



# China's large-scale power shortages of 2004 and 2011 after the electricity market reforms of 2002: Explanations and differences



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## HIGHLIGHTS

- Reasons of these two large-scale power shortages are analyzed.
- Characteristics of these two large-scale power shortages are summarized.
- Some effective measures to eliminate power shortage are suggested.

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## ABSTRACT

Since the electricity market reforms of 2002, two large-scale power shortages, one occurring in 2004 and one in 2011, exerted a tremendous impact on the economic development of China and also gave rise to a fierce discussion regarding electricity system reforms. In this paper, the background and the influence scale of the two power shortages are described. Second, reasons for these two large-scale power shortages are analyzed from the perspectives of power generation, power consumption and coordination of power sources and grid network construction investments. Characteristics of these two large-scale power shortages are then summarized by comparatively analyzing the performance and the formation of the reasons behind these two large-scale power shortages. Finally, some effective measures that take into account the current status of electricity market reforms in China are suggested. This paper concludes that to eliminate power shortages in China, both the supply and the demand should be considered, and these considerations should be accompanied by supervisory policies and incentive mechanisms.

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## 1. Introduction

It is acknowledged that the power industry, when viewed as a public utility, is the fundamental industry of national economies worldwide. In China, since the reform and opening policy of 1978, the percent of energy consumed by electricity with respect to the total primary energy consumption has increased from 21% to 44% (China Electricity Council (CEC), 2011a), and the percent of electricity consumption with respect to terminal energy consumption has similarly increased from 6% to 22% (CEC, 2011c). It is clear that the rapid development of the electricity industry provides strong support for the soaring development of China's national economy.

In 2002, market reforms for the electricity industry were adopted in China. These reforms were aimed at fully allocating resources and

thus establishing a new electricity system that conformed to the socialist economic system. During this process, the State Power Corporation was canceled and divided into five power generating companies and two grid companies. Meanwhile, competition was gradually introduced to the power generating companies (Chernia and Kentish, 2007). However, during the ten years following the electricity reforms, two large-scale electricity shortages occurred, one in 2004 and one in 2011, and as a result, the public has paid increasing attention to power shortages. It should be noted that there are differences between the two electricity shortages with respect to backgrounds, influence scales, causes and features. Accordingly, in this study, the backgrounds and features associated with the two electricity shortages (2004 and 2011) are thoroughly described. A multidimensional analysis on the causes of the two electricity shortages is then presented based on the statistical data. Finally, some effective strategies that are suitable for China are suggested, and the future of market reforms in the electricity sector is further discussed, that latter of which plays a significant role in eliminating power shortages in China.

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## 2. The two large-scale power shortages

Since the implementation of policy of the reforms and opening up in 1978, China has maintained sustainable economic growth. Accordingly, the total amount of power demand and supply has also been in a growth state. China's power demand and supply during 2000–2011 is shown in Fig. 1. From Fig. 1, we are able to determine why the two years—2004 and 2011—are viewed as the years of the two large-scale power shortages.

First, it is obvious that power shortages occur when the power demand exceeds the power supply for a given year. As is shown in Fig. 1, power demand exceeded power supply both in 2004 and 2011, while in other years the power demand and power supply was maintained at a constant level, with no significant differences between the two. Thus, 2004 and 2011 are considered to be the years when large-scale power shortages occurred.

Second, when power demand increases at an abnormally large growth rate and power supply cannot keep up with this growth rate, power shortages occur (Heffner et al., 2010; Karl and Chen, 2010). It is evident from Fig. 1 that growth rates for power demands in both 2004 and 2011 were much higher than the growth rates for power supply, indicating an imbalance between the growth rates for power demand and power supply, and hence, the power shortages of 2004 and 2011.

After explaining the reasons for the power shortages, we focus on the two years—2004 and 2011—and describe in detail what happened in those two years.

In 2004, power rationing and power cuts occurred in 24 provincial power networks in China (State Electricity Regulatory Commission People's Republic of China (SERC), 2005). Provinces such as Zhejiang, Jiangsu, Shanxi, South of Hebei and West of Inner Mongolia suffered severe continuous power cuts. With respect to regions, such as Beijing, Tianjin, Tangshan, Anhui, Shanghai, Henan, Hubei, Hunan, Gansu and Qinghai, power cuts occurred during peak usage times (Kyngé, 2004). Furthermore, power cuts also occurred during peak low-water periods in Jiangxi, Sichuan and Chongqing. Due to stringent coal supply policies, Shandong and Shanxi also faced power cuts during peak times. Even Ningxia was not immune to power cuts. Statistical data regarding electricity shortages in certain regions are summarized in Table 1.

In 2004, the power demand–supply gap in China ranged from 30,000 MW to 40,000 MW, and the maximum gap accounted for more than 10% of the maximum load, indicating that there was an evident imbalance between power supply and power demand in China (SERC, 2005). In addition, an increasing number of regions shifted from a seasonal electricity shortage to an annual power shortage. In this sense, the power shortage in 2004 was characterized by its national influence and long-term effects.

In 2011, the power shortage began to gradually emerge even before the peak season for power consumption arrived. Early in March, some regions were already facing power blackouts because

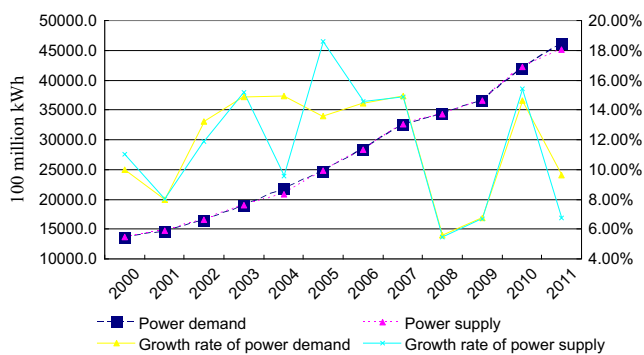


Fig. 1. China's power demand and supply from 2000 to 2011.

Table 1

Power demand–supply gaps of certain regions in 2004.  
Source: State Electricity Regulatory Commission People's Republic of China (SERC), 2005.

Provinces	Power demand–supply gap ( $\times 10$ MW)
Zhejiang	880(36.2%)
Jiangsu	870(25.7%)
Shanghai	400(23.4%)
Beijing, Tianjin, and Tangshan	273
Shanxi	260
Henan	259
Guizhou	250
South of Hebei	248
Sichuan	241
Fujian	240
Hubei	213
Guangdong	200
Chongqing	88
Anhui	80
Ningxia	70
Qinghai	31
Gansu	20

Table 2

Power demand–supply gap for certain regions in 2011.  
Source: China Electricity Council (CEC), 2011d.

Provinces	Power demand–supply gap ( $\times 10$ MW)	Percentage of the gap
Hunan	400	18.6
Jiangsu	800	14.0
Anhui	250	13.1
Jiangxi	130	12.2
Sichuan	400	11.7
Zhejiang	386	10.4
Chongqing	91	10.2
Yunnan	210	9.3
Guizhou	174	6.4
Guangdong	400	6.1
Hubei	200	4.6
Henan	110	2.3
Shanxi	70	2.2
Qinghai	14	1.1

of coal shortages and downtimes. Indeed, electricity shortage began in eastern provinces, such as Jiangsu and Zhejiang, and then spread to the central regions, such as Hunan and Shanxi (CEC, 2011b, 2011c). Needless to say, industrial enterprises and residents were affected. The statistical data for this electricity shortage in certain regions are summarized in Table 2.

In 2011, as the situation was regarded as a “regional, anti-seasonal shortage” power shortage rather than a countrywide electricity crisis, the power shortage was mitigated effectively using a series of economic policy measures.

## 3. Causes of electricity shortages in 2004 and 2011

As previously stated, a power shortage occurs when the demand for power exceeds the supply. Therefore, in this section, a thorough analysis on the profound reasons for the two power shortages is conducted on the basis of the generation and consumption of power. It is notable that statistics for the first four months of 2011 are adopted for this study.

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