

## **Present Situation of Power Supply and Demand in China**

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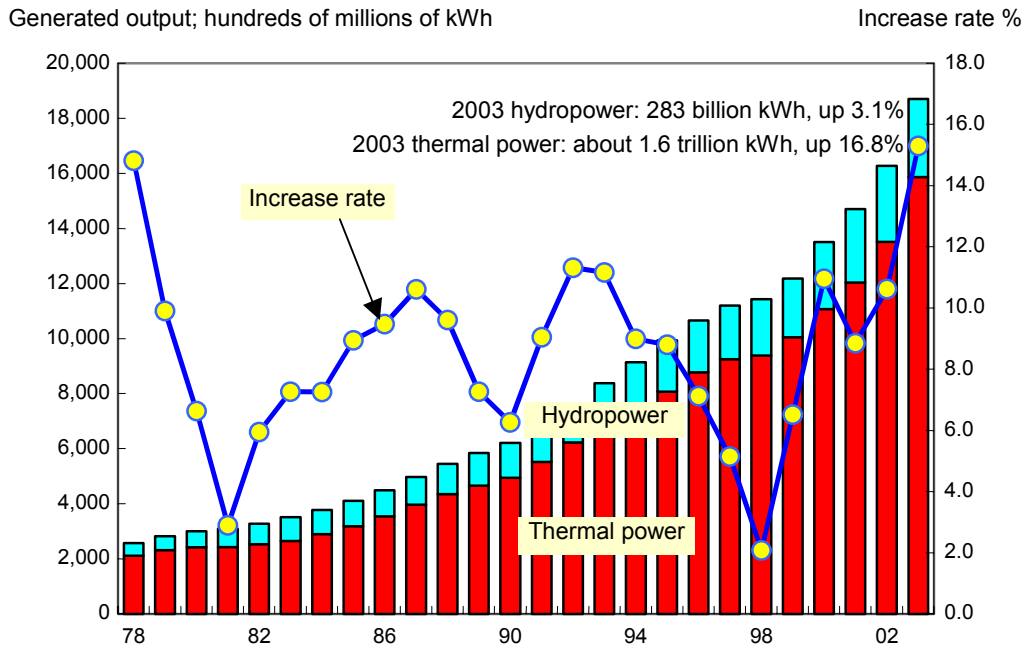
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### **Introduction**

In China, the total installed capacity of power generation facilities rose from 236.54 million kW in 1995 to 353.00 million kW in 2002, showing an increase at an average annual rate of 7.2% over the seven years. Moreover, the generated output in 2002 reached 1,638 billion kWh, the second-highest in the world. In 2003, however, power demand increased by 15.3%, and the country was faced with a serious power shortage. Of 34 provinces (and cities with the provincial status), 21 (including Beijing, Shanghai, Guangdong, and Jiangsu) experienced wide-area outages or limitations on the use of power. China had stated that the days of power shortage was over and that the supply was now balanced with the demand, but nevertheless fell back into a situation of supply shortage for some reasons. This paper begins with an analysis of the power supply and demand situation in China, and then discusses the related problems and prospective future trends. It concludes with a profile of currents in the power industry reform now under way.

### **1. Trend of power demand**

In the first half of the 1990s, demand for power in China increased at higher rates averaging around 10% than in previous years. In the second half, however, the increase began to slow, albeit while staying on a high level, along with the gradual decline in the rate of GDP growth. In 1998, following the outbreak of the Asian financial crisis, the demand increase was held to 115.91 million kWh, or 2.8% from 1997 (see Figure 1).



**Figure 1 Trend of power demand in China**

Source: Prepared by the Institute of Energy Economics Japan (IEE) based on data from editions of the "Zhongguo Tongji Nianjian" ("China Statistical Annual") and "Zhongguo Nengyuan Tongji Nianjian" ("China Energy Resource Statistical Annual") for the years in question (published by Zhongguo Tongji Chufan Co.), and the website of the China Electric Power Information Center.

Major factors behind the slowing of demand growth in the late 1990s were the business-cycle factor of a deceleration of industrial production due to increased inventories, and the influence of the Asian financial crisis. Beginning in 1998, the central and local governments took all sorts of policy measures to promote power consumption. For example, in the industrial sector, authorities reduced power prices to the electrolytic aluminum industry by 17% relative to the average price. In the residential and commercial sector, they took steps including promotion of the use of air conditioners, heaters, and showers; extension of power networks into rural districts; and expansion of the distribution network and capacity in urban districts. As a result of a business upturn and the aforementioned measures, the demand showed signs of recovery beginning in 1999. The final demand hit 1,497.9 billion kWh in 2002 (see Table 1). Of this total, the industrial sector accounted for 1,045.9 billion kWh and 64.6% of the final consumption. The corresponding figures for the residential and commercial sector were 198 billion kWh and 12.2%, and those for the commercial sector, 52 billion kWh and 3.2%. Power consumption increased at an average annual rate of 4.6% over the years 1996 - 1999 and 9.4%, more than double, over the next three years 1999 - 2002.

**Table 1 Trend of final power consumption in China (hundreds of millions of kWh)**

Year	Total	Agriculture, forestry, ranching, and fishery	Industry	Construction	Transportation and communication	Commercial	Other	Residential and commercial sector	Rate of increase relative to the previous year
1980	2,763	270	2,229	47	27	17	69	105	
1981	2,841	282	2,273	47	29	19	74	118	2.8
1982	3,018	286	2,429	50	30	20	82	121	6.2
1983	3,244	286	2,619	53	36	24	90	137	7.5
1984	3,484	288	2,808	58	41	29	101	159	7.4
1985	3,813	317	2,979	71	63	38	122	223	9.5
1986	4,175	322	3,317	54	67	41	127	248	9.5
1987	4,624	360	3,645	58	77	49	149	287	10.8
1988	5,087	379	3,985	63	90	63	165	343	10.0
1989	5,452	411	4,233	65	99	69	181	395	7.2
1990	5,796	427	4,439	65	106	76	202	481	6.3
1991	6,317	480	4,773	74	117	90	239	544	9.0
1992	7,043	522	5,284	83	136	111	267	640	11.5
1993	7,807	481	5,842	129	146	136	336	737	10.8
1994	8,664	531	6,387	150	164	179	387	867	11.0
1995	9,379	582	6,915	160	182	200	334	1,006	8.2
1996	9,995	618	7,275	182	198	223	365	1,133	6.6
1997	10,522	640	7,597	187	222	265	357	1,253	5.3
1998	10,808	624	7,615	189	256	293	507	1,325	2.7
1999	11,443	660	7,971	142	255	343	591	1,481	5.9
2000	12,535	673	8,717	155	281	394	643	1,672	9.5
2001	13,563	762	9,380	145	293	456	688	1,839	8.2
2002	14,979	780	10,459	160	330	520	750	1,980	10.4

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A look at the trend of demand increase over the last three years by sector reveals average annual increase rates of 5.7% in the agricultural sector, 9.5% in the industrial sector, 14.9% in the commercial sector, and 10.2% in the residential sector. The rate of increase in the power demand in the commercial and residential sectors was higher than that of final power consumption. This indicates that electrification was progressing in these sectors as an effect of the rise in the standard of living and policy measures for expansion of power consumption. One of the factors behind the big increase in consumption in the industrial sector was the aforementioned encouragement of electrolytic aluminum production and promotion of power consumption by the Chinese government. The increase was also reportedly due to the substantial expansion in production of articles that consume a lot of power over the same three years.

## 2. Trend of power supply

The installed generation capacity increased at an average annual rate of 8.4% over the years 1990 - 2002 and reached 335 million kW at the end of 2002. By type of source, thermal power accounted for 74.8% of this capacity, and was followed by hydropower at 24.0% and nuclear power at only 1.0%. The corresponding shares of generated output were 81.8% for thermal power, 16.5% for hydropower, and 1.5% for nuclear power. It can be seen that coal has an extremely high share of the total fuel mix for thermal power. The ratio of coal input to oil input for power generation was 75:25 in 1980, but had become 95:5 by 2001 as the weight carried by coal steadily increased over the period. As a result, coal makes up almost all fuel for power generation. As shown in Figure 2 and Figure 3, increase in the installed capacity has gradually slowed down since 1998. Whereas the power demand increased at an average annual rate of 9.1% over the years 1999 - 2002, the installed capacity increased at only 5.1%. National side indicates that almost no new projects for construction of thermal power plants have been approved by the Development and Reform Commission in the same period, and this suggests that there will not be much addition of such sources over the next three or four years. As for hydropower, the project for "xidian dongsong" (transmission of power generated in the western part of the country to the eastern part) is one of the three major ones on the national level. It encompasses thermal power as well as hydropower plants in the western part of the country, but the core consists of hydropower, the centerpiece being the Three Gorges Dam built on the Changjiang (Yangtse) River. Because power demand is extremely limited in the western part of the country, power generated there consequently must be transmitted to the eastern coastal region, which has a large demand and limited power resources. For this reason, the construction of transmission networks ranks alongside power source development as an element playing a key role in this project. The project envisions development on an enormous scale, and will entail a huge expenditure of both money and time. Now under construction, the Three Gorges Dam and other power plants are slated to commence operation steadily, but it will presumably be difficult to expand the generated output substantially within a short time.

As noted in the Introduction above, the 2003 power demand was up 15.4% from 2002, and 21 of the 34 prefectures nationwide were visited by large-scale outages that underscored the seriousness of the supply shortage. In the Shanghai delta and other areas that are economic centers, outages reportedly had a particularly adverse influence on the economy. In its tenth five-year plan, the central government originally envisioned new power source projects that would make a combined addition in the range of 60 - 80 million kW of capacity nationwide. In August, however, the plan was readjusted and the upper limit was raised 30 million kW, from 80 to 110 million kW. In 2005, the total installed capacity is supposed to reach 430

million kW. If the request of the State Council is followed, 25 million kW of capacity will be added in each of the last three years of the tenth five-year plan.

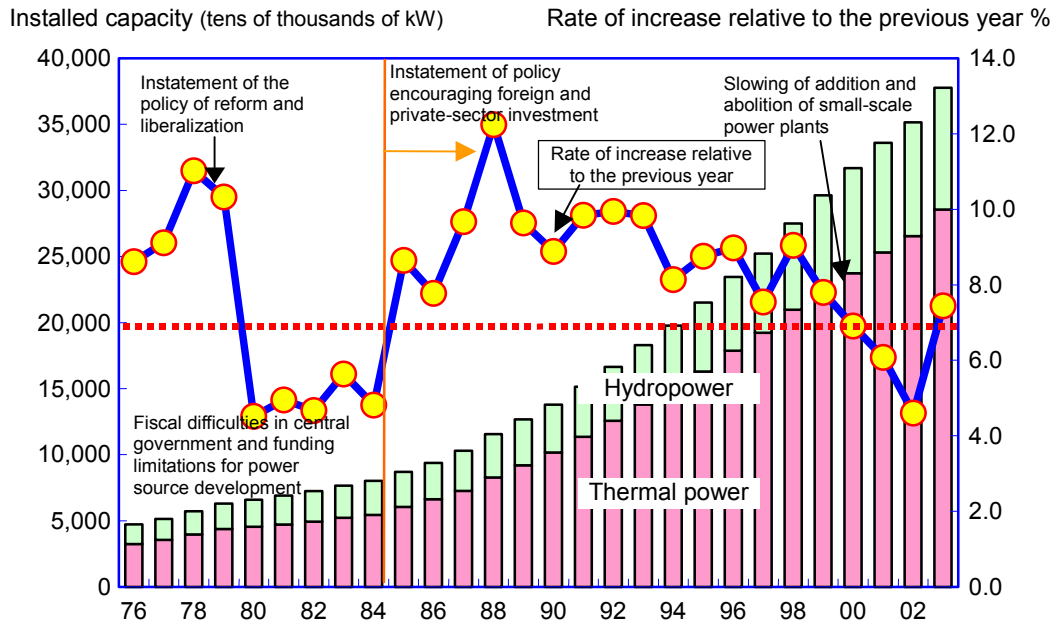
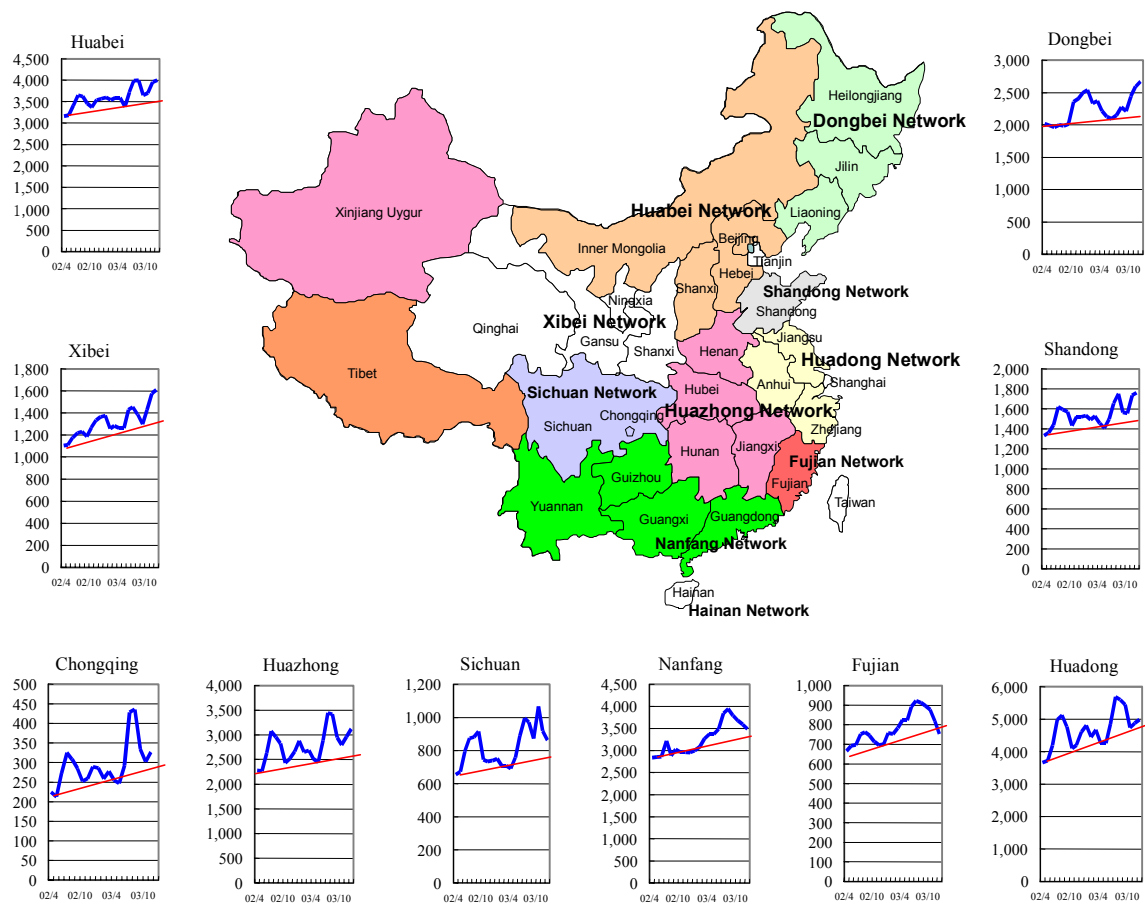


Figure 2 Trend of installed capacity



**Figure 3** Trend of peak power by regional power network (tens of thousands of kW)

Source: prepared by the IEE from the website of the China Electric Power Information Center

### **3. Power supply and demand - problems and future trend**

China proclaimed the end of the days of power shortage and the balancing of the demand with the supply, but has since somehow again fallen into a state of supply shortage. The reasons for this shortage are as follows.

- (1) The central government was too optimistic in its analysis of the power demand. The tenth five-year plan (2001 - 2005) predicted that the demand would increase at an average annual rate of no more than 6%. In reality, however, it increased at a pace far in excess of this forecast, recording rates of 10.4% in 2002 and 15.4% in 2003.
- (2) The power supply was affected by the expansion of production by industries that are big energy consumers and by measures to encourage consumption in the Residential and commercial sector. A particularly great influence was presumably exerted by the expanded production of electrolytic aluminum and increased consumption in the Residential and commercial sector.
- (3) Relations between the power industry and coal industry worsened. In spite of the power shortage, power plants in areas such as the eastern Shanxi, which is in a coal-producing region, had low utilization rates. The main cause was the difficulties encountered in negotiation of coal purchasing contracts between coal producers and power companies due to pricing problems.
- (4) Power network construction is lagging on both the national and interregional levels. In China, there is an imbalance between energy resources and demand for power and other energy. As a means of resolving this imbalance, efforts are being made to build up power networks in each region and interconnect them at the same time.
- (5) The demand is increasing faster than the supply, and there are not good prospects for resolution of this situation over the short term. Occurrence of large-scale outages and limitations on power use are likely to continue for the next three or four years.

### **4. Power rate schemes and power industry reform**

Power rates (tariffs) in each region are directly determined and managed by the local governments (except that their rate determinations must be approved by the central government). Nevertheless, some disruption is occurring in connection with the mechanism of power price formation and its levels, as follows.

- (1) The central and local governments sometimes place a cost surcharge on the nationally stipulated sales price.
- (2) There is a diversity of rate schemes; single-rate schemes are applied in some cases and

complex schemes with plural rates and time-of-use (peak/off-peak) rates in others. Furthermore, different power prices may be set for different industries, sectors, or types of power consumption.

- (3) In 2002, retail power prices averaged about 0.35 renminbi (RMB) per kWh nationwide, but there was much variation by region.

Under these circumstances, one of the key points in power sector reform is the question of whether or not power price adjustment is reasonable. China has already made preparations for executing a line of gradual liberalization and improvement of the power market. The objective lies in breaking power monopolies and creating conditions of ongoing competition along with reform of the power system and opening up of the power market. Measures will be aimed at improving efficiency and lowering costs at power companies, in order to get power prices moving in the direction of greater stability and in a downward trend. The centerpieces of the plan are a proposed unbundling, i.e., separation of plants and networks, and introduction of the competitive mechanism into price formation. In this case, power producers would offer their supply of power in the power network market, and the network companies would purchase power for the purpose of stable supply and assurance of the supply-demand balance. In April 2002, the State Council ratified the proposal for power industry reform centered around the unbundling of the generation and network divisions. As a part of this reform, in December 2002, it announced the institution of a new organization to replace the existing Guojia Dianli Gongsi (GDG, the state power corporation). As a result of the reform program executed in 2001, the regional division is to be as follows.

- \* Huabei (Northern) region including Shandong Province (served by Huabei Network)
- \* Dongbei (Northeastern) region including eastern Inner Mongolia (served by Dongbei Network)
- \* Huadong (Eastern) region including Fujian Province (served by Huadong Network)
- \* Huazhong (Central) region including Chongqing City and Sichuan Province (served by Huazhong Network)
- \* Xibei (Northwestern) region (served by Xibei Network)
- \* Tibet Network region
- \* Nanfang (Southern) region consisting of the provinces of Guangdong, Guangxi, Hainan, Yunnan, and Guizhou (served by Nanfang Network)

In the generation division, the generation assets that had been owned by the GDG were reorganized into a total of five independent power producers (IPPs) nationwide. One of these IPP functions is to be undertaken by the Huaneng Dianli Jituan Gongsi, a member of the GDG Group. The transmission division was divided into northern and southern halves, and



reorganized into two huge network companies.

With the exception of those in Yunan, Guizhou, and Guangxi, all the network assets which had been under the jurisdiction of the GDG are to be managed by the newly established Guojia Dianliwang Gongsi (the state power network corporation). Five regional network companies (Huabei, Dongbei, Xibei, Huadong, and Huazhong) are to be established under this new company, which will also manage the Tibet network by proxy.

The network assets in Guangdong and Hainan, which had been outside the jurisdiction of the GDG, are to be managed together with those in Yunnan, Guizhou, and Guangxi by the newly established Nanfang Network Company.

In addition, for management and supervision of the power sector, a new commission (the State Electric Power Management and Supervision Commission) was instituted directly under the State Council. The Commission has four major duties: 1) enactment of rules for and supervision of operation of the market; 2) coordination with price-supervising divisions in regard to power rates; 3) supervision and inspection of production quality standards, and issuance and management of business licenses; and 4) disposal of disputes in the market and supervision of policy measure execution.

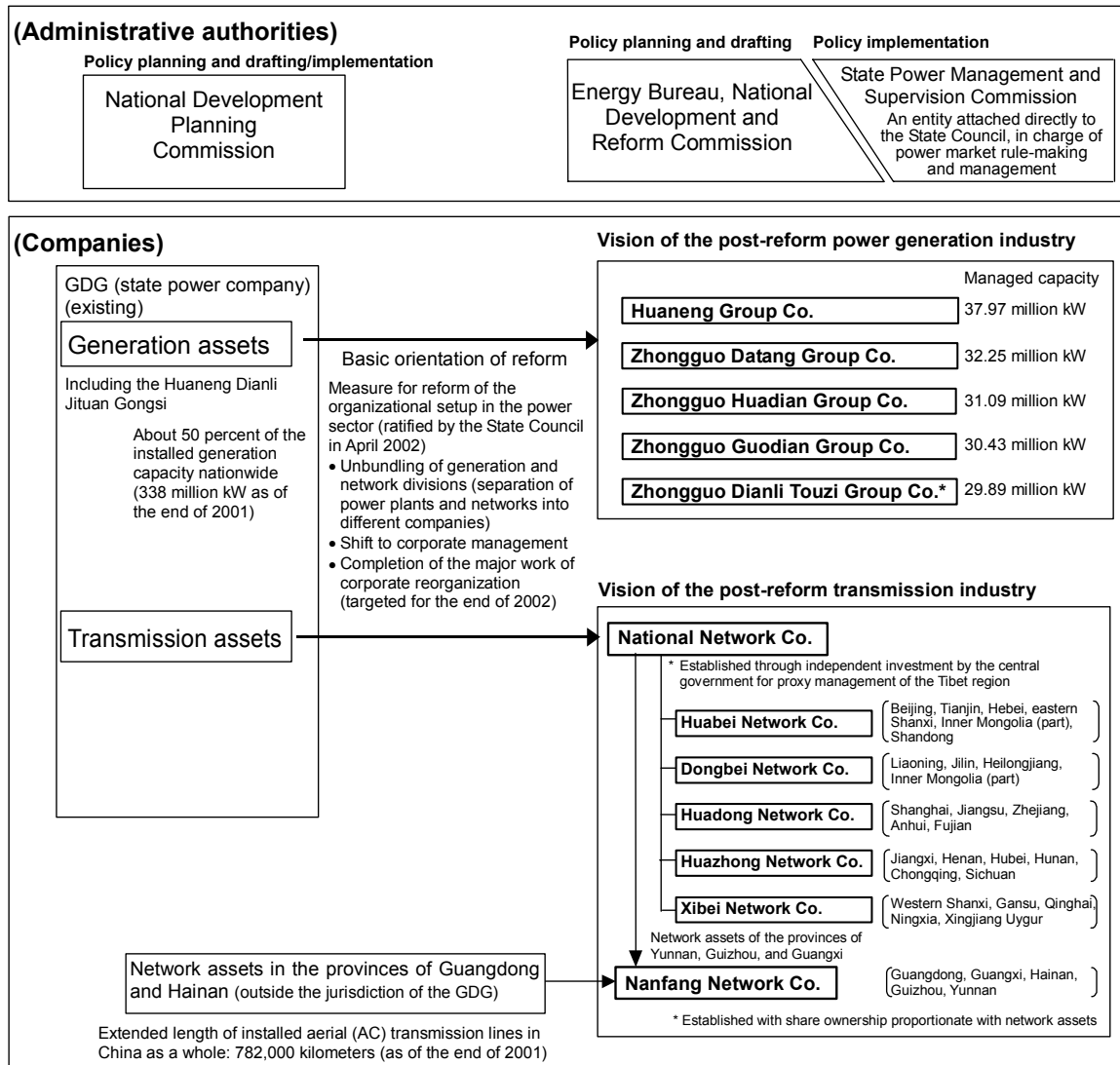


Figure 4 Outline of organizational reform in China's power sector

Source: JETRO data

### Conclusion

It would be difficult to resolve the problems of widespread outages and limits on use of power in China over the short term. Attainment of a stable supply of power within the next five years may be regarded as a vital task for the country's economic advancement. Generally, power sector reform is undertaken once the supply capacity outstrips the demand. Viewed from this perspective, the reform in China appears to be coming too early. Lastly, it may be noted that the major factors behind the occurrence of wide-area outages and use limitations are misjudgments on the part of policy makers, underdeveloped techniques of demand analysis and forecasting, and the problem of insufficient preparation of the statistical system.

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