



Predictive analysis on electric-power supply and demand in China

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Abstract

In order to analyze the electric-power demand and supply in China efficiently, this paper presents a Grey–Markov forecasting model to forecast the electric-power demand in China. This method takes into account the general trend series and random fluctuations about original time-series data. It has the merits of both simplicity of application and high forecasting precision. This paper was based on historical data of the electric-power requirement from 1985 to 2001 in China, and forecasted and analyzed the electric-power supply and demand in China by the Grey–Markov forecasting model. The forecasting precision of Grey-Markov forecasting model from 2002 to 2004 is 99.42%, 98.05% and 97.56% respectively, and in GM(1,1) Grey forecasting model, it is 98.53%, 94.02% and 88.48%, respectively. It shows that the Grey–Markov forecasting models has higher precision than GM(1,1) Grey forecasting model. The forecast values from 2002 to 2013 were as follows: 16106.7, 18541.3, 20575.7, 23940.5, 24498.0, 26785.1, 27977.2, 29032.2, 31247.5, 33428.8, 35865.4, and 38399.3 TW h. The results provide scientific basis for the planned development of the electric-power supply in China. © 2006 Elsevier Ltd. All rights reserved.

Keywords: GM(1,1); Markov chain; Grey–Markov; Forecast; Electric-power demand

1. Introduction

Along with economic growth of nearly 10% per year over the last two decades, electric-power use has been rapidly increasing in China. During the 1980s, because the developing speed of the economy was quicker than that of the electric-power industry, China had a

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scarcity of electric-power. To deal with the situation, China first innovated the investment system. In 1981, the Longkou power plant was constructed with joint venture by the central government and local units in Shandong province. In 1987, State Department advanced a “twenty-words policy” about power system innovation, which translated to English was “government and corporation should be separated, a province is an entity, unite the electric-power network, attempt the system united, raise funds to build power plants”. In 1984, a Japanese company constructed a new hydropower station in the Yunnan province, which was called as Lubuge hydropower station. Because it was the first power plant constructed by foreign capital, it was also called as “Lubuge shock wave” which influenced the investment system of electric-utility industry very much. From 1985, State Department set up Huaneng Power International Corporation and other power corporations to raise foreign capital.

With the new policies, Chinese electric-utility industry developed very quickly. After the total electric-power equipped capacity exceeded 1 TW in 1987, the total electric-power equipped capacity exceeded 2 TW in 1995 and exceeded 3 TW in 2000. In 2004, the additional electric-power equipped capacity was 0.51 TW, which was at the first place of the world. The total electric-power equipped capacity was 4.47 TW. Chinese electric-power demand and supply began to keep a balance from 1996 [1]. The electric generation production of 1985 was 4117.6 TW h, and that of 2004 was 20418.08 TW h. It means that there was 4.98 times increase from 1985. The electric generation production had grown at 8.82% per year between 1985 and 2004. The total electric-power equipped capacity and the generation production of China were at the second place of the world, from 1996 until now.

While great development was accessed in Chinese electric-utility industry, there were many problems which influenced the development of the society badly. Electric-power was a resource that could not be stored. The supply quantity had to equal the consumption. So neither the shortage of supply nor the short of consumption would influence the electric-utility industry seriously. Perhaps, the whole occupation would be deficient due to lack work, and maybe insufficient supply would affect the function of different fields in society. In late 1980s, consumption of electricity in our country kept increasing between 9% and 10%. It reached 16% and became the top in history in 1991, while in 1992 and 1993, it kept above 11%. This period was called as over-economic. The lack of electricity appeared in the whole society. The power cut appeared even in Beijing. The government started to adjust the quo-status in 1993, which made the economy in China come into “soft-land”. The consumption of the whole country was decreasing, and reached the bottom of 2.8%. It led to the free of electric equipments and the whole coal industry fell into deficit. The government made a stipulation on prohibiting building new electric factory during three years. However, the increase of consumption in 1999 recovered 6.2% and 9% in 2000. Since 2000, the lack of electricity pervaded from the delta in Changjiang River to Zhujiang River even the whole country. There were 12 provinces to cut power and limit the electric use. The lack of electric equipment was 20.35 GW. In 2003, the power of 22 provinces cut, the lack of electric equipment was 44.85 GW, which doubling compared to last year. The power of 24 provinces cut till 2004, and the largest lack of electricity reached 30 GW. It diffused in the whole country, including the undeveloped areas such as Guangxi, Yunnan, Guizhou, Shanxi, Neimenggu, Gansu, Qinghai, Ningxia et al. The summer of 2004, was considered to have experienced as the most serious lack of power since more than twenty years. The consumption of electricity was 19,458.4 TW h from January to November in this year. It increased 15.13% more than that in last year at the same time approaching to the top value.

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