ELECTRIC POWER INDUSTRY IN CHINA

2002

State Power Information Center

Contents

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Cover Story

Zhejiang Beilun Power Plant (5 × 600 MW)

Highlights of Electric Power Industry in China

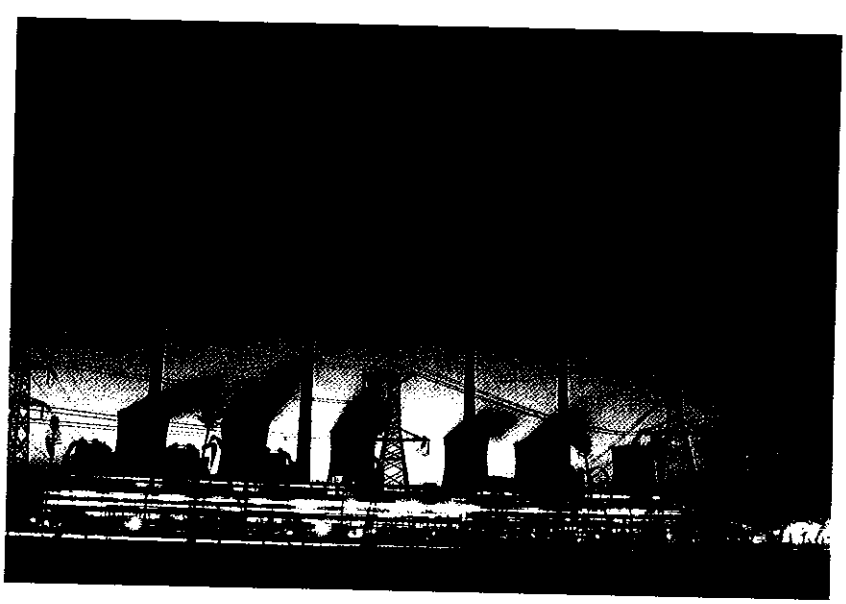
The year 2001 was the first year to implement the Tenth Five-year National Economic and Social Development Plan of China. In 2001, along with the steady growth of national economy, China's power industry witnessed tremendous achievements. Various tasks and objectives set at the beginning of the year were overall completed. The State Power Corporation (SP) continuously maintained the good situation of reform, development, laying a sound foundation for materializing the Power Development Plan and realizing SP's strategic targets, promoting the sustainable, fast and healthy development of national economy in the Tenth Five-year period.

■ Nationwide Power Production and Investment Achieved Gratifying Success

In 2001, the nationwide electricity generation completed 1483.856 TWh, an increase of 8.43%; electricity sales completed 1160.811 TWh, an increase of 9.79% over the previous year. Of which, electricity generation of SP completed 712.408 TWh, an increase of 8.39%, electricity sales completed 963.384 TWh, an increase of 9.21% over the previous year.

In the wake of quickening pace of trans-regional interconnection project, the investment in major network project rose; while power source construction scale continued to shrink, leading to power investment structure further improved. The investment in the nationwide power fixed assets completed 194.5 billion yuan (RMB). Of which, the investment in fixed assets of SP's power projects completed 170.8 billion yuan, the investment in the urban and rural power grid construction and upgrading projects completed 87.5 billion yuan. The nationwide newly-commissioned installed generating capacity reached 15,868.7 MW, of which, the newly-added installed capacity of SP's projects amounted to 10,006.6 MW. By the end of 2001, the nationwide installed generating capacity reached 338,611.9 MW, of which, SP's wholly owned and stock holding installed capacity reached 159,139.8 MW.

In 2001, the newly constructed and commissioned 110 kV and above lines amounted to 14,302 km and substation capacity 53,193 MVA, of which, SP built 13,017 km and 46,491 MVA respectively. The urban and rural power grid lines and substation capacity built and commissioned by SP amounted to 317,982 km and 662,240 MVA respectively.



Night view of Xuzhou Power Plant (1300 MW), Jiangsu

■ Power Construction Progressed Smoothly

To firmly grasp the national policy of economic development, power construction was unceasingly speeded up. The newly added "sending 10,000 MW power to Guangdong Network" projects progressed smoothly. Among the transmission and substation projects under construction of Three Gorges projects, four transmission lines and one substation had been built up. The first-phase preparations of Northwest 750 kV power network project achieved active progress. The nationwide interconnection project was continuously carried forward, the interconnection projects between the northeast and the North China, and between the East China and Fujian power networks had been built up and commissioned. To make full use of the existing generating capability and through reorganizing trans-regional power transmission, the power supplies of Beijing, Guangdong, Shanghai, Zhejiang provinces and municipalities where electricity usages grew rapidly were ensured.

The adjustment pace of power structure was quickened. The power sector persisted in the principle of giving priority to the development of hydropower and coal-power bases in the west China, and strictly controlled the newly planned thermal power projects in the east China, through sending power from west to east and nationwide interconnection, solved the power and energy balance of the east regions of China. In 2001, in the newly started power source projects, the total capacity of projects in the west China amounted to 12,510 MW, accounting for 72%, of which, the capacity of hydropower projects being 7260 MW, representing 42%.

■ Construction and Upgrading of Urban and Rural Power Grids Achieved Remarkable Success

As of the end of 2001, the upgrading projects of nationwide urban power grids entered completion and acceptance check period, 107.0 billion yuan of project investment were accumulatively completed, accounting for 88.1% of the total; among the 241 urban power grid upgrading projects, 137 projects were completed; 2200 substations on 35～220 kV were built up or upgraded, with 71,000 MVA of substation capacity and 16,500 km of high voltage lines newly added.

Tieling Power Plant (4 × 300 MW), Liaoning

As of the end of January 2002, the first phase rural power grid construction and upgrading projects of SP sector had accumulatively completed 149.209 billion yuan, representing 97.04% of the first phase total investment plan. Shandong, Jiangsu, Zhejiang, Tianjin, Shanxi, Liaoning, Jilin, Shanghai, Fujian, Hunan, Chongqing, Sichuan, Shaanxi, Qinghai, Ningxia etc. power corporations completed the first phase rural power grid construction and upgrading tasks ahead of schedule, and immediately

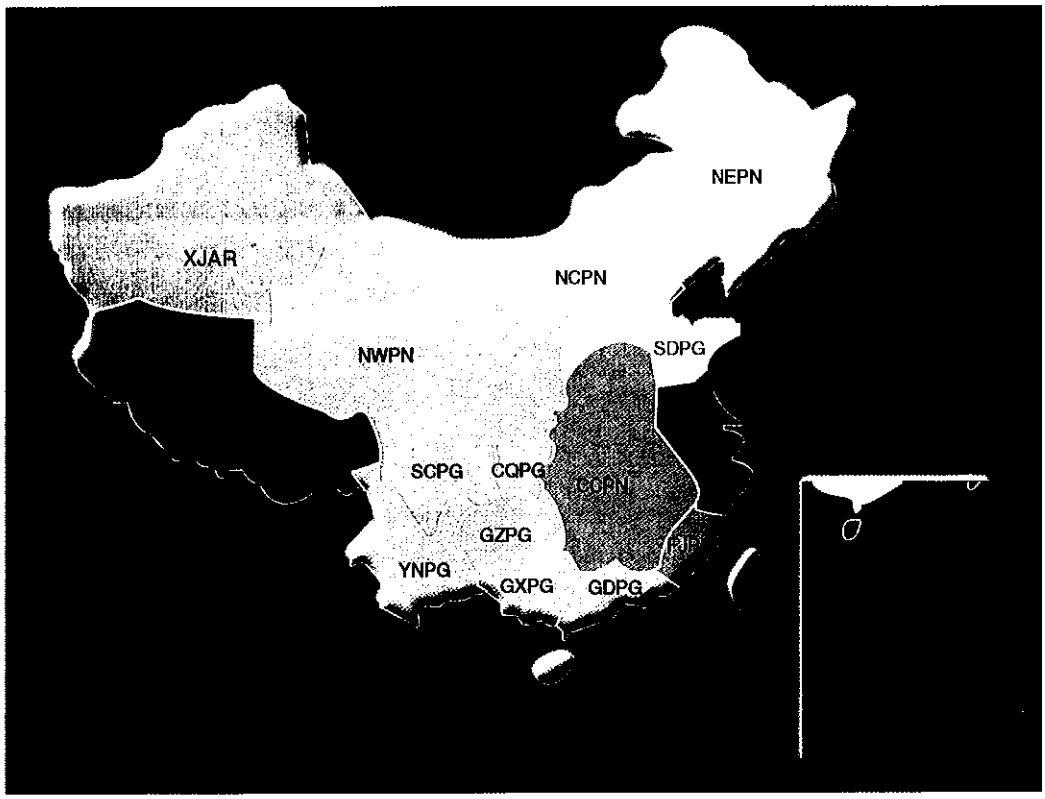
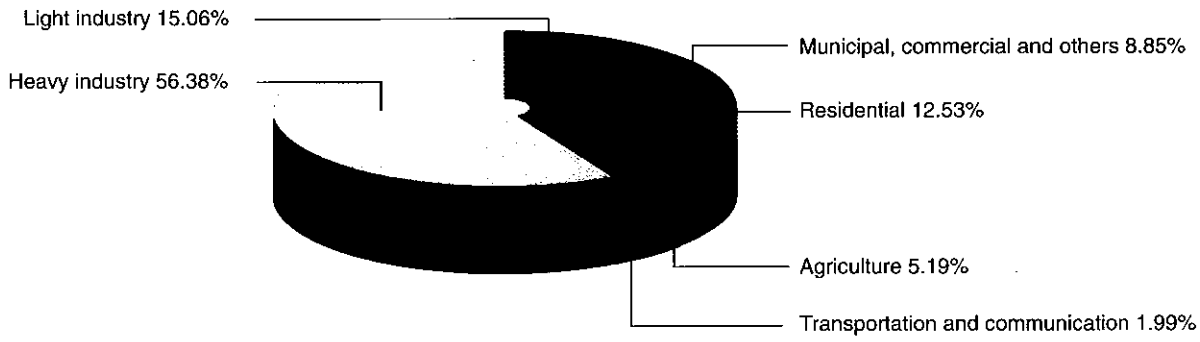
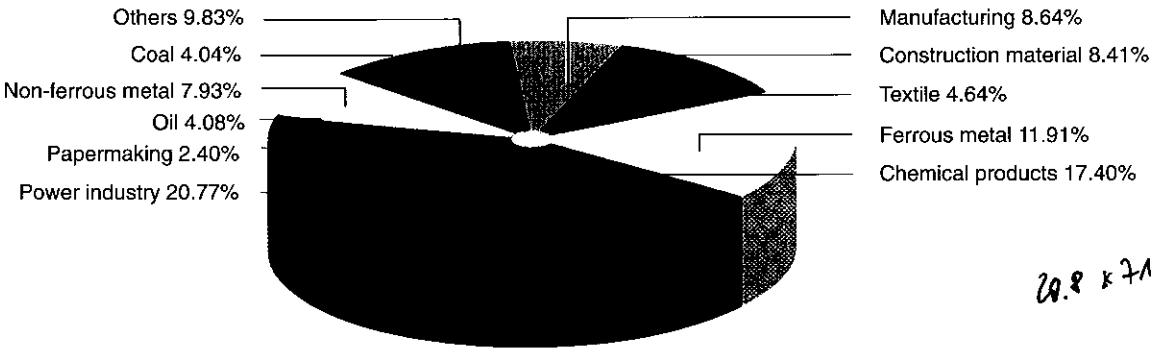


Figure 1 Distribution of power network service areas



a. Share of various sectors in total consumption



b. Share of various industrial sectors in total industry consumption
(power industry consumption includes house use of power and line losses)

Figure 2 Electricity consumption structure in 2001

Table 1 Generation, installed capacity and their composition (1980～2001)

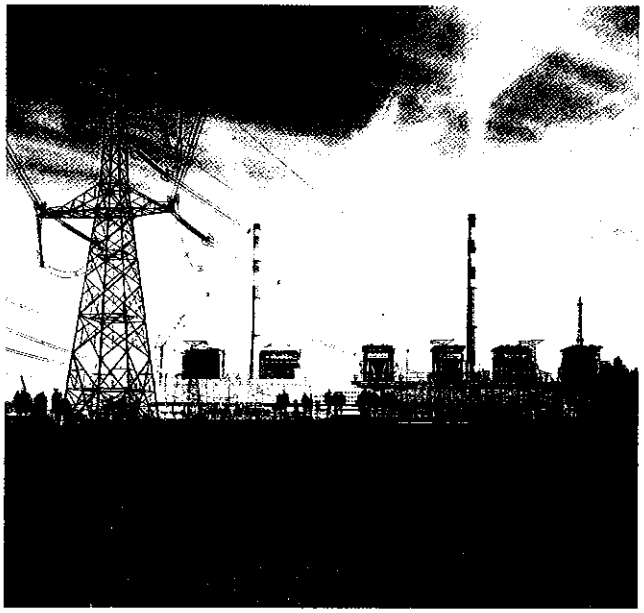
1980	65,869	20,320	45,550		300.6	58.2	242.4	
1990	137,890	36,045	101,845		621.3	126.4	495.0	
1992	166,532	40,680	125,852		754.2	131.5	622.7	
1994	199,897	49,061	148,736	2100	927.9	166.8	747.0	14.1
1996	236,542	55,578	178,864	2100	1079.4	186.9	878.1	14.3
1998	277,289	65,065	210,124	2100	1157.7	204.3	938.8	14.1
2000	319,321	79,352	237,540	2100	1368.5	243.1	1107.9	16.7

Table 2 Installed capacity and electricity generation by network in 2001

North China Power Network (NCPN)	45,835.1	6.85	224.11	1.27
Northeast Power Network (NEPN)	**39,157.1**	**14.54**	**159.75**	**6.26**
East China Power Network (ECPN)	59,322.2	10.75	282.38	4.09
Central China Power Network (CCPN)	**49,367.4**	**33.02**	**196.49**	**27.21**
Northwest Power Network (NWPN)	23,032.4	34.13	100.63	23.92
Shandong Provincial Power Grid (SDPG)	**20,119.2**	**0.28**	**106.47**	**0.03**
Fujian Provincial Power Grid (FJPG)	12,523.2	48.60	44.27	52.13
Guangdong Provincial Power Grid (GDPG)	**33,047.8**	**21.90**	**143.33**	**13.31**
Guangxi Provincial Power Grid (GXPG)	7,341.8	57.80	29.72	59.25
Chongqing Power Grid (CQPG)	**3,017.5**	**15.04**	**13.28**	**7.73**
Sichuan Provincial Power Grid (SCPG)	16,678.7	61.97	58.49	64.62
Yunnan Provincial Power Grid (YNPG)	**7,049.9**	**59.79**	**32.68**	**57.18**
Guizhou Provincial Power Grid (GZPG)	5,588.7	28.53	33.02	20.86
Hainan Provincial Power Grid (HNPG)	**1,917.6**	**28.07**	**4.67**	**35.54**
Urumqi Power Grid	2,891.4	4.64	14.65	2.89
Lhasa Power Grid	**206.0**	**70.96**	**0.56**	**82.14**

started the second phase rural power grid construction and upgrading projects.

Through three odd years of upgrading, the long-lasting simple and backward situation of rural power infrastructure in China has been fundamentally altered and now the rural electrification in China has entered a new developmental period. The better power supply quality and lower electricity price level in rural area have effectively improved the living standard and alleviated burdens from farmers. The low voltage line loss rate in rural area has been decreased to 12% after upgrading from 20~30% before upgrading, and through rectifying rural electricity price and canceling various arbitrary charges, the end-user electricity price has been decreased by about 0.1 yuan/kWh on the average throughout the nation's countryside.



Zouxian Thermal Power Plant (2400 MW), Shandong

■ Power Restructuring Made Steady Advance

The power restructuring of "separating governmental functions from enterprises" achieved important progress. By the end of 2001, the preparatory work of canceling the regional power administrations had been basically completed. Among the 27 provincial power bureaus under SP, 25 were cancelled. Power industry (trade, professional) associations were established in 21 provinces. In 4 provinces (municipalities), the experimental works of separating power plants from networks and

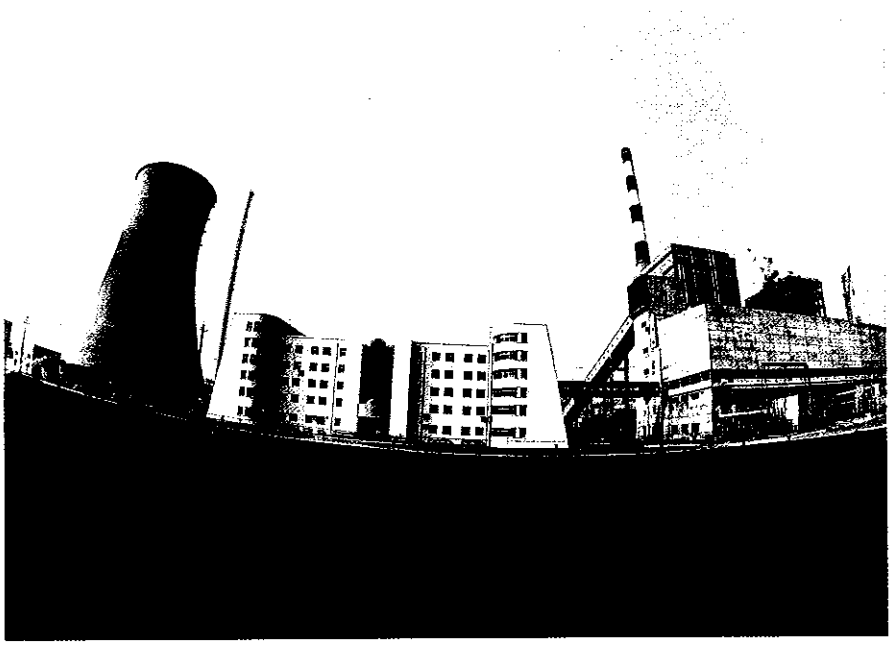
Table 3 Electricity consumption structures in recent years

Year	The whole society total (TWh)	Share of industry (%)			Share of agriculture (%)	Share of transportation and communication (%)	Share of municipal, commercial, and others (%)	Share of urban & rural residential household (%)
		Whole	Heavy	Light				
1989	576.20	79.8	64.0	15.8	6.95	1.7	5.1	6.4
1990	612.60	78.7	62.6	16.1	6.78	1.7	5.3	7.5
1991	669.68	77.8	61.8	16.0	6.93	1.7	5.6	7.9
1992	745.54	77.1	61.2	15.9	6.78	1.8	5.8	8.5
1993	820.11	76.7	61.2	15.5	6.30	1.8	6.3	8.9
1994	904.65	75.4	60.3	15.1	6.27	1.9	6.8	9.7
1995	988.64	74.8	59.8	15.0	6.22	1.8	6.9	10.2
1996	1057.03	74.1	59.3	14.8	6.11	1.9	7.2	10.7
1997	1103.91	73.0	58.3	14.6	6.19	1.9	7.6	11.3
1998	1134.73	71.8	57.6	14.2	5.88	1.9	10.0	12.2
1999	1209.23	71.82	57.46	14.36	5.75	1.96	10.06	12.16
2000	1346.62	71.69	56.75	14.94	5.26	1.94	8.68	12.42
2001	1468.25	71.44	56.38	15.06	5.19	1.99	8.85	12.53

Table 4 Trend of energy intensity with growth of electricity share

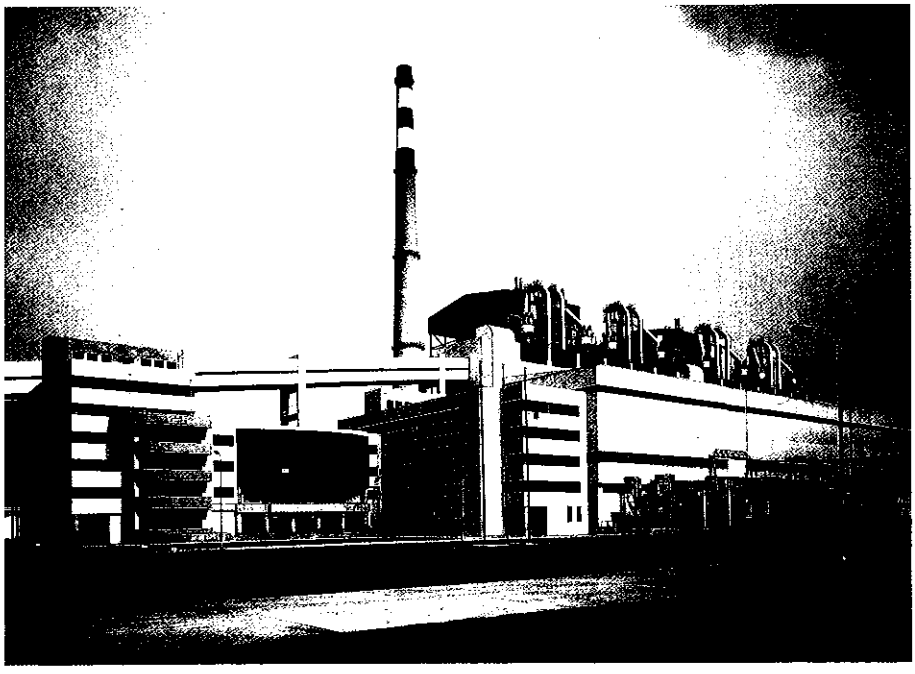
Year	GDP (1) (billion yuan RMB) (indexed at 1980)	Primary energy (2) (Mtce)	Share of electricity consumption (%)	Energy intensity (2)/(1) (kgce/yuan)	Growth index		
					GDP	Primary energy	Electricity
1980	451.78	602.75	20.60	1.33	100	100	100
1985	751.31	766.82	21.32	1.02	166	127	137
1990	1096.92	987.03	24.68	0.90	243	163	207
1991	1198.12	1037.83	25.46	0.87	265	172	225
1992	1368.44	1091.70	26.67	0.80	303	181	251
1993	1553.22	1159.93	28.74	0.75	344	192	278
1994	1749.74	1227.37	28.84	0.70	387	204	309
1995	1927.75	1290.00	29.58	0.67	427	214	335
1996	2114.74	1395.36	30.76	0.66	468	231	357
1997	2305.43	1381.73	32.76	0.60	510	229	377
1998	2484.79	1360.00	34.69	0.55	550	226	385
1999	2660.98	1220.00	40.07	0.46	589	202	410
2000	2877.84	1280.00	41.72	0.44	637	212	455
2001	3087.29	1320.00	42.90	0.43	683	219	494

bidding for accessing networks were continuously deepened. The rural power restructuring was further pushed on, the restructuring of township power administrative units were overall completed. The stock system transformation in 262 counties and subcompany restructuring experiments in 37 counties were completed. The works of "rural power grid upgrading, rural power restructuring and to implement same electricity prices for residents in cities and rural area" made substantial progress. Jiangsu, Shanghai and Shandong etc. provinces and municipalities had realized same electricity prices for residents' consumptions, there had been 365 counties throughout the country that had realized same electricity prices for residents' livelihood consumptions.



No.3 & 4 units in Pingliang Power Generation CO. Ltd are under construction, Gansu

In March 2002, the State Council printed and distributed the Power Restructuring Scheme. In accordance with this scheme, power restructuring in China will take an important step forward. The power system of organization in China will implement "separating power



Qingdao Thermal Power Plant (2 × 300 MW)— one of the six pilot units for "separating power plants from networks and bidding for access to networks"

plants from power networks in organizational administrations", reorganize power generation and power network enterprises; carry out bidding prices for access to network, set up power market operation rules and governmental supervision and administration system, establish initially competitive and open regional power market, carry out new power pricing mechanism; formulate environmental evaluation standard in terms of money for the discharges of power generation, form new mechanism for inspiring the development of clean power sources; launch experimental work on directly supplying power to large consumers from power generation enterprises, alter the situation of "sole network enterprises engage in buying power without competition"; continue to push on the reform of rural power administration system.

"Separation of power plants from network" mainly refers to that the assets administered by SP will be divided and recombined separately on the basis of two categories of power generation and network business. After the separation of power plants from networks, the power plant assets owned originally by SP, except those owned by the Huaneng Group Corporation which will be directly reorganized to an independent power enterprise, will be recombined to three or four national independent power generation enterprises on the roughly equal scale, which will be authorized by the State Council to operate separately.

In power network aspect, the State Power Network Corporation and the South China Power Network Corporation will be established. The former, as the investors' representative of power network assets administered by the original SP, will be set up as a wholly state-owned system, to be solely listed in the state plan. The newly set-up State Power Network Corporation will be responsible for organizing, establishing and running North China (including Shandong), Northeast (including east Inner Mongolia), Northwest, East China (including Fujian) and Central China (including Chongqing, Sichuan), five regional power network limited (-liability) companies. The management of Tibetan power enterprises as a limited liability company, will be entrusted to the State Power Network Corporation. The South China Power Network Corporation will be composed of the network assets of Guangdong, Hainan and those of Yunnan, Guizhou and Guangxi power corporations under SP.

To straighten out the pricing mechanism is the core content of power restructuring. The new power pricing system will include sales price to networks, transmission and distribution price and retail price to end consumers. In generation link, the competitive mechanism will be introduced first.

The State Power Corporation of China

General Description

The State Power Corporation of China (SP), founded in 1997, is absolutely the largest power corporation in China with registered capital of 160 billion yuan and staff members of 1.38 million. SP's business covers all the fields as project construction and management, trade, financing, international cooperation etc. in the fields of power generation, transmission and distribution, with power network construction and operation as the core.

Table 1 shows the installed capacity and electricity generation of SP in recent years. It can be seen from the table that, up to the end of 2001, SP had a total installed capacity of 159,139.8 MW and electricity generation of 712.408 TWh in 2001, increasing by 6.53% and 8.39% respectively compared with the previous year. Meanwhile, SP's total assets amounted to 1346.3 billion yuan, 7.75% over the previous year.

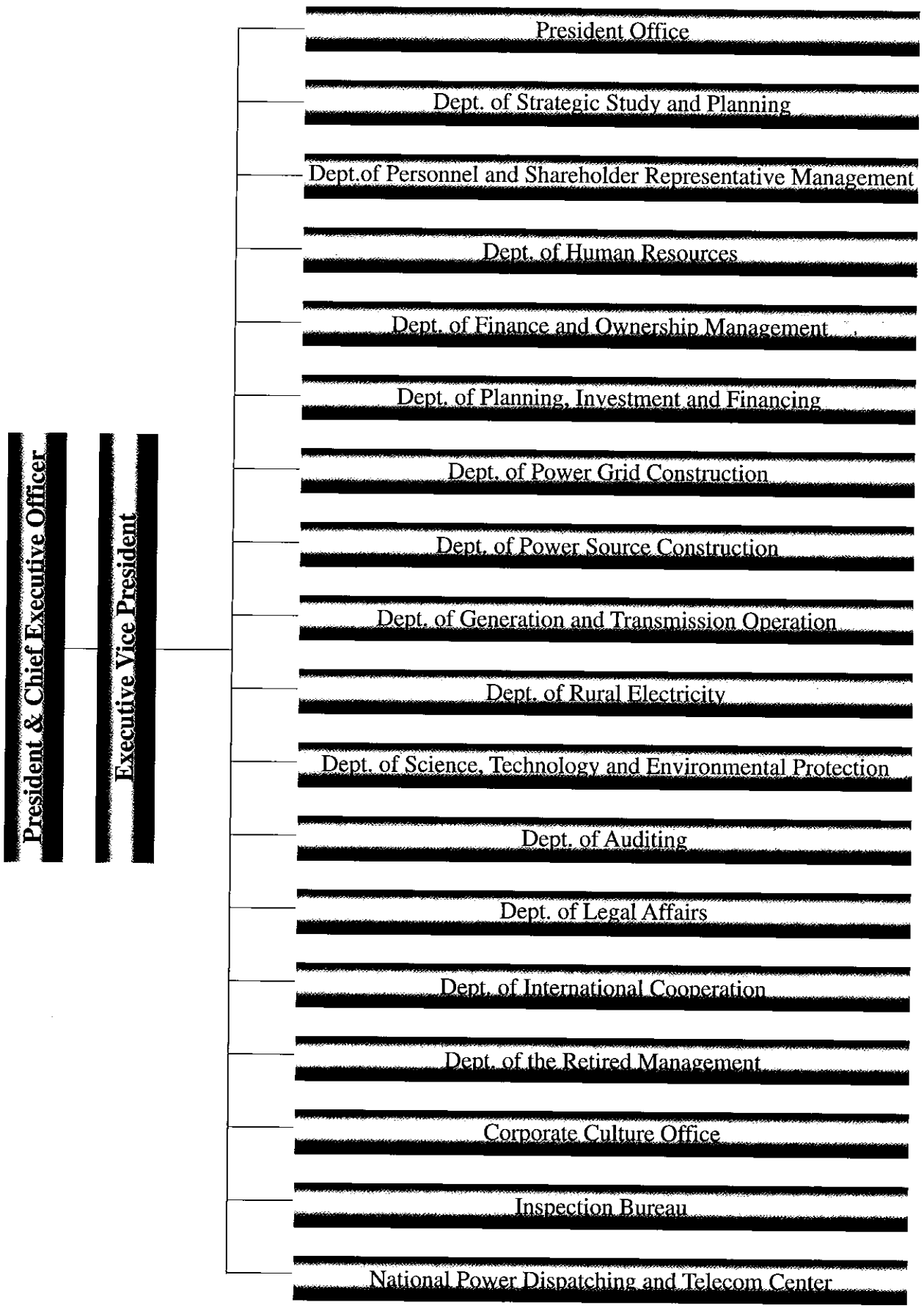
As to power network construction, by the end of 2001, SP had 466,804 km transmission lines at a voltage of 110 kV and above, with a substation capacity of 761,390 MVA. Along with the starting of the second batch of power sources project for sending power from west to east, SP paid more efforts on the power network construction to deliver electricity to Guangdong Province. With regard to the nationwide interconnection of networks, the interconnection between Northeast and North China networks and that between East China and Fujian networks were all completed and put into commission in 2001. As a result, power supply of Beijing, Guangdong, Shanghai and Zhejiang where power consumption increased rapidly was ensured. Meanwhile, significant success was achieved in the construction and retrofit of urban and rural networks, which entered into a stage of completion and acceptance in 2001.

Table 1 Installed capacity and electricity generation of SP in recent years

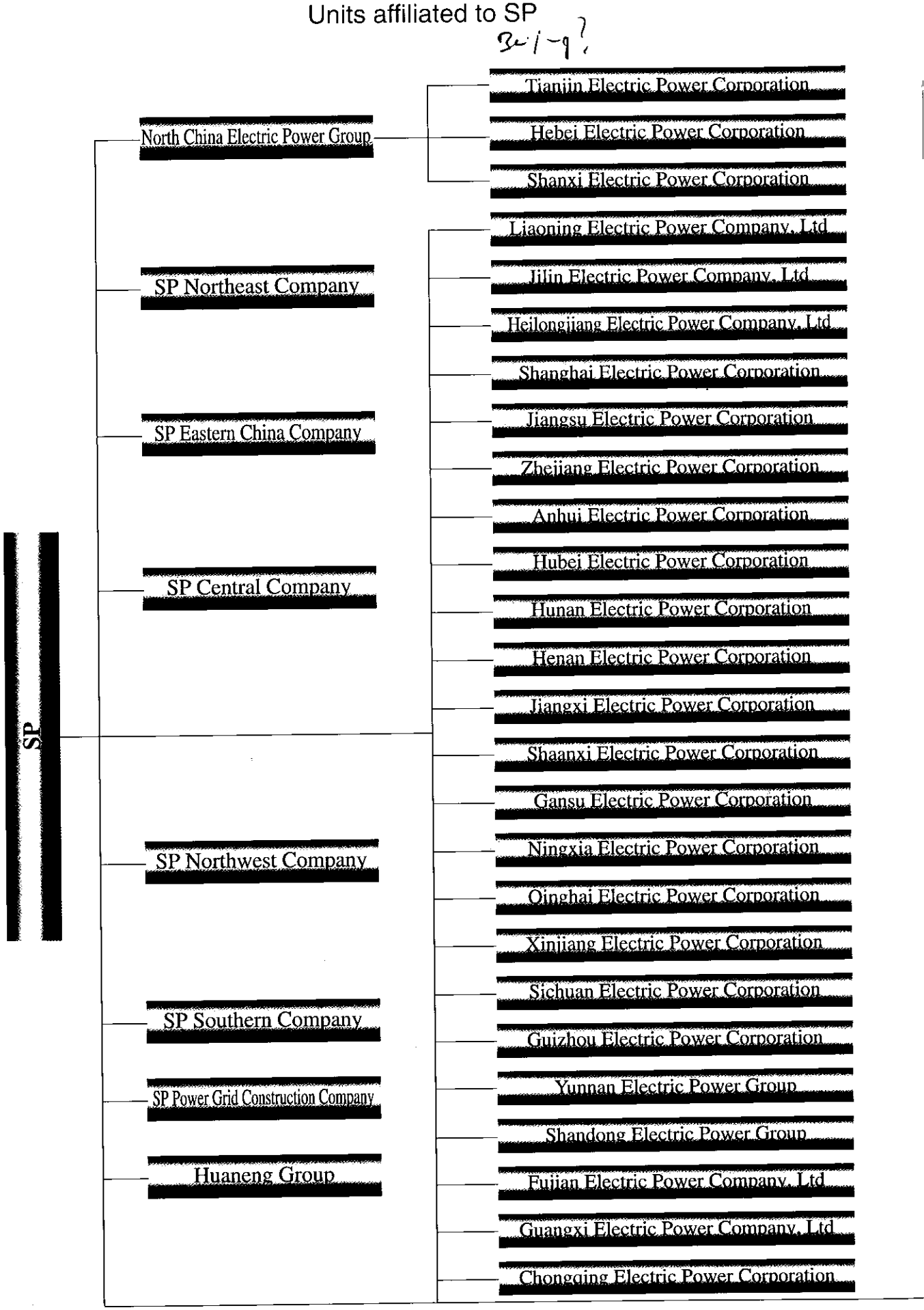
1992	103,438.9	22,363.9	81,075.0	521.330	74.638	446.992
1993	107,838.0	23,794.0	84,044.0	547.045	85.320	461.725
1994	115,952.0	26,964.0	88,988.0	591.325	97.010	494.315
1995	124,036.8	28,484.6	95,552.2	638.670	110.386	528.284
1996	132,511.8	29,996.7	102,515.1	665.804	105.070	560.734
1997	124,145.9	29,130.0	95,015.9	586.639	88.078	498.561
1998	138,338.8	31,222.8	107,027.5	604.358	92.942	511.264
1999	145,042.1	32,467.7	112,486.0	623.761	101.691	521.857
2000	149,385.0	33,938.7	115,371.0	657.293	106.262	550.861
2001	159,139.8	35,185.0	123,835.0	712.408	107.399	604.764

Note: Data from 1992 to 1996 are those of the former Ministry of Electric Power minus those of Inner Mongolia. Data from 1997 to 2001 are those of wholly owned and holding companies of SP.

Head office organization of the State Power Corporation



Units affiliated to SP



Units affiliated to SP

- China Gezhouba Water Resources & Hydropower Engineering Group Company
- China Water Resources & Hydropower Engineering Corporation
- SP Yichang Ultra-High Voltage Management Division
- China Power International Company, Ltd
- State Power Financial Company, Ltd
- China Power Import & Export Company
- Longyuan Power Group Company
- China Power Equipment Corporation
- Zhongxing Power Industrial Development Company
- China Water Resources and Power Materials Company, Ltd
- China Anneng Construction Company
- Wujing Hydro Power Development Company, Ltd
- SP Power Development Corporation
- SP Shenzhen Scientific Development Corporation
- Longtan Hydro Power Development Corporation
- SP Accessories Center
- SP Hydropower Planning and Designing Institute
- SP Power Planning and Designing Institute
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- SP Super Training Center

International Cooperation

In 2001, the international cooperation work of the State Power Corporation (SP) achieved great success. It was mainly to fulfill two strategic requirements, i.e. the strategy of transmitting power from west to east and the strategy of stepping to outside world.

The successful bidding of San—Guang and Gui—Guang DC equipment has not only greatly reduced construction cost, but also introduced advanced light triggering techniques, which has strongly promoted power transmitting from west to east and provided successful experiences for introducing foreign advanced technologies and equipment.

The foundation laying ceremony for Kirirom Hydropower Station Phase I Project of Cambodia in April 2001 indicated a substantial move of the SP toward outside world.

The main international cooperation activities of SP in 2001 are briefly described as follows:

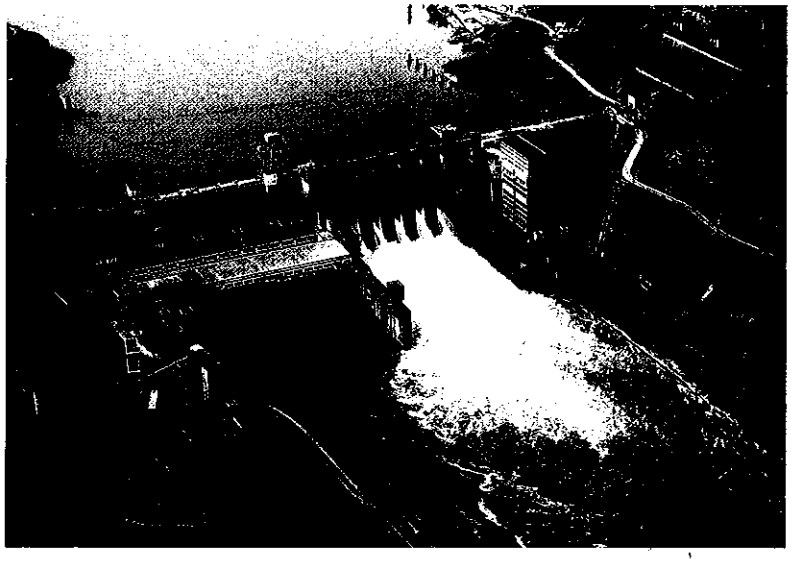
● Important delegations visited abroad

Senior executives of the SP visited abroad frequently in 2001. In addition to closely relate with important themes of business and development of SP itself, these visits appeared two prominent features. Firstly, the broad and in-depth study and understanding the general trend of worldwide power reform was to assimilate beneficial experiences and lessons centered on China power reform practice. Secondly, best efforts were given to push forward and lead enterprises under SP to participate actively the competition on international bidding of power projects and open up overseas market, using financial and engineering technical resources of SP. The visiting activities are listed briefly as follows:

(1) In April 2001, the Cambodian Prime Minister Samdech Hun Sen and many ministers together with several thousand people attended the celebrating ceremony of inauguration of Kirirom Hydropower Station Phase I Project. Chinese delegation including about ten department directors of SP attended this

The construction site of Kirirom Hydropower Station Phase I Project

ceremony. It is the first overseas BOT investment project by SP with an amount of more than US$ 20 million. This project acts also as a demonstration for enterprises under SP to open up overseas market.



Yantan Hydropower Station (1210 MW), Guangxi

(2) In February and April 2001, the SP organized delegations and invited leaders from the National People's Congress to visit and investigate jointly in the United States, Japan, UK, France, Belgium and European Union in succession, to understand the progress of power market reform, power legislation and power pricing mechanism after reform in western countries. The overall analysis on the development status, background, experience and lessons of world power market reform, and comprehensive analysis on objective rule of power system, principle of market, time and prospects of China power reform will further deepen the understanding of world power reform experience.

(3) Delegations led by senior executives of the SP visited also Zimbabwe, Argentina, Peru, Ecuador, Singapore, Algeria, South Africa, Cambodia, etc., to discuss in-depth with related government agencies for strengthening bilateral cooperation on engineering construction, technical consultancy, labor export, power equipment supply and manufacturing, joint running and investment in projects. The significant progress has been made.

● Important delegations visited SP

The State Power Corporation invited delegations led by Indian power minister, the President of Mirant Company of US and the executive director of Tokyo Power Company of Japan to visit SP, a bilateral cooperation agreement was signed with the Mirant Company. The Indian power minister highly appreciated the promotion of management level of SP, and expressed the hope of close cooperation with China power system on technical management, which has laid a solid foundation for future bilateral cooperation.

● Technical exchange and discussion

(1) Conforming to the need of power industry reform and development, the State Power Corporation held seminars on case study for Californian power problems and on North America power reform. In addition, 5 world famous investment banks and the market consulting company of Argentina were invited to discuss problems concerning world power market, market structure design, power crisis in California, PJM power market operation of US, power pricing mechanism, etc.

(2) Together with Mirant Company of US, a seminar on power market of open access was jointly held, and together with Ministry of Human Resources of China and Gaopei Center, a speech on special topic of modern enterprise strategy management was jointly held. On which, a number of senior executives from US enterprises and professors from universities were invited to give keynote address. The Power Generation and Transmission Department of SP held a technical seminar concerning "separating power plants from networks and setting up power market". Together with Asian Development Bank and a German Energy consulting firm, an International Seminar on Rural Power Development was jointly held in Haikou City

of Hainan Province. It was the first international conference ever held on rural electrification in the history of China power development.

(3) To coordinate with the Three Gorges transmission projects, the SP invited ABB, Siemens, Alsthom, and Electric Power Development Co. of Japan etc. to attend the seminar on DC transmission technologies. Together with CIGRE China National Committee, the CIGRE Technical Committee 2001 was held in Three Gorges and Wuhan. Together with Toshiba Co. of Japan, a technical introduction meeting on double circuit transmission tower was held. Together with EDF of France, the large power network interconnection technology was discussed. The 4th International Conference on High Voltage DC Transmission Operation was held. In addition, the seminar on power plant dry cooling system technology was jointly held by SP and GEA Energy Technology Co Ltd. and the seminar on safety assessment, strengthening and consolidation of Fengman Dam and hydropower equipment was jointly held by SP and Canadian International Development Agency.

Table 1 SP's major completed and ongoing power projects with external financing in 1984~2001 (not including Huaneng Group's projects)

A: Source of financing: World Bank		
1	**Yunnan Lubuge Hydropower Station**	600
2	Zhejiang Beilun Power Plant 1st phase (No.1-2 units)	1200
3	**Xuzhou-Shanghai EHV transmission & substation**	
4	Guangxi Yantan Hydropower Station	1210
5	**Shanghai Wujing Power Plant 6th phase**	600
6	Sichuan Ertan Hydropower Station 1st phase	3300
7	**Henan Yanshi Power Plant 2nd phase**	600
8	Shandong Zouxian Power Plant	1200
9	**Fujian Shuikou Hydropower Station**	1400
10	Zhejiang Tianhuangping Pumped Storage Hydropower Station	1800
11	**Jiangsu Yangzhou No.2 Power Plant**	1200
12	Zhejiang Beilun Power Plant 2nd phase	1800
13	**Sichuan Ertan Hydropower Station 2nd phase**	
14	Ertan 500 kV transmission & substation	
15	**Inner Mongolia Tuoketuo A Power Plant 1st phase**	1200
16	Tuoketuo Thermal Power Project—Beijing urban grid upgrading sub-project	
17	**Hunan Leiyang Power Plant Extension**	600
18	Shanghai Waigaoqiao Power Plant 2nd phase	1800
19	**East China Jiangsu 500 kV transmission & substation**	
20	Zhejiang Tongbai Pumped Storage Hydropower Station	1200
21	**Shanghai Renewable Enery Development Project**	20
22	Jiangsu Yixing Pumped Storage Hydropower Station	1000

Table 1 SP's major completed and ongoing power projects with external financing in 1984~2001 (not including Huaneng Group's projects)

(Continued)

B: Source of financing: ADB		
1	**Heilongjiang Qitaihe Power Plant retrofit project**	700
2	Hunan Lingjintan Hydropower Station	270
3	**Henan Yuzhou Power Plant**	700
4	Fujian Mianhuatan Hydropower Station	600
5	**Northeast China Liaoyang-Changchun-Jilin-Harbin 500 kV T&S**	
6	Yunnan Dachaoshan Hydropower Station outgoing T&S	
7	**Hebei Zhanghewan Hydropower Station**	1000
8	Liaoning Shenyang-Liaoning Dalian 500 kV T&S	
C: Source of financing: OECF		
1	**Tianshengqiao II Hydropower Station**	1320
2	Hunan Wuqiangxi Hydropower Station	1200
3	**Tianshengqiao I Hydropower Station**	1200
4	Beijing Shisanling Pumped Storage Hydropower Station	800
5	**Shanxi Hejin Power Plant**	700
6	Hubei Ezhou Power Plant	600
7	**Hebei Sanhe Power Plant**	700
8	Hunan Yuanshui River 1st phase development	465
9	**Chongqing Power Grid distribution system upgrading**	
10	Harbin Urban Power Grid upgrading	
11	**Jiangxi Jiujiang Power Plant 3rd phase**	700
12	Shaanxi Hancheng No.2 Power Plant	1200
13	**Shanxi Wangqu Power Plant**	1200
14	Shanxi Wangqu-Shandong Laiyang 500 kV T&S	
15	**Shandong Tai'an Pumped Storage Hydropower Station**	1000
16	Shanxi Xilongchi Pumped Storage Hydropower Station	1200
17	**Hunan Yuanshui Sanbanxi Hydropower Station**	1000
D: Source of financing: Japanese Export & Import Bank		
1	**Anhui Anqing Power Plant**	600
2	Jilin Cogeneration Power Plant retrofit	200
3	**Shaanxi Baqiao Cogeneration Power Plant**	200
E: Source of financing: Austria		
1	**Anhui Langyashan Pumped Storage Hydropower Station**	600

Dam site of Longtan Hydropower Station on Hongshui River

long distance EHV transmission, pumped storage station and large hydropower station projects, large combined cycle and circulating fluidized bed clean combustion technologies, large pit-mouth station, large super-critical and new energy generation technologies etc.

About US$300 million each year for importing foreign equipment by domestic sources shall be used mainly for import of high and new technological equipment as SDH optical communication equipment, power dispatching automation and information project, FGD installations, and dry cooling equipment etc.

● Introducing technologies and equipment by foreign funds

Since implementing reform and open policy, foreign funds being used for China power construction has also grown rapidly. Introducing foreign funds and advanced equipment has not only pushed forward and promoted power construction, but also spurred up power industry a leap forward.

As of the end of 2001, funds from International financial institutions and foreign governments loans used by China power industry totaled US$ 12 billion. Those foreign funds were mainly used for construction of large thermal power, hydropower, transmission and substation projects. Since 1998, along with alleviation of tense power supply, the use of foreign funds has transformed from scale and speed oriented to quality and benefit oriented, the work of using foreign funds has started to emphasize power structure adjustment and working quality of foreign fund usage. According to the State development plan, using foreign funds and introducing technical equipment should be incorporated with the strategy of western region development. The use of foreign fund should focus on strengthening trunk network construction, including large network interconnections, even the nation-wide interconnection projects, focus on DC transmission technology, large capacity and

The procurement for San–Guang and Gui–Guang DC transmission converter station equipment with a total cost of US$ 700 million through bidding was successfully implemented in 2001. Through competitive bidding, it has not only saved construction cost, the advanced light-triggering technology has been introduced on favorable conditions.

Importing electric/mechanical equipment and advanced technologies using foreign funds is indeed effective in terms of improving scientific management level and environmental level, which will definitely spur up progress of China power industry.

● Implementing "going overseas" strategy

2001 was the second year of implementing "going overseas" strategy set forth by Central Government. It was also the first year of comprehensively pushing forward "going overseas" strategy by SP. According to the development strategy of SP and under the deployment on a series of meetings, with the spirit of active exploration, bold in practice and hard struggle, the substantial headway has been made in international market penetration and overseas business achieved outstanding result. After realization of an amount of US$338 million new contracts for overseas business in

2000, the total amount of US$558 million new contracts signed in 2001 presented a new breakthrough, it was 65% increased over the previous year.

As of the end of 2001, over 50 enterprises under SP system were authorized to undertake overseas business by the State government. Their agencies abroad amounted to 45. Project contract, design, consulting, labor export or project investment were launched in more than 40 countries or areas, such as in Thailand, Bangladesh, Malaysia, Singapore, Burma, India, Syria, Iran, Georgia, Sudan, the United Arab Emirates, Israel, Peru, Tanzania, Zimbabwe, etc.

By the end of 2001, the work under "going overseas" strategy by SP system can be briefly described as: striving for support from governments and associated circle, to set the brand of SP and create good external environment for "going overseas" strategy. For this goal, the SP system enhanced coordination service, promoted overseas business consolidation and launched dynamic follow-up for key projects. Along with progressive enlargement of single project scale, the SP invested overseas projects has been transformed to production and processing field.

The SP system invested overseas projects in 2001 included:

— The first overseas BOT project, Kirirom Hydropower Station Phase I Project in Cambodia was started construction in April 2001.

— The first BOO overseas project, Khadori Hydropower Station in Georgia was also started construction in April 2001.

— A batch of overseas projects including the invested concrete electric pole factory in Vietnam, the power plant and lighters factory invested in Brazil were under different construction period in 2001.

In 2001, the works of "going overseas" strategy under SP system were still mainly on project contracting, along with single project scale enlarged, the large contracts signed included:

— Taleghan Dam and HPP Project of Iran with a construction cost of US$ 143 million, contracted by China Hydropower Construction General Company as a main contractor.

—The captive power plant project of ISPAT Steel Works in India with a construction cost of US$84 million, contracted by Shandong Power Construction General Company as a main contractor.

—The housing development project in Peru with a construction cost of US$ 84 million contracted by China Electric Power Technology Import & Export Corporation as a main contractor.

The Three Gorges DC T&D Project — Zhengping Converter Station under construction

Financial Performance

● Operation conditions

In 2001, the State Power Corporation endeavored to deepen reformation, strengthen administration and boldly create new ideas. It fulfilled all of the planned operating targets. Its economic strength and efficiency, the overall electricity sales, operational revenue and profit were remarkably promoted. The electricity sales under the State Power Corporation amounted to 972,548,963 MWh in 2001, it was 7.43% higher than that in 2000; the electricity generation amounted to 603,167,464 MWh, increased by 44,259,176 MWh, or 7.92% higher; power purchase amounted to 492,197,249 MWh, increased by 32,640,249 MWh or 7.10% higher than the previous year.

The operating revenue from main business amounted to 400,395,471 thousand yuan, increased by 43,354,123 thousand yuan, or 12.14% higher.

● Income analyses

The operating cost of main business amounted to 346,666,467 thousand yuan, increased by 37,192,526 thousand yuan, or 12.02% higher than the previous year, which is 0.12 percent points lower than that of operating revenue from main business.

The profit of main business amounted to 48,166,563 thousand yuan, increased by 5,620,168 thousand yuan, or 13.21 % higher than the previous year.

The gross profit amounted to 21,156,468 thousand yuan, increased by 2,236,234 thousand yuan, or 11.82% higher; the net profit after tax amounted to 8,125,809 thousand yuan, or 4.16% higher than the previous year.

● Assets analyses

By the end of 2001, the total assets of SP reached

Table 1 Consolidated balance sheet (as of December 31, 2001)

Prepared by: State Power Corporation of China (In thousand yuan RMB)

Item	Line No.	At beginning of the year	At end of the year
Current assets:			
Cash	1	166,224,052	169,044,528
Short-term investment	2	6,336,297	16,349,163
Less: Provision for loss on realization of short-term investment	3	3,335	16,618
Short-term investment, net	4	6,332,962	16,332,545
Notes receivable	5	3,292,569	4,295,545
Dividends receivable	6	170,313	577,709
Interest receivable	7	105,715	91,940
Accounts receivable	8	43,004,559	38,764,416
Other receivable	9	90,647,077	81,229,152

Table 1 Consolidated balance sheet (as of December 31, 2001)

(Continued)

Item	Line No.	At beginning of the year	At end of the year
Less: Provision for bad debts	10	927,926	1,228,961
Accounts receivable, net	11	132,723,710	118,764,607
Advances to suppliers	12	13,163,568	13,794,068
Subsidies receivable	13		197
VAT refund for export goods receivables	14	16,333	51,314
Inventories	15	19,113,888	19,177,006
Less: Provision for loss on realization of inventories	16	36,036	76,506
Inventories, net	17	19,077,852	19,100,500
Prepaid expenses	18	558,784	663,684
Net loss to be handed of current assets	19	222,011	269,900
Long-term bond investment maturing within one year	20	62,710	34,008
Other current assets	21	39,504,241	42,932,725
Total current assets	22	381,454,820	385,953,270
Long-term investment and allocated loans:			
Long-term equity investment	23	48,959,008	52,033,036
Long-term bond investment	24	20,927,131	17,026,930
Less: Provision for loss on realization of long-term investment	25	664,406	185,041
Long-term investment, net	26	69,221,733	68,874,925
Consolidated difference	27	1,286,856	1,939,295
Allocated loans	28		
Fixed Assets:			
Fixed assets, cost	29	926,969,165	1,072,203,347
Less: Accumulated depreciation	30	277,753,260	325,598,238
Fixed assets, net	31	648,842,793	746,392,718
Disposal of fixed assets	32	149,584	216,661
Material used for construction	33	15,479,182	13,034,270
Construction in progress	34	117,235,700	114,224,662
Net loss to be handed of fixed assets	35	83,734	117,945
Total fixed assets	36	781,790,993	873,986,256
Intangible assets and deferred expenses:			
Intangible assets	37	6,063,193	5,585,418
Deferred expenses	38	5,932,995	5,823,390
Total intangible assets and deferred assets	39	11,996,188	11,408,808
Other long-term assets:			
Other long-term assets	40	5,625,191	4,035,220
Including: Net value of temporary facilities	41	292,704	200,634
Deferred tax:			
Deferred tax-debit	42	9,520	134,325
Total assets	43	1,251,385,301	1,346,332,099

Table 1 Consolidated balance sheet (as of December 31, 2001)

(Continued)

Item	Line No.	Beginning of the year	End of the year
Current Liabilities:			
Short-term loans	44	31,707,556	41,589,393
Notes payable	45	845,845	2,034,173
Accounts payable	46	51,090,417	52,879,816
Advances from customers	47	14,547,403	16,222,261
Intra-branch	48		
Accrued payroll	49	18,077,011	19,519,037
Welfare payable	50	2,943,316	2,999,632
Tax payable	51	11,889,433	11,436,920
Dividends payable	52	3,859,669	3,796,977
Other unpaid	53	7,531,149	8,900,078
Other payable	54	97,754,677	98,795,492
Accrued expense	55	2,104,247	2,282,085
Long-term liabilities due within one year	56	12,602,340	20,500,702
Other current liabilities	57	26,177,339	26,159,733
Total current liabilities	58	281,130,402	307,116,299
Long-term liabilities:			
Long-term loans	59	451,623,595	490,245,840
Bonds payable	60	4,260,081	650,504
Long-term payables	61	13,803,619	5,358,629
Allocated loans from superior	62		
Other long-term liabilities	63	21,483,735	28,871,463
Including: Special item payable	64	19,092,215	23,160,123
Total long-term liabilities	65	491,171,030	525,126,436
Deferred tax:			
Defered tax-credit	66	405,864	386,624
Total liabilities	67	772,707,296	832,629,359
Minority interest:	68	65,473,422	71,371,614
Owner's equity:			
Paid-in capital	69	160,000,000	160,000,000
Including: State-owned capital	70	160,000,000	160,000,000
Corporation-owned capital	71		
Capital surplus	72	210,183,463	232,347,650
Including: Supplementary working capital	73		
Revenue reserve	74	47,039,142	54,865,257
Including: Public welfare fund	75	21,873,238	25,102,872
Supplementary working capital	76		
Unrecognized investment loss under equity method	77	-2,394,563	-2,604,504
Undistributed profit	78	-1,623,459	-2,277,277
Foreign currency converting difference	79		
Total owner's equity	80	413,204,583	442,331,126
Total liabilities and owner's equity	81	1,251,385,301	1,346,332,099

1,346,332.009 thousand yuan, increased by 94,946,798 thousand yuan, or 7.75% higher. The total liability amounted to 832,629,359 thousand yuan, increased by 59,922,063 thousand yuan, or 7.75% higher, the owner's equity amounted 442,331,126 thousand yuan, increased by 29,126,543 thousand yuan, or 7.05% higher, representing an assets and debt ratio of 61.84%, 0.09 percent points higher than the previous year.

● Tax duty

The State Power Corporation's unpaid tax at beginning of the year 2001 amounted to 11,889,432 thousand yuan and the tax due in the year amounted to 46,594,628 thousand yuan, the tax actually paid amounted to 47,047,141 thousand yuan, and the unpaid tax at the year end amounted to 11,436,920 thousand yuan, 452,512 thousand yuan lower than that in the year beginning.

Table 2 Consolidated cash flow statement (as of December 31, 2001)

Prepared by: State Power Corporation of China (In thousand yuan RMB)

Cash flow from operating activities:			
Cash received from sales of goods or rendering of services	1	437,158,696	457,267,863
Refunds of taxes	2	3,654,338	900,342
Other cash received relating to operating activities	3	134,666,737	141,008,319
Sub-total of cash inflows	4	575,479,771	599,176,524
Cash paid for goods and services	5	265,807,870	282,045,206
Cash paid to and on behalf of employees	6	32,905,002	37,785,567
Payments of all tapes of taxes	7	42,297,218	44,595,374
Cash paid relating to other operating activities	8	144,055,377	143,367,553
Sub-total of cash outflows	9	485,065,467	507,793,700
Net cash flows from operating activities	10	90,414,304	91,382,824
Cash flows from investing activities:			
Cash received from return of investments	11	20,029,704	19,075,337
Cash received from return on investments	12	5,149,798	3,069,597
Net cash received from the sale of fixed assets, intangible assets and other long-term assets	13	2,720,178	851,306
Cash received relating to other investing activities	14	17,763,059	13,083,272
Sub-total of cash inflows	15	45,662,739	36,079,512
Cash paid to acquire fixed assets, intangible assets and other long-term assets	16	120,556,791	132,400,762
Cash paid to acquire investments	17	44,115,723	21,907,006
Cash paid relating to other investing activities	18	29,312,483	19,179,893
Sub-total of cash outflows	19	193,984,997	173,487,661
Net cash flows from investing activities	20	-148,322,258	-137,408,149

Table 2 Consolidated cash flow statement (as of December 31, 2001)

(Continued)

Cash flows from financing activities:			
Cash received from investments by others	21	33,005,782	16,376,219
Including: Cash received from minority equity investment of subsidiary	22	264,558	483,827
Cash received from borrowings	23	152,260,565	152,469,056
Cash received relating to other financing activities	24	10,222,027	15,332,417
Sub-total of cash in-flows	25	195,488,374	184,177,692
Cash repayments of amounts borrowed	26	86,933,794	93,303,272
Cash paid for distribution of dividends or profits and interest expenses	27	24,858,459	28,463,437
Including: Subsidiary pay minority for dividends or profits	28	4,388	67,770
Cash paid relating to other financing activities	29	7,997,640	13,533,766
Sub-total of cash out-flows	30	119,789,893	135,300,475
Net cash flows from financing activities	31	75,698,481	48,877,217
Effect of foreign exchange rate changes on cash:	32	-20,664	-5,105
Net increase in cash and cash equivalents:	33	17,769,863	2,846,787
Reconciliation of net income to cash flows from operating activities:			
Net income	34	7,801,614	8,125,809
Add: Minority interests	35	5,602,755	6,624,169
Provision for impairment loss of assets	36	2,321,715	1,879,080
Depreciation of fixed assets	37	47,167,978	54,754,370
Amortisation of intangible assets	38	1,087,989	323,944
Amortisation of long-term prepaid expenses	39	1,399,716	1,259,025
Decrease in prepaid expense (or deduct: increase)	40	23,199	-156,379
Increase in accrued expense (or deduct: decrease)	41	184,014	449,021
Losses on disposal of fixed assets, intangible assets and other long-term assets (or deduct: gains)	42	1,305,354	1,024,667
Losses on scrapping of fixed assets	43	1,078,163	1,297,009
Financial expenses	44	19,470,241	23,850,420
Losses arising from investments (or deduct: gains)	45	-4,030,307	-3,898,314
Deferred tax credit (or deduct: debit)	46	585,157	-144,046
Decrease in inventories (or deduct: increase)	47	70,428	305,823
Decrease in operating receivables (or deduct: increase)	48	6,370,203	11,630,971

Table 2 Consolidated cash flow statement (as of December 31, 2001)

(Continued)

Increase in operating payables (or deduct:decrease)	49	6,828,617	8,045,466
Others	50	-6,852,532	-23,988,211
Net cash flows from operating activities	51	90,414,304	91,382,824
Investing and financing activities not involving cash receipts and payments :			
Conversion of debt into capital	52	37,441	1,209,532
Reclassify convertible bonds to be expired within one year as current liability	53		
Fixed assets financed by financing leases	54	6,900	58,210
Others	55	148,988	661,115
Net increase in cash and cash equivalents :			
Cash at the end of the period	56	166,224,052	169,044,528
Less: Cash at the beginning of the period	57	151,433,644	166,224,052
Plus: Cash equivalents at the end of the period	58	3,368,765	3,395,076
Less: Cash equivalents at the beginning of the period	59	389,310	3,368,765
Net increase in cash and cash equivalents	60	17,769,863	2,846,787

Table 3 Consolidated income statement (as of December 31, 2001)

Prepared by: State Power Corporation of China

(In thousand yuan RMB)

Sales	1	357,041,348	400,395,471
Less: Cost of sales	2	309,473,941	346,666,467
Operating tax and surcharges	3	3,917,636	4,424,498
Operating expense	4	1,144,859	1,191,177
Add: Procurement and consignment income	5	36,707	53,234
Others	6	4,776	
Sales income	7	42,546,395	48,166,563
Add: Income from other business	8	2,806,375	3,254,920
Less: Loss on realization of inventories	9	3,990	421
General and administrative expenses	10	9,509,920	10,253,365
Financial expenses	11	18,673,327	22,767,950
Others	12	981	121,493

Table 3 Consolidated income statement (as of December 31, 2001)

(Continued)

Item	Line No.	2000	2001
Operation income	13	17,164,552	18,278,254
Add: Investment income	14	4,030,307	3,898,314
Income from subsidy	15	146,132	2,393,166
Non-operating income	16	1,480,801	1,055,929
Others	17	19,060	114,859
Less: Non-operating expense	18	5,496,259	4,822,965
Others	19	193,916	179,064
Add: Adjustment to previous year's income and expense	20	1,769,557	417,975
Income before tax	21	18,920,234	21,156,468
Less: Income tax	22	7,073,957	6,811,279
Minority interests	23	5,602,755	6,624,169
Add: Unrecognized investment loss under equity method	24	1,558,092	404,789
Net income	25	7,801,614	8,125,809

Table 4 Electricity consumption mix & average tariff of SP by categories, 2001 (including tax)

Large industry	48.52	48.10	-0.42	372.30	381.86	9.55
None & ordinary industry	**7.46**	**7.22**	**-0.24**	**498.60**	**518.15**	**19.55**
Residential use	8.88	8.87	0.00	379.12	384.80	5.68
Non-residential lighting	**4.04**	**3.78**	**-0.26**	**553.54**	**592.41**	**38.86**
Commercial	2.27	2.81	0.53	676.38	693.62	17.24
Agricultural production	**1.67**	**1.41**	**-0.26**	**328.65**	**325.56**	**-3.10**
Drainage & irrigation of poverty counties	0.61	0.66	0.05	146.82	147.60	0.79
Whole sales	**23.16**	**25.83**	**2.67**	**329.71**	**331.15**	**1.44**
Total	100.00	100.00		376.40	384.77	8.37

Note: The extra tariff income for loan payment of rural grid is not included in the average tariff. If it were included, the average tariff in 2001 would be 396.07 yuan/MWh.

Table 5 Average tariff of SP's branches and provincial companies (tax included)

(yuan/MWh)

North China Power Network	387.26	397.64	383.19		4.07	14.45
North China Electric Power Group	412.44	426.17	404.71	383.95	7.73	21.46
Shanxi	292.48	303.98	285.95	282.54	6.53	18.04
Hebei	346.02	359.06	345.05	323.44	0.97	14.01
Shandong	427.04	431.45	423.70	416.36	3.34	7.75
East China Power Network	444.02	458.62	446.40		-2.38	12.21
SP Eastern China Company	420.52	420.52	407.20	331.29	13.32	13.32
Shanghai	514.38	532.62	515.21	483.71	-0.83	17.41
Zhejiang	476.81	496.46	482.13	429.82	-5.32	14.33
Jiangsu	425.77	439.81	428.01	443.77	-2.24	11.80
Anhui	393.47	394.99	400.78	397.04	-7.32	-5.80
Fujian	398.62	412.54	398.84	404.56	-0.22	13.70
Central China Power Network	368.90	380.42	364.40		4.50	16.02
SP Central Company	170.02	170.02	175.84	182.13	-5.82	-5.82
Hubei	384.85	401.28	381.60	370.53	3.25	19.69
Henan	346.90	360.43	350.61	329.93	-3.71	9.82
Hunan	391.85	403.40	392.58	384.14	-0.72	10.82
Jiangxi	405.59	417.99	409.86	403.81	-4.27	8.12
Sichuan	346.58	351.21	352.34	352.60	-5.76	-1.12
Chongqing	384.72	391.55	367.87	359.79	16.85	23.68
Northwest China Power Network	314.47	316.11	300.83		13.63	15.28
SP Northwest Company						
Shaanxi	368.09	373.39	354.75	334.48	13.35	18.64
Gansu	284.90	295.41	273.90	263.11	11.00	21.51
Qinghai	253.38	265.90	255.23	254.66	-1.86	10.67
Ningxia	281.18	293.28	267.79	262.37	13.38	25.49
Xinjiang	309.36	322.41	311.68	304.20	-2.31	10.73
Northeast China Power Network	407.95	418.37	365.68		42.27	52.69
SP Northeast Company	252.05	252.05	246.65	309.10	5.40	5.40
Heilongjiang	432.45	438.38	394.18	359.16	38.27	44.20
Jilin	360.64	372.67	298.54	302.03	62.11	74.14
Liaoning	430.61	442.61	391.78	354.02	38.83	50.83
South China Power Network	266.90	272.78	249.49		17.41	23.29
Guizhou	247.64	250.68	251.58	218.48	-3.94	-0.90
Yunnan	296.52	308.04	302.75	291.38	-6.23	5.29
Guangxi	344.39	350.82	255.89	198.90	88.50	94.93
SP Southern Company	121.42	121.42	84.50	178.52	36.92	36.92
Average	384.77	396.07	376.40		8.37	19.67

Power Sources Construction and Environmental Protection

Upholding the principles of vigorous exploiting hydropower, optimized development of thermal power, appropriate development of nuclear power and active opening up new energy resources in the light of local conditions, the power industry of China has made heartening headway in the development of power sources and environmental protection in 2001, which will be detailed as follows.

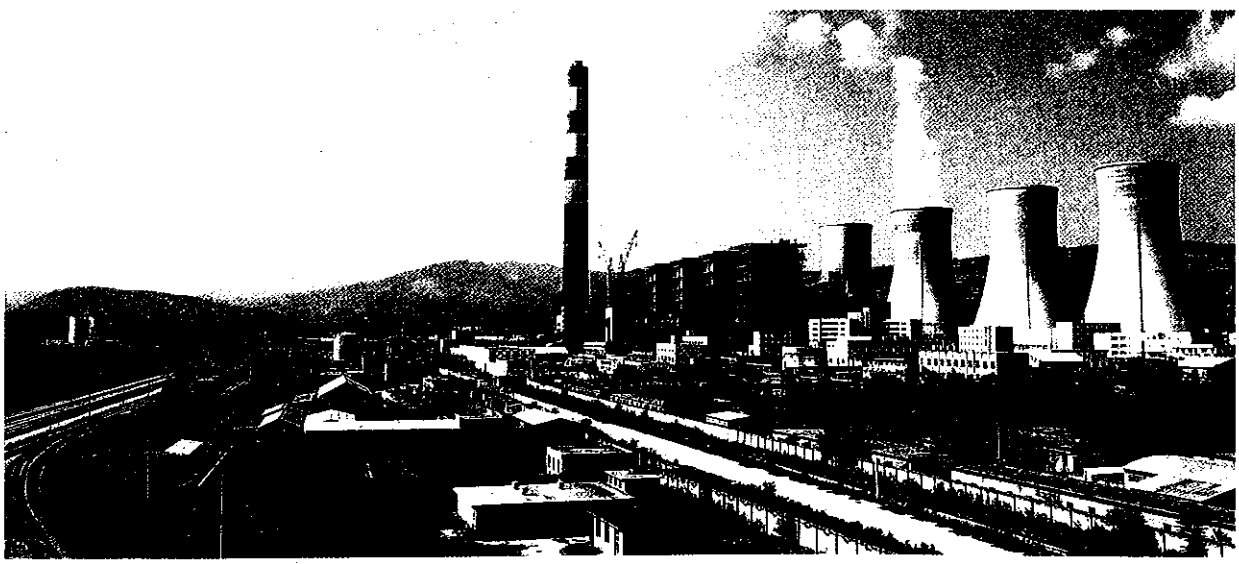
Power Sources Construction

[1] Thermal Power

● Major data

In 2001, the annual electricity generation throughout the country amounted to 1483.856 TWh, of which 1204.478 TWh were of thermal power generation (representing 81.17% of the total). By the end of 2001, the nationwide installed capacity reached 338,611.9 MW, of which 253,137.0 MW were of thermal power (representing 74.76% of the total). These two indexes ranked second in the world for several years running. The annual electricity generation under the State Power Corporation was 712.408 TWh, 8.39% higher as compared with the previous year, of which 604.764 TWh was of thermal power generation, its total installed capacity reached 159,139.8 MW by the end of 2001. The newly commissioned generating capacity totaled 15,868.7 MW in countrywide in 2001, of which thermal power capacity was 12,973.2 MW. There were 10,006.6 MW of generation projects completed and 18,306.0 MW of generating units started to construct under SP's enterprises.

The national average net coal consumption was reduced to 385 g/kWh and that of SP was reduced to 367 g/kWh. The national average house service rate of



Baoji No.2 Power Generation Co. Ltd. (4 × 300 MW), Shaanxi

Table 1 China power production statistics in 2001

(1) Installed generating capacity (MW)	338,611.9	6.04%
Of which: Hydropower (MW)	83,006.4	4.61%
Thermal power (MW)	253,137.0	6.57%
Nuclear power (MW)	2,100.0	0%
(2) Electricity generation (TWh)	1483.856	8.43%
Of which: Hydropower (TWh)	261.108	7.39%
Thermal power (TWh)	1204.478	8.71%
Nuclear power (TWh)	17.472	4.79%
(3) Net coal consumption rate of 6 MW and above thermal power (g/kWh)	385	-7 g/kWh
(4) House service rate (%)	6.24	0.04%
Of which: Hydropower	0.46	-0.03%
Thermal power	7.25	-0.06%
(5) Utilization hours of 6 MW and above power plants (h)	4,588	71 h
Of which: Hydropower	3,129	-129 h
Thermal power	4,900	52 h

thermal power plants was 6.24% (see Table 1).

Up to the end of 2001, the installed capacity of power plants with desulphurization equipment built up and under construction reached 5000 MW.

● Further developing large units with high parameters

In 2001 there were a number of newly added units, among which, Shanxi Yangcheng Power Plant is a large anthracite-fired plant with a construction scale of 2100 MW (6 × 350 MW) and a total investment of 13.2 billion yuan and USD 915.05 million. The first four units were put into commission in February to November 2001 successively. The last two units will be built up in 2002. Guangdong Zhuhai Power Plant is the largest of coal-fired power plants in Guangdong, of which the second 700 MW unit was handed over to production in 2001. Up to this point the whole plant was completed. Its total investment added up to more than 10 billion yuan. Panshan Power Generation Company commissioned a 600 MW unit, which is the first largest one in Beijing-Tianjin-Tangshan Power Network. Four billion yuan were invested in this project. Fujian Meizhouwan Power Plant has two 362 MW units with an investment of more than USD 0.7 billion. These two units went into production in 2000 and 2001 respectively. In addition to the units mentioned above, the newly added units included No.4 unit of Shaanxi No.2 Baoji Power Plant (4 × 300 MW), two 300 MW units of Hunan Yiyang Power Plant, of which the planned capacity was 1800 MW, a 300 MW unit of Yunnan Xuanwei Power Plant phase Ⅳ (2 × 300 MW), No.10 unit (300 MW) of Guangdong Shaoguan Power Plant with an investment of 1.83 billion yuan, No.4 unit (300 MW) of Shandong Liyan Power Plant as well as No.1 unit (350 MW) of Heilongjiang Qitaihe Power Plant (4 × 350 MW) etc.

In the period of 1992~2001, the number of generating units with single capacity of 300 MW and above was increased from 74 (25,500 MW) to 313 (109,980 MW) in China.

In 2001, thermal power projects started to build included a 900 MW unit in Shanghai Waigaoqiao Power

Plant, Ningxia Shizuishan Power Plant extension project (4 × 300 MW), Hunan Zhuzhou Power Plant renovation project (to construct 2 × 300 MW units substituting for old power units) etc. Besides, the second batch of projects for sending electricity from west to east began construction in November 2001, including 6 thermal power projects. They were Guizhou Anshun Power Plant Phase II (2 × 300 MW with a dynamic investment of 2519.73 million yuan), Guizhou Nayong Power Plant (4 × 300 MW, investing 4142 million yuan), Guizhou Qianbei Power Plant (4 × 300 MW, investing 4536 million yuan), Flue gas control project of Guiyang Power Plant (investing 1115.53 million yuan), Hunan Liyujiang Power Plant, extension project (2 × 300 MW, investing 2278 million yuan), and Yunnan Qujing Power Plant Phase II (2 × 300 MW, investing 2201.43 million yuan).

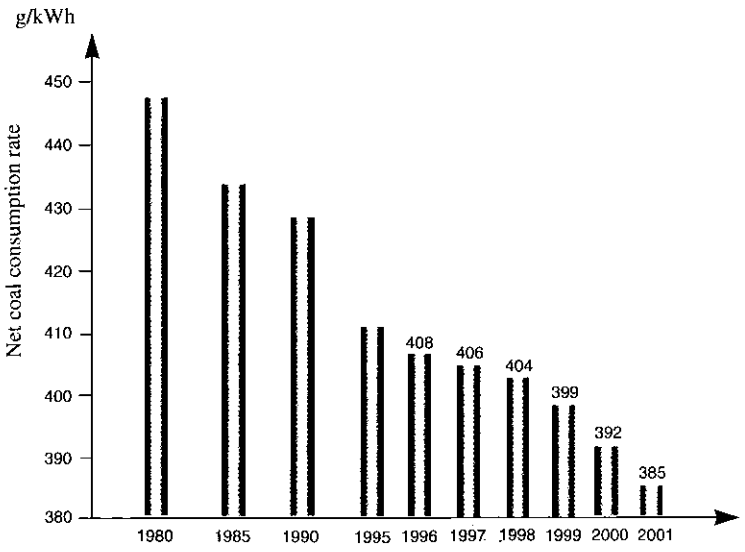


Figure 1 Net coal consumption rate trends of thermal power plants

Along with the development of large units and large power plants, small thermal power plants with a combined capacity of 1400 MW were closed and shut down in 2001.

By the end of 2001, the large-sized thermal (including nuclear) power plants with a single installed capacity of 1000 MW and above in operation are shown in Table 2. Average reliability indexes of thermal power units with a single capacity of 100 MW and above are shown in Table 3.

● Stepping up pace of preparation work for a coal-power base project in the north Shaanxi Province

In 2001 the State Power Corporation and the Shaanxi Provincial Government drawn up a construction plan of the coal-power base in the north Shaanxi Province. According to this plan, power plants with a total capacity of 22,800 MW and coal mines with an annual output of 65~100 Mt will be built. These power sources will be mainly located at Niujialiang and Jinjitan (Yulin), Jinjie and Yingdichang (Shenmu). It is planned to have an ultimate generating capacity of 10,800 MW.

● The state preferential policies on the development of the west China and the power generation demonstration project with clean coal technology

(1) On December 21, 2001, the State Council issued the "*Suggestions Concerning Implementation of Some Policy Measures for Development in the Western Part of China*". These Suggestions render various preferential policies (investment, financing, credit, taxation and pricing) for enterprises in west China. This will further stimulate development of power industry in this area.

(2) On July 25, 2001, the State Development Planning Commission sent out a circular on power demonstration projects of clean coal technology. It decides to carry out preferential policy on customs, funds arrangement, power dispatching and power pricing on the demonstration projects. These measures will contribute to the improvement of economy and competitive strength of the demonstration projects.

Table 2 Principal fossil and nuclear power plants in operation and under construction (1000 MW and above) as of December 31, 2001

No.	Name of power plant	Location (province, municipality or autonomous region)	Plant capacity	Unit capacity and number (MW x Nos)	Steam condition		Fuel
					Pressure (MPa)	Temperature (℃)	
			Thermal Power Plant				
1	Dagang	Tianjin	1280	320 x 4	16.60	538/538	Coal, Oil
2	Junliangcheng	Tianjin	1000	200 x 4	12.75	535/535	Coal
3	Jixian (Panshan)	Tianjin	1000	500 x 2 600 x 1	23.54 23.54	540/540 540/540	Coal
4	Shalingzi (Zhangjiakou General Power Plant)	Hebei	2100 2400	300 x 8	16.67	537/537	Coal
5	Douhe	Hebei	1550	125 x 2 250 x 2 200 x 4	12.75 16.07 12.75	538/538 538/538 535/535	Coal
6	Hanfeng	Hebei	1320	660 x 2	16.80	540/540	Coal
7	Huaneng Shang'an	Hebei	1300	350 x 2 300 x 2	16.60 16.67	540/540 537/537	Coal
8	Xingtai	Hebei	1255	200 x 6	12.75	535/535	Coal
9	Xibaipo	Hebei	1200	300 x 4	16.67	537/537	Coal
10	Qinhuangdao	Hebei	1000	200 x 2 300 x 2	12.75 16.67	535/535 537/537	Coal
11	Matou	Hebei	1000	200 x 4	12.75	535/535	Coal
12	Yangcheng	Shanxi	1400	350 x 4	16.60	538/538	Coal
13	Shentou No.1	Shanxi	1250 1300	200 x 2 200 x 4	12.75 16.20	540/540 530/530	Coal
14	Taiyuan No.1	Shanxi	1250 1312	300 x 4	16.67	535/537	Coal
15	Datong No.2	Shanxi	1200	200 x 6	12.75	535/535	Coal
16	Yangquan No.2	Shanxi	1200	300 x 4	16.67	537/537	Coal
17	Zhangze	Shanxi	1040	100 x 2 210 x 4	8.83 12.75	535 535/535	Coal
18	Shentou No.2	Shanxi	1000	500 x 2	16.60	535/535	Coal
19	Yuanbaoshan	Inner Mongolia	1500	300 x 1 600 x 1 600 x 1	17.75 17.75 16.75	540/540 540/540 537/537	Coal
20	Dalate	Inner Mongolia	1320	330 x 4	16.60	538/538	Coal
21	Fengzhen	Inner Mongolia	1200	200 x 6	12.75	535/535	Coal
22	Tuoketuo	Inner Mongolia	1200	*600 x 2	16.67	537/537	Coal
23	Yimin	Inner Mongolia	1000	500 x 2	23.54	540/540	Coal
24	Suizhong	Liaoning	1600	800 x 2	23.54	540/540	Coal
25	Huaneng Dalian	Liaoning	1400	350 x 4	16.60	538/538	Coal
26	Qinghe	Liaoning	1200	100 x 4 200 x 4	8.83 12.75	535 535/535	Coal, Oil
27	Jinzhou	Liaoning	1200	200 x 6	12.75	535/535	Coal
28	Tieling	Liaoning	1200	300 x 4	16.67	537/537	Coal
29	Liaoning	Liaoning	1050	200 x 2	12.75	535/535	Coal

Table 2 Principal fossil and nuclear power plants in operation and under construction (1000 MW and above) as of December 31, 2001

(Continued)

No.	Name of power plant	Location (province, municipality or autonomous region)	Plant capacity	Unit capacity and number (MWx Nos)	Steam condition		Fuel
					Pressure (MPa)	Temperature (℃)	
30	Shuangliao	Jilin	1212	300 x 4	16.67	537/537	Coal
31	Harbin No.3	Heilongjiang	1600	200 x 2 600 x 2	12.75 16.67	535/535 537/537	Coal
32	Fularji No.2	Heilongjiang	1200	200 x 6	12.75	535/535	Coal
33	Mudanjiang No.2	Heilongjiang	1020	100 x 4 210 x 2 200 x 1	8.83 12.75 12.75	535 535/535 535/535	Coal
34	Shidongkou	Shanghai	1500	300 x 4 *300 x 1	16.20 16.67	535/535 537/537	Coal
35	Shidongkou No.2	Shanghai	1200	600 x 2	24.13	547/547	Coal
36	Waigaoqiao	Shanghai	1200	300 x 4	16.67	537/537	Coal
37	Wujing No.2	Shanghai	1200	600 x 2	16.67	537/537	Coal
38	Baogang Industrial	Shanghai	1199.7	350 x 3	16.60	538/538	Coal
39	Wujing	Shanghai	1000	100 x 1 125 x 1 300 x 2	8.83 12.75 16.67	535 535/535 537/537	Coal
40	Jianbi	Jiangsu	1600	100 x 3 300 x 4	8.83 16.20	535 550/550	Coal
41	Ligang	Jiangsu	1400	350 x 4	16.60	538/538	Coal
42	Huaneng Nantong	Jiangsu	1400	350 x 4	16.60	538/538	Coal
43	Xuzhou	Jiangsu	1300	125 x 4 200 x 4	13.24 12.75	550/550 535/535	Coal
44	Changshu	Jiangsu	1200	300 x 4	16.67	537/537	Coal
45	Wangting	Jiangsu	1200	300 x 4	16.20	550/550	Coal, Oil
46	Yangzhou No.2	Jiangsu	1200	600 x 2	16.80	540/540	Coal
47	Beilun	Zhejiang	3000	600 x 5	16.67	537/537	Coal
48	Taizhou	Zhejiang	1410	125 x 6 330 x 2	12.75 16.67	535/535 537/537	Coal
49	Zhenhai	Zhejiang	1050	125 x 2 200 x 4	12.75 12.75	550/550 535/535	Coal, Oil
50	Pingwei	Anhui	1200	600 x 2	16.67	537/537	Coal
51	Luohe	Anhui	1200	300 x 4	16.62	550/550	Coal
52	Huaneng Fuzhou	Fujian	1400	350 x 4	16.60	538/538	Coal
53	Houshi	Fujian	1200	600 x 2	16.67	537/537	Coal
54	Zouxian	Shandong	2400	300 x 4 600 x 2	16.67 18.07	555/555 541/541	Coal
55	Shiliquan	Shandong	1225	125 x 5 300 x 2	13.24 16.67	550/550 540/540	Coal
56	Huaneng Dezhou	Shandong	1200	300 x 4	16.67	537/537	Coal
57	Liaocheng	Shandong	1200	600 x 2	16.67	537/537	Coal
58	Shiheng	Shandong	1200	300 x 4	16.70	538/538	Coal
59	Longkou	Shandong	1000	100 x 2 200 x 4	8.83 12.75	535 535/535	Coal
60	Huaneng Luohuang	Chongqing	1440	360 x 4	17.0	538/538	Coal

Table 2 Principal fossil and nuclear power plants in operation and under construction (1000 MW and above) as of December 31, 2001

(Continued)

No.	Name of power plant	Location (province, municipality or autonomous region)	Plant capacity	Unit capacity and number (MWx Nos)	Steam condition		Fuel
					Pressure (MPa)	Temperature (℃)	
61	Pucheng	Shaanxi	1320	330 x 2 *330 x 2	16.67 16.67	537/537 537/537	Coal
62	Weihe	Shaanxi	1300	300 x 4	16.67	537/537	Coal
63	Baoji No.2	Shaanxi	1200	300 x 4	16.67	537/537	Coal
64	Qinling	Shaanxi	1050	125 x 2 200 x 4	12.75 12.75	550/550 535/535	Coal
65	Jingyuan	Gansu	1400	200 x 4 300 x 2	12.75 16.70	537/537 537/537	Coal
66	Pingliang	Gansu	1200	300 x 2 *300 x 2	16.67 16.67	537/537 537/537	Coal
67	Shizuishan	Ningxia	1486	286 *300 x 4	16.67	537/537	Coal
68	Daba	Ningxia	1200	300 x 4	16.67	537/537	Coal
69	Hanchuan	Hubei	1200	300 x 4	16.67	537/537	Coal
70	Yangluo	Hubei	1200	300 x 4	16.67	537/537	Coal
71	Xiangfan	Hubei	1200	300 x 4	16.67	537/537	Coal
72	Jiaozuo	Henan	1260	200 x 6	12.75	535/535	Coal
73	Yaomeng	Henan	1170	270 x 1 300 x 1 300 x 2	16.20 16.20 17.75	550/550 550/550 540/540	Coal
74	Shouyangshan	Henan	1020	210 x 2 300 x 2	12.75 16.67	535/535 537/537	Coal
75	Fengcheng	Jiangxi	1200	300 x 4	16.67	537/537	Coal
76	Shajiao C	Guangdong	1980	660 x 3	16.80	540/540	Coal
77	Zhuhai	Guangdong	1320	660 x 2	16.80	540/540	Coal
78	Shajiao A	Guangdong	1200	200 x 3 300 x 2	12.75 16.67	535/535 537/537	Coal
79	Zhujiang	Guangdong	1200	300 x 4	16.67	537/537	Coal
80	Mawan	Guangdong	1200	300 x 4	16.67	537/537	Coal
81	Zhanjiang	Guangdong	1200	400 x 3	16.67	537/537	Coal
82	Huangpu	Guangdong	1100	125 x 4 300 x 2	12.75 16.20	550/550 535/535	Coal,Oil
83	Anshun	Guizhou	1200	300 x 2 *300 x 2	16.67	537/537 537/537	Coal
84	Qianbei	Guizhou	1200	*300 x 4	16.67	537/537	Coal
85	Nayong	Guizhou	1200	*300 x 4	16.67	537/537	Coal
86	Qujing	Yunnan	1200	300 x 2 *300 x 2	16.67 16.67	537/537 537/537	Coal
	Nuclear Power Plant						
87	Tianwan	Jiangsu	2000	*1000 x 2	PWR		Nuclear
88	Daya Bay	Guangdong	1800	900 x 2	PWR		Nuclear
89	Ling'ao	Guangdong	1800	*900 x 2	PWR		Nuclear
90	Qinshan No.3	Zhejiang	1400	*700 x 2	CANDU		Nuclear
91	Qinshan No.2	Zhejiang	1200	*600 x 2	PWR		Nuclear

*Unit under construction

Table 3 1997～2001 averaged reliability indices of thermal units with single capacity of 100 MW and above

100	1.3	62.67	92.22	0.96	1.06
125	1.87	72.32	92.1	1.09	1.28
200	2.26	112.17	89.59	1.67	1.92
300	3.78	145.7	89.27	2.23	2.5
330	6.74	396.22	85.31	6.02	6.2
350	3.43	107.58	90.34	1.5	1.65
500	3.37	351.31	83.82	5.07	5.46
600	5.3	265.12	85.83	3.76	4
660	12.99	942.86	75.44	12.08	15.6

1.1 Hydropower

In 2001, remarkable progress was obtained for hydropower construction in China. As of the end of 2001, the installed capacity of hydropower reached 83,010 MW in China mainland, ranking first in the world. The hydropower generating units under construction and planning outnumbered 30,000 MW and 50,000 MW in capacity respectively. They also occupied the first place in the world. Table 4 shows the large-sized hydropower plants with a single installed capacity of 1000 MW and above in operation as of December 31, 2001.

The generating unit of Suizhong Thermal Power Plant (2 × 800 MW) in installation and trial operation, Liaoning

● Projects scale under construction and commissioned

In 2001, SP invested hydropower projects under construction totaled 5127 MW including Songjinghe (350 MW) in Jilin Province, Mianhuatan (600 MW) in Fujian Province, Hongjiang (225 MW) and Wanmipo (240 MW) in Hunan Province, Tuolin (240 MW) in Jiangxi Province, Nanyahe (372 MW) in Sichuan Province, Hongjiadu (600 MW) and Yinzidu (360 MW), as well as the extension project of Wujiang (600 MW) in Guizhou Province, Dachaoshan (1350 MW) in Yunnan Province and Xiaoguanzi (80 MW) and Lengzhuguan (110 MW) belonged to Huaneng Corporation.

In 2001, the construction of the Three Gorges Project progressed rapidly in flood discharging dam section, left bank power-house and its dam section, and permanent ship-lock etc. The completed quantities of construction and investment are listed in Table 5.

2780 MW hydropower units were newly put into operation in China in 2001. These mainly included Dachaoshan (1 × 225 MW) in Yunnan, Xiaolangdi (3 × 300 MW) in Henan, Zhelin (1 × 120 MW, extension project) in Jiangxi, Mianhuatan (4 × 150 MW) in

Table 4 Large hydropower stations (1000 MW and above)
as of December 31, 2001

1	Three Gorges	Yangtze River	Chongqing		39.3	G	181			*700 x 26	84.7
2	Gezhouba	Yangtze River	Hubei	1981-1988		BA	47	18.61	4300	170 x 2 125 x 19	16.222
3	Xiaolangdi	Yellow River	Henan	2000-	12.65	R	154	112	1342	300 x 6	5.85
4	Lijiaxia	Yellow River	Qinghai	1997-1999	79.38	G	155	120	416	400 x 4	5.053
5	Gongboxia	Yellow River	Qinghai		0.62	G	127	99.3	717	*300 x 5	5.14
6	Liujiaxia	Yellow River	Gansu	1969-1974	4.15	G	147	100	877	255 x 2 260 x 2 320 x 1	4.863
7	Longyangxia	Yellow River	Qinghai	1987-1989	76.84	AG	178	120	440	320 x 4	5.072
8	Wanjiazhai	Yellow River	Inner Mongolia Shanxi	1998-2000	0.896	G	90			180 x 6	1.464
9	Xiaowan	Lancang	Yunnan		15.13	A	292	204	1210	700 x 6	19.06
10	Dachaoshan	Lancang	Yunnan	1997-	0.94	G	111		133	225 x 2 *225 x 4	5.93
11	Manwan	Lancang	Yunnan	1993-1995	0.26	G	128	83.5	1200	250 x 5	5.718
12	Longtan I	Hongshui	Guangxi		16.21	G	192		1460	*600 x 7	15.67
13	Yantan	Hongshui	Guangxi	1992-1995	1.53	G	111	55.5	1760	302.5 x 4	5.632
14	Ertan	Yalong	Sichuan	1998-1999	3.37	A	240	155	1670	550 x 6	8.385
15	Tiansheng-qiao II	Nanpan	Guizhou Guangxi	1992-2000	0.018	G	58.7	176	615	220 x 6	5.934
16	Tiansheng-qiao I	Nanpan	Guizhou Guangxi	1998-2000	6.701	R	180	110	612	300 x 4	3.645
17	Baishan	Songhua	Jilin	1983-1991	3.54	AG	149.5	110	239	300 x 5	1.786
18	Fengman	Songhua	Jilin	1943-1998						1002.5	0.88
19	Shuikou	Minjiang	Fujian	1993-1996	0.7	G	101	43.5	1728	200 x 7	2.04
20	Wuqiangxi	Yuanshui	Hunan	1994-1996	2.02	G	87.5	42	2050	240 x 5	4.969
21	Geheyan	Qingjiang	Hubei	1993-1994	2.2	AG	151	99	390	300 x 4	2.506
22	Guangzhou Pumped Storage	Tributary of Liuxi River	Guangdong	1994-2000	0.01/0.01 (U/D)	R	68/34 (U/D)	523/542 (G/P)	222/273 (G/P)	300 x 8	2.958
23	Tianhuangping Pumped Storage		Zhejiang	1998-2000		ER/S (U/D)	73 92			300 x 6	1.451

Notes: U / D-upper reservoir / downstream reservoir
Dam type: G-gravity dam; BA-barrage; A-arch dam; AG-archgravity dam; R-rockfill dam; ER-earth and rockfill Dam; S-slab dam.
*Unit under construction

Liujiaxia Hydropower Station (1350 MW) after uprating and retrofit, Gansu

Fujian, Nanyahe (3 × 44 MW) in Sichuan, as well as Xiaoguanzi (1 × 40 MW) and Lengzhuguan (1 × 60 MW) of Huaneng Corporation etc.

● Priorities on hydropower development and construction shifted to the western regions

Among the power sources projects newly started in 2001, the projects in the western region amounted to 12,510 MW, accounted for 72% of the nation's total. Furthermore, 7260 MW were of hydropower projects, occupying 42%. These include some key projects such as Longtan Phase I (4200 MW) in Guangxi, Gongboxia (1500 MW) in Qinghai and Futang (360 MW) in Sichuan, which are detailed as follows.

(1) Longtan Hydropower Station Phase I

Longtan Hydropower Station is located in Tian'e County of Guangxi Province, on the upper reaches of Hongshui River and is 15 km upstream to the town. It is one of the key stations in cascade development of Hongshui River, and is featured better regulation, better comprehensive benefit, as well as better economic indexes in the hydropower resources development of Hongshui River. Longtan Hydropower Station is planned to develop in two phases with a total capacity of 9600 MW and a total construction period of 9 years.

The phase I project is constructed with a total storage of 16.21 billion cubic meters with the ability of

Table 5 The completed quantities of construction and investment of the Three Gorges Project,1984~2001

Earth-rock excavation (10^6m^3)	0	92.68	15.02	52.01	5.73	5.87	124.5
Earth-rock filling (10^6m^3)	0	21.61	2.65	2.29	4.41	3.31	34.27
Concrete placement (10^6m^3)	0	3.491	11.91	4.585	5.482	4.06	29.528
Metal structure (10^3t)	0	0.8	0	7.20	22.6	58.10	88.70
Grouting works (10^3m)	0	39.3	58.8	89.6	104.9	159.3	451.9
In-plant road (km)	12.0	49.48	0	0	0	0	61.48
Building construction (10^6m^3)	79.0	329.50	0	0	0	0	406.5
Investment (10^6yuan)	745.6	25,551.60	9,002.93	11,273.45	12,532.93	14,034.59	73,141.1

carry-over storage. The dam is a roller compacted concrete one with a maximum height of 192 m. The station will install 7 Francis turbines with a single unit capacity of 600 MW and a total installed capacity of 4200 MW. The total dynamic investment of the project will be 24,697 million yuan.

Longtan Hydropower Development Co. Ltd. is responsible for the construction, operation and business management of the project. The project was started to construct on July 1, 2001, and based on a reasonable schedule, its first unit will start to generate electricity in 2007 and the rest units will be commissioned in 2009. Longtan Hydropower Development Co. Ltd. was formally established in December 1999 and jointly invested by SP (33%), Guangxi Power Corporation (32%), Guangxi Investment Company (30%) and Guizhou Investment Company (5%).

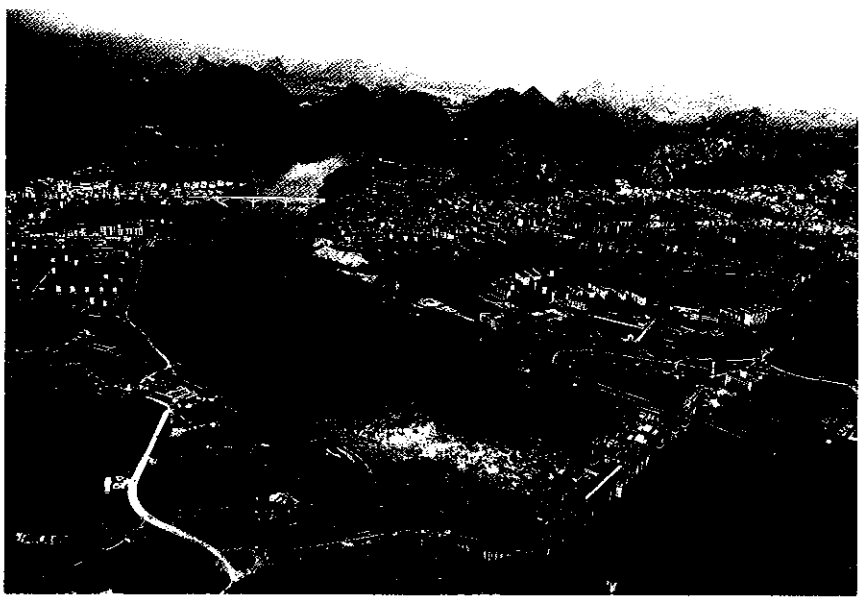
(2) Gongboxia Hydropower Station

Gongboxia Hydropower Station is located at the boundary between Xunhua Sala Autonomous County and Hualong Hui Autonomous County of Qinghai Province, 153 km to the capital city — Xining. Sited in a minority region, the development of Gongboxia Hydropower Station is of special importance to realizing the strategies of sustainable development and western region development.

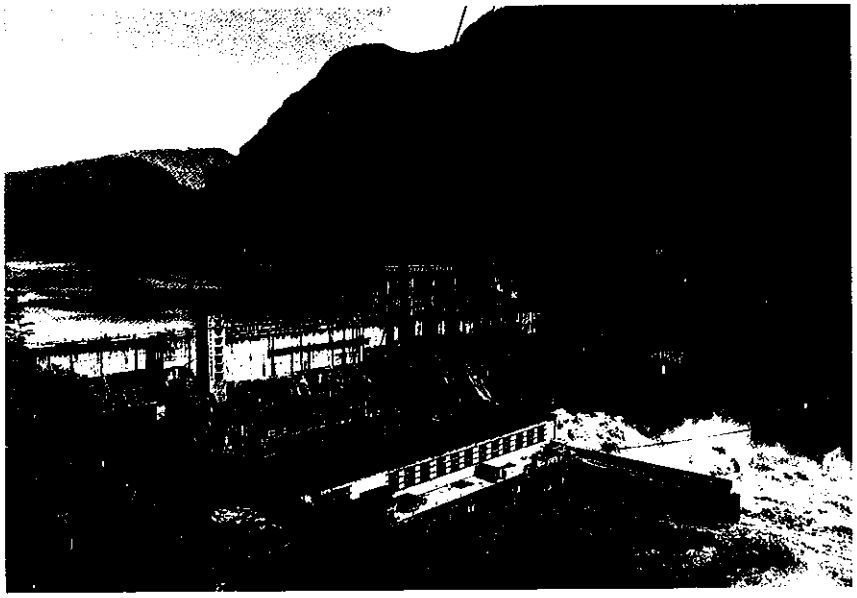
The station is regulative with a total storage capacity of 620 million cubic meters. The dam is a rock-fill one with concrete facing. Its maximum dam height is 139 m. The station will install 5 Francis turbines with total installed capacity of 1500 MW. The total dynamic investment of the project will be 6257 million yuan. The station was started to construct in August 2001. The construction period for the whole project is 6 and a half years and its first unit is scheduled to finish within four and a half years.

The construction, operation and management of Gongboxia Hydropower Station is charged by Huanghe Upstream Hydropower Development Co. Ltd, which was founded on October 28, 1999 by 10 stock holders including SP (26.5%), SP Northwest Power Company (35%), Qinghai Power Company (21.1%), Shaanxi, Gansu and Ningxia power companies (1.5% each), Shaanxi and Gansu power construction and investment companies (3.9% each), Qinghai Power Investment Company (4.0%), as well as Ningxia Power Development & Investment Company (1.1%).

When establishing Huanghe Upstream Hydropower Development Co. Ltd, Longyangxia (1280 MW) and Lijiaxia (1600 MW) hydropower stations which had been already built up were incorporated entirely into the Company as mother stations for the rolling development of hydropower resources in Longqing Section of upper reaches of Yellow River. Presently, the Company is constructing Gongboxia Hydropower Station, and is proceeding simultaneously with the pre-engineering works of Laxiwa Hydropower Station



Dahua Hydropower Station (4 × 100 MW), Guangxi



Gongzui Hydropower Station built on Dadu River

(4200 MW) and Suzhi Hydropower Station (210 MW).

(3) Futang Hydropower Station

Futang Hydropower Station is sited in Wenchuan County, Aba Prefecture, Sichuan Province. The construction of the station is significant for accelerating the people in Aba to get well off and prompting the economic development in Aba minority region.

The station is of diversion type installed with 4 × 90 MW Francis turbines. Its total dynamic investment will reach 1945 million yuan. The station was started to construct in early 2001 and expected to finish in 2005.

Futang Hydropower Station will be built, operated, and managed by Sichuan Futang Hydropower Co. Ltd, which is established and invested by Sichuan Aba Hydropower Development General Corporation (50%), Sichuan Langjiu Winery Group Corp. Ltd. (20%), Sichuan Chengdu Quanxing Group Co. Ltd. (15%) and SP Chengdu Investigation and Design Institute (5%).

● Emphasizing the construction of pumped storage stations

To alter the situations of weak peaking ability and big peak to valley difference in the power system, construction of pumped storage stations have been enhanced in China. According to the investigations, the pumped storage resources are rich enough to meet the requirements of power sources allocation. Except for Shanghai, all the twenty-two provinces, municipalities and autonomous regions have certain potentialities of this kind. Presently, nearly 247 sites for pumped storage stations have been investigated in the whole country, with a scale of 310,000 MW.

By the end of 2001, eleven pumped storage stations with an aggregate capacity of 5700 MW had been built up in China. Among these, there are four large ones including Guangdong Pumped Storage Hydropower Station (2400 MW), Zhejiang Tianhuangping (1800 MW), Beijing's Shisanling (800 MW) and Hebei's Panjiakou (270 MW), and five medium ones, of which Hubei's Tiantanghe Pumped Storage Hydropower Station (2 × 35 MW) was put into operation on May 26, 2001 with a total investment of 390 million yuan.

● Some considerations on hydropower development

In light of power industry development emphases and arrangements, hydropower construction will mainly focus on large hydropower stations with better regulating performance and hydro-energy indexes as well as medium and small stations based on local conditions. Key hydropower stations should be developed combining cascade development of river basins. The river basins—the upper reaches of Yellow River, the trunk stream and tributaries on middle and upper reaches of Changjiang River, Hongshui River, the middle and lower reaches of Lancang River as well as Wujiang River etc. will be emphatically developed. Hydropower development in western region and minority region should be supported

and speeded up so as to boost vigorously the strategies of "sending power from west to east" and "developing western region". In regions that are short of coal and rich in hydro-energy like Central China, Fujian, Zhejiang, Sichuan and etc., a batch of medium and small rivers on which stations to be built could have better regulating performance and generate high-quality electricity will be chosen to proceed with cascade development. In power networks short of peaking ability and with big peak to valley difference, pumped storage stations will reasonably be built on right sites on the basis of enhancing the peaking duty of the systems.

Nuclear Power

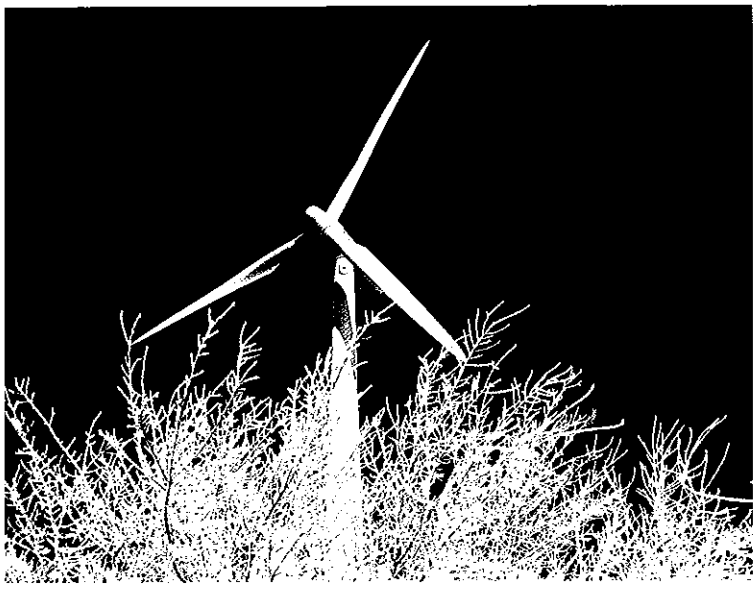
As of the end of 2001, there were two nuclear power plants in China, i.e., Qinshan Phase I and Daya Bay in commission. The combined installed capacity and annual electricity generation were 2100 MW and 17.47 TWh respectively. The Qinshan Nuclear Power Plant Phase I is equipped with a domestic made 300 MW unit (PWR). In 2001 its annual production reached 2.47 TWh and the plant's load factor was 94.05%. Daya Bay Nuclear Power Plant is equipped with 2 × 900 MW units (PWR). In 2001 its yearly electricity generation was over 15 TWh and the electricity sent to power network amounted to 14.365 TWh, of which 10.055 TWh to Hong Kong. The plant's availability factor was 89.5%, and load factor 87.0%. Since its commissioning, a repayment of capital construction loans accumulated to USD 4303 million, accounting for 80.5% of the total repayable principal with interest. Currently, Daya Bay Nuclear Power Plant came up to advanced world standards in safe operation.

At present there are various nuclear projects under construction, such as Qinshan phase II and III projects, Ling'ao Project and Tianwan Project.

Qinshan Phase II Project involves two 600 MW generating units, PWR, independently manufactured and constructed by China. In June 1996 the main body project started to construct. By the end of 2001, the first unit had passed the hydraulic pressure test of primary circuit, the strength and sealing performance tests of containment and others. It achieved critical targets for the first time and on February 6, 2002 went into operation. The second unit will be put into commercial commission in June 2004 on schedule.

Qinshan Phase III Project is a turnkey project built by China in cooperation with Canada; the designed capacity is 1400 MW (two 700 MW units, Candu). From starting construction to the end of 2001, the

Turbine installation in Daya Bay Nuclear Power Plant (2 × 900 MW), Guangdong



Tongyu Wind Farm, Jilin

project had altogether completed an investment of 16,750 million yuan, which represented 70% of the approximate sum.

Ling'ao Project Phase I has a designed capacity of 2 × 900 MW, PWR. The first unit carried out fuel loading on December 8, 2001 and put into commercial operation on May 28, 2002 in advance of the schedule. It is estimated that the second unit will be put into commercial commission in 2003. The percentage of domestically manufactured equipment stood at 30%, in which the nuclear island 11%, the conventional island 23%, BOP 50%. The localization has been entirely brought about in all respects of civil works, installation, commissioning and operation.

Tianwan Nuclear Power Plant has a designed capacity of 2 × 1000 MW, PWR. As of the end of 2001, the internal structure of reactor building for the first unit had been built up on the whole. On November 14, 2001, its containment has been roofed smoothly. For the first unit the civil works of turbine house have been completed basically. For the second unit the reactor building and turbine house are under construction. It is planned that these two generating units will go into operation in 2004 and 2005 respectively.

Wind Power

China has exploitable wind energy reserves of 253 GW. And the wind power made great strides forward in the country. In the period of 1990～2001, its nationwide installed capacity was increased from 41 MW to 399.3 MW, with an annual growth rate of over 20%, becoming part of China power industry. Currently, Inner Mongolia, Xinjiang, Liaoning, Gansu, Guangdong and Fujian regions/provinces all put forward their own willingness or planning on developing wind power. Among them Inner Mongolia has now planned to build up 100 MW Huitengxile Wind Power Farm and to be preferentially equipped with homemade generating units.

Major Targets of Power Sources Construction for 2002

Taking a structure readjustment as principal line, the power sources restructuring will be continuously promoted in 2002. For this reason, it is necessary to improve the rolling development of river basins for hydropower, give impetus to the pre-engineering work of north Shaanxi's coal-power base, speed up the construction preparation works of large mine-mouth power plants and hydropower projects in China's southwest and northwest areas, appropriately develop nuclear power and new energy power, etc.

The major targets for power sources construction in the year 2002 are as follows:

— An investment of 129.3 billion yuan in power fixed assets will be made, in which, money invested in power sources construction amounts to 43.8 billion yuan;

— Power source projects will be started for 15,000~20,000 MW;

— An installed generating capacity of 8290 MW will be put into commission;

— Small thermal power units with a combined capacity of 1040 MW shall be closed and removed.

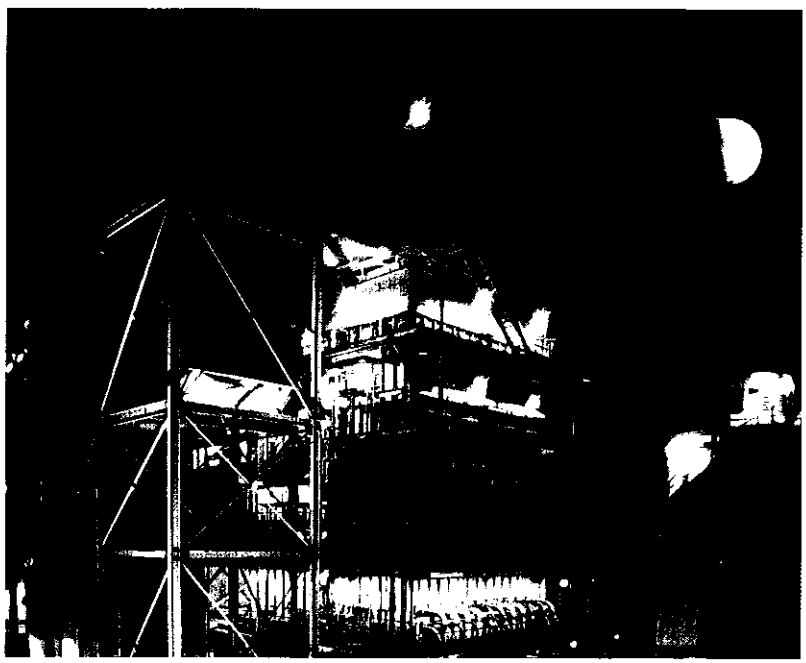
Environmental Protection

● Encouraging advances in 2001

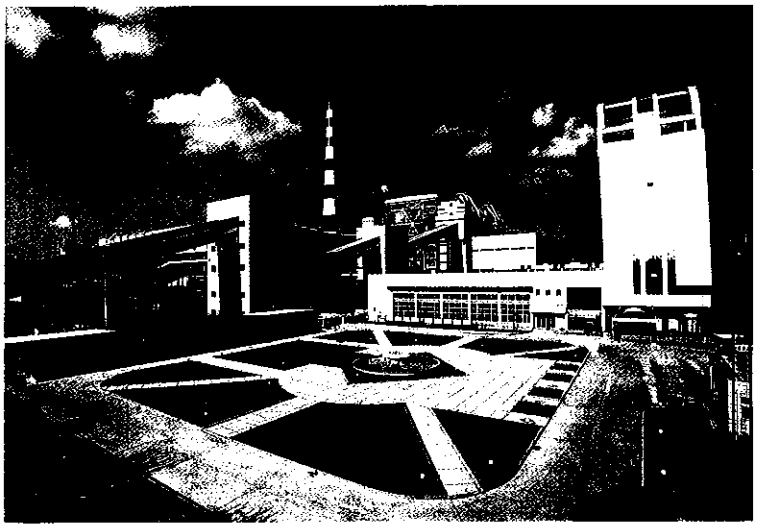
In accordance with the basic principles of the revised *Law on Prevention and Control of Atmospheric Pollution*, which had been put into force on September 1, 2000, the State Council and other governmental departments came to grips with the establishment (revision) of some relevant regulations concerned in 2001. They were the measures for aggregate emission control of atmospheric pollutants, the standard of pollutants emission of thermal power plants, the technical policies of prevention and control of SO_2 emission, the charging method for pollutants emission. They provided more and more stringent requirements for the environmental protection of power industry, especially SO_2 emission control. The state's 10th Five-year Plan of Environmental Protection was also drawn up and issued last year.

The State Power Corporation of China (SP) also devotes much attention to the environmental protection work all along. In the fourth quarter of 2001, the corporation commenced in particular a trial implementation of planned management of four environmental indicators. Those were an up-to-the-standard rate of smoke dust discharge, an up-to-the-standard rate of wastewater discharge, a specific (per kWh) SO_2 emission and an execution rate of completion acceptance of environmental protection projects. As a result the up-to-the-standard rate of smoke dust and wastewater discharge was stable with a slight rise by comparison to that of 2000. The rate of smoke dust and wastewater reached 98.2% and 97.3% respectively. The specific SO_2 emission stood at 7 g/kWh. The execution rate of completion acceptance was 100%.

It should be noted that the desulfurization projects made great strides forward in 2001. In terms of generating capacity newly commissioned desulfurization projects reached 325 MW, under-construction projects 400 MW, bid-invited projects 600 MW, and feasibility-studied projects 1200 MW. From 1997 (prior to setting up of SP) to 2001 a thermal power capacity of SP system was increased by 252 GW, but the SO_2 emission was decreased by 0.7 Mt, the specific SO_2 emission was cut down by 20%. As of the end of 2001 the nationwide installed capacity with desulfurization facilities commissioned and under construction (including CFBC projects) amounted to 130 GW, in which the SP's accounted for about 75%. Significant success was achieved in the localization of desulfurization equipment for larger generating units. Enterprises under the jurisdiction of the State Power Corporation are already capable of constructing large FGD projects. Their



Night scene of the FGD equipment in Huaneng Luohuang Power Plant (4 × 360 MW)



The first FGD demonstration plant—Nanjing Xiaguan Power Plant

construction costs were decreased to about 600 yuan/kWh being half as much as that of the projects contracted by foreign companies. This furnished a technical guarantee to launch FGD projects on a big scale. Furthermore, the utilization rate of wastewater went up to 50%, the comprehensive utilization rate of pulverized coal ash up to 55%. The growing trend of NOx emission was restrained by means of low-NOx combustion. In 2001 the State Power Corporation and its subordinated enterprises have finalized the environmental impact reports of 17 thermal power, 15 hydropower and 2 T&D projects, and submitted soil conservation schemes to competent departments for approval under legal process. In power construction the principles of laying equal stress on development and protection was upheld; great attention was paid to soil conservation and ecological protection.

● Targets of the 10th Five-Year Plan

To Response to the state's overall requirements for the power environmental protection focusing on lessening SO_2 emission, SP has set the targets of environmental protection for 2001～2005, and will give a top priority to solve environmental protection questions in key regions and cities.

The end of 2005 should control the aggregate smoke dust discharge below 1.6 Mt from thermal power plants. It is to be accomplished that "the production is increased, but the smoke dust discharge is not increased". The specific discharge will reach 2.4 g/kWh, decreasing by 17% as compared to that of 2000.

By the end of 2005 the installed capacity with desulfurization facilities to be commissioned and under construction will amount to 18 GW. The total SO_2 emission from thermal power plants should be controlled to the level of 3.85 Mt decreasing by 10.4% in comparison to that of 2000. The specific SO_2 emission will be 5.8 g/kWh falling 25% as compared with that of 2000. It is a critical measure and key task to control SO_2 emission that the generating units to newly be built and the existing ones in the key areas should be fitted with desulfurization equipment.

The reclamation rate of wastewater should reach over 60%, 10 percentage points higher than that of 2000. The comprehensively utilized quantity of pulverized coal ash and by-products from desulfurization should swell to 67 Mt a year. All filled ash yards should anew be reclaimed or planted. It is stipulated that any power project has to strengthen an ecological protection and prevent soil erosion.

The plan of power industry restructure has put forward that it is necessary to lay down a standard of conversion into money on pollutants emission from electricity generation and improve real-time monitoring and controlling systems for environmental protection. This will promote clean production of more electric energy and its precedent supply to power networks. The environmental protection facing generation and network enterprises is an arduous task. Therefore, the power enterprises must vigorously investigate new characteristics of the environmental protection of power industry under the current situation. It is an important problem to be solved.

Power Networks

Through joint efforts from associated departments, in particular by meticulous power dispatching on different levels, power networks in China achieved great progress in 2001. In all power networks, there have been no instability fault, system splitting fault and vast area blackout fault happened for 5 years running, with the national targets remarkably accomplished.

■ Scale of Power Networks by the End of 2001

● Installed generating capacity

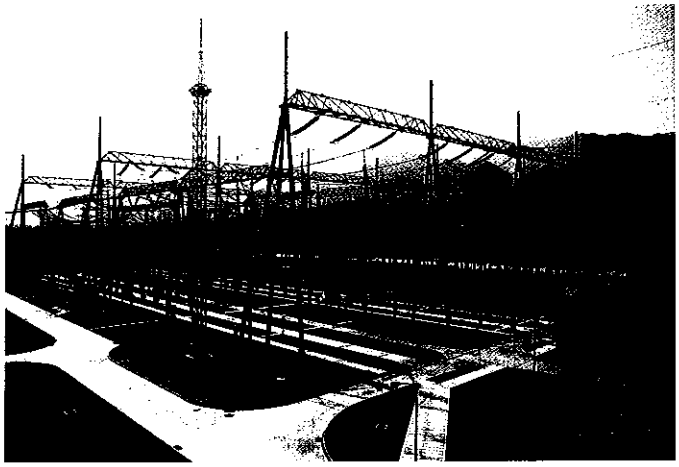
As of the end of 2001, the national total installed generating capacity amounted to 338,611.9 MW, it was 6.04% higher than the previous year. Among the total capacity, thermal power amounted to 253,137.0 MW, hydropower 83,006.4 MW and nuclear power 2100.0 MW.

● Transmission and substation equipment

As of the end of 2001, the national total substation capacity on 220 kV and above amounted to 472.840 GVA, in which 500 kV 117.310 GVA, 330 kV 15.270 GVA. The total length of transmission lines on 220 kV and above amounted to 176,598 km, in which 500 kV 31,486 km, 330 kV 9177 km. In addition, the length of 500 kV DC lines amounted to 2005 km, with the converter station capacity of 3.816 GVA.

Table 1 Circuit length of transmission lines (35 kV and above) by the end of 2001

North China	106,304	4,031		20,183	32,134
Northeast China	88,628	5,011		22,126	5,661
East China	103,751	6,737		21,123	26,707
Central China	133,729	4,397	71	24,242	42,210
Northwest China	62,765		9,107	3,319	22,869
Shandong	46,086	1,318		9,244	11,945
Fujian	22,368	746		3,953	7,181
Guangdong	39,024	2,079		8,167	16,728
Guangxi	30,228	558		4,433	7,425
Chongqing	10,415	439		1,783	3,345
Sichuan	47,986	1,956		7,023	14,164
Yunnan	33,967	688		4,036	10,534
Guizhou	23,398	353		3,525	8,070
Hainan	4,268			570	1,738
Xinjiang	24,624			2,079	8,914
Xizang	1,010				427
Trans-regional	3,303	3,174		129	
Total	781,854	31,488	9,177	135,935	220,051



500 kV Wanxian Substation, started to build in Feb. 2001 and commissioned in Dec. 2001, Chongqing

● Transmission line and substation capacity newly added in 2001

The newly added substation capacity on 220 kV and above amounted to 57.95 GVA, or 13.96% higher than the previous year, of which 22.84 GVA on 500 kV, or 24.18% higher than the previous year. The transmission lines on 220 kV and above newly added in this year totaled 12,978 km, or 7.9% longer, of which 4649 km on 500 kV, or 17.3% longer than the previous year.

● Analyses on power network scale

By the end of 2001, the total installed capacity in China reached 338.612 GW. The ratio between generation capacity and substation (220 kV and above) capacity was 1:1.396, and the ratio between generation capacity and transmission line (220 kV and above) was 1 MW:0.5215 km. The evolution of ratios between generation capacity, transmission and substation from 1998 to 2001 are shown in Figure1.

From the generation capacity newly added in 2001, it can be seen that the growth of transmission and substation equipment on 220 kV and above has kept synchronous growth with that of the geneation capacity.

Construction of 500 kV network projects made significant progress in 2001. There were 48 lines newly added and upgraded in 2001, which obviously improved 500 kV network configurations.

■ Power Generation Analyses

● Electricity generation in 2001

The nation's total accumulated electricity generation was 1483.9 TWh in 2001, it was 8.43% higher than 2000, accomplished. Among total generation, thermal power accumulated 1204.5 TWh, or 8.71% higher, hydro-electricity accumulated 261.1 TWh, or 7.39% higher and nuclear electricity accumulated 17.5 TWh

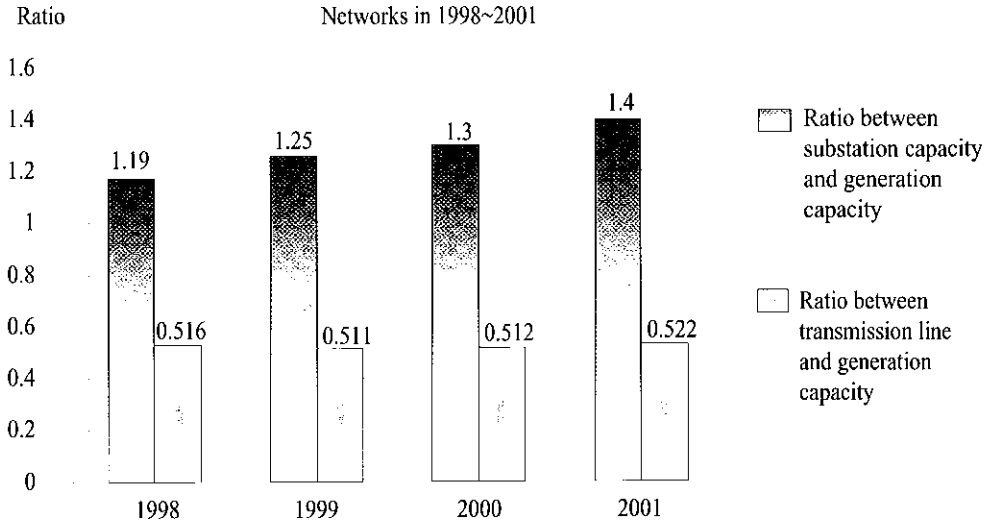


Figure 1 Ratios between transmission line or substation capacity (220 kV and above) and generation capacity

in 2001, or 4.39% higher than the previous year.

From monthly generation as shown in Figure 2, the trends of monthly generation in recent 3 years are basically coincident and steadily increased, but the growth rates have been slowed down. The summer and winter peaks are about on equal level.

● Power exchange between provinces in main power networks in 2001

North China Power Network Due to the commissioning of Weixian 500 kV series compensation station and Feng–Wan 500 kV No.2 line, transmitting capacity from Shanxi Province and west Inner Mongolia to east part of North China has been greatly increased. But the actual energy transmitted in 2001 was kept on about the same level with 2000. The net electricity imported from Northeast Power Network to Beijing–Tianjin–Tangshan Area was greatly increased (9.929 TWh), which was benefited by the interconnection between the two power networks.

East China Power Network The East China Power Network, consisting of three provincial and a municipal power grids, has its load increased rapidly, which has caused active power interchange among provincial grids. The Anhui Provincial Power Grid rich with thermal power has sent a large amount of thermal energy to Shanghai and Zhejiang areas, where lack of energy resources. The commissioning of multiple units in Yangcheng Power Plant in Shanxi Province and the link between Shanxi and Jiangsu have further relieved the tense of energy supply in East China Power Network.

Central China Power Network In 2001, electric energy interchange within Central China Power Network amounted to 5.164 TWh, it was a little decrease than in 2000. Because of coal shortage and dry weather, Central China Power Network appeared again tense in power supply. Since December 2000, Hubei, Hunan and

Table 2 High voltage transformer capacity by the end of 2001

Power network/grid	Transformer capacity 35 kV & above (MVA)	In which 500 kV			In which 220 kV		
		Nos. of substations	Nos. of transformers	Capacity (MVA)	Nos. of substations	Nos. of transformers	Capacity (MVA)
North China	178,170	15	55	17,280	222	428	57,200
Northeast China	115,630	15	65	16,750	207	354	38,870
East China	242,280	19	63	25,940	329	587	77,660
Central China	150,040	13	54	13,280	233	377	47,770
Northwest China	73,750				46	97	10,120
Shandong	80,010	7	27	5,750	121	186	24,480
Fujian	29,110	3	3	2,400	40	69	9,540
Guangdong	107,720	10	20	15,000	119	238	36,480
Guangxi	21,760	2	3	2,000	38	62	6,760
Chongqing	17,490	3	4	3,000	27	41	5,440
Sichuan	43,500	2	3	2,250	58	92	11,010
Yunnan	24,590	2	10	2,500	34	76	8,160
Guizhou	21,060				26	61	5,880
Hainan	3,410				5	7	900
Xinjiang	10,140				12	19	2,140
Xizang	290						
Trans-regional	8,910	8	39	8,910			
Total	1,117,710	102	349	117,310	1,505	2,675	340,260

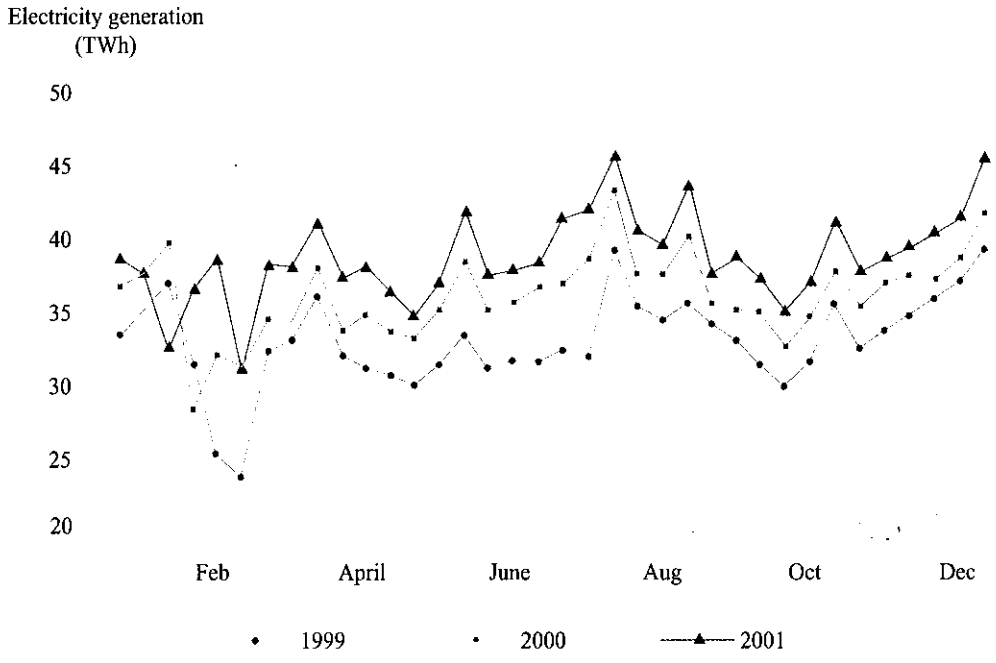


Figure 2 Nation's total electricity generation changes by month in 1999~2001

Table 3 Length of transmission line by the end of 2001

(km)

Pole length	330,763	49,227	214,380	129,878	9,177	30,794	764,219
Circuit length	332,795	52,411	220,051	135,935	9,177	31,486	781,854

Table 4 High voltage transformer capacity by the end of 2001 (35 kV & above)

Nos. of substations	24,596	3,019	7,675	1,505	41	102	36,938
Nos. of transformers	45,134	5,183	13,609	2,675	75	349	67,025
Capacity (MVA)	194,470	48,030	402,380	340,260	15,270	117,310	1,117,710

Table 5 Length of transmission line under SP by the end of 2001

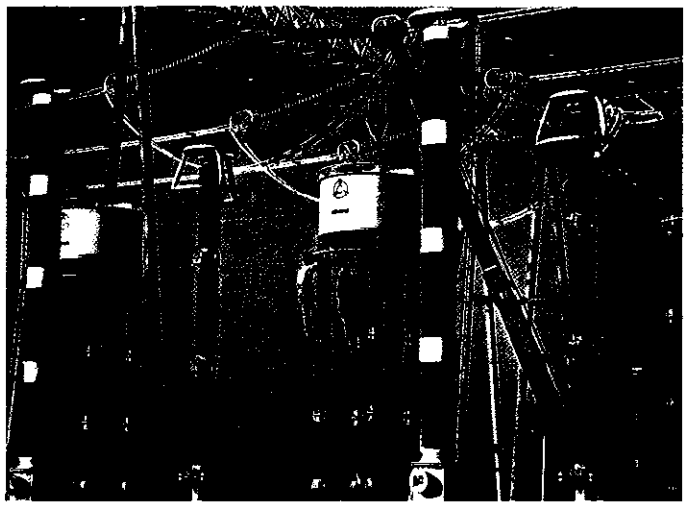
(km)

Pole length	122,081	21,764	150,988	117,843	9,177	29,554	451,406
Circuit length	124,083	24,739	155,244	123,358	9,177	30,203	466,804

Table 6 High voltage transformer capacity under SP by the end of 2001 (35 kV & above)

Nos. of substations	7,686	773	4,828	1,307	41	105	14,717
Nos. of transformers	13,805	1,298	8,505	2,277	75	350	26,275
Capacity (MVA)	77,950	23,540	261,590	290,660	15,270	94,720	761,390

Henan provinces have been forced to successive load curtailments. Under the leadership and support from SP and Central China Power Corporation, closely coordinated by the network and provincial power dispatchers, certain rational deployments of energy resources were taken within the region. The network interconnection has played active role in relief the tense supply situation, including Hubei and Hunan province received power from Jiangxi Provincial Power Grid and purchased power from East China Power Network through Ge—Shang HVDC line.



Installation of the outdoor electric equipment for Three Gorges—Wanzhou 500 kV Substation, Sichuan

Northwest China Power Network Due to the decrease in output of Longyangxia and Lijiaxia two hydropower stations, power transmitted from Qinghai Province became lesser in 2001. The electricity interchange among Shaanxi, Gansu, Ningxia and Qinghai four provinces/regions totaled 14.7 TWh, these indicated mutual supplement within the network in different seasons and different time periods by fully using mutual regulating and supplementing functions of Yellow River and Hanjiang River systems and between hydro and thermal power.

Southern Interconnected Power Network Power and electricity interchange in 2001 could be divided into two stages, i.e. from January to June, because the power purchase contract had not yet been signed, power transmission was little, basically no power was transmitted from Yunnan and Guizhou to Guangdong Province; from July to December, the power

Table 7 Net electricity interchange within East China Power Network

Province	2000 (TWh)	2001 (TWh)	Increase over the previous year (%)
Shanghai	4.491	5.627	25.30
Jiangsu	-0.213	0.046	121.60
Zhejiang	6.060	7.641	26.09
Anhui	-2.870	-5.736	-99.86

Table 8 Electricity interchange in Central China Power Network

Hubei to Henan	1.766	1.663	-5.83
Henan to Hubei	0.291	0.464	59.45
Net to Henan	1.475	1.199	-18.71
Hubei to Hunan	2.387	2.371	-0.67
Hunan to Hubei	0.025	0.021	-16.00
Net to Hunan	2.362	2.350	-0.51
Hubei to Jiangxi	0.718	0.636	-11.42
Jiangxi to Hubei	0.003	0.009	200.00
Net to Jiangxi	0.718	0.627	-12.67

Table 9 Electricity interchange in Northwest Power Network in 2001

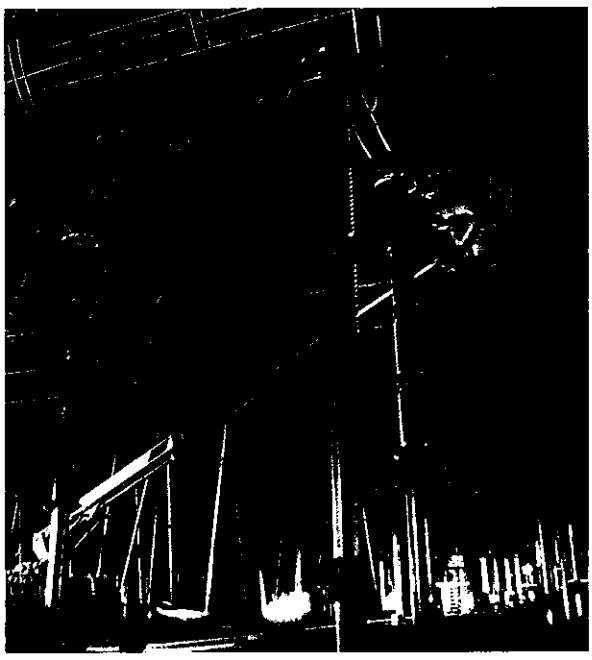
Items	Electricity exported (TWh)	Electricity purchased (TWh)	Net purchased (TWh)	Compared with the previous year (TWh)	Increase over the previous year (%)
Shaanxi	0.57	1.11	0.54	0.86	-37.6
Gansu	3.11	4.25	1.14	1.43	-20.6
Qinghai	2.79	0.23	-2.56	-2.83	-9.4
Ningxia	0.88	1.77	0.89	0.54	65.9

purchase contract had been signed, in which load curve and power price were clarified, together with the commissioning of bipolar Tian—Guang HVDC line which increases transmitting capability from west to east, the ultimate electricity transmitted to Guangdong amounted to 11.5 TWh, or 55.93% increase over the previous year. Electricity transmitted to Guangxi Autonomous Region amounted to 3.584 TWh, at about the same level with the previous year.

Sichuan-Chongqing Power Grid The net electricity transmitted from Sichuan Power Grid to Chongqing Power Grid amounted to 0.814 TWh in 2001, it was 18.84% decrease from the previous year.

■ Load Characteristics

Based on rapid growth of nationwide electricity consumption in 2001, the growth of peak load in some power networks including Northeast, Northwest, Central China and Shandong appeared lower than 7%, those having growth rate higher than 10% include only Sichuan, Chongqing, Fujian and Southern Interconnected power networks. East China, Central China, North China and Guangdong provincial power networks had their peak load appearing in summer, with the growth rates over 7%. Along with the economy recovery in some regions in the second half of 2001, the industrial consumption grew quickly, some power networks, such as Shandong, Northwest China power networks, etc. shifted their peak load to winter. Since entering into winter, the nation's total power demand increased steadily, the yearly peak load appeared in December.



Night view of 500 kV Nanning Substation, Guangxi

Peak to valley difference in main power networks as shown in Table 10 had increased to different extents, only except Northeast China and Southern Interconnected power networks, East China, Sichuan and Chongqing power networks had their peak to valley difference increase over 10%.

■ Power Energy Quality

● Frequency qualification

The nation's average frequency qualification rate reached 99.95% and higher in 2001. Along with interconnections between large power networks, peaking measures have been gradually improved, together with the introduction of market mechanism, power plants' initiatives on peaking duty have been mobilized. Most power networks have installed and practised Automatic

Generating Controls (AGC), which have further improved frequency regulation.

● Voltage qualification

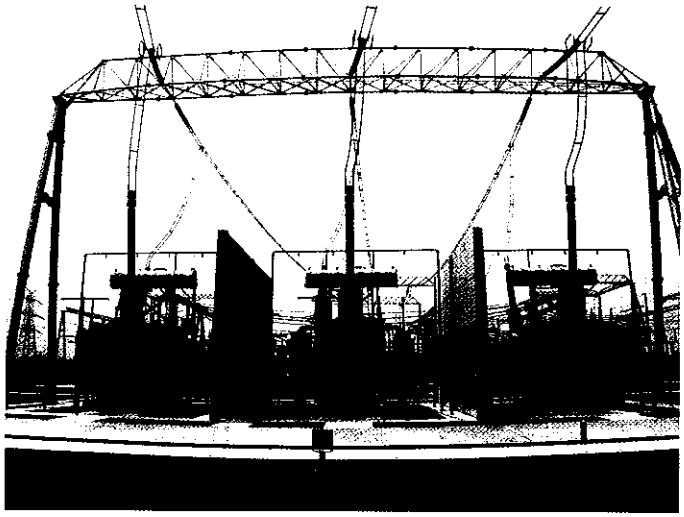
According to the reactive power management regulations, issued by the former Ministry of Electric Power, all regional and provincial power networks should keep their voltage qualification rate over 98%.

Power network dispatching centers on different levels have conducted strict operational management, monitoring and regulation, except the 8 provincial power grids have their voltage qualification rates a little decreased, all remaining power networks have somewhat improved their voltage qualification rates. However, the problem of voltage escalation during slack hours and holidays is still prominent. With the further increasing power demand, the deterioration of voltage qualification to a certain degree is expected.

■ Major Changes on Trunk Networks

The 48 lines newly built on 500 kV networks in 2001 have significantly improved configurations of main power networks.

As a result of the building-up of Jiangjiaying 500 kV Substation and Jiang–Shun 500 kV line, and through 500 kV Sui–Jiang line, the interconnection between Northeast and North China power networks has been realized. This is the first time for China to accomplish successfully the interconnection between two large regional power networks through AC link. As a result of the commissioning of Fuzhou 500 kV Switching Station and 500 kV Shui–Fu line, and through 500 kV Fu–Shuang line, the Fujian Provincial Power Grid has been integrated into East China Power Network. The commissioning of Tian–Guang 500 kV bipolar HVDC system has constituted a power transmission channel with "two AC and one DC" trunks from west to east, which symbolizes that, the



100 kVA main transformer of Chefang 500 kV Substation in Suzhou, Jiangsu

Table 10 Peak to valley difference in main power networks

Power Network	Peak load		Peak to valley difference	
	Peak (GW)	Increase (%)	Maximum (GW)	Increase (%)
North China	32.52	9.13	10.57	6.88
Northeast	21.80	0.72	8.19	-0.16
East China	42.31	7.93	16.03	16.96
Central China	27.12	6.14	10.20	6.69
Northwest	11.55	5.71	3.40	7.16
South China	30.02	12.43	12.02	-16.00
Shandong	13.867	6.50	5.36	8.55
Sichuan	7.305	15.84	3.463	10.20
Chongqing	3.412	14.50	1.388	12.39
Fujian	7.2157	14.41	2.4833	8.30

Jining Maqing Substation, Shandong

Southern Interconnected Power Network has entered into the stage of AC/DC hybrid operation. This has greatly strengthened the trunk framework and enhanced transmitting capability of Southern Interconnected Power Network from 1200 MW to 3000 MW. In Yangcheng generating-transmission system for transmitting thermal power from coal rich Shanxi Province to energy thirsty Jiangsu Province, Yang–Dong I line and Nos. 2, 3, and 4 units in Yangcheng Power Plant have been commissioned.

North China Power Network The North China Power Network is configured by the 500 kV double loop circuit around Beijing–Tianjin–Tangshan Area and separately through 2 lines connected with Shanxi Power Grid, 3 lines with south Hebei Power Grid and 2 lines with west Inner Mongolia Power Grid, forming the radial network structure.

Northeast China Power Network The Northeast China Power Network basically consists of a 500 kV double circuit channel from north to south, but now operates on 500 kV and 220 kV two voltage levels, forming electro-magnetic looping. Of which, 2 × 500 kV and 5 × 220 kV lines connect Liaoning Province with Jilin Province; 2 × 500 kV and 4 × 220 kV lines connect Jilin Province with Heilongjiang Province.

East China Power Network It consists of 2 × 500 kV and 2 × 220 kV lines from the north of Jiangsu to the main grid in south Jiangsu; 1 × 500 kV line from Anhui to Jiangsu and 1 × 500 kV line to Zhejiang; and 1 × 500 kV line from Zhejiang to Jiangsu and 2 × 500 kV lines to Shanghai, forming a triangle loop around Shanghai load center. Also the 500 kV Ge–Shang HVDC line connects East China Power Network with Central China Power Network.

Central China Power Network Central China Power Network covers Hubei, Hunan, Henan and Jiangxi 4 provincial power grids, with 2 × 500 kV lines from Henan to Hubei, 1 × 500 kV line from Hubei to Hunan and 1 × 500 kV line from Jiangxi to Hubei. It is basically a radial system centering on Hubei Power Grid.

Northwest China Power Network There are 3 × 330 kV lines connecting Shaanxi Power Grid with Gansu Power Grid, and there are 6 × 330 kV lines from Gansu to Qinghai. Other 3 × 330 kV lines connect Shaanxi Power Grid with Ningxia Power Grid.

Southern Interconnected Power Network Yunnan Power Grid connects with Guangxi Power Grid through one 220 kV line, Guizhou Power Grid connects with Guangxi Power Grid through 500 kV Tian–Gui line and Tianshengqiao I and II hydropower stations, and then through Tian–Guang bipolar HVDC lines connect with Guangdong Power Grid. The power flow directs mainly toward Guangdong Province.

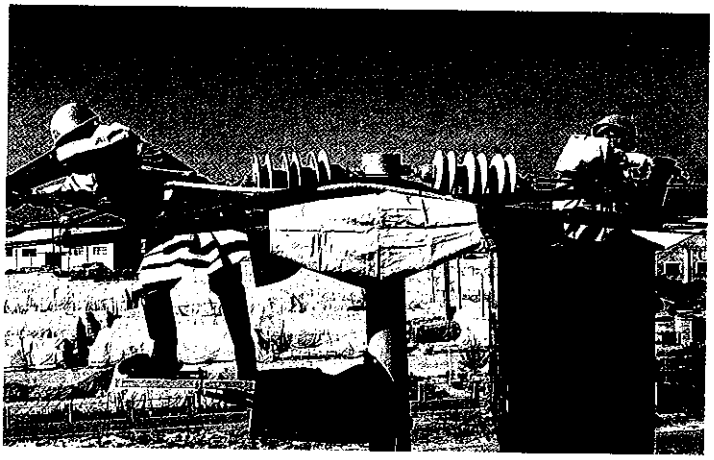
Sichuan-Chongqing Power Grid Sichuan Power Grid connects with Chongqing Power Grid through 2 × 500 kV lines and 5 × 220 kV lines, thus forming electro-magnetic loop. The Ertan Hydropower Station has 3 × 500 kV outgoing feeders connected with Chongqing Power Grid.

Shandong, Xinjiang, Hainan and Xizang are of independent power grids.

■ On Power Transmission from West to East

In respect of continuing to fight poverty in western

regions and keeping relatively balanced economic development between the east and the west, the government has given priority to and invested more funds in western regions. Particularly, the uneven distribution of energy resources, i.e. 80% of national hydropower potential and 40% of national coal reserves are in these regions, has spurred power transmission from west to east.



Maintenance of transmission line

According to the layout of the north, the central and the south three bulk power channels and in the meantime to speed up mutual supplement between the north and the south, the energy deployment is to be optimized.

(1) The North Power Channel from the coal rich Shanxi Province to Beijing–Tianjin–Tangshan load center was started in late 1970s. By the end of 2000, Shanxi had accumulatively sent out 114.5 TWh with the peak load of 1500 MW and West Inner Mongolia had accumulatively sent to 46 TWh, the peak load hit 938 MW.

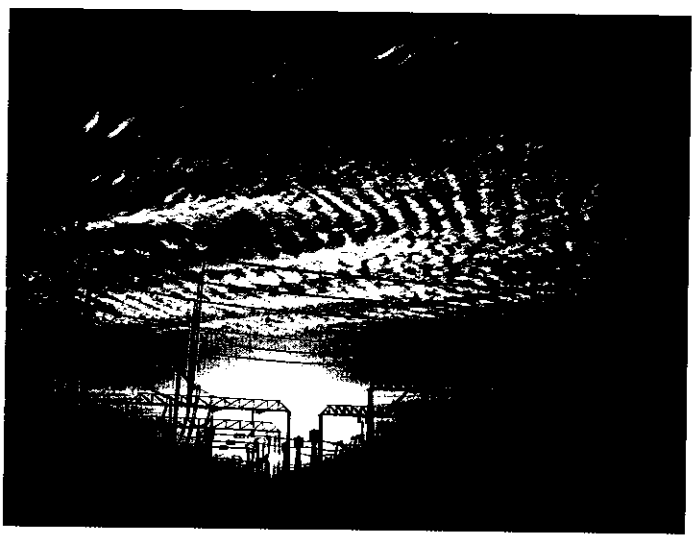
To transmit bulk hydropower from Northwest Power Network to North China Power Network, the 750 kV transmission and substation projects have been under planning, and the construction of Gongboxia Hydropower Project is now in full swing.

(2) The Central Power Channel gives its priority to the construction of Three Gorges Hydropower Station and transmission projects. In the meantime, some large hydropower projects in Sichuan Province have been started to construct for sending power to Central and East China power networks.

According to the power allocation scheme, the Three Gorges Station with a total capacity of 18.2 GW will send 7.2 GW to East China, 3.0 GW to Guangdong Province, and the balance will be consumed in the central China region.

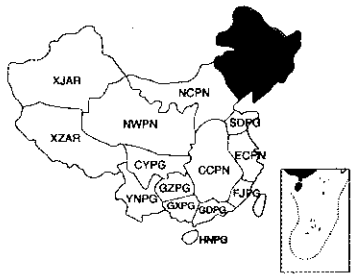
For the seasonal surplus power in Sichuan Province, a 500 kV line from Wanxian to the Three Gorges was constructed for transmitting power from the Ertan Hydropower Station to Central China, and further to Guangdong and East China.

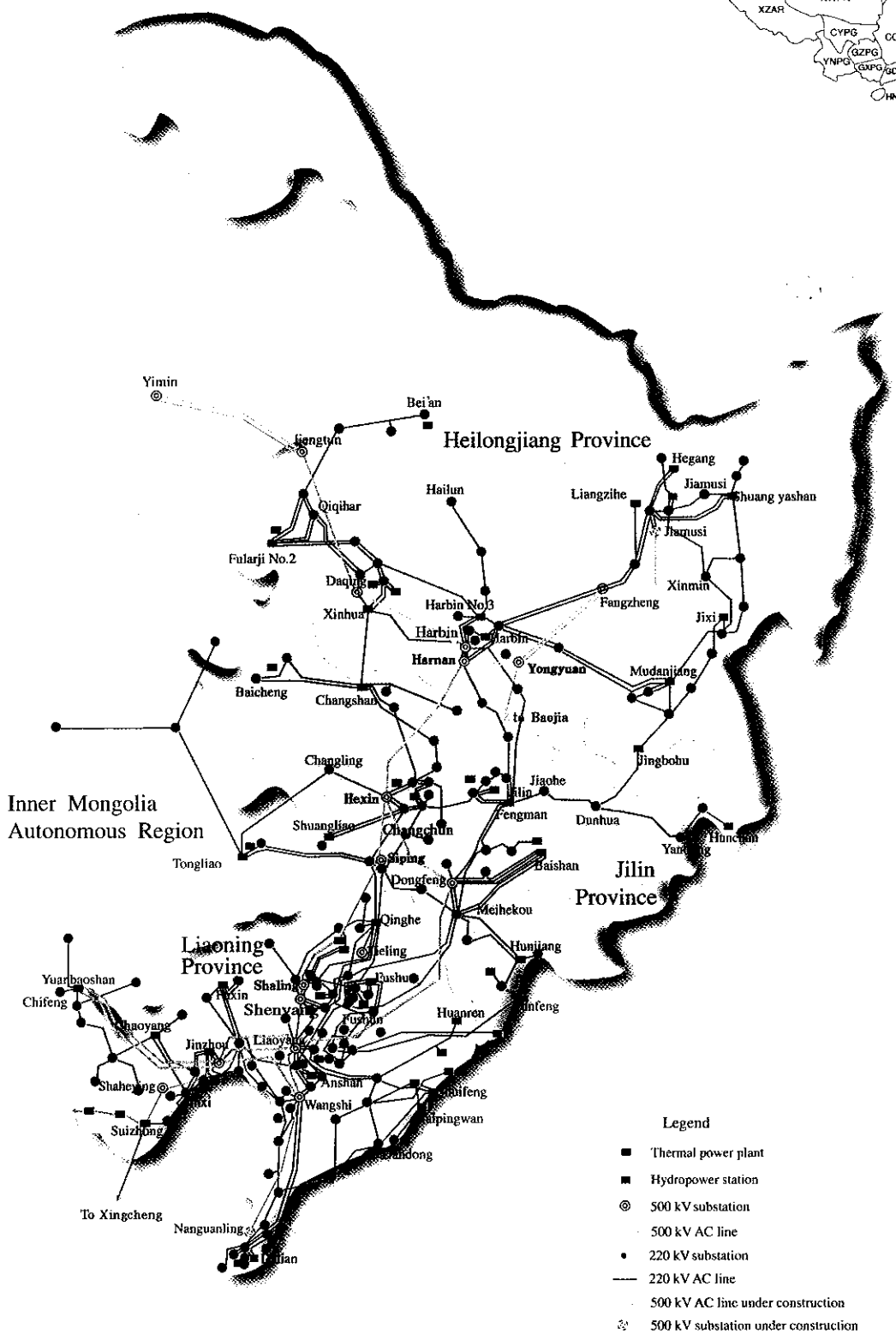
(3) The South Power Channel is aiming at sending 10 GW to Guangdong Province in the 10th Five-year Plan period, on this basis, 6 GW will be added each year to Guangdong in the coming 5 years. To realize this aim, the government has decided to construct several large hydro and thermal power stations in Yunnan and Guizhou provinces, from which a batch of 500 kV AC and DC transmission lines to Guangdong will be constructed.



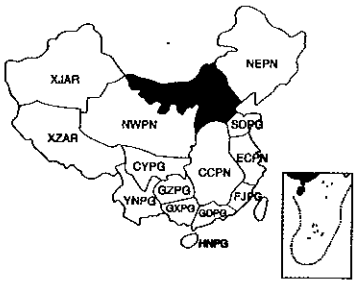
500 kV Chengdu Longwang Substation, Sichuan

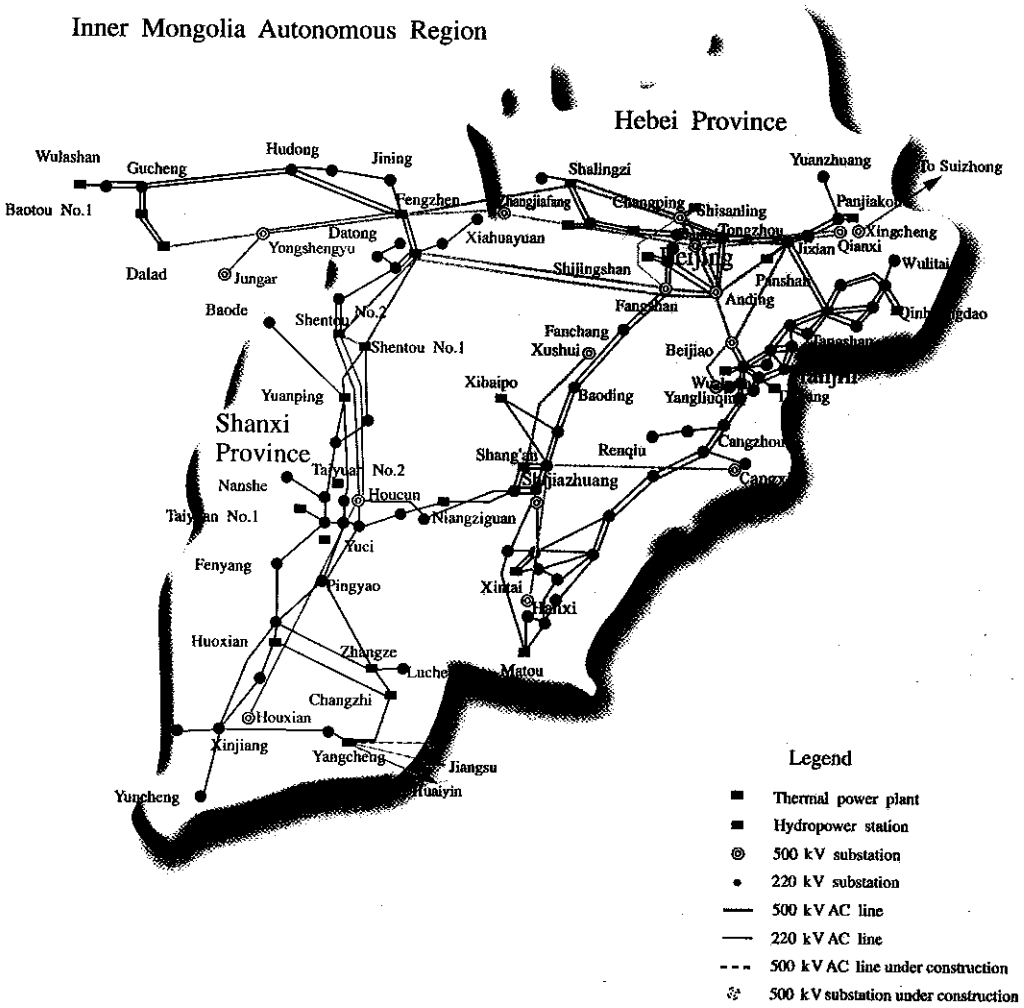
Northeast Power Network



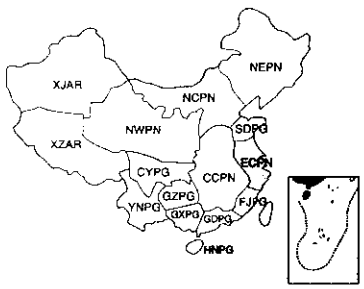


North China Power Network





East China Power Network



Shandong Province

Henan Province

Jiangsu Province

Anhui Province

Hubei Province

Jiangxi Province

Fujian Province

Shanghai

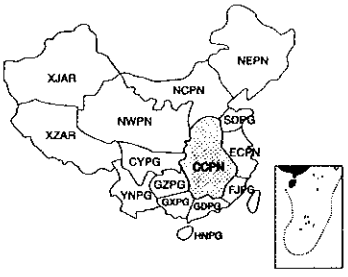
To Dongming

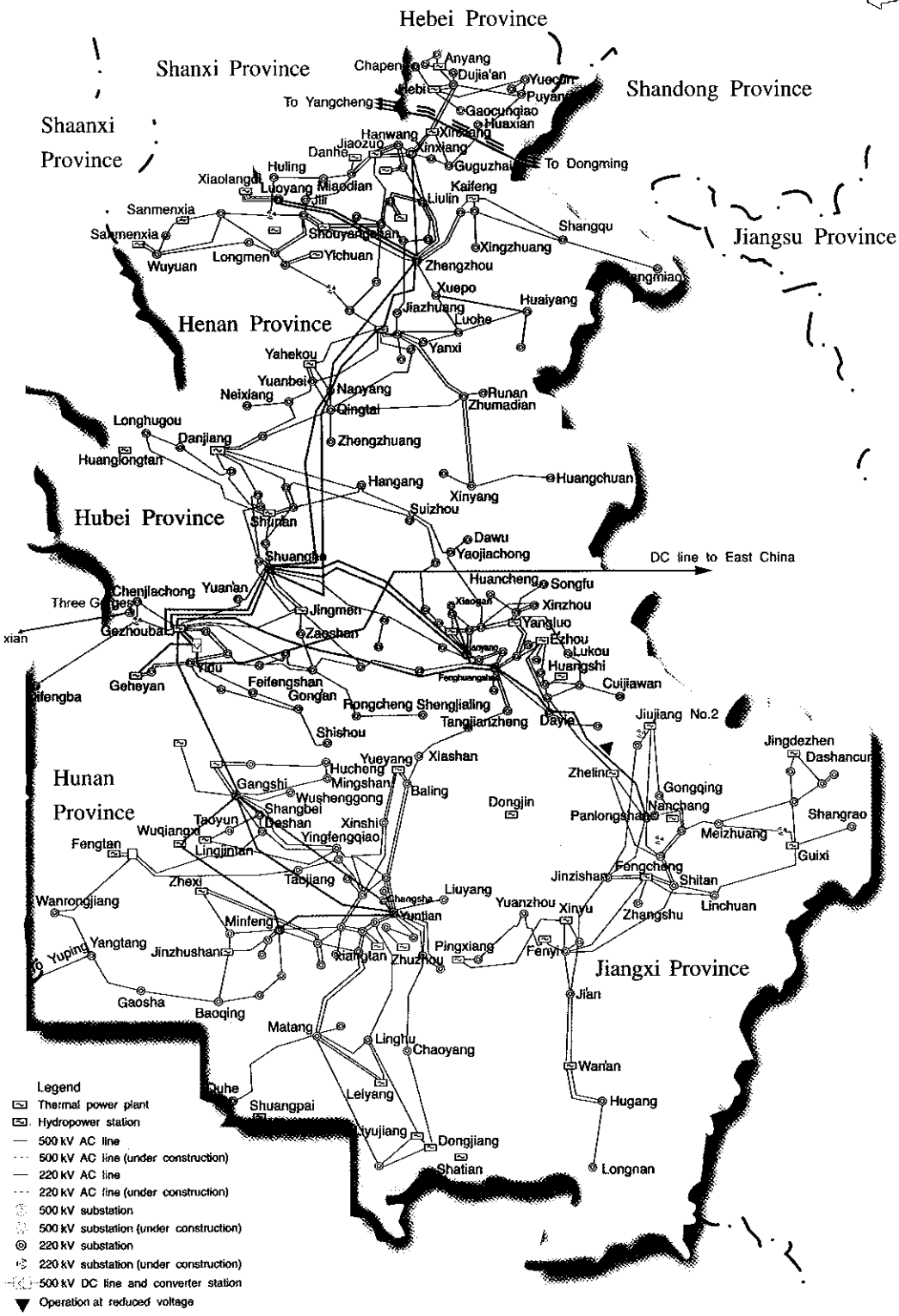
To Gezhouba

To Shidongkou No.2

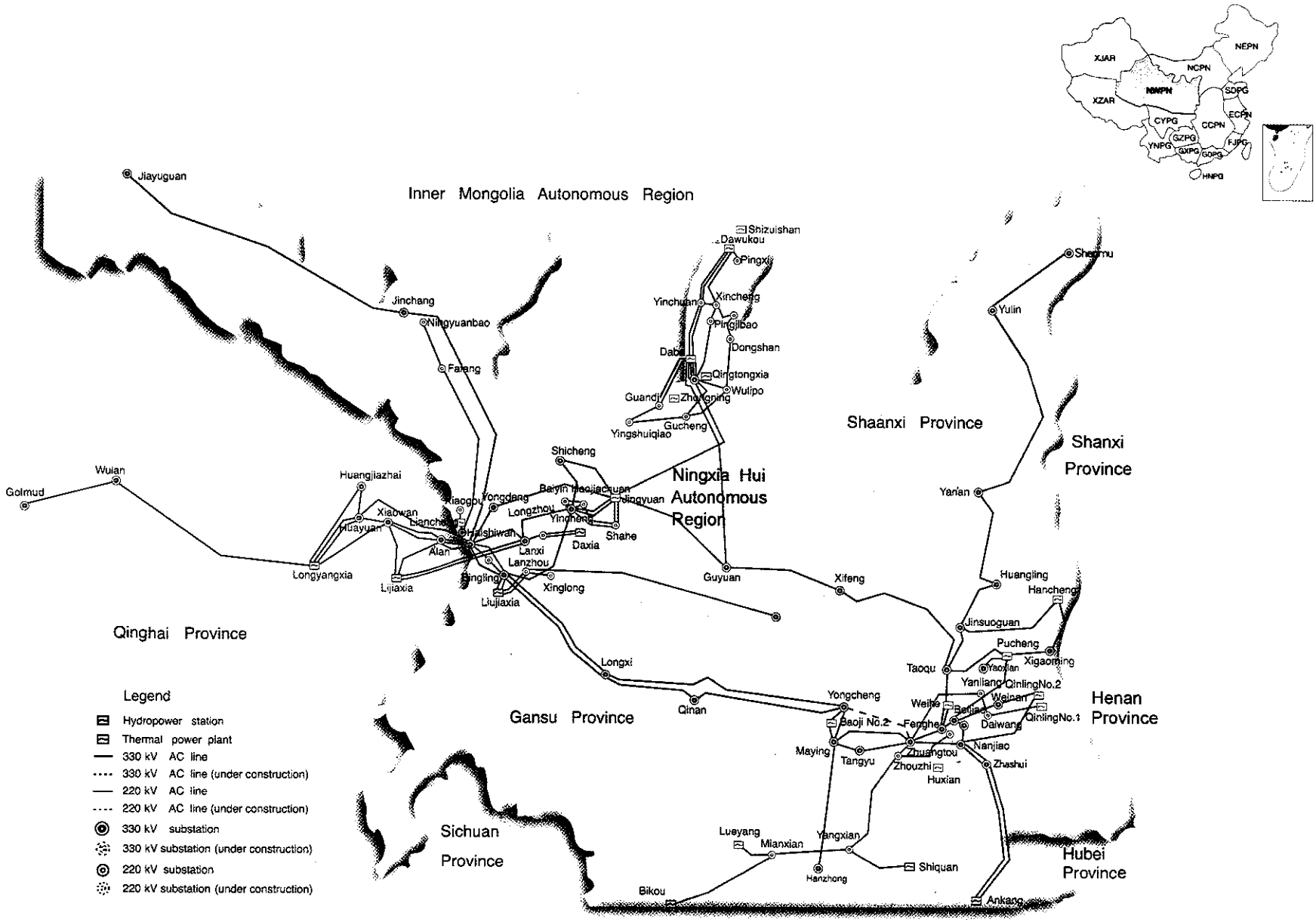
Shencheng
Xinhai
Shuanghu
Pingdun
Xuzhou
Pangjiaan
Huazhuang
Muyang
Nanzhuang
Sheyanggang
Huaibei
Huaibei No.2
Siyang
Huaiyin
Huaiyin
Yumin
Yancheng
Sudong
Lingbi
Woyang
Anyi
Hongguang
Maba
Haian
Mengcheng
Taihe
Luji
Banghu
Jiashan
Tianchang
Jiangdu
Yangzhou
Matang
Fuyang
Dingyuan
Chuxian
Yangzhou No.2
Tianshenggang
Nantang
Changle
Huilong
Liqiang
Changjiang
Feidong
Hefei
Hefei No.2
Maanshan
Pengshanqian
No.1
Walgaoqiao
Zhabei
Yanggao
Liuan
Xiangshuidian
Feixi
Chaohu
Wuhu
Wuwei
Liyang
Xixinan
Jiuxian
Fanchang
Liantang
Lujiang
Tongling
Tongcheng
Anqing
Ningguo
Zhenhai
Chencan
Wanan
Legend
Pumped storage hydropower station
Thermal power plant
Hydropower station
500 kV AC line
500 kV AC line (under construction)
220 kV AC line
220 kV AC line (under construction)
500 kV substation
500 kV substation (under construction)
220 kV substation
220 kV substation (under construction)
500 kV DC line and converter station
220 kV switchgear station
Nuclear power plant

Central China Power Network





Northwest Power Network



South China Interconnected Power Network