

Energy consumption with sustainable development in developing country: a case in Jiangsu, China

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Abstract

Jiangsu is one of the provinces in China that have great population density and fast economic development. Therefore it is important to ensure large quantity of stable and high-quality energy supply for its development. With the development of the economy, the demand for energy is increasing very fast while the energy supply is going short. The supply of the local primary energy is only 23% of the demand. The final energy consumption reaches 78 Mtce (1 tce = 7,000,000 kcal), among which the industry and construction account for 78%. Though the total consumption is large, the energy consumption per capita is only 1.13 tce, the electricity consumption per capita 1017 kW, and the household electricity consumption per capita is 138 kW. Coal accounts for about 76% of the total energy consumed. This paper discusses utilization ratio of energy and the serious pollution caused by energy consumption.

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1. Introduction

Energy is the vital basis of the development of human society, which is associated with several aspects of the social production and daily life. With the increasing world population and the rising living standards, the demand for energy in the world is steadily increasing. As energy is the important resource and motive power, its cheap and stable supply is the safeguard of the economy and social development. Developing countries are facing the double pressures of economic growth and environmental protection as they enter the 21st century. The energy exploitation and utilization should be based on the sustainable development and better ecological environment in developing countries, so that we can attain the objective of coordinating the relationships among society, economy, energy and sustainable environment that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987; Demirbas, 2001; Dincer, 1998).

China has made great strides in the last two decades in bringing prosperity to a greater share of its people. The

country's Gross Domestic Product (GDP) averaged an annual growth rate of 9.6% between 1979 and 1999. Many older state-run industries are being replaced by a dynamic new economy. Unfortunately, this economy requires a huge engine to run it, and the prosperity has brought it with a huge cost in the form of air pollution. In 1999, two-thirds of the primary energy consumed in China was produced by the burning of coal. Even with improvements in end-use energy efficiency, energy demand continues to grow and so does the air pollution. In China, pollution is causing serious health problems, crop damage and acid rain, all of which are taking a social and economic toll.

Jiangsu lies in the east of China, bordering on the Yellow Sea, with An'hui to its west, Shantung to its north, Shanghai and Zhejiang to its Southeast. Jiangsu is located in the beautiful and richly endowed Yangtze River delta, which consists of Sunan plain, Jianghuai plain and Huanghuai plain. Its total land area is 102,600 km², accounting for 1.05% of the national area. The area of plain and water account for 69% and 17%, respectively. By the end of 1998, Jiangsu has had a population of 71,824,600, about 700 per km², taking the first place of the whole country. The GDP of Jiangsu province in 1998 was 7199.95 × 10⁸ yuan (RMB). Allocable income per capita was 6020 yuan and net income

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Table 1
Gross domestic product (GDP) and the energy consumption in Jiangsu in recent years

Year	GDP (10 ⁸ yuan)	Energy consumption (Mtce)
1985	651.82	40.2
1986	744.94	42.8
1987	922.33	47.8
1988	1208.85	55.0
1989	1321.85	55.9
1990	1416.50	55.0
1991	1601.38	57.8
1992	2136.02	62.9
1993	2998.16	63.8
1994	4057.39	73.6
1995	5155.25	80.5
1996	6004.21	78.7
1997	6680.34	79.1
1998	7199.95	81.1

Source: Jiangsu Statistical Bureau, Jiangsu Statistical Yearbook, (1999).

per capita in the rural area was 3377 yuan. In recent years, Jiangsu has got a great development in its manufacturing industries, national economy and every social service. And all of these should have energy supply as its guarantee, which has caused great pressure to the environment and ecological system. Table 1 gives the GDP and the energy consumption in Jiangsu in 1985–1998, and it indicates the elasticity ratio of energy consumption in this time is 0.273. At the same time, the self-supporting ratio of energy in Jiangsu is rather low, the occupation of energy resource per capita was 0.26 tce in 1998. The majority of the energy should be imported either from other provinces or foreign countries. Therefore it is a long-term policy to ensure the balance between supply and demand, reasonable utilization and sustainable development. This paper analyzes energy resource, production and consumption in Jiangsu province and appeals for the focus on the saving of energy and raw materials, promoting the utilization ratio of resource and protecting the environment. It also brings forward some advice about the coordinated development among economy, energy and environment.

2. Local energy resources

The output of local primary energies in 1998 was 19 Mtce, among which coal occupies a large proportion. The output of coal was 23.8 Mt (17 Mtce), crude oil 1.3 Mt (2 Mtce), natural gas 17 Mm³ (0.032 Mtce), hydro-electricity 57GWh (0.032 Mtce). Coal and crude oil accounted for 90% and 10%, respectively of the total energy output. The decrease of the coal output made the self-supporting ratio of primary energy decline from 25% in 1998 to 23% in 1999.

3. Importation from other provinces

Due to the low self-supporting ratio of energy resource, Jiangsu has to import energy from other districts in order to meet the demands from both production and people's life. For instance, in 1998, Jiangsu imported about 72 Mtce energy from Shanxi, Sanxi, Henan, Anhui, Shandong and other provinces. Deducting the 11 Mtce export, the net import was 61 Mtce, which accounted 75% of the total energy consumption.

4. Primary energy processing and transformation

In 1998, the energy input in energy processing and transformation enterprises was 57 Mtce, and the secondary production of energy was 35 Mtce. Table 2 shows the output and the efficiency of each energy processing and transformation.

5. The energy consumption

The total energy consumption in Jiangsu province in 1998 is 81 Mtce (Electrical energy includes energy required to produce electricity, 1 kWh = 0.404 kgce), and the final energy consumption this year is 78 Mtce, an increase of 1.63% compared with that of last year. It is far less than 11% of the GDP' growth rate in the corresponding period. In final energy consumption, the consumption in agriculture is 4.7 Mtce, in industry and construction 60.4 Mtce, in transportation 3.3 Mtce, in household and commerce 9.3 Mtce (Fig. 1). The consumption of low-quality solid fuel is 29.9 Mtce, accounting for 39% of the final consumption; while the total consumption of high-quality energies, such as liquid fuel, gas fuel, heat and electric power, is 48 Mtce, accounting for 61%, an 3% increase compared with last year.

More utilization of high-quality energy resources not only promotes the final utilization efficiency of energy, but also relatively cuts down the demand for energy, which indicates the improvement of the increasing modernization of a district and reflects the reasonable utilization of energy. Due to its great population, the consumption of energy in Jiangsu is large, but the energy consumption per capita is only 1.13 tce, the electricity consumption per capita 1,017 kWh, and the household electricity consumption per capita is 138 kWh, which equals to the global average consumption of energy per capita in the 1950s (Table 3).

5.1. Coal consumption

Coal plays a very important role in Jiangsu's industrial energy consumption; it is the main fuel to

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