mineral bases has not been identified. The sophisticated geological conditions, however, prevent any expected increase of proven reserves from being come true eventually. Actually, China had a deficit of proven oil reserve increase between the mid-1980s to the mid-1990s. Such an unfavorable mineral base is a threshold to China's future energy supply.

3.2 Balance Between Consumption and Supply

Remaining a balance between consumption and supply is the most crucial dilemma for China's energy security, and it is heightened in both quantity and quality.

According to the government presumption, GDP per capita of the country in 2020 would be redoubled against to that of 1995. It implies that the total physical volume

of primary energy consumption of the country in 2020, if accounted on the world's average of the energy consumption per capita nowadays, will go up to 3.200×10^9 t of SCE, or 1.4 times higher than that of 1995.

Along with a rapid development of industrialization and urbanization in the early of the 21st century, China will confront with a greater pressure to improve the poor quality of the traditional energy supply dominated by indigenous coal sources.

3.3 Production and Supply

First of all, energy production in China has long been puzzled by some unfavorable geological conditions, and this is particularly true to oil production. In fact, the oil production cost of China now is in the highest place of the world (Fig. 5).

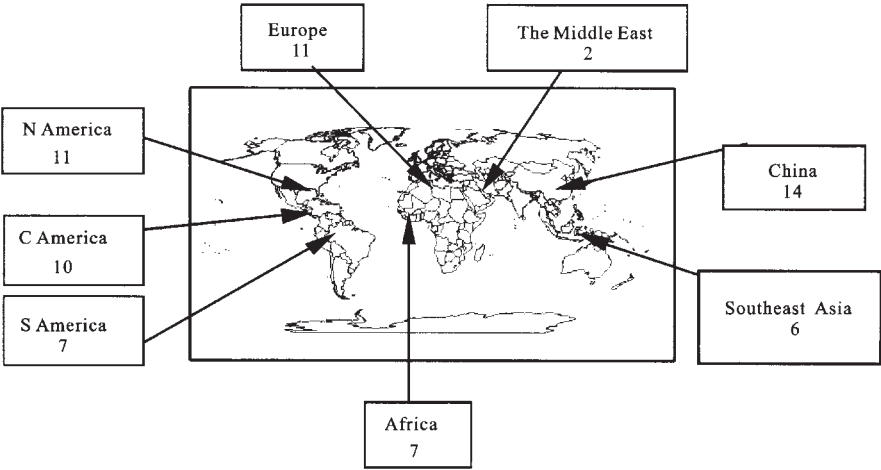


Fig. 5 General pattern of oil production costs of the whole world, 1998 (Unit: US\$/barrel)
Source: International Energy Agency, 2001

Second, the uneven distribution of energy resources causes massive energy transportation between consumption and production regions. Coal conveyed from the north to the south has underpinned China's coal production for a long time, and the net transported volume of coal in the south increased 16 to 46 times during the period between the mid-1950s and the mid-1990s (Table 2).

Last, but not the least, energy mining and relative activities swallow up many other natural resources, like water and land, and cause a great damage to local envi-

ronments, and this is particularly true in coal production. In terms of National Bureau of Statistics of China, 89% of the total waste gas emission in China come from coal burning, for example.

3.4 Oil Trade

Utile now, China's oil trade can be featured like a more imported and a less exported (Fig. 6). Between 1986 and 2000, imported crude oil of China increased from 2.2×10^6 t to 57×10^6 t, with a growth rate much faster than

Table 2 Net coal imported for five regions in different years ($\times 10^4$ t)

Region	1957	1967	1975	1985	1995
Shanghai-Jiangsu-Zhejiang	6.56	13.93	19.71	39.93	133.62
Beijing-Tianjin-Hebei	4.38	4.55	5.64	26.36	68.21
Liaoning-Jilin	1.04	10.20	6.09	32.22	48.10
Hubei-Hunan-Jiangxi	—	4.13	11.25	23.64	34.81
Guangdong-Hainan-Guangxi-Fujian	1.17	2.40	2.40	12.22	52.71
Total	13.15	35.21	45.09	134.37	337.45

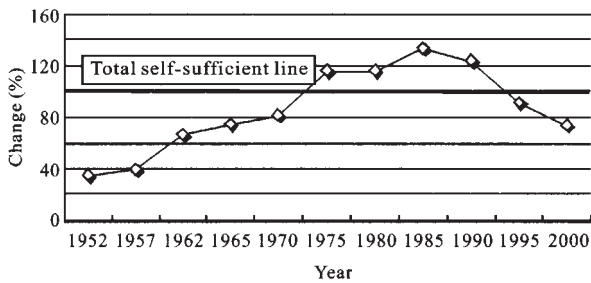


Fig. 6 Changing pattern of self-sufficient ratio of crude oil supply in China, 1952–2000

Source: National Bureau of Statistics of China, 2001

that of the country's foreign trade as a whole. As a result, the self-sufficient rate of oil supply (including oil products) dropped from 134% in 1985 to 91% in 1995, and to 73.5% in 2000. Undoubtedly, this trend will continue in the whole 21st century as the country's economy being expanded.

4 POLICY ADJUSTMENT

4.1 Concept Adjustment

For many years, China's energy security has used to adhere to a principal concept on the stability of energy supply in quantity. Such a concept underpinned the national energy production and supply system in the early stage of industrialization before the mid-1990s.

Considering the most fragile man-land relationship of the country, a rational concept of the national energy security should be adjusted, and the new mode could be conformed as an integration of energy supply and environmental improvement. In other words, the national energy security in the 21st century must concerns both of energy supply stability and environment safety.

4.2 Reconstruction of Energy Supply System

The most important task of energy supply system reconstruction could be its structural diversification. A basic object of the diversification would be as the followings: the shares of oil and gas as well as electricity (including nuclear power) together should reach as much as 55% of the country's total primary energy consumption in 2020 while the left 45% for coal.

In order to carry out such an ambitious task, energy supply globalization should be put forward as much as possible. It is, therefore, the total physical volume of imported oil and natural gas of the country would be soaring up to 200×10^6 – 250×10^6 t and 100×10^9 m³ in 2020, respectively. As a result, the oil self-sufficient rate of China would be shrunk about 45%. Two factors, however, could greatly curb the development of China's oil im-

port. First, upturned international oil prices will shave the mind of China's government to import more oil and its products from the international market. Second, a widespread point of deleted oil and gas reserves of the world will puzzle China to practice a plan of an oil-based industrialization, although the proven oil reserves of the world has had an increase since the 1950s and there have no any sense of the reserves being exhausted in the next 10 or 20 years.

4.3 Oil Import Policies

In the past ten years, the source of China's imported oil was diversified, and in which Africa replaced the South-east Asia as the second large importer. In future, Russia would be the next important region for China's imported oil due to a great potential of its oil reserves.

As the mode of imported oil, China should transform itself from current way of importing oil from the world's market directly to a new one as the country entering the world oil stock market.

4.4 Infrastructure Construction

There are three aspects should be emphasized. First of all, the clear-coal addressing program should be speed up, and the clear coal ratio of domestic use should be doubled in 2020. Secondly, the national hub port of oil-import in Ningbo, Zhejiang Province, should be set up in order to meet the ever growing needs of local oil consumption of the east areas and the low and the middle reaches of the Changjiang (Yangtze) River. Thirdly, a long-distance pipeline of oil imported from Russia in North China could be constructed.

4.5 Strategic Oil Stockpile

As one of the largest oil importers in the world, China should pay more attention to expand its capability of stabilizing oil supply. In terms of the world's practices, the best way for doing that is to set up a national strategic oil stockpile. It is, therefore, the central and local governments and enterprises should joint together to construct a nationwide oil stockpile system within the next 10–15 years.

5 CONCLUSIONS

The greatest challenge of China's national energy security in the 21st century would be, if continuing to follow the traditional mode resisted in indigenous coal and emphasized on a highly self-sufficient rate of supply, to transform it to a new one grounded on fully diversified sources of supply. Analyses show that the principal three-

should for practicing the object mainly comes from the psychological obstacles of the planners to open the country's oil market more widely to the whole world rather than both rocked oil prices and deleted oil reserves themselves.

Regard to the oil resource of the world, there seems no big problem for China to pursue its ambitious industrialization target rooted on the world oil resources, but the rocked oil prices of the world would undermine the diversification of China's energy supply through the international market. From the viewpoint of the national energy security practiced by other countries, China's government should be pay great attention to adjust its energy policies which involve in innovating supply concepts, consolidating relative infrastructure, reconstructing energy supply system, diversifying oil-import sources and constructing strategic oil stockpile.

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