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STAFF APPRAISAL REPORT

CHINA

YANSHI THERMAL POWER PROJECT

December 17, 1991

Industry and Energy Operations
Country Department II
East Asia & Pacific Regional Office

CURRENCY EQUIVALENTS
(As of October 31, 1991)

Currency	=	Yuan (Y)
Y 1.00	=	100 fen
$1.00	=	Y 5.38
Y 1	=	$0.19

FISCAL YEAR

January 1 to December 31

WEIGHTS AND MEASURES

km	=	Kilometer (= 0.62 miles)
kWh	=	Kilowatt hour (= 860.42 kcals)
GWh	=	Gigawatt hour (1,000,000 kilowatt hours)
TWh	=	Terawatt hour (1,000,000,000 kilowatt hours)
kW	=	Kilowatt (1,000 watts)
MW	=	Megawatt (1,000 kilowatts)
GW	=	Gigawatt (1 million kW)
Kcal	=	Kilocalorie (= 3.97 British thermal units)
kV	=	Kilovolt (1,000 volts)
kVA	=	Kilovolt-ampere (1,000 volt-amperes)
MVA	=	Megavolt-ampere (1,000 kilovolt-amperes)
GVA	=	Gigawatt-ampere (1 million kVA)
mg	=	Milligram
m3	=	Cubic meter
toe	=	Tons of oil equivalent

ABBREVIATIONS AND ACRONYMS USED

CCEPA	-	Central China Electric Power Administration
CCPG	-	Central China Power Grid
EPPEI	-	Electric Power Planning and Engineering Institute
GOC	-	Government of China
GNP	-	Gross National Product
HIPDC	-	Huaneng International Power Development Corporation
HAB	-	Henan Audit Bureau
HPEPB	-	Henan Provincial Electric Power Bureau
HPG	-	Henan Power Grid
IAEA	-	International Atomic Energy Agency
LRMC	-	Long Run Marginal Cost
MOE	-	Ministry of Energy
MOF	-	Ministry of Finance
MWREP	-	Ministry of Water Resources and Electric Power
PCBC	-	People's Construction Bank of China
SAA	-	State Audit Administration
SEIC	-	State Energy Investment Corporation
SPC	-	State Planning Commission
SWCEPDI	-	Southwest China Electric Power Design Institute
WREPERI	-	Water Resources and Electric Power Economic Research Institute

CHINA

YANSHI THERMAL POWER PROJECT

Loan and Project Summary

Borrower: People's Republic of China

Beneficiary: Henan Provincial Electric Power Bureau (HPEPB)

Amount: $180 million equivalent

Terms: 20 years, including five years grace, at the standard variable interest rate.

Onlending Terms: The proceeds of the loan will be onlent from the Government to HPEPB under a subsidiary loan agreement, with a 20-year term, including five years grace and at the Bank's variable interest rate. HPEPB will bear the foreign exchange risk and the commitment charges.

Project Objectives and Description: Principal project objectives are to: (i) alleviate the acute power shortage of a major load center in Central China by providing additional generating capacity in an environmentally and economically sound manner; (ii) support the national policy of locating thermal power plants at mine-mouths or close to coal mines; (iii) introduce up-to-date methods for investment planning, tariff study, and system operation; (iv) assist in transferring modern technologies and construction/management practices for large thermal power plants; (v) enhance institutional development of HPEPB by strengthening its organization through staff training and introducing principles of economic efficiency and pricing; (vi) provide technical assistance in: project design and implementation; prudent financial management; and efficient operation and maintenance of the power system; and (vii) contribute to further improvement of the environmental aspects of HPEPB's thermal power stations, including a monitoring program. The proposed project is located about 90 km west of Zhengzhou in Henan province. The project would include: (i) extension of the existing Yanshi Thermal power plant by installing two 300 MW generating units; (ii) construction of five 220 kV transmission lines (about 350 km long) with associated substations; (iii) provision of technical assistance for project engineering, a tariff study and a tariff action plan for the Henan Power Grid (HPG); (iv) a monitoring program for environmental protection, and (v) a training program for upgrading the technical, financial and management skills of HPEPB staff.

Benefits and Risks:

The project will help to relieve the power shortages in Henan in the 1990s, thereby supporting planned industrial growth and improved living standards for the population. An economic analysis of the project, based on optimizing the Henan power system has confirmed that there are no better alternatives than the proposed project in meeting future power demand. The extension of the existing Yanshi power plant provides the most efficient and effective method of augmenting base load capacity. Also, the project will contribute to institutional development by strengthening the managerial and technical capabilities of HPEPB. The technical and economic feasibility of the project has been well established. No major risks, including environmental problems, are foreseen. Construction risks are within reasonable limits and should be manageable with the continuous supervision arrangements. The economic risks, if any, should be minimal. The project has been designed taking into account the requirement that the environmental impact from operating the station not exceed the internationally accepted norms. An environmental monitoring program will be included in the project. HPEPB will also replace the precipitators for the existing 2x200 MW units with high efficiency electrostatic precipitators.

Estimated Costs:	Local	Foreign	Total
	------	($ million)	-------
Civil works	44.1	6.4	50.5
Plant equipment and materials	57.4	159.9	217.3
Transmission system	26.1	-	26.1
Environmental protection	0.2	0.1	0.3
Training	1.3	1.0	2.3
Tariff study	0.5	-	0.5
Engineering and construction management	17.0	1.2	18.2
Base Cost	146.6	168.6	315.2
Contingencies			
Physical	14.6	8.4	23.0
Price	13.8	3.0	16.8
Total Project Cost /a	175.0	180.0	355.0
Interest during construction			
IBRD loan	-	48.1	48.1
Local loan	56.5	-	56.5
Total Financing Required	231.5	228.1	459.6
Project Financing Plan:			
IBRD loan	-	180.0	180.0
SEIC loan	115.8	32.1	147.9
Provincial government loan	115.7	16.0	131.7
Total	231.5	228.1	459.6

Estimated Disbursements:

Bank FY	1993	1994	1995	1996	1997	1998
	----------	----------	($ million)	----------	----------	----------
Annual	44.2	79.9	40.6	6.6	5.3	3.4
Cumulative	44.2	124.1	164.7	171.3	176.6	180.0

Economic Rate of Return: 16 percent

/a The project is exempt from taxes and duties.

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YANSHI THERMAL POWER PROJECT

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This report is based on the findings of an appraisal mission which visited China in September 1988 and a post-appraisal mission in September 1991. The report was prepared by V. Mastilovic (Task Manager), W. Cao (Senior Power Engineer), B. Baratz (Principal Environmental Specialist), S. Kataoka (Senior Power Engineer), H.E. Sun (Finanial Analyst), O. Koenig (Economist), and K.C. Ling (Consultant). Peer reviewers comprised: C.K. Chandran (Principal Engineer), S. Shum (Senior Financial Analyst), and N. Anderson (Senior Project Officer). The Acting Division Chief is B. Kafka and the Department Director is S.J. Burki.

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MAP

IBRD 21114R Yanshi Thermal Power Project

CHINA

YANSHI THERMAL POWER PROJECT

I. THE ENERGY SECTOR

A. Overview

1.1 China has made remarkable progress in developing its energy resources over the last four decades and became the third largest producer of commercial energy in the world. In that period, the output of coal has increased at an average annual rate of 9.1 percent, crude oil production at 19.3 percent, and electricity generation at 13.1 percent. In 1990, the country's primary commercial energy supply amounted to 727 million tons of oil equivalent (toe) Coal is the most important source of commercial energy, accounting for about 74 percent of the total. Oil accounts for 19 percent of the total and provides about 7 percent of the country's export earnings. Hydroelectric power (4.6 percent), natural gas (2 percent), and small quantities of shale oil and geothermal power make up the balance. Noncommercial energy, equivalent to about one-third of commercial energy production, is very important in rural China.

1.2 In 1990, China's final consumption of commercial energy was estimated to be about 686 million toe. The largest consumer of commercial energy is the industrial sector (62 percent), followed by households (24 percent), services (9 percent), and agriculture (5 percent). About 20 percent of oil and 2 percent of coal production currently are exported. Coal and its by-products meet 70 percent of the fuel requirements for industry and power generation, provide 60 percent of the raw materials for chemicals, and satisfy 80 percent of the commercial energy needs of households. The country also is the third largest consumer of commercial energy in the world. Still, energy consumption per capita is low--about 0.6 toe, or one-third of the world average.

Energy Resources

1.3 Coal. China has large coal deposits with recoverable reserves of about 900 billion tons, of which 30 percent are proven. There are now twelve provinces and autonomous regions with more than 10 billion tons of coal reserves; Shanxi and Inner Mongolia each have reserves of over 200 billion tons. In 1990, the country produced 1.1 billion tons of raw coal, of which it exported only 16 million tons. By the year 2000, China aims to produce 1.4 billion tons of coal a year. Coal is produced in many provinces, and the amount and quality may vary. The best quality coals are found in North China, which is also the region with the largest coal surplus. However, insufficient transport capacity makes it extremely difficult to move coal from mines in North China to the large consuming centers in Southeast, Central, and East China. The safety and environmental problems associated with coal mining and utilization also are serious (paras. 1.17 and 1.19).

1.4 Hydroelectric Potential. China is rich in water resources and has a long tradition of harnessing them for energy and other uses. The country's hydroelectric potential is estimated at 1,900 TWh a year, but only about 9 percent of it has been developed. Most of the potential is located in four major river basins in the Southwest (70 percent) and Northwest (12 percent), about 1,500 km away from the main demand centers. The long gestation period for hydroelectric projects also has inhibited the more rapid development and utilization of hydroelectric resources.

1.5 Crude Oil. China's ultimately recoverable reserves of crude oil have been estimated at some 80 billion tons, of which 16 percent are proven. The country produced 138 million tons of crude oil in 1990, and the target output for the year 2000 is 200 million tons. In view of the natural decline in production from existing aging fields, it seems unlikely that this production target can be met. China's refining capacity is the sixth largest in the world and allows it to produce a relatively high share of high and medium distillates.

1.6 Natural Gas. China's natural gas resources are estimated at 33 trillion cubic meters (m3), of which 2.6 percent are proven. About 50 percent of the gas produced is nonassociated gas. In 1990, China produced 15 billion m3 of natural gas. The target output for the year 2000 is 25 billion m3. Most of the gas is used as feedstock for fertilizers and petrochemicals.

1.7 Biomass. Firewood and crop stalks account for 57 percent of the 224 million toe of rural energy supplies. About 70 percent of all fuelwood is used for cooking. Some areas of the country have been suffering from serious deforestation, stemming primarily from fuelwood collection and land clearing for various purposes. The estimated offtake of fuelwood is 230 million tons (91 million toe), or 2.6 times the sustainable amount. The Government is taking various measures to address this problem, such as encouraging more efficient use of wood, planting trees, improving management of natural forests and wood lands, making greater use of charcoal, and substituting coal for wood. China also produces many agricultural residues which are used as fuel.

1.8 Nuclear Energy. Known uranium reserves in China are sufficient to sustain 15,000 MW of nuclear power capacity for 30 years. In 1991/92, China plans to commission Qinshan nuclear power plant (300 MW), located near Shanghai. In 1992/93, Daya Bay nuclear power plant (2x900 MW) should be commissioned; 70 percent of its output is intended for nearby Hong Kong. The construction of a few additional plants is planned before the year 2000, primarily in regions which lack coal and hydroelectric resources.

1.9 Other Energy Resources. Other energy resources play a small role in energy supply and are used mostly in remote areas. Geothermal energy has been found in more than 3,000 locations covering nearly all provinces and autonomous regions. The Yangbajing geothermal power plant, located in Tibet, supplies about 50 GWh a year, or about 20 percent of the electricity consumption in Lhasa's power system. Although wind and solar energy have promising prospects (e.g., wind in Inner Mongolia), they are not expected to affect the overall supply of energy significantly during the next two decades. Unofficial estimates of oil shale suggest that deposits are large, but little is exploited because of lack of technology.

Institutions of the Energy Sector

1.10 In 1988, the Ministry of Energy (MOE) was established to manage and develop the energy sector. Its formation was intended to reduce the duplication and overlapping responsibilities of the former ministries in charge of coal, petroleum, and nuclear power. MOE also was given responsibility for electric power, formerly held by the Ministry of Water Resources and Electric Power (MWREP). The new ministry has primary responsibility for planning and establishing policies and regulations to promote the rational development and use of energy resources. Under MOE are various companies and administrations responsible for operations in individual energy industries. Chart 1 shows the organization of MOE.

1.11 The State Energy Investment Corporation (SEIC) was established during the same period to handle project financing in the coal and electricity industries. SEIC is responsible for onlending funds for projects of national importance and representing the Government in the joint financing of projects with other parties; it is expected to operate as a revenue earning entity. Petroleum and nuclear power investments are covered under separate corporations. Both MOE and SEIC operate under the purview of the State Planning Commission (SPC), which has ultimate authority for project approval, budget allocations, and financing arrangements.

Energy Investments

1.12 Most investments in energy supply go to support projects with long gestation periods. Energy investments for the 1980s were planned based on an expected economic growth rate of 7.5 percent a year. Actual economic growth rates exceeded this target by an average of 2.5 percent a year, (4.5 percent in peak years). Also, industrial growth far exceeded what had been planned. The discrepancy between projected and actual growth rates has exacerbated the energy shortages that already existed at the start of the decade. China faces an additional difficulty in developing its relatively abundant energy resources, as many of the resources are located far from consumption areas and must be transported over long distances at high cost. In recent years, the Government has thus given priority to shifting resources into bottleneck sectors such as energy and transport.

1.13 In 1989, China dedicated 3.4 percent and 1.3 percent of its Gross National Product (GNP), respectively, to develop infrastructure for energy production and transportation. It invested a total of Y 44.6 billion ($12 billion) in energy supply, representing 29 percent of state capital construction. In the early 1980s, energy supply investments accounted for 21 percent of state capital construction. The shares of power and petroleum investments have increased since 1988 to 62 percent and 22 percent, respectively. State coal investment has declined (to 16 percent) but this decline has been offset by an increase in investment by coal collectives. About 20 percent of the investment requirements of the Chinese energy sector are met by foreign loans and direct investments. Direct foreign investment has financed most offshore petroleum exploration to date, although recent trends indicate a decline in direct investment for this purpose. On the other hand, there has been an increase in suppliers credit and bilateral lending for the petrochemical and power industries.

B. Energy Sector Issues

1.14 In addition to the already noted energy shortages, the main energy sector issues are: (i) the high energy intensity of the Chinese economy; (ii) the dominance of coal use and associated environmental problems; (iii) the need to improve scale and technology in energy industries; (iv) the inadequacy of energy pricing policies; and (v) the weak investment funding system.

Intensity of Energy Use

1.15 In 1980, China's consumption of commercial energy was estimated at 1.5 toe per $1,000 of GNP. That high a level of energy intensity was due to the emphasis placed on heavy industry, the small scale of industrial units, and the raw materials and technologies employed. In the late 1970s, the Government began to address the inefficiencies in the economy by instituting regulations on energy use, establishing conservation centers to provide technical assistance, and allocating a larger share of investment funds for industrial modernization, particularly for projects which contributed to energy conservation. The elasticity of energy consumption with respect to GNP growth, which averaged 1.74 from 1952 to 1977, was reduced to 0.5 in the 1980s. In 1989, the country's energy intensity was 1.1 toe, a 27 percent reduction from the 1980 level. It is estimated that technical and operational improvements and the closure of some inefficient small-scale plants are responsible for about 70 percent of the energy savings, and the shift in the output mix of the economy for the other 30 percent. The efficiency gains have been evenly spread over heavy and light industry. Despite these improvements, China's energy intensity is still high. A target of the Eighth Five-Year Plan (1991-95) is to reduce it further by 10 percent. More energy could be saved by increasing the scale of operations, employing more efficient operating practices, and using more modern technologies in energy intensive industries.

The Dominance of Coal and Related Environmental Problems

1.16 Unlike the situation in most countries, the electric power subsector is not the largest consumer of coal in China. Industrial use of coal is much greater. The growth of coal consumption in the household sector also has been strong, due to urban population growth and the increasing use of coal in rural areas. Moreover, there is considerable latent energy demand in the residential sector, primarily for space heating, as present heating arrangements meet only minimal needs.

1.17 Many of the environmental problems in China are related to the country's heavy use of coal and the dispersed, small scale application of coal in industry and households. Environmental problems occur at every stage of the coal chain: mining and disposal of mine waste, coal washing, transport and handling, processing and combustion, and ultimately ash disposal. Water pollution occurs both in mining regions and in dense urban areas, caused by problems in disposing of coal mining and processing wastes and the coal ash remaining after combustion. In many large cities, ambient concentrations of particulates and sulfur dioxide are very high. The concentration of particulates is the most serious problem; it is largely related to the extensive use of coals, their high ash content (20-30 percent), and the often incomplete

combustion due to poor matching of coal qualities to boilers used. The average sulfur content of the coal is relatively low (in the range of 1.2-1.7 percent), but because coal is used so extensively sulfur emissions are increasing. Moreover, some provinces use coal which has a very high sulfur content.

1.18 The environmental implications of continued increases in coal use are sobering. They highlight the need for stronger regulatory enforcement and more resources devoted to investments to conserve coal and mitigate its environmental effects. In addition, more resources should go to the exploration and development of cleaner fuels. In many industrialized countries, oil and natural gas have replaced coal in households. At the present time, however, China has limited scope for substituting cleaner and often more cost effective fuels in industrial and residential applications. The country has insufficient confirmed natural gas resources; its production of oil is increasingly absorbed by transport and petrochemicals; and its large hydropower resources are located far away from major consuming centers.

Scale and Technology in Energy Industries

1.19 Coal Subsector. Over half of the coal produced in China comes from small-scale mining operations which use traditional technologies such as hand hewing or drilling and blasting. A major problem common to coal mines is worker safety. China has considerable potential for developing medium-size mines capable of supporting investments in semimechanized or mechanized systems, safety equipment, storage and handling systems, and washery plants, reducing safety and environmental problems while improving the quantity and quality of output. In the larger centrally-controlled mines, productivity and safety could be increased by making greater use of mechanized long wall systems and employing more economic designs for mines and washeries.

1.20 Electric Power Subsector. Large-scale power development in China is beneficial from the standpoint of both energy conservation and environmental protection. Modern power plants, with unit capacities of 300 MW and 600 MW, are about 10 percent more efficient than smaller plants and consume about 150 grams of coal less per kWh. This means that the faster the pace of electric power development in China, the sooner the country will be able to reduce its consumption of coal to meet energy demand. The boilers of the modern utilities also support better pollution control equipment, raising the efficiency of particulate removal.

1.21 Petroleum Subsector. In the petroleum subsector, there is a need to employ more modern equipment and technology at all stages of exploration and development; seismic survey and related data processing, exploratory drilling, and enhanced oil recovery in order to increase production from aging fields. Improvements in operating and maintenance practices also are needed to increase the efficiency of the subsector. Moreover, better management of the oil and gas reservoirs would help to maximize ultimate recovery rates.

Energy Pricing

1.22 Average energy prices have been rising in recent years because of the broadening of the free market. Coal prices have increased rapidly during the last five years, largely because the market has expanded to as much as

50 percent of sales, depending on location. Indeed, free market prices for coal in East China are at or above the level of international prices. The administered price of coal, although it has been raised in recent years, is still below domestic supply costs; just as importantly, the price structure does not fully reflect differences in quality, such as calorific value and ash content. The dual pricing system (para. 1.25) creates various distortions; some high calorific value coals are still underpriced and may not be directed to their most economic uses.

1.23 While the average price levels of some light petroleum products are close to international prices, average prices of crude oil and heavy fuel oil are substantially lower. The pace of domestic oil price adjustments have remained slow, while extraction costs have risen sharply. Producer prices for natural gas are also distorted and should be adjusted to provide an incentive to find and develop more resources.

1.24 Electricity prices are largely based on tariffs which do not reflect the differential cost of service arising from consumption during peak load periods and power distribution at various voltage levels. In 1987/88, revenue enhancements were introduced in order to improve funding of power development. In particular, a "new plant, new price" policy guarantees that power prices will be sufficient to allow the power entities to fully service the debt on newly commissioned projects. As a result of this policy, electricity prices are expected to rise substantially. Already a multitiered price system is emerging in some provinces; while most consumers are charged just a fraction of the long-run marginal cost (LRMC) of supply, some industrial users are charged prices, at the margin, that are well above the LRMC (para. 2.14).

1.25 The recent increases in the price of coal and electricity and the initiation of energy rationing are helping to promote conservation and should positively influence investment and operating decisions in the sector. However, the full benefits of these actions will not be realized as long as a dual pricing system for energy is not abandoned. Under this system, one set of prices applies to goods allocated under the plan and another set of prices applies to goods distributed by the market. Because allocated prices tend to be significantly lower than free market prices, the system encourages consumers to use fuels covered by allocated prices regardless of their suitability. Similarly, the system encourages energy suppliers to focus on markets offering free market prices and to neglect the economically legitimate requirements of other markets which offer allocated prices. For example, the low prices for town gas inhibit investments for supplying gas in forms suitable for household energy (natural gas, coal-based gas, and process gas) in an environmentally sound manner. The existing price structure still does not provide all necessary incentives for investment to improve coal quality and for electricity consumers to shift their demand to off-peak hours or to be connected to higher voltage.

1.26 China needs strong price incentives and rigorous enforcement standards to encourage consumers to conserve energy. It must continue its program to raise energy prices, close the gap between administered and free market prices for coal, and begin to correct the most serious distortions in the pricing structures for coal, gas, and electricity. Energy price reform based on full recovery of supply costs also will help to remove anomalies in the

funding of energy investments. The Government remains committed to its overall price reform program. For example, in the last several months, the Government has implemented significant price increases and reduced the subsidies in a number of basic commodities, such as grains, cement, and steel. It also indicated its readiness to abandon dual pricing in coal and electricity.

Investment Funding System

1.27 China has taken decisive steps recently in energy conservation, environmental protection, and fuel diversification. Improvements in the scale and technology of energy supply systems have multiplied in recent years, and the share of funds channeled into the energy sector is now approaching acceptable levels. However, the funding of investments has suffered as a result of distorted pricing policies that led to a haphazard and compartmentalized mobilization of resources, and an inefficient development of energy sources. To reduce financial pressures on the central government, responsibility for funding of energy investments gradually has been shifting to the provinces, with mixed results. In the coal subsector, local production now exceeds state production but is not operating at the scale required to achieve higher efficiency or improve safety. Because of insufficient electric power supplies, some local enterprises are making their own investments in power plants. The investment approval system actually biases local investment in favor of less efficient small-scale plants, as these plants do not require clearance or any financial contribution by the central government.

C. Energy Sector Strategy

1.28 The Government of China (GOC) is working to eliminate energy shortages in an environment of rapid economic growth. The Government's principal objectives in the energy sector are to: (a) accelerate the expansion of electric power and oil/gas production; (b) expand and improve the scale of coal production; (c) increase the efficiency and change the forms of coal utilization; (d) minimize the environmental impact of energy use; (e) rationalize energy prices and investment funding; and (f) encourage the transfer of modern know-how and technology in energy industries.

1.29 Allowing the power subsector a larger share in final energy consumption will help to modernize the Chinese economy, reduce overall energy intensities, and curtail pollution through the harnessing of hydropower, more efficient technologies, and larger-scale plants. The same holds true for the oil and natural gas subsectors, both of which yield cleaner, more efficient fuels than coal. The continued development of coal mining is an inescapable necessity but it must occur under conditions of higher efficiency, safety, and environmental acceptability.

D. Bank Role in the Energy Sector

1.30 The Bank has supported nine projects in electric power, five in petroleum (including one gas project), and one in coal. In all three subsectors, the objectives have been to support technology transfer, modern management practices, and the development of efficient, large-scale energy production. Through its sector work and project-related technical assistance, the Bank has assisted in studies to enhance improvements in energy pricing and

investment policies. The power-specific aspects of the Government's strategy and the role of the Bank are covered in paras. 2.17-2.18.

1.31 With the Bank's assistance, the Chinese have done a good job in evaluating the economic costs of electric power and coal and in suggesting approaches for gradual price reform. With regard to electricity, LRMC and target tariffs were established for East China in 1988. Since then, the Bank has sponsored the formulation of action plans and adapted them to the specific conditions of each regional power grid, with the objective of promoting their execution under repeater projects. An action plan for power pricing reform in Henan is included under the proposed project (para. 5.16). For coal, the Chinese have set pricing guidelines for various types of coal nationwide, but the recent surge in inflation has prevented the Government from moving decisively along these lines. However, plans for a large increase in administered coal prices are still alive and the Bank will continue to promote the formulation and execution of a plan to rationalize the level and structure of coal prices, with special attention to the most sensitive coal users.

1.32 A Coal Transport Study, being conducted jointly by the Bank and various Chinese institutes, will develop a model to identify optimal investments in infrastructure to move coal more efficiently, taking into consideration quality requirements and the impact of more efficient utilization in major consuming areas. A Coal Utilization Study has evaluated options to improve coal use and reduce its environmental impact both in industry and households. In regard to the petroleum subsector, two seminars have been organized in China over the past five years--one on gas utilization and another on petroleum subsector management. Improving the planning of investments and operations for the power subsector has been the focus of many Bank-sponsored activities (paras. 2.11 and 2.19).

1.33 Future Bank operations in the energy sector will continue to support rational energy development and technology transfer, energy efficiency and conservation, and improved environmental management. Through both project and sector work, the Bank continues to encourage policies which provide the proper incentives for sustainable energy development and conservation. Finally, the Bank will continue to promote modern enterprise management, greater autonomy and accountability, as well as improvements in the regulatory framework of the sector.

II. THE POWER SUBSECTOR

A. Background

2.1 China is the fourth largest producer of electricity in the world. In 1990, the country had a total installed capacity of 135 GW, 74 percent based on thermal power and 26 percent based on hydropower. That same year it generated 618 TWh of electricity, of which 492 TWh was from thermal. Plant use and network losses accounted for 6.9 and 8.0 percent of generation, respectively. Fuel consumption in thermal plants has been reduced to about 400 gram of standard coal per kWh. These levels of electricity generation, losses, and fuel consumption are close to those in industrialized countries. Power is mostly distributed through 16 major grids, 13 of which exceed 1 GW in capacity and account for about 90 percent of total capacity. By the end of 1990, the total length of the extra high voltage transmission lines reached 7,302 km and the capacity of substations amounted to 20.7 GVA.

2.2 The Government's rural electrification policy emphasizes the development of local energy resources. Therefore, as much as possible, mini hydropower development is encouraged in isolated areas. In 1989, mini-hydro, small thermal, and diesel generating sets had a total installed capacity of 19 GW. Mini-hydro plants alone had a capacity of 12.4 GW and an annual generation of 34.3 TWh. The networks in rural areas are made up of 1,990,000 km of 110 kV lines, and 4,020,000 km of low-voltage lines (35 kV and below). These networks have a transformer capacity of 85.9 GVA at high voltage and 142.5 GVA at low voltage. Approximately 94 percent of townships and 85 percent of villages are electrified.

2.3 The growth of installed capacity, electricity generation, and sales since 1949 is depicted in Annex 1. Annex 2 shows the historical trend of electricity generation, primary energy demand, and the GNP. The target of quadrupling the GNP between 1980 and the year 2000 should result in average growth of 7.0 percent a year for power demand. On this basis, the Seventh Five-Year Plan (1986-90) called for an increase in generating capacity of about 35 GW (8 GW from hydropower) with an additional 120 GW planned between 1990 and 2000. Power generation capacity expansion during the period 1986-90 met the plan objectives for hydropower and surpassed those for thermal power by 80 percent. Various steps are being taken to satisfy power demand. Large thermal power stations are being constructed mainly near ports and major coal mines in Shanxi, Heilongjiang, Henan, Shaanxi, and Shandong. Major hydroelectric stations are planned at the middle and upper reaches of the valleys of the Yellow River, Yangtze River, and Hongshui River. Two nuclear power plants are being constructed in Guangdong and Zhejiang Provinces (para 1.8). A 500 kV transmission network is being built to integrate regional grids. The first high-voltage direct-current transmission link was commissioned in 1989 to transfer hydropower from Gezhouba in Hubei Province to Shanghai.

2.4 In 1990, China consumed 525 TWh of electricity; 69.4 percent was consumed by industry, 17.3 percent by agriculture including rural household, 2.0 percent by transportation/communications, and 11.3 percent by municipal and residential users. Details of electricity consumption by sectors are

given in Annex 3. Average per capita consumption in 1990 reached nearly 550 kWh; household use was about 85 kWh in cities and 20 kWh in rural areas.

2.5 Between 1986 and 1990, electricity demand increased faster than generating capacity. As a result, power shortages reached about 20 percent of industrial electricity requirements, which translated into the idling of industrial capacity for one or two days a week. Electricity is still allocated through quotas based on priorities set by local and central authorities and demands for new connections are closely screened; still, power cuts are frequent. The rapid growth of demand can be attributed both to the very high economic growth and to the increasing share of electricity in commercial energy requirements: 13 percent in 1970, 18 percent in 1980, possibly 27 percent by the year 2000. Since 1986, residential, manufacturing, and transportation showed the highest growth rates: 20 percent for residential uses due to income growth and 19 percent for transportation due to railway electrification. The manufacturing sector is already a large electricity consumer and is expected to maintain its share in the future. Notwithstanding concerted efforts at energy conservation, the growth of power supply should not be allowed to fall behind GNP growth. As economic growth is only targeted at 6 percent a year under the Eighth and Ninth Five-Year Plans, the power output is planned to grow at the commensurate rate of 5.8 percent a year to 1,100 TWh in the year 2000; however, such a figure may prove to be too conservative. Indeed, a faster pace of power system development would be justified in order to accelerate the retirement of the less efficient and more polluting small coal-fired plants.

B. Institutions, Planning, and Technology Transfer

2.6 Institutions. MOE oversees all strategic aspects of power development (para. 1.10), including five regional power administrations which coordinate the operations of the power systems and prepare long-term development programs for the approval of MOE. There are 19 provincial and municipal power bureaus under the regional administrations operating as part of the regional power systems and eight other bureaus which operate in isolation. A number of investigation and design institutions are affiliated with MOE, as are the 16 construction companies involved primarily in building power projects. Several universities, colleges, and research and training centers also fall under the auspices of MOE.

2.7 The Huaneng International Power Development Corporation (HIPDC) was created in 1985 as a financing arm of the former MWREP. It was designed to attract foreign capital and technology for power generating plants located mainly in the open cities of the coast. Unlike the provincial power bureaus (the beneficiaries of multilateral financing), HIPDC has a mandate to raise funds directly from the international financial market. The HIPDC has been active in tapping bilateral and suppliers' credits, and a few commercial bank loans. As a result, the power subsector in China has claimed a significant share of the country's external financing in recent years (Annex 4).

2.8 Separate corporations also have been created for developing major hydroelectric schemes. These new institutional arrangements are beneficial because such corporations are allowed to maximize their efficiency through specialization and economies of scale and to reinvest their earnings into

future power development. However, in order to achieve maximum efficiency, this division of labor creates a need for coordination of investments and operations among the various power entities in the same region, including transfer pricing arrangements.

2.9 The power industry in China employs about 1.8 million people. Of these employees, fewer than 30% have received formal education beyond the junior secondary level. As a result, there is a shortage of trained manpower, particularly trained technical and administrative staff. MOE has initiated a long-term program to upgrade the skills of the staff at all levels. The program is carried out primarily by the provincial power bureaus and regional power administrations. The training component of the proposed project is designed to support the MOE program and assist in developing manpower to meet the project's human resource needs (para. 3.6).

2.10 Power System Planning. Power system planning in China is the responsibility of the Planning Department of MOE, which reviews the plans proposed by the regional power administrations and bureaus. For the expansion of thermal power plants and transmission networks, the research, planning and designs are carried out by the regional electric power design institutes. For major hydroelectric projects, the research, planning, and design are carried out by the regional hydroelectric investigation and design institutes and the MOE's Water Resources and Hydropower Planning Institute.

2.11 As planning for China's power development becomes increasingly complex, there is a compelling need for Chinese planners to adopt state-of-the-art system planning techniques. These techniques are particularly important for evaluating large-scale projects which have long lead times and for making decisions about generation mix, power plant location, and grid configuration. Least-cost generation planning techniques were first introduced for thermal generation in East China through technical assistance from the International Atomic Energy Agency.1/ Under the Planning Support and Special Studies Project (Credit 1835-CHA), least cost planning techniques are being introduced for hydroelectric generation and transmission network expansion plans for the Sichuan and East China power systems. Training in the use of these techniques is being provided to staff of the concerned power bureaus and the Water Resources and Electric Power Economic Research Institute (WREPERI). These staff, in turn, will be able to assist other power bureaus and regional power administrations.

2.12 Modern Technology Transfer. For China to achieve its ambitious goals for increasing power production, the development and transfer of appropriate modern technologies will be crucial. Technology transfer is very important for thermal power plants, where increases in the steam parameters and size of units can reduce net fuel consumption. Since thermal generation from coal-fired units is expected to provide about three quarters of total generation until the end of the century, reducing the amount of fuel consumed for power generation would reduce pressures on both the supply and transport of coal, as well as on the environment. The Bank is helping to provide state-of-the-art technology for the construction and operation of large coal-fired

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1/ Under the Bank's Second Power Project (Loan 2493-CHA).

units (300 MW and 600 MW), including environmental assessments and impact mitigation. Technology transfer is also needed for large hydroelectric projects, particularly in connection with the interpretation of geological data, the design of sophisticated structures and large underground works, the selection of equipment, efficient construction management, and environmental assessments. Assistance in technology transfer is being provided under ongoing projects and will be continued under the proposed project (paras. 5.11-5.18).

C. Power Pricing

2.13 China's current electricity pricing system has evolved from reforms begun in the mid-1980s and strengthened during the last three years. The current prices faced by consumers represent a complex combination of "old system" rates based on the tariff structure of 1976, and a new set of rates and surcharges for above-quota allocation, which are basically designed to improve cost recovery, especially for reinvestment. Recent reforms have included both reforms in the "old" tariff, and the development and expansion of the role of the new set of rates and surcharges. "Old system" base rates were increased by 57 percent during 1986-90, and, adding in a new across-the-board surcharge, "old system" rates now average from 10 fen to 17 fen/kWh, depending upon the region. The "new rates" are generally 20-30 fen/kWh, or twice as high as the base rates. A key component is the price charged for electricity from new generating plants, under the "new plant, new prices" policy enacted in 1988 (para. 1.24). Under this policy, prices for power from new plants, which are largely financed by loans, are set at significantly higher levels to adequately cover the debt service of the power utilities.

2.14 As the role of the "new rates" increases with system expansion, the combined average rates continues to increase. However, there remain considerable distortions in the structure of electricity prices. Further, the prevailing system is far too complicated, and not sufficiently transparent. The low "old" tariff to many customers provides little incentive for efficiency improvement, while new industrial customers are charged at a level which may exceed LRMC. The GOC has made commitments to confront these issues. It has announced its intention to unify old and new system rates into single, more transparent tariffs, and has taken concrete measures in this direction. Introduction of peak/off-peak and seasonal rates has been expanding. The Government also is eliminating certain preferential prices which have existed for some very electricity intensive heavy industries.

2.15 The Bank is engaged in a very active dialogue with the Government on the topic of power pricing. The financial covenants under Bank-financed projects have long supported improvements in power price levels, and collaborative work on tariffs is now reinforcing the corrective actions already taken by GOC to adjust prices. In a specific effort to support a systematic overhaul of power prices by the Government, the Bank financed a study covering East China under the Beilungang Thermal Power Project (Loan 2706-CHA). The primary recommendations of this study--to bring tariffs more in line with the LRMC--are gaining broad acceptance and are being used in formulating specific pricing reforms for power systems with predominantly coal-fired generation. A specific power pricing study is included in this proposed project. This study

should lead to the definition of a concrete action plan to gradually improve the tariff structure of the Henan province (para. 5.16)

D. Subsector Issues and Strategy

2.16 China faces the following major issues in the power subsector: (i) acute power shortages; (ii) inadequate power pricing and investment funding; (iii) protracted implementation periods for large projects; (iv) environmental impacts of power supply; (v) weak interconnection within regional power systems; (vi) scarcity of skilled manpower; and (vii) outdated methods for planning, operation, and financial management.

2.17 The Government's basic policy for the power subsector is to modernize it, expand it, and increase its efficiency at a rate sufficient to meet the requirements of industrial development and improve the living conditions of the population. This policy translates into the following objectives: (a) expand coal-fired thermal capacity at mine-mouths or near ports and load centers in order to reduce the rail transportation requirements and use of lower grade coal in urban centers; (b) replace small- and medium-size thermal units with larger, less polluting, and more efficient units; (c) accelerate the pace of hydroelectric development; (d) construct extra high-voltage transmission lines; (e) introduce a more rational pricing system; and (f) adopt modern techniques in project design, environmental impact mitigation, and system planning.

E. Role of the Bank in the Power Subsector

2.18 The Bank's participation in the power subsector in China has particularly focused on institution building and the transfer of appropriate modern technology. The Bank has supported the Government's sectoral strategy through sector work, policy dialogue, and a series of lending operations in association with the regional power bureaus. The Bank has helped to introduce state-of-the-art system planning methodologies which identify cost-effective, sustainable development policies for the power subsector and, presently, it is participating in the formulation of the Five-Year Plans in Sichuan and East China (para. 2.11). Repeater projects allow the Bank to assist the Government in applying power tariff reforms based on the findings of earlier pricing studies (para. 2.15). Through the Second Beilungang Thermal Power Project (Loan 2955-CHA), the Bank is extending its policy dialogue to cover the reorganization, management, and regulation of power bureaus.

2.19 Since China has become a member of the World Bank Group, the Bank has helped to finance nine large power generation projects (600 MW - 3,300 MW)--five thermal and three hydro operations--and one high-voltage transmission project. Through these operations, the Bank has successfully (i) introduced international competitive bidding (ICB) for civil works and equipment; (ii) supported the transfer of modern technology in project construction and management; (iii) helped to improve the efficiency of pollution abatement equipment; (iv) promoted the integration of a regional power system in East China; (v) supported the development of master plans for modern distribution networks; and (vi) promoted operational efficiency and prudent financial management. Under the Technical Cooperation Credit (TCC), the Bank assisted in supervising and reviewing a feasibility study for the Three Gorges Project.

2.20 Most of the ongoing power projects financed by the Bank are being implemented in a satisfactory manner, on schedule, and within budget. The first power operation, Lubuge Hydroelectric Project (Loan 2382-CHA), is virtually completed. The second power operation, the 500 kV Xuzhou-Shanghai Transmission Project (Loan 2493-CHA), was put into service, as scheduled. The Yantan Hydroelectric Project (Loan 2707-CHA) is also progressing satisfactorily. Several problems were encountered early in the implementation of the Shuikou Hydroelectric Project (Loan 2775-CHA): project management was weak, and the original Government allocation was too low to cover large cost increases associated with the resettlement component. Among measures to resolve these problems, the Bank agreed to revise the loan allocation and finance the importation of materials needed for resettlement; project management is also being strengthened. The project is now back on schedule. The construction of the Ertan Hydroelectric Project (Loan 3387-CHA) started successfully in September 1991. The Daguanba Multipurpose Project (Loan 3412-CHA and CR 2305-CHA) was approved just recently. Furthermore, the Bank is involved in financing three thermal power projects--Beilungang (Loan 2706-CHA), Wujing (Loan 2852-CHA), and Beilungang Extension (Loan 2955-CHA). The Beilungang project encountered delays early on due to procurement problems and poor coordination among the suppliers of various islands. These problems have now been resolved, and construction is almost back on schedule. To minimize problems of coordination among suppliers for the Wujing project, procurement was carried out using a single responsibility contract.

2.21 The lessons learned from the previous power projects in China have been taken into account in preparing the proposed project. These lessons include: (i) improving procurement and contractual arrangements; and (ii) enhancing the role of project management and the use of engineering consultants. Particular attention was given to the further improvement of the environmental aspects of the projects. A study on pollution control is being carried out in China financed under the Japanese Yen Grant Facility in order to minimize air pollution from thermal power plants in the coastal regions.

III. THE BENEFICIARY

3.1 The beneficiary of the proposed loan would be the Henan Provincial Electric Power Bureau (HPEPB). This would be the first Bank loan to be onlent to HPEPB.

A. Legal Status and Organization

3.2 HPEPB is a state-owned enterprise operating under the direction of the Central China Electric Power Administration (CCEPA). The bureau falls under the jurisdiction of MOE and is a legal entity with contractual and self-accounting capabilities. The Government has assigned it responsibility for executing within its jurisdiction the program for power generation, capital investment, power sales and tariffs, employment and payroll, materials consumption, and tax. A charter for HPEPB has been issued which is acceptable to the Bank.

3.3 HPEPB is headed by a director who is appointed by MOE. Reporting to the director are four deputy directors, accountable for, respectively: capital construction; production, power supply, and load dispatching; administration, including labor and personnel; and management, including finance, general affairs, and training. The planning, security, and auditing divisions report directly to the director. In addition, the director is assisted by a chief engineer and a chief accountant. Operations are carried out through a number of units engaged in power generation, transmission, power supply, construction, and manufacture and repair. Each of these units is headed by a chief with line responsibility to HPEPB's deputy directors for production and construction. The current organizational structure of HPEPB is presented in Chart 3.

B. Management

3.4 Under the current institutional framework, HPEPB appears to be well managed. Recent performance indicators for the Henan Power Grid (HPG) shown in Annex 5 reveal high plant capacity factors and low transmission and distribution losses. While the customer-per-employee ratio is low, the kWh sales per employee is reasonable. HPEPB prepares accounting information in a timely fashion (para. 3.13) and maintains an effective billing and collection system (paras. 3.23-24). At present, the central government maintains a high degree of control over the power subsector. As the institutional framework becomes less centralized and the power bureaus receive greater financial autonomy and responsibility for decision-making, HPEPB must prepare itself to manage this transition. The upgrading of management systems and procedures and the strengthening of financial planning deserve special attention in this regard (paras. 3.8-3.12). The proposed project includes specific training in utility management and financial planning (para. 5.12 and Annex 13).

3.5 HPEPB is capable of formulating its own expansion program and implementing medium-size thermal projects (100-300 MW) by itself. Outside assistance is, however, required for the preparation of bid documents, bid evaluation, and contract negotiations for the procurement of equipment on an

ICB basis, interfacing of engineering and design of different islands and review of vendor's drawings.

C. Staffing and Training

3.6 HPEPB is understaffed in engineering and technical workers, and overstaffed in semi-skilled and unskilled workers. As of December 31, 1990, the bureau had a total staff of about 48,692. Of the total about 9 percent were college graduates, 21 percent graduates of polytechnic institute, 25 percent senior high school graduates, and 45 percent junior high school graduates. Except for the core group of key technical and managerial personnel who are assigned by MOE, almost all of HPEPB's employees are recruited locally. Most of the employees also are hired on a permanent basis, except for laborers contracted to do construction. HPEPB has 15 divisions and offices in its headquarters and 39 outside units (Annex 6).

3.7 The Education Division of HPEPB runs three technical schools for skilled workers, one secondary technical school for training technicians, and one staff college for HPEPB's staff. This training capacity is not sufficient to meet HPEPB's long-term needs; currently it meets only about 30 percent of the bureau's annual requirement. The quality of teaching staff and teaching facilities needs to be upgraded and modernized. Training should be designed to help senior managerial and technical staff adapt to the new situations brought about by larger units, higher voltage levels, and a larger power grid. The training component included in the proposed project is designed to meet these needs. It covers upgrading and equipping of HPEPB's technical schools and project-related training for technical staff (paras 5.11-5.15).

D. Planning, Budgeting and Control

3.8 The evolution of the systems for planning, budgeting, and control used in China's power bureaus is discussed in detail in Annex 7. In brief, all power bureaus are responsible for developing annual and five-year production and investment plans which are integrated into the national plans and are approved, through MOE's and SEIC's auspices, by SPC. In the past, these plans have emphasized the planning of quantities of inputs and outputs. Financial planning was confined to attaching monetary values, predetermined by MOE, to the quantities being planned. Although a power bureau's plan might be revised to reflect changes in inputs or outputs arising from changed or unforeseen circumstances, the plans ordinarily would not be revised merely to reflect differences between the prices being assumed for planning purposes and those actually being paid by a particular power bureau. This planning system functioned effectively in an environment where prices were controlled and were relatively free of inflation and where investments were financed almost exclusively by grants.

3.9 However, under initiatives taken in the early 1980s, prices have begun to move, albeit slowly, toward market levels and the government is increasingly using loans rather than grants to finance investments. Therefore, money is taking on the characteristics of the other commodities which need to be planned, including: (a) possible variations in constituent prices on account of unforeseen circumstances, and (b) a cost, payable over a period

of years, associated with the financing of investments. Because of this, MOE will need to adjust its planning system to include financial planning.

3.10 MOE and SEIC recognize the importance of financial management in the power subsector in China and are organizing a comprehensive training program for all the power bureaus under their control. MOE already has begun to make adjustments to its management systems by providing many of the power bureaus with computers and software to use in planning, budgeting, and control accounting functions. As the bureaus have grown larger and technically more complex and as the scope of their business has expanded, the manual methods used to compile these records have become increasingly unwieldy. Information stored in the computer diskettes can be transferred to MOE, where it will be consolidated into regional and national data.

3.11 The new systems represent a good first generation of automated management information; however, they still are not sufficiently flexible to take into account price changes at the local level or those associated with large-scale debt service obligations. Currently MOE and SEIC, with assistance from the Bank, manage a number of seminars in China as well as overseas, comprehensively covering not only the computer-based management information system but also those items of tariffs, cost control, project financing, and organization and structure of financial management. Through these seminars and training the Bank continues to discuss with MOE and SEIC the possibility of assisting in the development of an automated information system.

3.12 While it is developing a management information system that will include modern financial planning, budgeting and control accounting systems, MOE has agreed to introduce a rudimentary financial planning system in power bureaus implementing Bank-financed projects. In connection with the Lubuge Hydroelectric Project (Loan 2382-CHA), the Bank furnished MWREP with a financial forecasting model. This model allows the power bureaus to study the impact of both their expansion plans and variations in prices on their future financial positions. MOE continues to use this model successfully in preparing projects for appraisal by the Bank. The model also forms the basis for the rudimentary financial plans which the bureaus are to provide to the Bank each year. Assurances have been obtained from HPEPB that, by April 30 of each year commencing in 1993, HPEPB will furnish to the Bank a rolling financial plan containing projected income statements, sources and application of funds, and balance sheets for the next eight years.

E. Accounting

3.13 Each of HPEPB's operating units maintains financial accounts which are consolidated with those of all other HPEPB operating units. The units prepare accounting information in a timely fashion each month; headquarters compiles consolidated accounts monthly, quarterly and annually. Accounts for all units are prepared on an accrual basis using a double entry system. MOF establishes the regulations governing the presentation of financial accounts for all sectors. These regulations cover matters such as accounting methods and procedures; form of accounts; procedures for distribution of net income and depreciation; taxation; allocations to and use of proceeds from Special Funds, etc. MOF reviews the regulations and corresponding accounting stan-

standards on an ongoing basis. These regulations and standards are supplemented by detailed implementation procedures issued by MOE.

3.14 HPEPB has a large accounting staff who are well-trained in maintaining ledgers and in compiling accounts according to standards. However, these accounts are used primarily to document historical financial information, so HPEPB is just beginning to develop other analytical financial capabilities. As it modernizes its financial management practices, HPEPB staff will have to learn modern management techniques involving the analysis of financial and cost accounting for decision-making purposes. A technical assistance component for training on utility management and financial planning has been included in the proposed project (para. 5.12).

3.15 HPEPB has several construction units that are responsible for constructing its power plants, erecting transmission and distribution facilities, and implementing asset renovations. Accounts for construction units which primarily manage construction are consolidated with those of HPEPB's operating units. Accounts for construction units which function primarily as contractors for the bureau are handled separately. Since most of the major new assets are being financed with loans issued directly to HPEPB, HPEPB will remit progress payments to those construction units functioning as contractors. In this way, HPEPB's future accounts should properly reflect the value of major new assets under construction.

F. Audit

3.16 Before 1982, the financial statements of organizations in China were not subject to comprehensive audit. Entities such as Ministry of Finance (MOF), the line ministries, tax bureaus, provincial financial bureaus, and banks conducted individual checks to meet their own particular needs. None of them prepared independent reports on the accuracy or reliability of their annual financial statements. China had no professional body of auditors to prescribe auditing standards and regulations.

3.17 When China's new constitution was ratified by the People's Congress in December 1982, this situation changed. A State Audit Administration (SAA) was established in September 1983 and given the status of a ministry reporting directly to the State Council. Provincial audit bureaus also are being established in each province and municipality (large cities). MOF has been responsible for establishing the audit bureaus and has drafted regulations and standards based on international auditing practices in other countries. These interim regulations have been promulgated by the State Council.

3.18 To date, SAA's Foreign Investment Audit Bureau has been conducting the audits of Bank-financed projects; it focuses particularly on audits of enterprises or undertakings with foreign participation in the form of equity or loan financing. SAA's staff have been receiving financial training under the Technical Cooperation Credit (Credit 1664-CHA) of the Bank.

3.19 The Henan Audit Bureau (HAB) was established in September 1983. Under the proposed project, HPEPB's annual accounts will be audited by HAB under the overall supervision of SAA. This arrangement is satisfactory.

Assurances have been obtained from HPEPB that it will furnish annual financial statements, certified by an acceptable auditor, to the Bank within six months of the end of each financial year commencing in 1993.

Internal Audit

3.20 HPEPB recently has developed an internal auditing staff (including four chartered accountants) who periodically will examine the accounts of each operating unit; they also will conduct occasional spot checks. The objective of these examinations is primarily to test for accuracy and compliance with MOF regulations. The internal auditing unit is not expected to review the appropriateness of accounting regulations or procedures; such reviews are considered to be the responsibilities of MOF and MOE. The Bank will review the internal auditing function during project implementation with a view toward increasing its efficiency and usefulness to HPEPB. The first HAB audit report for HPEPB is expected to include a review and commentary on HPEPB's internal checks and controls and internal audit.

G. Electricity Tariffs

3.21 HPEPB's tariffs, generally are too low to cover economic costs. HPEPB's tariff includes four main categories of consumers: (a) large industry, (b) commercial and small industry, (c) lighting or domestic uses, and (d) agricultural production. Present tariffs are shown in Annex 8. Among the users, agricultural users pay much less than HPEPB's average tariff per kWh. Large industrial consumers pay both a demand charge, based on the maximum demand or capacity of their installed transformers, and an energy charge based on consumption. All other consumers just pay an energy charge. Large industrial consumers pay an average charge of about 11.0 fen/kwh (USc2.0/kWh), or about 103 percent of the average tariff. Large and small industrial consumers also pay connection charges, which include the cost of substations and distribution lines. Domestic customers do not pay a connection charge to HPEPB but must provide their own meter and internal wiring. Their average rate (20.4 fen or USc3.8/kWh) is almost 1.9 times as high as HPEPB's average tariff per kWh (10.65 fen or USc2.0/kWh). The tariff study for the East China power grid has been completed under the Bank-financed Beilungang Thermal Power Project (para. 2.15). While the general findings of this study are broadly applicable to the predominantly thermoelectric systems of China, there is a need to tailor the tariff target and reform strategy to each particular grid. A similar study is being carried out for HPEPB under the proposed project to achieve this objective and to disseminate modern tariff design techniques in Central China on the basis of the experience gained in East China.

H. Billing and Collection

3.22 As of December 31, 1990, HPEPB sales were distributed according to the consumer categories shown in Table 3.1. The greatest number of customers were found in the urban residential category. Together the urban residential and municipal and other categories account for almost 84 percent of customers, although they only represent about 6.5 percent of HPEPB's power sales. Large industrial users, rural communities, and agriculture account for much larger shares of power sales (about 93.5 percent).

Table 3.1: DISTRIBUTION OF HPEPB'S CONSUMPTION
(As of December 31, 1990)

Customer Category	No. of Consumers	%	Consumption (GWh)	%
Large industrial	3,582	1.3	15,268	55.0
Ordinary industrial	20,737	7.5	1,248	4.5
Agriculture	19,278	7.0	4,994	18.0
Rural communities	826	0.3	4,439	16.0
Urban residential /a	231,706	83.9	1,387	5.0
Municipal and others /a	31	-	411	1.5
Total	276,160	100.0	27,747	100.0

/a Urban residential and municipal and others include public service establishments, public transportation, and street lighting.

3.23 HPEPB conducts its billing and collection activities through twelve power supply bureaus. All major industrial consumers (consuming between 1,000-10,000 MWh/month) are charged in advance three times per month at approximate ten-day intervals. The last two bills, rendered on about the eleventh and twenty-first days of the month, are based on estimated usage derived from the consumer's contractual power consumption. The first bill, rendered on about the first day of the month, is also based on estimated usage but includes an adjustment to reflect the previous month's actual usage as computed from a meter reading. Smaller industrial consumers (consuming below 1,000 MWh/month) are billed twice a month, normally on the first and the fifteenth days of the month. These bills are also based on estimated usage, and the bill rendered on the first contains the adjustment for the previous month's meter reading. All other customers are billed once a month based on actual usage. All consumers buying power from HPEPB are metered individually. Most rural communities in the Henan Province receive bulk power directly from HPEPB; they, in turn, distribute it for agricultural, light industrial, and low voltage consumption within their jurisdictions. HPEPB measures these sales at its step-down transformer, normally 35 kV, serving the rural community. All higher and lower voltage consumption within agricultural communities is metered.

3.24 Industrial, commercial and bulk consumers pay their bills through direct debit from their bank accounts. Urban residential and low voltage agricultural consumers receiving power directly from HPEPB render payments either directly to HPEPB offices or to local branches of the National Bank. Payment is due within three to ten days of receipt of the bill. Regulations stipulate that consumers who do not pay within this period are to be charged a fine of 0.03-0.05 percent per day of delay, and that after several notices those who still refuse to pay their bills are to be disconnected. Because this regulation is strictly enforced, consumers very rarely allow themselves to fall into arrears. Any nonagricultural consumer is required to pay a

charge for reconnection. All power supply bureaus are required to submit their monthly bill collections before the eighth of the next month to the headquarters, i.e., HPEPB. These arrangements have established a reliable cash flow from sales and brought HPEPB's accounts receivable from current power sales down to fairly low levels. At the end of 1990 they were less than Y 45 million on sales of Y 2,545 million, which is satisfactory.

I. Insurance

3.25 Agencies such as the People's Insurance Company of China are now available in China providing commercial coverages. HPEPB currently purchases commercial insurance, covering assets, vehicles and public liability; these arrangements are satisfactory.

J. Distribution System

3.26 HPEPB's primary distribution system operates at 1 kV, 10 kV and 35 kV voltage levels. Unfortunately, the power shortages in China have focused attention on generation and transmission projects at the 110 kV level and above. When extensions to the distribution network have been the responsibility of the municipal or local governments, the activity has often been neglected owing to lack of funds.

3.27 According to HPEPB, system losses have been averaging about 14.1 percent (8.4 percent for plant use, 2.3 percent for transmission losses at 220 kV, and 3.7 percent for distribution losses below 110 kV). The distribution losses appear to be low in view of the paucity of investment in distribution. This is because HPEPB sells a significant percentage of its power in bulk to industrial, agricultural, and rural consumers, and the losses in their systems are not reflected in HPEPB's losses. To acquire a firmer grasp of the situation, the system losses at different voltage levels will be measured and analyzed under the tariff study to be carried out under the proposed project.

3.28 In order to reduce distribution losses for bulk supply, HPEPB has been taking the following measures since 1986: (a) replacing or renovating of old distribution transformers; (b) installing static capacitors so as to improve the power factor; (c) improving distribution networks by reconductoring at a pace of above 2,000-3,000 km annually; (d) implementing a meter monitoring and repairing program; and (e) setting aside 30 percent of the bulk supply revenue as a rural electrification development fund to be used for the extension and improvement of distribution networks in the rural area. Up to 1990, 24,900 units of old transformers (out of a total of 46,800) have been replaced; 80 percent of the bulk suppliers have a power factor of 0.8 or better; and 435,000 meters have been inspected and repaired. As a result of these measures, losses in bulk-supplied networks have been reduced from 10.3 percent in 1987 to 8.8 percent in 1990.

IV. THE POWER MARKET AND THE PROGRAM

A. The Central China Power Grid

4.1 The Central China Power Grid (CCPG) covers the provinces of Hubei, Hunan, Henan and Jiangxi, which have a combined population of 240 million. In 1990, the installed capacity of CCPG was about 20,100 MW, consisting of about 11,780 MW of thermal capacity (58.6 percent) and 8,320 MW of hydro capacity (41.4 percent). The system peak load and energy generation in that year were 10,950 MW and 96,654 GWh, respectively. About 37,664 GWh, or 39 percent, was generated from hydro plants.

4.2 At present, 500 kV is the highest transmission voltage in CCPG, connecting the provinces of Henan, Hubei and Hunan. At the end of 1990, the system had 2185.9 km of 500 kV transmission lines, 70.9 km of 330 kV lines and 12,447 km of 220 kV lines. There were six 500 kV substations with a total capacity of 4,482 MVA and ninety-one 220 kV substations with a total capacity of 15,424 MVA. A 500 kV direct current transmission line (1,100 km) was commissioned in 1989 extending from the Gezhouba hydro station near Ichang to the East China Power Grid.

4.3 There are four load dispatching centers in the CCPG: Wuhan, Changsha, Zhengzhou and Nanchang. Wuhan, located in Hubei Province, is under the supervision of CCEPA and has overall responsibility for controlling power transfer among the four provinces. The centers of Changsha (in Hunan Province), Zhengzhou (in Henan Province) and Nanchang (in Jiangxi Province) control the operation of generating stations and transmission and sub-transmission systems within their respective provinces.

B. The Henan Power Grid

4.4 The province of Henan had a population of about 86.5 million in 1990. At that time its power system had a total installed capacity of 6,081.6 MW. Of this, 5,706.1 MW (93.8 percent) was thermal-based and 375.5 MW (6.2 percent) was hydrobased. The major generating facilities include ten thermal power plants and one hydro plant; these are described in Annex 9. Yaomen and Jiaozuo are the two largest thermal plants, with 1,200 MW and 824 MW capacities, respectively. Sanmenxia, with 250 MW, is the only major hydro plant located within the area.

4.5 In 1990, the province generated a total of 31,777 GWh of electricity. HPEPB plants generated 25,186 GWh, or 79.2 percent of the total, and local, government-owned and industrial plants generated the remaining 6.591 GWh, or 20.8 percent. Hydro generation accounted for 1,404 GWh (4.4 percent), and thermal generation, primarily from coal, for 30,373 GWh (95.6 percent).

4.6 The transmission system in Henan in 1990 consisted of 324.0 km of 500 kV lines, 70.9 km of 330 kV lines, 3,180.2 km of 220 kV lines, and 6,778.8 km of 110 kV lines. All 500 kV and 220 kv lines and 4,230.4 km of the 110 kV lines were owned and operated by HPEPB. The first 500 kV line from Pingdingshan to Wuhan was put into service in 1981 to interconnect the Henan Power Grid (HPG) with CCPG. The 330 kV line was completed in 1985 and runs from Sanmenxia hydro station to Qinling in Shaanxi province. The thirty one

220 kv step-down substations had a total capacity of 5,266 MVA, two hundred and seven 110 kV substations had a capacity of 11,754.3 MVA. All 220 kV substations and 5,713 MVA of the 110 kV substations (117 in total) were owned and operated by HPEPB.

4.7 The growth of peak demand and energy requirements of the CCPG and HPG systems between 1981 and 1990 is shown in Table 4.1. The growth rates for CCPG are substantially higher than those for HPG because CCPG experienced both natural growth and additional demand due to absorption of other power grids over the period; the Henan Power Grid was interconnected to the system in 1983, the Jiangxi Power Grid in 1984, and the East China Power Grid in 1989. The system has a daily load factor of 90 percent and an annual load factor of about 78 percent. The peak load usually occurs in the month of June due to the heavy pumping load associated with irrigation.

Table 4.1: HISTORICAL LOAD GROWTH FOR CENTRAL CHINA AND HENAN POWER GRIDS

Year	Peak demand (MW)		Energy Supply /a (GWh)	
	CCPG	HPG	CCPG	HPG
1981	3,536	2,202	27,500	15,137
1982	3,790	2,320	29,500	16,254
1983	5,350	2,444	47,850	17,397
1984	7,020	2,512	51,200	18,641
1985	7,581	2,682	54,430	19,516
1986	7,961	3,015	59,190	20,888
1987	9,130	3,387	64,270	22,082
1988	10,300	3,658	73,100	24,140
1989	11,450	3,932	80,100	25,950
1990	10,950	3,956	78,676	27,153
Average rate of growth (%)	13.4	6.7	12.4	6.7

/a Including generation and purchased energy.

4.8 Industries account for the largest share of energy consumed in Henan. Of the 28,224 GWh of energy consumed in the province in 1990, 70.5 percent was consumed by industrial users, 18.4 percent by rural consumers, 8.9 percent by residential, commercial and other municipal loads in the cities, and 2.2 percent by transportation. Annex 10 provides more details of the energy consumed by different categories of consumers in Henan province between 1985 and 1990.

C. Load Forecast

4.9 As part of the economic planning process carried out by HPEPB, load forecasts were developed by applying a combination of statistical methods and planning targets to every major consumer category. Industrial loads were

estimated on the basis of a market survey and analysis of projected industrial products and unit consumption per product for different categories of industries. Rural loads were estimated based on past growth trends for drainage and irrigation loads, rural industrial loads, and lighting. Municipal loads were estimated based on market surveys of hotels, buildings, and government projects to be put into operation over the next ten years. Population growth and increasing use of home appliances were taken into consideration in estimating residential and commercial loads. Transportation loads, which are relatively small, were estimated according to past growth trends for airports and railway stations and projected load for railroad electrification. Table 4.2 presents the resulting forecasts for peak demand and energy requirements for CCPG and HPG between 1991 and 2000.

Table 4.2: LOAD FORECAST FOR CENTRAL CHINA AND HENAN POWER GRIDS

Year	Peak demand (MW)		Energy requirement (GWh)	
	CCPG	HPG	CCPG	HPG
1990 (Actual)	10,950	3,956	78,626	27,153
1991	11,777	4,313	82,703	28,896
1992	12,661	4,636	88,818	31,063
1993	13,661	4,984	95,385	33,393
1994	14,631	5,358	102,438	35,897
1995	15,728	5,759	110,012	38,589
1996	16,908	6,192	118,142	41,484
1997	18,176	6,656	126,883	44,595
1998	19,539	7,228	136,372	47,940
1999	21,005	7,792	146,354	51,535
2000	22,580	8,400	157,187	55,400
Average rate of growth (p.a.) (%)	7.5	7.8	7.2	7.4

4.10 Based on this forecast, the peak demand for CCPG would increase from 10,950 MW in 1990 to 22,580 MW in 2000; energy generation would increase from 78,626 GWh to 157,187 GWh. These figures represent average annual growth rates of 7.5 percent and 7.2 percent, respectively. This is because no additional demand due to absorption of other power grids is anticipated. For the HPG system, peak demand would increase from 3,956 MW to 8,400 MW and the energy requirement would increase from 27,153 GWh to 55,400 GWh. Their respective annual growth rates would be 7.8 percent and 7.4 percent.

4.11 These load forecasts and growth rates are on the conservative side considering that: (a) power shortages have been occurring for a long time, so there is quite a bit of suppressed demand for electricity, especially for the first five years; (b) as the rural economy improves, the load for lighting and agro-industries in rural areas will increase; and (c) as the standard of liv-

ing in the cities improves, per capita electricity consumption will increase rapidly, particularly for lighting and home appliances.

D. The Power Development Program (1991-2000)

4.12 Henan is short of hydroelectric potential. The 250 MW Sanmenxia hydro station is the only sizeable hydro development in the area. Another hydro project which is mainly for flood control, Xiaolangdi (6 x 260 kW), is being planned by the Ministry of Water Resources downstream of Sanmenxia on the Yellow River, but it is not expected to be completed before year 1999. Expanding generation capacity in the near term therefore will require the use of coal-fired thermal power stations.

4.13 A study of the least-cost investment program was made by WREPERI in February 1987. This study confirms that a number of thermal power stations will need to be built over the next decade utilizing local coal as well as coal imported from nearby Shanxi province. A summary of the power development program for the HPG system, including generation and transmission, is given in Annex 11. The balance between power demand and supply is given in Annex 12; it indicates that there still would be power shortages up to 1995. Only after the completion of Yanshi Phase II development in 1996, would the Henan power grid have adequate reserve capacity and be able to export baseload energy to the Central China power grid (see para.5.2).

V. THE PROJECT

A. Project Objectives

5.1 In the past, shortfalls in electric generating capacity have been a major constraint to China's economic growth. This situation is likely to continue in the near term unless changes are made. The Government of China gives high priority to electric power development and has developed a comprehensive strategy for power development. This strategy combines (a) expanding generating capacity by developing coal-fired thermal stations at mine-mouths or near ports and load centers where applicable, and accelerating the pace of hydroelectric development; (b) increasing the financial and managerial autonomy of the power bureaus; (c) introducing a more rational pricing system; (d) adopting modern techniques in project design and system planning; (e) constructing extra high voltage transmission lines for interconnection between regions; and (f) replacing low pressure medium-sized (50-100 MW) thermal units with higher pressure 300-600 MW units. The proposed project reflects the basic conception of these policies.

5.2 The major objectives of the proposed project are to: (a) alleviate the acute power shortage of a major load center in Central China; (b) support the national policies of developing thermal power plants at mine-mouths or near coal mines; (c) introduce up-to-date methods for investment planning, tariff restructuring, and system operation; (d) introduce techniques for modern construction and management of thermal power plant; (e) upgrade HPEPB's capability in financial management and in the operation and maintenance of thermal power plants with 300 MW units; and (f) further improvements in the environmental impact of HPEPB's thermal power stations, including an environmental monitoring program.

5.3 The proposed project would be the first Bank financed power project in the central part of China. This would enable the Bank to extend the institution-building functions that are being carried out in East and South China under previously approved Bank loans, help maintain the momentum reached and enhance further institutional developments in one of the most populous provinces in China.

B. Project Description

5.4 The proposed project is located about 90 km west of Zhengzhou and 27 km east of Luoyang in Henan province. It is situated on a site with favorable topographical conditions and easy access by railroad and highway. Water for the makeup (supplementary water to compensate losses) and circulating water systems will be supplied from underground wells along the banks of the Yi and Luo Rivers. Cooling water towers will be used for recirculation. The existing railroad system with a short branch will supply coal to the project site from the Xinan and Yima mines, located 60 km and 90 km west of the power station, respectively. Xinan has a reserve of 560 million tons and Yima has 627 million tons. Annual production of coal in 1990 was 10.6 million tons at Yima and 1.8 million tons at Xinan. Both mines contain low grade coals which are economically suitable for use in power generation. At appraisal the Government confirmed that these supplies of coal would be guaranteed for the project.

5.5 The proposed project would consist of:

(a) extension of the existing Yanshi thermal power plant by adding two coal-fired generating units of 300 MW each, comprising:

(i) civil works including main building piling and foundation, building structures, cooling water towers and a chimney; and

(ii) electrical and mechanical equipment including boilers, turbine-generators, ash handling facilities, and other auxiliaries;

(b) construction of five 220-kV transmission lines about 350 km in length with associated substations;

(c) carrying out a monitoring program for environmental protection;

(d) carrying out training program for upgrading the technical, financial and managerial skills of HPEPB staff including a management information system, equipping and upgrading HPEPB's technical schools, and training for the operations and maintenance staff of large thermal power plants with 300-MW units;

(e) carrying out a tariff study and an action plan for tariff structure improvements; and

(f) provision of consulting services.

5.6 Project Origin and Design. The proposed project represents the Phase II development of the Yanshi Thermal Power Project. The first phase, consisting of two 200-MW units has been successfully completed. The first unit was put into operation in March 1988 and the second unit in 1989.

5.7 The project was first brought to the attention of the Bank during the Bank/GOC annual review of the lending program for FY87 and FY88, held in June 1986. In September 1986, an identification mission visited the project site and the implementing agency--HPEPB. Between August 1985 and March 1986, a feasibility study of the project was prepared by the Southwest China Electric Power Design Institute (SWCEPDI). This study later was revised to conform to the requirements of a Bank loan. In April 1987 the report was reviewed by MWREP, and in May 1987 it was finalized. The report demonstrated that the project was technically sound and economically justified.

5.8 Extension of the Yanshi Thermal Power Station. Site conditions are well known and there have been no unusual occurrences. A study of the power development program (para. 7.3) has confirmed that the Yanshi thermal power station is the least cost solution for HPEPB's future development program. The station is located at the load centers of Zhengzhou and Luoyang, which have experienced acute power shortages for many years; it also is situated close to the coal mines, reducing both transmission and fuel costs.

5.9 The Phase II development will consist of two 300 MW coal-fired units of conventional design with drum type boilers and reheat tandem compound type

turbine-generators. They will be operating with a steam condition of 169 kg/cm2 pressure and 538 degrees celsius temperature.

5.10 Transmission System. In order to feed power from the Yanshi plant to the HPEPB system, five 220-kV transmission lines will be constructed. The lines will extend a total of 350 km and run from Yanshi to Zhengzhou (104 km), Yanshi to Gaucun through Luobei and Luonan (137 km), Yanshi to Dengfong (60 km), and include two other short connection lines (49 km). The existing Luobei, Jili and Gongxian substations all will be extended. Luobei will receive a 150 MVA transformer, Jili a 90 MVA transformer, and Gongxian a 120 MVA transformer, representing a total 600 MVA of additional capacity among the three substations. Two new 120 MVA substations will be established at Dengfong and Mixian (see Map IBRD 21114).

5.11 Training. A training program with the following three components will be included in the project (Annex 13):

(a) training of HPEPB staff in the areas of utility management, financial planning, and development of a management information system;

(b) project-related training for technical staff; and

(c) upgrading and equipping of HPEPB's technical schools.

5.12 To modernize the management and financial planning of the utility, study tours and training will be arranged in which HPEPB managers and financial staff will visit a few selected utilities overseas. The objectives are to provide high-level staff with the skills needed to meet the circumstances of the nineties: modern and larger power plants, larger automated grids with load dispatch systems, higher voltage transmission, modern accounting/costing/pricing and a self-sustained investment planning organization. Before that, seminars on utility management and financial planning will be conducted in China with the assistance of management specialists. Since this type of training is already included with ongoing Bank loans, seminars and overseas training can be arranged jointly with the other power bureaus.

5.13 Project related training for the technical staff would include: (a) on-the-job training for engineering and design staff by providing opportunities for them to work together with the consultants; (b) training of electrical and mechanical staff by suppliers of major equipment included under the contracts; (c) training of the operations and maintenance staff at selected power stations available in China; and (d) training of project staff for environmental monitoring. A training center equipped with a simulator in CCPG will be used to train operators. New technology on construction, especially installation of large generation units and interfacing between different islands will be introduced throughout the project implementation.

5.14 To meet HPEPB's long-term needs for human resources, expansions will be made in its staff college, the Zhengzhou Secondary Technical School for Electric Power, and three technical schools for skilled workers. All these schools will be provided more laboratory equipment and teaching aids and the skills of their teaching staff will be upgraded.

5.15 All the training components will be implemented by HPEPB. Assurances have been obtained from HPEPB that it will carry out the training in accordance with a program acceptable to the Bank.

5.16 Tariff Action Plan. A tariff study is being carried out by HPEPB with the assistance of WREPERI to prepare a concrete plan of tariff restructuring (Annexes 14 and 15). The purpose of this study is to review the level and structure of the power tariff on the basis of long-run marginal costs. The study also will take into account other considerations such as the financial requirements and objectives of HPEPB. A tariff action plan will be executed by HPEPB in order to bring tariffs more in line with the cost of supply for various customer categories, based on the findings of the power pricing study. Assurances have been obtained from HPEPB that it will carry out the tariff study and action plan in accordance with the program agreed with the Bank.

5.17 Consulting Services. As the proposed project physically resembles the Wujing Thermal Power Project (Loan 2852-CHA) in its scope and in the size of units, the same consulting arrangements have been made. The China International Engineering Consulting Corporation (CIECC) is the leading firm, supported by the China Electric Power Consulting Corporation (CEPCC) and SWCEPDI to provide the overall consulting services. Sargent and Lundy Engineers U.S.A., a foreign consulting firm retained for the Wujing Project, is used to provide assistance in the review of bidding documents, bid evaluation, including the preparation of bid evaluation report, and in the interfacing of engineering and design for different islands. Terms of reference for these services (Stage I and Stage II) are detailed in Annex 16.

5.18 An amount of $0.6 million has been provided for Stage I services (for project preparation) as one of the subprojects under the Second Technical Cooperation Credit (Credit 1664-CHA).1/ Stage II services for project implementation will be financed under the proposed Bank loan.

C. Cost Estimate

5.19 The estimated cost of the project is summarized in Table 5.1. The cost estimates reflect December 1991 prices and are based on the latest tendering information available for 300 MW units in China. Unit costs of civil works are based on information obtained during the implementation of Phase I (2 x 200 MW). Since this is an extension project, site conditions are well known. Physical contingencies are calculated at 5 percent for the foreign costs of plant equipment, materials and services, and 10 percent for civil works and other local costs. The price escalation for costs expressed in terms of foreign exchange (US dollars) is calculated according to anticipated international price movements of 3.9 percent per annum in average for 1992-1997. The price escalation for costs expressed in local currency is calculated according to projected local inflation rates of 8.0 percent per

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1/ Technical Cooperation Credit is used for project preparation only. This $0.6 million has not been included in the project cost estimate shown in Table 5.1.

annum for 1992, 5.0 percent per annum for 1993 and thereafter. Detailed estimates of project costs are provided in Annex 17.

Table 5.1: SUMMARY OF PROJECT COSTS

	Local	Foreign	Total	Local	Foreign	Total	Foreign cost as % of total
	(Y million)			($ million)			
Civil works	237.3	34.4	271.7	44.1	6.4	50.5	12.7
Plant equipment and materials	308.8	860.3	1169.1	57.4	159.9	217.3	73.5
Transmission system	140.4	-	140.4	26.1	-	26.1	-
Environmental protection	1.1	0.5	1.6	0.2	0.1	0.3	33.3
Training	6.9	5.4	12.3	1.3	1.0	2.3	43.5
Tariff study and action plan	2.7	-	2.7	0.5	-	0.5	-
Engineering and construction management	91.5	6.5	98.0	17.0	1.2	18.2	6.6
Total Base Cost	788.7	907.1	1,695.8	146.6	168.6	315.2	53.5
Contingencies							
Physical	78.6	45.2	123.8	14.6	8.4	23.0	36.5
Price	74.2	14.0	88.2	13.8	3.0	16.8	17.9
Total Project Cost	941.5	966.3	1,907.8	175.0	180.0	355.0	50.7
Interest during construction							
IBRD loan	-	258.8	258.8	-	48.1	48.1	100.0
Local loan	304.0	-	304.0	56.5	-	56.5	-
Total Financing Required	1,245.5	1,225.1	2,470.6	231.5	228.1	459.6	49.6

Notes: 1. Base cost and physical contingency (at December 1991 price) have been calculated using an exchange rate of Yuan1 = $0.19.
2. The project would be exempted from import duties and taxes.
3. Total physical contingencies are about 7.3% of base cost; local price contingencies are about 8.6% and foreign price contingencies are about 1.7% of the base cost plus physical contingencies, when expressed in US dollars. Since bids were already opened for the boiler and turbine generator packages on a firm price basis, no escalation of prices were provided after contract award, targeted for early 1992.

D. Financing Plan

5.20 The financing plan for the project is shown in Table 5.2:

Table 5.2: FINANCING PLAN FOR THE PROJECT
($ million equivalent)

	Local cost	Foreign cost	Total
IBRD	-	180.0	180.0
SEIC	115.8	32.1	147.9
Provincial Government	115.7	16.0	131.7
Total	231.5	228.1	459.6

5.21 The proposed Bank loan of $180 million will be used to meet 51 percent of the total project cost, or 79 percent of the foreign exchange requirements. The loan will finance the following components:

(a) steel products and timber for civil works;

(b) construction equipment;

(c) boiler island package;

(d) turbine-generator island package;

(e) ash disposal system package;

(f) instrumentation and control package;

(g) electrical equipment and cables;

(h) water treatment package;

(i) environmental protection equipment;

(j) training program; and

(k) consulting services.

5.22 Financing for the remaining foreign exchange requirement, interest during construction on the Bank loan will be obtained from SEIC and provincial government. These local loans will be repaid over 15 years, beginning after the project is completed. All local costs will be financed equally by SEIC and the provincial government of Henan (ie. an equivalent of $116 million each).

5.23 The proposed Bank loan will be made to the People's Republic of China at the standard variable interest rate for a 20 year term (including 5 years grace for repayment of principal). Assurances have been obtained from GOC that it will onlend the proceeds of the proposed Bank loan to HPEPB under a subsidiary loan agreement with a 20-year term including 5 years grace at the Bank's variable interest rate with no premium. HPEPB will bear the commitment charges and the foreign exchange risk. A Project Agreement will be concluded between the Bank and HPEPB. The execution of a subsidiary loan agreement satisfactory to the Bank would be a condition of effectiveness for the loan.

E. Procurement

5.24 Equipment and materials financed under the proposed Bank loan will be procured by international competitive bidding (ICB) in accordance with the Bank's Procurement Guidelines. Based on the experience gained from the Wujing Thermal Power Project, the procurement of this project will be carried out on an island basis instead of the single responsibility concept. For selected goods, bids offering domestically manufactured plant, equipment and other components will receive a preference in bid evaluation of 15 percent of the c.i.f. price or the import duty, whichever is lower. Equipment estimated to

cost less than $200,000 per contract up to an aggregate amount of $3.0 million could be procured by Limited International Bidding (LIB) in accordance with the Bank's Procurement Guidelines. Civil works to be financed by the borrower will be procured following local competitive bidding procedures (LCB), which has been reviewed by the Bank and found satisfactory.

5.25 Procurement arrangements are summarized in Table 5.3 below:

Table 5.3: PROCUREMENT ARRANGEMENTS
($ million)

Item	Procurement Method ICB	Other	N.B.F.	Total cost
1. Works				
1.1 Site preparation	-		12.1	12.1
1.2 Civil works	-	-	39.7	39.7
2. Goods				
2.1 Plant equipment and materials	170.6 (170.6)	3.0 (3.0)	68.5	242.1 (173.6)
2.2 Transmission system	-	-	31.8	31.8
2.3 Construction equipment	-	3.9 (3.9)	-	3.9 (3.9)
3. Consultancies				
3.1 Engineering and construction management	-	21.8 (1.3)	-	21.8 (1.3)
3.2 Training	-	2.7 (1.1)	-	2.7 (1.1)
3.3 Tariff Study	-		0.6	0.6
3.4 Environmental protection	-	0.1 (0.1)	0.2	0.3 (0.1)
Total	170.6 (170.6)	31.5 (9.4)	152.9	355.0 (180.0)

Note: Figures in parentheses are the respective amounts financed by the Bank loan.
N.B.F. = Not Bank-financed.

5.26 All procurement documents related to bidding packages for goods financed by the Bank and estimated to cost more than $1.0 million equivalent would be subject to the Bank's prior review; this covers the procurement of eight major packages (para. 5.21) to be financed out of the Bank loan. The procurement schedule is shown in Annex 18.

F. Project Implementation

5.27 Since this is an extension project, all the land needed for the power plant already is available and most of the common facilities have been completed. The detailed engineering and design for the new extension is being carried out by SWCEPDI. A well-staffed construction unit has been set up under HPEPB to supervise and coordinate the construction of the project. Bidding documents for the boiler and turbine generator were issued on January 25, 1989. Bids were opened on May 4, 1989 and contracts are expected to be negotiated pending Bank loan approval.

5.28 Chart 4 presents the implementation schedule for the various components of the project. Key dates of project implementation are given in Annex 19 and estimated annual contractual and other payments are given in Table 5.4. The civil work construction is well within the capability of the local contractor. Site preparation started in July 1989 under the Phase I development. Foundation excavation will be started in August 1992, and piling will begin in September 1992. Commissioning of the first 300 MW unit would be December 1995; commissioning of the second unit would follow twelve months later, in December 1996. The project completion date would be June 30, 1997, and the closing date of the Bank loan would be December 31, 1997.

Table 5.4: ESTIMATED ANNUAL CONTRACTUAL AND OTHER PAYMENTS
($ million equivalent)

Project Element	Project Year /a							Total Payment	Remarks
	1991	1992	1993	1994	1995	1996	1997		
Works									
Site preparation	0.8	5.8	5.2	0.3	-	-	-	12.1	NBF
Civil works	1.4	4.3	14.3	13.9	4.2	1.6	-	39.7	LCB
Goods									
Plant equipment and materials	-	15.8	81.1	49.2	16.0	5.1	3.4	170.6	ICB
		(15.8)	(81.1)	(49.2)	(16.0)	(5.1)	(3.4)	(170.6)	
	-	0.1	1.6	0.9	0.2	0.2	-	3.0	Other
		(0.1)	(1.6)	(0.9)	(0.2)	(0.2)		(3.0)	
	0.1	4.1	28.5	23.3	7.8	4.7	-	68.5	NBF
Transmission system	-	1.3	3.1	14.2	11.6	1.6	-	31.8	NBF
Construction equipment	-	0.4	3.5	-	-	-	-	3.9	Other
		(0.4)	(3.5)	-	-	-	-	(3.9)	
Environmental protection equipment	-	0.1	0.2	-	-	-	-	0.3	IS,NBF
	-	-	(0.1)	-	-	-	-	(0.1)	
Consultancies									
Engineering & construction mgmt.	1.4	3.3	5.5	5.4	4.8	1.4	-	21.8	Other
	-	(0.2)	(0.7)	(0.2)	(0.2)	-	-	(1.3)	
Training	-	0.3	1.0	1.0	0.4	-	-	2.7	Other
		(0.2)	(0.5)	(0.4)	-	-	-	(1.1)	
Tariff study	0.3	0.3	-	-	-	-	-	0.6	NBF
Total	4.0	35.8	144.0	108.2	45.0	14.6	3.4	355.0	
(Bank-Financed)		(16.7)	(87.5)	(50.7)	(16.4)	(5.3)	(3.4)	(180.0)	

/a Calendar year.

G. Disbursement

5.29 The Bank loan would be disbursed against: (a) 100 percent of the foreign expenditures for directly imported equipment and materials quoted on a c.i.f. basis; (b) 100 percent of local expenditures ex-factory for locally manufactured items; (c) 75 percent of the cost of other items procured locally; and (d) 100 percent of the expenditure for consulting services and training. For expenditures relating to training and contracts for goods and services valued at less than $200,000 equivalent, reimbursement will be made on the basis of statements of expenditures. Documentation supporting such expenditures need not be submitted to the Bank but should be retained in the HPEPB office in Zhengzhou and made available for review by the Bank's supervision mission. To facilitate disbursements under this project, a Special Account will be established with an authorized allocation of $10.0 million, representing approximately four months of average project expenditures. Applications for replenishment will be submitted monthly or when the amounts withdrawn equal 50 percent of the initial deposit, whichever comes sooner.

5.30 Annex 20 presents the disbursement schedule for the proposed Bank loan as well as a Bank-wide standard profile of disbursements for all sectors in China. Since the project involves the addition of two units for which most of the preparation works and common facilities were already completed and for which procurement of major plant equipment was in the advanced stage, the implementation period is expected to be shorter than for conventional projects. The disbursements therefore are expected to be faster, scheduled for five and a half years instead of the Bank-wide profile of six years.

H. Monitoring and Reporting

5.31 Satisfactory procedures for financial reporting have been established for use in monitoring the progress of the project (paras. 3.13 and 3.20). HPEPB will submit half yearly progress reports on project execution and a project completion report when the work is finished.

I. Environmental Considerations

5.32 The Yanshi site is located about 90 km west of the capital city of Zhengzhou and 27 km east of Luoyang. It is primarily an agricultural area with a population density of about 8,500 within one km and 45,000 within a radius of 5 km. The nearest township is Yanshi, located about 2 km east of the plant site. The prevailing wind direction is NEE or NE. As Yanshi is a developed site, there would be no need for land acquisition and resettlement.

Environment Impact

5.33 An environmental impact (EI) report has been reviewed and approved by the Henan Provincial Environmental Protection Bureau. The project has been

designed taking into account all recommended mitigating measures in the EIS into the project design. The following issues deserve special note.

5.34 Air Quality. The coal to be used for the plant would be low grade coal with a heat value of 4,250 kcal/kg, a sulfur content of less than 1 percent, and an ash content of about 24 percent. Ground level concentrations of dust particles and sulfur dioxide would be kept within the limits of the national standard and comply with the World Bank Guidelines for four units in operation. The stack emission for dust particles also would conform to the requirements of the World Bank Guidelines (see Annex 21). These conditions would be met by using a stack height of 240 m and employing electrostatic precipitators with an efficiency of 99.4 percent for Phase II development. However, this is not the case for the existing Phase I development of two units of 200 MW which have a Venturi water-filmed type of precipitator. HPEPB has agreed to improve the efficiency of these units by replacing them with high efficiency electrostatic precipitators. Procurement of these precipitators has been started with HPEPB's own funds and installation is scheduled for 1992/93.

5.35 Liquid Chemical Effluent. Plant liquid chemical effluents will be held in a neutralization basin and treated before they are discharged into rivers.

5.36 Ash Disposal. Ash from the power plant will be disposed in the gullies along the northern slope of the Mang-shan range enclosed by dams. The total storage capacity of ash disposal yards is about 37.5 million m^3, which is adequate for 30 years of operation. The pH value in the ash water will be kept within the allowable limit of 6-9 before it is discharged into the Yellow River. Facilities to treat the ash water will be provided during project implementation.

5.37 A complete summary of all environmental mitigating measures to be taken is presented in Annex 22 and an environmental monitoring program, in Annex 23. HDEPB will undertake the recommended mitigating measures and rectify problems, if any, during the testing and operation periods. Assurances have been obtained from HPEPB that it will take all necessary steps to implement an environmental monitoring program satisfactory to the Bank.

Resettlement

5.38 The transmission facilities will be designed and installed in accordance with current technological practices and are expected to cause minimum disturbance to the environment. The area through which the three major 220 kV transmission lines will pass is primarily agricultural, consisting of 75 percent wheat or cotton fields and 25 percent uncultivated hills. There will be no houses or people to be relocated. As the land under the line still could be utilized for cultivation, there should be no difficulty to acquire land for tower foundation (about 5.2 ha).

VI. FINANCIAL ASPECTS

A. Introduction

6.1 HPEPB is a financially independent entity which reports to MOE. It follows the financial regulations issued by MOF for all state enterprises and the procedures developed by MOE for adapting those MOF regulations for use by power bureaus. Within this framework, HPEPB manages its own affairs. In the past its revenues have covered its operating requirements and left it with comfortable liquidity. However, most surpluses have been remitted to the Government; in turn, the Government has provided all the funds needed for investments in approved projects. Historically, these funds have been provided on a grant basis, but more recently they have been provided as loans.

B. Financial System

6.2 All Chinese power bureaus conduct their affairs according to a standardized financial system, the salient points of which are described briefly in Annex 24. As was the case under previous Bank-financed projects for the Chinese power subsector, HPEPB is not permitted to retain more than a nominal amount of its earnings, and the cash corresponding to the earnings that are retained must ultimately be applied to certain specified categories of expenditures or investments. Thus, HPEPB has limited incentive to realize revenues in excess of its obligations. Also, the traditional indicators of financial performance, such as rate of return and self-financing ratio, have only limited applicability to an analysis of HPEPB at this time. As part of the ongoing economic reforms, the Government is reassessing the present fiscal system, with particular focus on tax reform issues and options. Since details of such reforms are still being formulated, there are considerable uncertainties relating to the specific parameters affecting the bureaus' future finances. Nevertheless, in keeping with the spirit of the recently enacted Enterprise Law, the integrated measures of the economic reform would be directed at enhancing rather than impeding the commercial orientation of the state enterprises.

C. Past and Present Financial Performance

6.3 HPEPB's financial statements for the period 1985-90 are shown in Annex 25 and summarized in Table 6.1.

6.4 During 1985-90, HPEPB's sales increased by about 41 percent, while operating revenues increased by about 129 percent. Although the tariff was not adjusted during this period, average revenues per kWh increased by about 64 percent, reflecting a modest increase in the proportion of higher priced urban residential and commercial consumption. Despite the increase in average revenues, the operating ratio increased from about 84 percent to 91 percent, indicating that the increase in HPEPB's operating cost is outpacing the increase in average revenues. The downward trend of the rate of return, specifically for 1985-88, is not due to HPEPB's inefficiency in operation but due mainly to its rapidly increasing fixed assets formation during the period; while HPEPB's rate base increased by nearly 39 percent in 1986 and 18 percent in 1988. In order to meet the cost increases expected in the future and to

Table 6.1: HPEPB'S KEY FINANCIAL INDICATORS, 1985-90 /a
(in million Yuan)

Year ended December 31	1985	1986	1987	1988	1989	1990
Electricity sales (GWh)	16,992	18,062	19,773	21,870	23,392	23,892
Average revenue (fen/kWh)	6.5	7.1	7.4	7.7	10.0	10.7
Operating revenues	1,110	1,289	1,464	1,680	2,330	2,545
Operating income /b	172	162	152	98	198	154
Capital expenditure	879	864	591	424	196	238
Net fixed assets in operation	2,137	2,991	3,070	3,625	3,919	4,500
Cash at end of year	93	120	142	280	323	344
Operating ratio (%)	84	87	90	94	93	91
Rate of return (%) /c	12.0	7.4	5.7	2.7	4.1	5.3
Debt service coverage (times)	72.0	37.0	9.0	9.0	7.0	7.1
Current ratio (times)	1.6	1.6	1.9	1.7	1.8	3.4

/a In October 1983 the Sanmenxia hydro power station (5 x 50 MW), of which the value of net fixed assets then was 185.7 million Yuan, was transferred from HPEPB to the Yellow River Water Conservancy Commission under the directive of MWREP.
/b Operating revenues less the aggregate of fuel, power purchases, administration, operation and maintenance, and depreciation.
/c Based on historically valued average net fixed assets in operation.

remain financially viable, HPEPB will need to increase its tariff considerably for the period 1990-2000.

Valuation of Assets

6.5 The Chinese financial system does not employ the concept of revaluing fixed assets. In the short run, the revaluation of assets would not have a major impact on HPEPB's financial status because inflation has been low over the last 30 years and because there is little foreign content in existing assets in the power sector. However, as incipient changes take place in the structure of prices, revaluation of assets will become more important. Since the adoption of a revaluation policy would have impacts beyond the power sector, it will not be addressed solely in the context of the proposed project. Instead, this subject will become a component of the continuing policy dialogue between the Bank and MOF. In the meantime a pro forma revaluation was conducted during appraisal of the proposed project, to assess the impact of revaluation on HPEPB's average rate of return on assets. The effect of this revaluation was to reduce the average rate of return on assets by one-third for the period 1991 and 2000.

Tariffs

6.6 In the past, HPEPB's tariff allowed the bureau adequate operating revenue and provided substantial general revenues to the State (para. 6.3). However, in the future inflation and other specific price adjustments are

expected to have a much greater effect on HPEPB's cost structure. For example, the price the bureau pays for coal, the major part of its cost structure, already increased substantially in 1987/88. In order for HPEPB to recover the full additional cost of coal price increases MOE has authorized it to introduce a gradual fuel adjustment into its primary pricing arrangements. The pricing study, being carried out under the project, will form the basis for further discussions with GOC on the level and structure of the power tariff.

D. Financing Plan

6.7 HPEPB's financing plan for the project implementation period (1992-97) is displayed in Table 6.2:

Table 6.2: HPEPB'S FINANCING PLAN, CY92-97

Item	Y million	$ million /a	% of total
Sources of funds			
Internal cash generation	11,625	2,161	67
(less) Increment in working capital	(889)	(166)	5
(less) Increment in Special Fund assets	(1)	(0)	0
(less) Repayment of loans	(4,199)	(780)	24
(less) Remittances to Government	(1,789)	(333)	10
(less) Special Fund expenditures	(1,955)	(363)	11
(less) Chargeable IDC	(284)	(53)	2
Cash Available for Investment	2,508	466	15
Proposed IBRD loan	968	180	6
Other loans for proposed project	1,571	292	9
All other loans	12,199	2,267	70
Total financing	14,738	2,739	85
Total sources of funds	17,246	3,205	100
Application of funds			
Proposed project	2,221	413	13
Other construction	11,927	2,217	69
Interest during construction	1,132	210	6
Renovations	1,700	316	10
Distribution improvements	266	49	2
Total application of funds	17,246	3,205	100

/a Y 1 = $0.19.

The Chinese financial system prevents a power bureau from meeting more than nominal amounts of its investment program from internal cash generation. In the case of HPEPB, more than 78 percent of the cash available for investment is earmarked for renovations and distribution improvements through the Special Fund allocation system. The rest of the cash available for investment would cover a portion of interest during construction which, pursuant to regulations, must be met from net income. The proposed project (excluding interest during construction) accounts for about 13 percent of HPEPB's investment program for the period. The proposed Bank loan will only meet about 6 percent of HPEPB's financing requirements.

6.8 The estimated foreign exchange requirement of the proposed project exceeds the proposed Bank loan by $48.1 million, which represents interest during construction. SEIC has arranged for HPEPB to borrow the yuan equivalent of the additional foreign exchange requirement from the People's Construction Bank of China (PCBC) at 8.28 percent per annum interest, with repayment over a 10-year period beginning upon completion of the project. Arrangements have been made to allow HPEPB to purchase the needed foreign exchange from the Bank of China.

6.9 HPEPB will borrow one half of the local currency portion of its financing requirements from the Henan provincial government and the remaining half from PCBC (through SEIC) on terms prevailing at the time of commitment. Currently these terms include interest at 8.28 percent per annum and repayment in equal installments over 10 years beginning after construction is completed.

E. Future Finances

6.10 Projections of HPEPB's financial performance for the period 1991-2000 are displayed in Annex 25 and summarized in Table 6.3. These projections are based on the assumptions presented in Annex 25.

Table 6.3: HPEPB'S KEY FINANCIAL INDICATORS, 1990-2000
(million yuan)

Year ended 12/31	Actual 1990	Forecast 1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Projected average 1991-2000
Energy sales (GWh)	23,892	25,152	27,017	28,961	31,090	33,638	37,173	40,569	43,341	47,416	53,361	
Average price/kWh (fen)	10.65	13.50	15.38	17.23	19.01	21.00	22.46	24.24	27.05	28.80	28.80	
Operating revenue	2,545	3,396	4,155	4,991	5,910	7,065	8,350	9,835	11,723	13,654	15,366	
Operating income	238	441	766	1,120	1,593	2,180	2,714	3,543	4,581	5,400	5,923	
Remittances to government	27	34	93	138	286	326	438	509	564	616	834	
Annual capital expenditure	591	1,330	1,414	2,333	2,749	3,048	3,577	4,125	4,494	4,603	4,648	
Rate base	4,500	4,877	5,901	7,114	8,298	10,101	12,606	14,834	17,381	22,565	27,651	
Long-term debt	2,067	2,952	3,834	5,359	7,248	8,959	11,062	13,192	15,098	16,489	17,905	
Debt service	344	313	314	294	348	351	408	440	523	665	1,045	
Cash in banks	152	187	227	245	264	271	297	386	463			
Rate of return												
Historically valued assets (%)	5.3	9.0	13.0	15.7	19.2	21.6	21.5	23.9	26.4	23.9	21.4	19.6
Notionally revalued assets (%)	3.9	5.8	8.1	9.6	11.7	13.5	14.0	15.7	17.4	16.4	14.9	12.7
Self-financing ratio (%)	17.3	24.5	22.4	22.2	24.0	25.7	25.0	26.8	25.5	26.2	30.0	25.2
Operating ratio (%)	90.6	87.0	81.6	77.6	73.1	69.1	67.5	64.0	60.9	60.4	61.5	70.3
Debt/total capital (%)	37.0	44.2	49.2	55.2	60.7	62.6	64.5	64.9	63.2	60.2	58.4	58.3
Debt service coverage	7.1	2.6	2.2	1.9	2.2	1.8	1.8	1.6	1.5	1.4	1.5	1.8

6.11 Between 1990 and 2000, HPEPB is projected to maintain high rates of growth. Energy sales are expected to increase by about 123 percent over 1990 levels, representing a compound annual growth rate of about 8 percent. Net fixed assets in operation are expected to increase by about 548 percent over

current levels, representing a compound annual growth rate of about 21 percent. Annual capital expenditure is expected to increase by about 686 percent over the 1990 level, representing a compound annual growth rate of about 23 percent. If HPEPB is to maintain its financial viability in the face of this growth, the forecast implies that it will need to increase its average revenue by 170 percent, from 10.65 fen/kWh in 1990 to 28.8 fen/kWh in 2000. This represents a compound annual growth rate of about 10.5 percent in nominal terms, or 4.7 percent per annum in real terms. As early as 1991, HPEPB would have to introduce general tariff revisions in addition to the coal adjustments already approved (para. 6.6).

6.12 Although conventional indicators of financial performance such as rate of return and self-financing ratio have limited applicability to a government-controlled utility such as HPEPB (para. 6.2 and Annex 24), the relationships between pricing, operating costs, and size of investment program are becoming increasingly important to MOE and SEIC. In their role as nationwide managers of the sector, MOE and SEIC must arrange financing for the large and rapidly expanding investment programs of the numerous power bureaus. In the process they have become acutely aware of the need to mobilize appropriate resources from the consumer. To further their efforts at resource mobilization, assurances have been obtained that HPEPB will take measures, including but not limited to tariff increases, to ensure that annually it earns a cash surplus (net operating income) sufficient to meet at least 20 percent of its three-year average investment program for the years 1992-94, and at least 25 percent for the years thereafter. For HPEPB, the earned cash surplus would be defined as total cash revenues (including income from the sale of electricity and from connection charges) less the aggregate of (a) cash operating expenses; (b) interest charged to operations; (c) income taxes; (d) gross increases in working capital (including changes in cash balances); (e) net increases in Special Fund Assets; (f) loan repayments; and (g) Special Fund Expenditures for Maintenance and Employee Benefits. For purposes of this agreement, the Adjustment Tax would not be considered a reduction in earned cash because it is a remittance of a residual and not a tax built into the cost structure and the proceeds are generally recycled into investments in the sector. The average annual investment program would be defined as the average of (a) the previous year's actual capital expenditure; (b) the current year's planned capital expenditure; and (c) the next year's projected capital expenditure.

6.13 In view of HPEPB's increasing capital expenditures in the next 5-6 years (from Y 1,414 million in 1992 to Y 4,125 million in 1997: an increase of about 192 percent), the minimum self-financing ratio set at 20 percent initially and 25 percent by the year 1995 cannot be considered an easy target. Specifically, in order to comply consistently with the recommended self-financing ratio target, the average revenue of HPEPB would have to be increased by 9.5 percent per annum in nominal terms (or about 4 percent per annum in real terms) during the projection period. Its self-financing ratio is expected to average 25 percent; its rate of return on historically valued assets is expected to average 19.6 percent; and its operating ratio is expected to average 70 percent. These already acceptable financial performance indicators could improve substantially as the anticipated tariff reforms are realized.

6.14 The Government's current policy of using loans rather than grants to finance capital expenditure is expected to have an important effect on HPEPB during the projection period. Under the current fiscal arrangement all capital investments except renovations and distribution improvements are to be financed exclusively by loans. As a result, HPEPB is projected to move from a capital structure which included only about 38 percent debt in 1990 to a debt/total capital ratio of about 65 percent in 1997. While the assumption of 100 percent debt financing is the most conservative one and in any case HPEPB is not allowed to raise debt for any purpose other than capital investments, HPEPB's debt/total capital ratio would not exceed 75 percent throughout the projection period, which is acceptable. The debt/total capital ratio will be used for monitoring HPEPB's financial operation in the future; HPEPB will report it to the Bank annually. Debt service coverage, which is projected to drop from about 7.1 in 1990 to about 1.4 in 1997, remains satisfactory; however, this ratio should be monitored carefully. Assurances have been obtained from HPEPB that it will incur additional debt only if a reasonable forecast of its revenues and expenditures indicates that internal cash generation would provide debt service coverage of at least 1.3. This assurance, taken in conjunction with HPEPB's agreement to annually furnish the Bank with eight-year rolling financial projections (para. 3.12), is expected to draw HPEPB's attention to the long-term financial impact of decisions relating to its investment program.

VII. JUSTIFICATION

A. Need for the Project

7.1 CCPG is the third largest regional grid in China in terms of installed capacity (para. 4.1). HPG is one of the most important grids within CCPG, providing 30 percent of the capacity (6,082 MW) and 33 percent of the power generation (31,777 GWh). Shortages of generating capacity have been a major constraint to economic development of the area. The system's dependable capacity of 3,968 MW 1/ is not sufficient to meet the peak demand of 3,956 - MW. Even with purchased power there is not adequate reserve capacity. In fact, the power load has been greatly suppressed. In 1990, power curtailments by rotation of supply were enforced almost every day except during the spring festival. Most industries were forced to operate only four days a week, causing considerable underutilization of plant facilities and manpower. In addition, there were 48 new applications from large consumers ready to receive power in 1990.

7.2 The energy and capacity balances of the HPG system with and without the two additional units of the Yanshi plant are shown in Table 7.1. These balances clearly indicate the urgent need for the proposed project, since without it HPEPB's reserve margin would be precarious and the system would not be able to meet the energy requirement in the mid 1990s.

Table 7.1: ENERGY AND CAPACITY BALANCE

	1995		1996		1997	
	Without project	With project	Without project	With project	Without project	With project
Peak demand (MW)	5,759	5,759	6,192	6,192	6,656	6,656
Dependable peaking capacity (MW) /a	6,168	6,468	6,518	7,118	7,068	7,668
Reserve capacity requirement (MW)	864	864	929	929	998	998
Power purchased (MW)	250	250	250	250	--	--
Capacity shortage or surplus (MW)	-205	95	-353	247	-586	14
Energy requirement (GWh)	38,589	38,589	41,484	41,484	44,595	44,595
Energy generation	37,632	38,532	39,982	42,692	43,082	46,832
Energy purchased (GWh) /b	500	500	500	500	--	--
Energy shortage or surplus (GWh)	-457	443	-1,002	1,698	-1,513	2,237

/a The dependable peaking capacity of a thermal unit is its rated capacity unless it has to be derated for some reason.

/b The energy generation of thermal units is calculated at an annual capacity factor of 68.5 percent (6,000 hours) for the first year, and 74.0 percent (6,500 hours) for the second year and thereafter.

1/ See Annexes 9 and 10.

B. Least Cost Studies

7.3 An economic analysis of the Yanshi Power Plant, based on optimizing the Henan System, has been prepared by WREPERI. Least cost expansion sequences have been developed for the period 1990-2000. This analysis confirmed that the development program of HPG should depend largely on the construction of large coal-fired base load thermal plants at mine-mouths or near railway lines which can easily utilize coal from local mines and those of neighboring Shanxi province. The study also confirmed that there are no other alternatives better than the proposed project. Base load coal-fired plants form the major part of the least cost development program for the HPG, and extension of the existing Yanshi power station provides the most cost-effective and efficient method of augmenting base load capacity. Since the site also is located close to major load centers, only a minimum of transmission facilities would be required.

C. Economic Rate of Return

7.4 The economic benefits from electricity consumption were measured by the internal economic rate of return (IERR). The IERR was calculated using the estimated economic costs of inputs for the project and associated investments in transmission and distribution. HPEPB's projected average revenues (adjusted to the 1991 price level) of 16.4 - 18.5 fen/kWh over the period 1995-2000, were taken as a minimum proxy for the economic value of electricity. Added to these figures were a newly applied 2.0 fen/kWh charge for power development to all consumers except lighting, agricultural use and industries who operate at a loss, a 10 percent local government surcharge for urban consumers, and connection charges to new large consumers. These charges, amounting to 1.4 fen/kWh, were added to reflect the surplus benefits. On this basis, the IERR is about 15.7 percent (see Annex 26 for details).

Sensitivity Analysis

7.5 The sensitivity of the IERR of the project was measured under three other possible scenarios: (a) with a 10 percent increase in investment cost, (b) with a one-year delay in commissioning and (c) with a coal price of Y130 per ton. It is unlikely that project parameters will exceed these limits. The following results were obtained.

	IERR (%)
Base case	15.7
10% cost overrun	14.7
One-year delay in commissioning	14.1
Coal prices increase from Y 110/ton to Y 130/ton	14.7

7.6 The economic rate of return was also calculated on the basis of the HPEPB's overall expansion program for the period 1991-2000. The expansion program consists of 6,800 MW base load coal-fired plants, including the transmission and distribution system. On this basis, the economic rate of return of HPEPB's expansion program, including the proposed project, is 13.4 percent.

D. Risks

7.7 No major risks, including environmental problems are foreseen. Since this is an extension project, land is already available and field conditions are well known. The technical soundness and economic feasibility of the project have been well established. Consulting engineers, both local and foreign, will assist in engineering and design, procurement, coordination and review of venders' design drawings. Construction risks are within reasonable limits and should be manageable with continuous supervision. The economic risks, if any, should be minimal. The project has been designed taking into account the requirement that the environmental impact from operating the station not exceed the internationally accepted norms. An environmental monitoring program is included in the project. HPEPB will replace the precipitators for the existing 2x200 MW units by high efficiency electrostatic precipitators.

VIII. AGREEMENTS REACHED AND RECOMMENDATION

8.1 During negotiations, the following assurances have been obtained:

(a) from the Government, that it will onlend the proceeds of the proposed Bank loan to HPEPB on terms satisfactory to the Bank (para. 5.23) and;

(b) from HPEPB, that it will:

(i) furnish each year to the Bank by April 30 of each year, commencing in 1993, a rolling eight-year financial plan containing projected income statements, sources and application of funds, and balance sheets (para. 3.12);

(ii) furnish its annual financial statements, certified by an accept able auditor within six months from the end of each financial year commencing in 1993 (para. 3.19);

(iii) carry out the training in accordance with a program acceptable to the Bank (para. 5.15);

(iv) carry out a tariff study and an action plan for tariff structure improvements acceptable to the Bank (para. 5.16);

(v) take all necessary steps to implement an environmental monitoring program satisfactory to the Bank (para. 5.37);

(vi) take measures, including but not limited to increasing its tariffs, to ensure that it earns a cash surplus (net operating income) sufficient to meet a minimum of 20 percent of its annual investment program for the period of 1992-1994, and a minimum of 25 percent of its annual investment program thereafter (para. 6.12); and

(vii) incur additional debt only if a reasonable forecast of its revenues and expenditures indicates that internal cash generation would provide debt service coverage of not less than 1.3 (para. 6.14).

8.2 Execution of the subsidiary loan agreement between the Government and HPEPB will be a condition of loan effectiveness (para. 5.23).

8.3 Subject to the above assurances, the proposed project is suitable for a Bank loan of $180 million to the People's Republic of China for a term of 20 years, including a 5-yenr grace period, at the Bank's standard variable interest rate.

CHINA

YANSHI THERMAL POWER PROJECT

Installed Capacity, Electricity Generation and Sales in the Power Sector

Year	Installed Capacity (MW) /a			Energy Generation (GWh) /a			Energy Sales/b (GWh)
	Hydro	Thermal	Total	Hydro	Thermal	Total	
1949	163	1,686	1,849	710	3,600	4,310	3,460
1952	188	1,776	1,964	1,260	6,001	7,261	6,277
1957	1,019	3,616	4,635	4,820	14,515	19,335	16,407
1962	2,379	10,686	13,065	9,042	36,753	45,795	n.a.
1965	3,020	12,056	15,076	10,414	57,190	67,604	56,802
1970	6,235	17,535	23,770	20,450	95,420	115,870	n.a.
1971	7,804	18,478	26,282	25,060	113,300	138,360	101,274
1972	8,700	20,801	29,501	28,820	123,630	152,450	123,600
1973	10,299	23,626	33,925	38,900	127,860	166,760	135,106
1974	11,817	26,291	38,108	41,440	127,410	168,850	135,708
1975	13,428	29,978	43,406	47,630	148,210	195,840	156,969
1976	14,655	32,492	47,147	45,640	157,490	203,130	164,698
1977	15,765	35,686	51,451	47,670	175,740	223,410	181,691
1978	17,277	39,845	57,122	44,630	211,920	256,550	210,239
1979	19,110	43,906	63,016	50,120	231,827	281,947	233,577
1980	20,318	45,551	65,869	58,211	242,416	300,627	251,639
1981	21,933	47,069	69,002	65,546	243,723	309,269	258,976
1982	22,959	49,401	72,360	74,399	253,279	327,678	275,299
1983	24,160	52,280	76,440	86,450	264,990	351,440	297,126
1984	25,547	54,373	79,920	86,780	290,207	376,987	319,600
1985	26,120	60,373	86,493	92,374	318,315	410,689	348,353
1986	27,542	66,276	93,818	94,480	355,091	449,571	357,057
1987	30,193	72,704	102,897	100,229	397,092	497,321	420,019
1988	32,698	82,799	115,497	109,177	435,888	545,065	464,013
1989	34,570	92,060	126,637	118,475	466,200	584,675	495,135
1990	35,370	99,630	135,000	126,000	492,000	618,000	527,154
Average growth rate (p.a.)			11.0%			13.0%	12.9%

/a On a country-wide basis.

/b Energy sales not including uses by stations and captive plants.

Source: MOE.

CHINA

YANSHI THERMAL POWER PROJECT

Growth Index of Electricity Generation and Primary Energy Demand

Year	Installed Capacity Total (MW)	Installed Capacity Share of hydro(%)	Electricity Generation Total (TWh)	Electricity Generation Share of hydro(%)	GNP	Growth Index Primary Energy	Growth Index Electricity Generation
1979	63,015.9	30.3	281.9	17.8	100	100	100
1980	65,869.1	30.8	300.6	19.4	108	103	107
1981	69,132.6	31.7	309.3	21.2	113	102	110
1982	72,359.6	31.7	327.7	22.7	122	106	116
1983	76,444.9	31.6	351.4	24.6	135	110	125
1984	80,116.9	31.9	377.0	23.0	155	121	134
1985	87,053.2	30.3	410.7	22.5	174	132	144
1986	93,818.5	29.4	449.6	21.0	189	136	159
1987	102,897.0	29.3	497.3	20.2	210	141	176
1988	115,497.1	28.3	545.1	20.0	233	148	193
1989	126,638.6	27.0	584.7	20.2	242	157	207
1990	135,000.0	26.2	618.0	20.4	255	160	219

Source: MOE

ANNEX 3

CHINA

YANSHI THERMAL POWER PROJECT

Electricity Consumption by Sectors

Year	Nation's total (TWh)	Share of industry (%) Whole	Heavy	Light	Share of transport-ation (%)	Share of rural (including household (%)	Share of municipal & residential (%)
1949	3.5	69.1	34.4	34.7	0.6	0.6	29.8
1952	6.2	80.0	43.0	37.0	0.9	0.7	18.4
1957	16.4	82.9	58.6	24.3	0.4	0.7	16.0
1962	37.8	84.6	70.0	14.6	0.6	4.1	10.7
1966	70.0	84.1	69.1	15.0	0.6	7.8	7.5
1972	123.6	82.3	69.7	12.6	0.6	10.5	6.6
1976	164.7	78.3	64.6	13.7	1.1	14.1	6.5
1977	186.3	78.5	65.0	13.5	1.2	13.7	6.6
1978	214.9	79.0	65.9	13.1	1.1	13.7	6.3
1979	233.6	79.0	65.9	13.1	0.6	13.9	6.5
1980	251.6	77.9	64.5	13.4	0.6	14.9	6.6
1981	259.0	76.2	62.6	13.6	0.8	16.0	7.0
1982	275.3	76.0	62.0	14.0	0.7	16.0	7.6
1983	297.1	75.7	60.9	14.8	0.7	16.0	7.6
1984	319.6	75.2	60.5	14.7	0.8	15.9	8.1
1985	348.5	73.8	58.8	15.0	0.9	16.5	8.8
1986	379.7	72.9	57.7	15.2	1.2	16.4	9.5
1987	423.5	72.5	57.9	14.6	1.2	16.4	9.9
1988	461.3	71.3	57.3	14.5	1.9	16.4	9.9
1989	495.2	71.0	53.9	17.1	1.9	16.7	10.4
1990	524.7	69.4	52.1	17.3	2.0	17.3	11.3

Source: MOE

CHINA

YANSHI THERMAL POWER PROJECT

Ongoing Major Hydro and Thermal Power Projects by External Financing
Under the Seventh and Eighth Five-Year Plans /a

	Installed capacity (Unit x MW)	Year of commis-sioning	Source of finance	Loan amount ($ mln)
HYDRO POWER				
East China				
Shaqikou hydro	3 x 75	1988-90	Kuwait Fund for Arab Economic Development	32.5
North China				
Ming Tombs pumped storage	4 x 200	1997-99	OECF loan	46.0
Panjiakou pumped storage	3 x 90	1989-90	Government of Italy	38.7
Central China				
Geheyan hydro	4 x 300	1993-95	Canada Supplier's Credit	108.0
Wuqiangqi hydro	5 x 240	1994	OECF loan	153.0
Southwest China				
Tienshengqiao (II) hydro	4 x 220	1990-92	OECF loan	600.0
Tienshengqiao (I) hydro	4 x 300	1998-99	OECF loan	230.0
Subtotal	5,775			1,208.2
THERMAL POWER				
East China				
Nanton thermal	2 x 350	1989	USA-GE, Supplier's Credit	180.0
Shidongkou thermal	2 x 600	1992	USA, France, Japan, Supplier's Credit	350.0
Fuzhou thermal	2 x 350	1989	Japan, Supplier's Credit	180.0
North China				
Tienjin Beidagang thermal	2 x 320	1991	Italy, Government concessional loan and Supplier's Credit	200.0
Shangan thermal	2 x 350	1989	Canada, USA-GE, Supplier's Credit	180.0
East Beijing thermal	2 x 300	1994-95	OECF loan	150.0
Hejing thermal	2 x 300	1994-95	OECF loan	150.0

	Installed capacity (Unit x MW)	Year of commis-sioning	Source of finance	Loan amount ($ mln)
THERMAL POWER (cont'd)				
Northeast China				
Dalian thermal	2 x 350	1989	Japan-Mitsubishi, Supplier's Credit	180.0
Central China				
Yueyang thermal	2 x 360	1990-94	UK, 1/2 Government concessional loan and 1/2 Supplier's Credit	190.0
Ezhou thermal	2 x 300	1994-95	OECF loan	190.0
Jiujiang thermal	2 x 300	1994-95	OECF loan	190.0
South China				
Guangdong Shajiao thermal	2 x 350	1987	Japan-Mitsubishi, Supplier's Credit	230.0
Shantou gas turbines	3 x 10.5	1987-88	France, Supplier's Credit	33.8
Southwest China				
Chongqing Lohuang thermal	2 x 350	1991-92	UK, France/Japan, 1/2 Government concessional loan and 1/2 Supplier's Credit	250.0
Chongqing gas turbines	3 x 10.5	1987-88	EEC Credit and UK Government Loan	12.6
Subtotal	14,997			2,666.4
Total	20,772			3,874.6

/a World Bank-financed projects are not included.

CHINA

YANSHI THERMAL POWER PROJECT

Performance Indicators for Henan Power System

	1984	1985	1986	1987	1988	1989	1990
Installed Capacity (NW)	3,393.2	3,926.5	4,147.9	4,549.4	4,944.8	5,451.1	6,081.6
HPEPB	2,761.0	3,261.0	3,461.0	3,722.0	3,922.0	4,122.0	4,522.0
Local & captive plants	632.2	665.5	686.9	829.4	1,022.8	1,329.1	1,559.6
Energy Generation (GWh)	19,772	20,854	23.074	25,837	27,643	30,066	31,777
HPEPB	17,181	17,922	19,921	22,082	22,900	24,450	25,186
Local & captive plants	2,591	2,932	3,153	3,755	4,743	5,616	6,591
Energy Generation (GWh)	19,772	20,854	23,074	25,837	27,643	30,066	31,777
Thermal	18,282	19,415	21,805	24,611	26,394	28,507	30,373
Hydro	1,390	1,439	1,269	1,225	1,249	1,559	1,404
Net Energy Purchase (GWh)	1,568.4	1,843.0	1,453.0	1,390.2	1,568.3	2,755.8	1,967.0
HPEPB	1,174.0	1,540.0	710.0	1,037.0	1,060.6	2,283.2	1,417.0
Capacity Factor (%)	66.5	60.6	63.5	64.8	63.8	62.9	59.6
HPEPB	71.0	68.0	65.7	67.7	66.6	67.7	63.6
Local & captive plants	46.8	50.3	52.4	51.7	52.9	48.3	48.4
Peak Demand (MW)							
HPEPB	2,512	2,682	3,015	3,387	3,658	3,932	3,956
Energy Sales (GWh)							
HPEPB	16,056	17,204	17,869	19,903	20,585	23,200	23,761
System Losses (GWh)	2,299	2,438	2,762	3,216	3,375	3,533	3,543
Plant use (%)	7.77	7.81	7.86	7.87	7.83	8.04	8.59
HPEPB	7.53	7.63	7.67	7.69	7.62	7.76	8.38
Local & captive plants	9.95	9.40	9.30	9.52	9.14	9.47	9.48
T & D losses (%)	10.19	9.59	10.60	10.18	9.36	9.92	9.43
HPEPB	5.85	5.96	6.44	6.69	6.59	6.56	6.02
Total (%)	16.22	15.88	16.72	16.61	16.50	17.70	17.20
HPEPB	12.26	12.34	12.92	13.32	14.10	14.50	14.10
Average coal consumption (standard coal) (g/kwh)	419	417	417	409	407	412	411
HPEPB	399	396	395	385	379	377	375
Local & captive plants	585	592	578	568	572	564	548
Number of customers	159,040	176,589	186,824	218,730	253,603	265,754	275,404
Number of Employees	39,539	41,278	43,949	45,473	47,771	48,268	48,692
Customers per Employee	406,080	416,783	405,674	481,010	530,839	550,580	565,604

Source: HPEPB

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YANSHI THERMAL POWER PROJECT

Staff of HPEPB
(As of December 31, 1990)

	Number of units	Number of staff	%
By Speciality			
Staaff			
Administration /a		4,311	8.8
Technical			
Engineers		2,047	4.2
Technicians		3,549	7.3
Subtotal		9,907	20.3
Workers			
Junior		9,997	
Average skilled		13,592	
Highly skilled		7,022	
Apprentices		1,112	
Subtotal		31,723	65.2
Others		7,06?	14.5
Total		48,692	100.0
By Functional Users			
Headquarters	15	460	1.0
Generation	10	21,799	44.7
Supply and services	12	13,621	27.9
Construction and installation	4	8,892	18.3
Education	5	958	2.0
Design	1	725	1.5
Repair	2	1,353	2.8
Miscellaneous /b	5	884	1.8
Total	54	48,692	100.0

/a Including personnel, finance and accounting, and social welfare.
/b Including one research institute and material supply enterprise.

CHINA

YANSHI THERMAL POWER PROJECT

Planning, Budget and Control of Chinese Power Bureaus

1. All power bureaus are responsible for developing annual and five-year production and investment plans. These plans are integrated with the national plans and approved by SPC through MOE and SEIC auspices. MOE and SEIC play a major role in shaping the bureaus' individual plans. MOE, in conjunction with regional administrations, uses past operating results from the bureaus to compile the quantities and related prices to be used by the bureaus in developing their operating plans. The investment plans are developed on a project-by-project basis using estimates of quantities and prices of inputs included in feasibility studies prepared by the regional design institutes. However, the investment plans do not take into account movements in prices after the final design is completed. Thus, in the planning process, the bureaus them selves do not make a direct linkage between their projected and realized costs. The bureaus' operating plans do include monitoring indicators, and variance analyses are conducted to compare quantities actually produced or consumed with plan targets. Because the bureaus themselves do not link their plan targets directly to realized financial performance, the variance analyses have limited usefulness as measures of the efficiency of their operations and the cost effectiveness of their investment programs. Still, this approach to planning has served reasonably well within the environment of a centrally planned economy, where large grants were used to finance large portions of investment and prices were maintained at stable levels.

2. Until 1980, all funds required to implement the annual construction plans were provided through grants allocated from the State budget. The State also provided minor amounts of financing to cover liquidity requirements through an account entitled Working Capital Funds. Under China's economic reform program which began around 1978, major changes have been introduced to encourage economic use of the Government's limited resources. Funds for major new investments are now being provided in the form of loans from the People's Construction Bank of China. These loans are made only after projects have been reviewed extensively and cost estimates have been approved. In addition to construction loans, which now bear an annual interest rate of about 3.6%, non-repayable government contributions are provided for liquidity; these carry annual finance charges of 3%. The construction loans are scheduled for repayment over 15 years after work is completed.

3. Until 1984, the prices the power bureaus paid for the constituents of operating and investment costs were kept fairly constant. However, since then the Government has announced that it is relaxing controls over the pricing system and will allow prices gradually to move toward market levels. In the future, as the power bureaus continue to expand their operations and as costs become more variable, planning and budgeting will be based more and more on actual cost data and projections of productivity improvements, future price movements, and interest rates. Furthermore, as the cost of inefficiency

increases over time, management will need better tools to evaluate and control the operations of individual cost centers.

4. The Chinese system of planning and budgeting does not make provision for long term financial planning. In connection with the Lubuge Hydroelectric Project (Loan 2382-CHA), the Bank furnished MWREP with a financial forecasting model so that the power bureaus could study the impact of both their expansion plans and variations in prices on their future financial positions. Under all subsequent Bank-financed power projects, assurances have been obtained that, by December 31 of each year commencing in the year following loan signing, the beneficiary power bureau will furnish the Bank with a financial plan containing forecast income statements, sources and uses of funds, and balance sheets for the next five to eight years. So far, Yunnan, Jiangsu, Guangxi, Fujian, Zhejiang and Shanghai Power Bureaus have been required to furnish such rolling plans.

5. MOE and SEIC recognize that they need to modernize the financial and management procedures followed by the power bureaus. They have authorized many bureaus to acquire microprocessors for financial, planning, and administrative purposes. In addition, they have developed some software to allow the bureaus to produce standard computerized reports on a regular basis. For their part, most of the power bureaus which already are dealing with the Bank have computerized some of their personnel, payroll, and administrative records and are adapting software to computerize materials management, system planning, and production management. Once the bureaus finish computerizing these records, they all will be expected to furnish monthly reports to MOE and SEIC on diskettes rather than on paper. Some of the Bank-financed projects have included a provision allowing the beneficiary power bureaus to obtain additional microprocessors and allowing them and MOE to obtain the software sup port needed to facilitate implementation of this first generation of computerized reporting.

6. The first generation of computerized reporting should allow MOE, SEIC, and the power bureaus themselves to process, compile, consolidate and retain far more information than in the past. However, the computer approaches used to date have been designed almost exclusively to satisfy the reporting requirements of MOE and SEIC. The software does not allow for a more active role for the power bureaus or for a broader use of data by bureau management. Moreover, the systems being developed still do not include rudimentary financial planning or allow the necessary direct linkages between realized performance and planning forecasts. Thus, while the systems represent much progress over current reporting systems, a second generation of reporting systems will be needed to accommodate changes already in progress in the managerial environment.

7. During appraisal of the Yantan Hydroelectric Project (Loan 2707-CHA), the Bank retained a consultant to assess the management and use of data in MWREP and several power bureaus. His findings confirm that the systems currently being developed are adequate for the existing environment but are not flexible enough to adapt to expected future trends. However, MOE and SEIC have doubts about the substance and extent of these anticipated changes and

prefer to be cautious about making further adjustments to reporting procedures in the near term.

8. In considering ways to modernize financial and management practices, the Government is taking the initiative in adapting a modern methodology for use in the Chinese environment. However, given the additional adjustments that are likely to become necessary within a few years, the Government would benefit from greater exposure to state-of-the-art technology in management systems. Under the Beilungang Thermal Power Project (Loan 2706-CHA), the Yantan Hydroelectric Project (Loan 2707-CHA), the Shuikou Hydroelectric Project (Loan 2775-CHA) and the Wujing Thermal Power Project (Loan 2852-CHA), the Government is obtaining training in up-to-date financial management and utility accounting practices. Overseas training and study tours are included in these projects so that senior officials of relevant governmental units can observe the management techniques used by utilities and service organizations in other countries. The first overseas training was held in May 1988, and the outcome was successful. MOE and SEIC plan to have other training sessions in coming years.

CHINA

YANSHI THERMAL POWER PROJECT

Electricity Tariffs of HPEPB /a
(As of December 31, 1990)

Tariff category	Rate	Unit
Lighting		
Up to 1 kV	16.2-20.0	fen/kWh
Over 1 kV	15.0-.0.0	fen/kWh
Average	20.41/b	fen/kWh
Commercial and Small Industry /c		
Up to 1 kV	12.52	fen/kWh
1-10 kV	12.01	fen/kWh
Above 35 kV	11.07	fen/kWh
Average	12.15/b	fen/kWh
Large Industry (above 320 kVA)		
Energy charge /d		
1-10 kV	11.59	fen/kWh
Above 35 kV	10.75	fen/kWh
Capacity (per month)		
Based on peak demand	6.00	Yuan/kW
Based on average capacity	4.00	Yuan/kW
Average	11.00/b	fen/kWh
Agricultural Production (Direct Supply)		
Up to 1 kV	8.68	fen/kWh
1-10 kV	10.08	fen/kWh
Above 35 kV	7.28	fen/kWh
Average	8.68/b	fen/kWh
Bulk Supply		
Average	8.62/b	fen/kWh
Others		
Average	15.95	fen/kWh
Total Average	10.65	fen/kWh

/a The indicated rates include a sales tax of about 15% of the electricity bill.
/b Including fuel adjustment and additional charge for consumption above the approved amount.
/c This tariff is applied to productive uses. Lighting consumption by commercial and small industrial customers is billed at the lighting rate.
/d Industries enjoy a fen/kWh discount.

Source: HPEPB.

CHINA

YANSHI THERMAL POWER PROJECT

Major Generating Facilities in Henan Province

Name of plant/unit	Name plate rating (MW)	Year of commissioning	Maximum output (MW)
Luoyang Thermal			
No. 1	25.0	1957	25.0
No. 2	25.0	1958	25.0
No. 3	25.0	1958	25.0
No. 4	25.0	1959	25.0
No. 5	25.0	1960	25.0
No. 6	50.0	1961	50.0
Subtotal	175.0		175.0
Zhengzhou Thermal Plant No. 1			
No. 1	12.5	1957	10.5
No. 2	12.5	1957	10.5
No. 3	6.0	1965	0.0
No. 4	10.0	1960	8.0
No. 5	25.0	1965	25.0
No. 6	25.0	1966	25.0
No. 7	25.0	1967	25.0
Subtotal	116.0		104.0
Xinxiang Thermal			
No. 1	50.0	1966	50.0
No. 2	50.0	1968	50.0
No. 3	50.0	1969	50.0
No. 4	200.0	1989	200.0
No. 5	200.0	1990	200.0
Subtotal	550.0		550.0
Nanyang Thermal			
No. 1	6.0	1966	4.0
No. 2	6.0	1968	4.0
Subtotal	12.0		8.0

Name of plant/unit	Name plate rating (MW)	Year of commissioning	Maximum output (MW)
Yanshi Thermal			
No. 1	200.0	1988	200.0
No. 2	200.0	1989	200.0
Subtotal	400.0		400.0
Anyang Thermal			
No. 1	-	Retired	-
No. 2	-	Retired	-
No. 3	25.0	1960	20.0
No. 4	25.0	1961	20.0
No. 5	40.0	1972	40.0
No. 6	50.0	1975	50.0
No. 7	100.0	1977	100.0
No. 8	100.0	1977	100.0
Subtotal	340.0		330.0
Kaifeng Thermal			
No. 1	40.0	1973	40.0
No. 2	40.0	1974	40.0
No. 3	125.0	1978	120.0
No. 4	125.0	1978	110.0
Subtotal	330.0		310.0
Yaomeng Thermal			
No. 1	300.0	1975	270.0
No. 2	300.0	1980	240.0
No. 3	300.0	1985	300.0
No. 4	300.0	1987	300.0
Subtotal	1,200.0		1,110.0
Danhe Thermal			
No. 1	100.0	1973	100.0
No. 2	100.0	1975	100.0
Subtotal	200.0		200.0

Name of plant/unit	Name plate rating (MW)	Year of commissioning	Maximum output (MW)
Jiaozuo Thermal			
801	-	Retired	-
802	-	Retired	-
803	-	Retired	-
804	-	Retired	-
805	12.0	1960	0.0
806	12.0	1964	8.0
No. 1	200.0	1979	200.0
No. 2	200.0	1980	200.0
No. 3	200.0	1985	200.0
No. 4	200.0	1986	200.0
Subtotal	824.0		808.0
Pingdingshen Thermal			
No. 1	50.0	1970	50.0
No. 2	50.0	1971	47.0
No. 3	25.0	1987	25.0
Subtotal	125.0		122.0
Sanmenxia Hydro /a			
No. 1	50.0	1977	
No. 2	50.0	1976	
No. 3	50.0	1976	
No. 4	50.0	1973	
No. 5	50.0	1979	
Subtotal	250.0		250.0
HPEPB Total	4,522.0		4,367.0
Local and Captive Plants	1,559.6		-
Total	6,081.6		4,367.0

/a Owned and operated by the Yellow River Water Conservancy Commission but dispatched by HPEPB.

Source: HPEPB.

CHINA

YANSHI THERMAL POWER PROJECT

Energy Consumption by Category of Consumer /a

Consumers	1985 GWh	1985 %	1986 GWh	1986 %	1987 GWh	1987 %	1988 GWh	1988 %	1989 GWh	1989 %	1990 GWh	1990 %
Rural load												
Lighting	259	1.4	297	1.5	343	1.5	386	1.6	441	1.7	645	2.3
Drainage & irrigation	1,108	5.8	1,394	6.9	1,392	6.2	1,738	7.2	1,920	7.4	1,316	4.7
Rural processing & industries	2,347	12.5	2,278	11.2	2,690	11.9	2,583	10.7	2,984	11.5	3,237	11.4
Subtotal	3,741	19.6	3,969	19.5	4,425	19.6	4,707	19.5	5,345	20.6	5,198	18.4
Industrial load												
Light	2,398	12.5	2,558	12.6	2,935	13.0	3,259	13.5	3,633	14.0	3,582	12.7
Heavy	11,420	60.0	12,143	59.7	13,288	58.9	13,880	57.5	14,532	56.0	16,321	57.8
Subtotal	13,818	72.6	14,701	72.5	16,223	71.9	17,139	71.0	18,165	70.0	19,904	70.5
Municipal load												
Urban lighting	775	4.1	767	3.8	848	3.8	917	3.8	986	3.8	1,400	4.9
Water supply & drainage	244	1.3	265	1.3	271	1.2	289	1.2	337	1.3	423	1.5
Nonindustrial power	210	1.1	228	1.1	248	1.1	265	1.1	311	1.2	367	1.3
Others	158	0.8	182	0.9	213	0.9	241	1.0	259	1.0	324	1.2
Subtotal	1,387	7.3	1,442	7.1	1,580	7.0	1,714	7.1	1,894	7.3	2,514	8.9
Transporation	103	0.5	166	0.8	352	1.5	458	1.9	560	2.1	608	2.2
Total	19,048	100.0	20,327	100.0	22,580	100.0	24,140	100.0	25,950	100.0	28,224	100.0

/a Statistics were based on the province as a whole.

Source: HPEPB.

CHINA

YANSHI THERMAL POWER PROJECT

Power Development Program of HPG (1991-2000)

A. Generating Stations

	Installed capacity (MW)	Location	No. of units	Unit size (MW)	Scheduled Commissioning date
Jiaozuo 3rd stage	400	Jiaozuo	2	200	1991,1992
Hebi	400	Hebi	2	200	1991,1992
Zhengzhou (cogeneration)	400	Zhengzhou	2	200	1992,1993
Sanmenxia I	600	Sanmenxia	2	300	1993,1994
Yanshi phase II	600	Yanshi	2	300	1995,1996
Yahekou	700	Nanyang	2	350	1995,1996
Luoyang Extension	400	Luoyang	2	200	1996,1997
Yaomeng IV	600	Pingdingshan	2	300	1997,1998
Qinbei I	1,200	Jiyuan	2	600	1998,1999
Sanmenxia II	1,200	Sanmenxia	2	600	1999,2000
Yongcheng	600	Yongcheng	1	300	2000
Total	6,800				

B. Transmission Lines

Name	Length (kW)	Voltage level	Completion
Associated Transmission for Generation Projects			
Jiaozuo 3rd stage	166	220	1992
Hebi	201	220	1992
Zhengzhou (cogeneration)	37	220	1993
Sanmenxia I	367	220	1995
Yanshi phase II	350	220	1995
Yahekou	550	220	1996
Luoyang Extension	76	220	1996
Yaomeng IV	296	220	1998
Qinbei I	150	500	1999
	350	220	1999
Sanmenxia II	300	500	2000
Yongchang	150	220	2000
Other Lines for System Expansion	250	220	1992-2000
Total	3,243		

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YANSHI THERMAL POWER PROJECT

System Demand and Energy Balance of HPG

Year	System demand		System capacity		Energy generated	Power purchased		Power balance reserve		
	Peak (MW)	Energy (GWh)	Installed (MW)	Dependable (MW)	(GWh)	Capacity (MW)	Energy (GWh)	Capacity (MW)	Margin (%)	Energy (GWh)
1988	3,658	24,140	3,922	3,467/a/b	22,900	250	1,240	59	1.6	-
1989	3,932	25,950	4,122	3,667	24,450	250	1,500	-15	-	-
1990	3,956	26,330	4,522	3,968	25,186	250	1,144	262	6.6	-
1991	4,313	28,896	4,922	4,368	26,732	250	2,164	305	7.1	-
1992	4,636	31,063	5,522	4,768	29,132	250	1,931	382	8.2	-
1993	4,984	33,393	6,022	5,368	32,532	250	861	634	12.7	-
1994	5,358	35,897	6,322	5,868	35,632	250	265	760	14.2	-
1995	5,759	38,589	6,972	6,468	38,532	250	500	959	16.6	-
1996	6,192	41,484	7,822	7,118	42,682	250	500	1,176	14.9	1,698/c
1997	6,565	44,595	8,322	7,668	46,832	-	-	1,012	15.2	2,237/c
1998	7,228	47,940	9,222	8,168	50,032	-	-	940	13.0	2,092/c
1999	7,792	51,535	10,422	9,068	55,032	-	-	1,276	16.3	3,497/c
2000	8,400	55,400	11,322	10,268	61,932	-	-	1,868	22.2	6,532/c

/a Definitions of dependable capacity and energy generation by thermal units are given in Table 7.1.
/b The dependable capacity of HPEPB in 1988 is calculated as follows: 4,944.8 - 1,022.8 (local and captive plants not connected to the system) - 255 (derated capacity) - 200 (capacity completed at end-1988).
/c Energy available for export to CCPG.

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Training Program

Training Objectives and Needs

1. In order to make management more efficient, high level staff of HPEPB will have to improve their professional skills, understand the strategies of decision-making, and learn how to use relevant methods and software for decision making.

2. The training program has the following broad objectives:

(a) to allow HPEPB to function as an autonomous entity able to raise and operate its own funds, as planned under the newly reformed economic system;

(b to equip HPEPB with a management information system and other modern techniques to assist it in making sound management decisions; and

(c) to allow HPEPB to set an example for the senior staff of power plants and power supply bureaus to enhance their performance and promote energy sales.

3. In order for high level staff to develop the required decision-making capabilities, it is essential that they receive training in the following spheres: planning of grid expansion, planning of power system investments, management of funds, setting up of electricity tariff policy, accounting and sales management (including management of the cost of power bought from other systems), personnel management and labor training, computer technology, information processing systems, and regulations and contract management.

4. Because new recruits must receive pre-service training at various levels, existing training centers and professional schools will need to be provided with sophisticated training facilities such as simulators, computers and audio-visual teaching aids. Similarly, their laboratories and workshops will have to be equipped with advanced technology. The professional skills of teaching staff, particularly the teachers of professional schools, also will need to be upgraded.

The Training Program

5. The training program will include: (a) a training program for high level staff; (b) a training program for technicians and engineers (see Table 2); (c) procurement of training equipment; and (d) a training program for the teaching staff of professional schools.

6. The training program for high level staff will be carried out in three steps: systematic study, investigation, and practical application (see Table 1). In the first step, high level staff of HPEPB, including division chiefs, will investigate and study the management systems of foreign electric power companies similar to HPEPB. In the second step, HPEPB staff will review managerial methodology and technology and prepare action programs and proposals to improve management of the bureau. Further, high level staff of large power plants and power supply bureaus will investigate and study a similar foreign power plant and an electricity distribution company. They will formulate proposals to improve the management of their own power plants and power supply bureaus. In the third step, the action plans will be implemented. HPEPB, the power plants and power supply bureaus will carry out improvements in their management at all levels after their action plans are approved by the Central China Electric Power Administration and the Bank. HPEPB's financial staff will participate in the overseas and domestic seminars which MOE is now planning to organize under Power III-VII.

7. Under the proposed project an action program for training is provided, shown in Table 1. A training program for high level staff through seminars in China and overseas training is shown in Table 2 and a project-related training programs for technical staff is shown in Table 3. A list of training programs for schools is given in Table 4. A development plan for the existing schools is given in Table 5.

8. The implementation schedule is as follows:

		Completion Date
(a)	Detailed training program for high level staff	September 30, 1992
(b)	Overseas training and investigation	September 30, 1993
(c)	Action Programs and proposals to improve management	September 30, 1994
(d)	Training for engineering and design staff	June 30, 1993
(e)	Training for operation and maintenance staff	December 31, 1994
(f)	Training for electrical and mechanical staff	December 31, 1994
(g)	Expansions of the existing schools	December 31, 1996

Table 1: ACTION PROGRAM FOR TRAINING

Objectives	Proposed action	Status of progress
To provide high-level staff with the skills needed to meet the circumstances of the nineties: modern and larger power plants, larger automated grid with automated load dispatch system, higher voltage transmission, modern accounting/costing/pricing and a self-sustained investment planning organization.	Provide ad hoc training, send senior staff on study tours, revise existing management and accounting systems, and advise and recommend necessary reforms to senior management.	A detailed training program is being prepared by HPEPB.
To ensure smooth implementation of the proposed project on technical matters, and good follow-up after the project is completed.	Provide project-related training to: (a) engineering and design staff for the project through on-the-job training with the Consulting Engineers engaged for this project and liaison meeting. (b) operation and maintenance staff, using those facilities available in China which are similar to the facilities of this project, and (c) electrical and mechanical staff working on the power plant construction site by the vendors of major equipment for this project in their factory or on site.	Training schemes are being integrated into the bidding documents for major equipment (Table 3).
To increase the output of existing HPEPB schools and improve the quality of such output in order to raise the percentage of annual new recruits from own institutions and to provide for higher quality input to HPEPB.	Augment the training capacity of all five existing schools of HPEPB. Upgrade the equipment used in workshops and laboratories and provide modern facilities such as simulators, computers and language laboratories.	School development plans have been prepared by HPEPB (Table 5). An equipment list has been prepared by HPEPB (Table 4).

Table 2: TRAINING PROGRAM FOR HIGH LEVEL STAFF AND TEACHING STAFF

A. Specialists Required for Seminars in China /a

Training program	Number of trainees	Number of specialists	Duration (months)
Planning	25	2	1.0
Financial management	25	3	1.0
Personnel management	10	1	1.0
Management information systems	25	4	3.0
Load dispatch and automation	25	2	2.0
Total	110	12	

B. Overseas Training

Organization	Number of trainees	Duration (months)
HPEPB	20	1.0
Power plant	10	2.0
Power supply bureaus	10	2.0
Teaching staff	6	6.0
Environmental monitoring unit	4	2.0

/a Seminars may be carried out in association with other power bureaus.

Table 3: TRAINING PROGRAM FOR TECHNICAL STAFF

Category of staff	Number of trainees	Man-months
A. Training for Engineering and Design Staff Through Liaison Meetings		
Design staff	20	80
Engineering staff	25	100
Total	45	180
B. Training for Electrical and Mechanical Staff		
Construction management	5	10
Installation	10	20
Testing	5	10
Inspection	10	40
Operation	10	60
Maintenance	10	60
Total	50	200
C. Training for Operation and Maintenance Staff		
Operation engineers	30	300
Maintenance engineers	30	150
Total	60	450

Note: Training for A and B will be included in the Vendor's Contract. Training for C will be carried out in China under the technical services.

Table 4: TRAINING EQUIPMENT TO BE IMPORTED

Description	Quantity	Unit	Remarks
Main parts and auxiliaries for VAX 8250 computer	1	set	See note below
WI-7700N senior type	48	set	One set of phonetic teaching equipment for 48 seats
Video tape for operation and maintenance of plant	1	lot	
Video tape for operation of transmission and distribution	1	lot	
Software of management and training	1	lot	

Note: VAX 8250 type computer auxiliaries included:

1. Built-in memory 128 MB.
2. Other auxiliaries including control desk, drum, tape, network supporting module, module input and output, digital input and output.
3. Software.
4. Major parts of computer.

Table 5: DEVELOPMENT PLAN FOR EXISTING SCHOOLS

Name of School	Present capacity			Capacity after development			Cost estimated (Y'000)		
	Enrollment	Staff	Graduates	Enrollment	Staff	Graduates	Civil works	Equipment	Total
Zhengzhou Secondary Technical School	840	247	-	2,000	675	560	8,324	3,700	12,024
College level	200	-	-	720	-	240	-	-	-
Secondary level	640	-	240	1,280	-	320	-	-	-
Henan Staff College	200	60	-	360	100	120	-	-	-
Henan Technical School for Skilled Workers	775	245	281	1,000	313	320	2,431	1,455	3,886
Nanyang Technical School for Skilled Workers	340	164	118	720	226	240	3,795	1,091	4,886
Anyang Technical School for Skilled Workers	180	59	-	360	90	120	-	-	-
Total	2,335	802	639	5,720	1,404	1,360	14,550	6,246	20,796

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YANSHI THERMAL POWER PROJECT

Action Plan for Power Tariff Structure Improvements

Background

1. The power tariff study of Henan Province is being carried out by HPEPB with the assistance of WREPERI and an interim report was submitted to the World Bank in June 1991. The action plan of power tariff structure improvements shall be conducted phase by phase and step by step, in accordance with the actual characteristics and specific conditions of the Henan Power Grid.

Objectives

2. The main objectives of the action plan are:

(a) to achieve a gradual transition towards a unified tariff;

(b) to increase the capacity charge of large-size industrial consumers to better reflect the relative cost of capacity and energy;

(c) to conduct test cases and gradually implement a time-of-day power tariff system for peak and off-peak power consumption; and

(d) to reform the bulk sale power tariff.

Action Plan

3. Program for the First Year (to be completed in 1992)

(a) Completion of the power tariff study to determine target power tariff levels, tariff structure and implementation steps for tariff reform.

(b) Particular attention will be given to the preparation of a detailed proposal for the process of unification and to the evaluation of this process, targeted for implementation within a five-year period. This proposal and the implementation schedule will be subject to the approval of related agencies and reviewed by the Bank before implementation.

Program for the Following Years (Implementation)

Specific components to be implemented in the framework of the restructuring program are as follows:

4. Second Year Execution Program (to be completed in 1993)

(a) To increase the capacity charge for large and medium-size industrial consumers, so as to make the ratio between capacity charge and energy charge more reasonable.

(b) To carry out the test-case for time-of-day tariff system which differentiates between peak power consumption and off-peak power consumption and to select test-case consumers based on the specific conditions in the Henan Power Grid.

5. Third Year Execution Program (to be completed in 1994)

(a) To undertake a detailed study of the bulk sale power tariff, prepare a concrete scheme for bulk sale reform and carry out relevant test-case.

(b) To consolidate the experience and existing problems into implementing the time-of-day power tariff system and to propose concrete measures to further improve the tariff system.

6. Fourth Year Execution Program (to be completed in 1995)

(a) Gradually implement the bulk sale tariff reform.

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Terms of Reference for the Tariff Study

Objectives and Scope of the Study

1. The major objective of the study is to develop a practical state-of-the-art methodology for setting electricity prices in Henan province. The study will be based on the experience gained from the East China Power Pricing Study which was completed under the Beilungang Thermal Power Project. In particular this study will look into the practical problems raised by the transition from the existing to the proposed pricing arrangements. Because electric power tariff reform is likely to remain a long-term process, more detailed studies will be needed before new tariff options are implemented in China.

2. First priority in the study will be given to the development and dissemination of analytical skills in the entities concerned. In particular the study should evaluate and highlight the relative merits/demerits of the proposed approach in comparison to the ones adopted in China so far, particularly the two tier pricing system very recently put in place. This training will serve to familiarize Chinese staff with the various pricing criteria and rate setting steps, emphasizing the complementarity and differences between financial cost and marginal cost approaches. Workshops are planned at three important stages: study start-up, review of Interim Report, and selection of tariff options for the Final Report.

3. The tariff study for the Henan province grid will include the following tasks:

(a) analyzing consumption patterns and demand projections;

(b) reviewing the system expansion plan and operating policies;

(c) analyzing marginal economic costs by voltage level;

(d) calculating marginal cost of service and comparing it with existing revenues for typical customers;

(e) designing several candidate rate structures;

(f) analyzing the financial cost and revenue associated with these rate structures;

(g) reviewing issues in the taxation and regulation of power utilities;

(h) selecting a target rate structure, and adjusting the average rate level; and

(i) making recommendations for future work.

Output

4. The findings of the above tasks, up to and including the design of alternative rate structures and their revenue implications, will be presented in an Interim Report. A summary of these findings and amplified recommendations for a target rate structure, a rate level adjustment to meet precise financial targets, and a possible framework for its implementation will be presented in the Final Report. The Final Report will include a proposal for a concrete action plan to be executed over a five-year period.

Organization, Schedule and Resources

5. The study is being carried out by HPEPB and the Water Resources and Electric Power Economic Research Institutes under MOE auspices. The study is managed through a Steering Committee representing each of the above agencies; this committee has three working groups addressing, respectively, the power market, the supply system, and subsector finances. The working groups are coordinated by a Principal Investigator from the MOE. MOE and HPEPB will exchange views with the Bank on the progress and findings of the study.

6. Key dates in the timetable for the study are planned as follows:

Start-up	December 1990
Interim Report	December 1991
Final Report	December 1992

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Terms of Reference for Consulting Services

The Project

1. The thermal power station is located in Yanshi, about 90 km west of Zhengzhou and 27 km east of Luoyang. It is owned by the Henan Provincial Electric Power Bureau (HPEPB). The installed capacity of the first phase development is 2 x 200 MW. The first unit was put into operation in March 1988 and the second unit is expected to be commissioned by mid-1989. The proposed project involves developing the existing site to its ultimate capacity of 1,000 MW by adding two 300-MW units.

2. The following components would be included under the proposed project:

(a) construction of civil works including cooling water towers, a chimney, and auxiliary structures;

(b) installation of boilers, turbo-generators and other auxiliary electrical and mechanical equipment;

(c) construction of associated 220 kV transmission lines and substations to feed into the power grid.

Local Consultant

3. The conceptual design, engineering, and detailed design of the project is being carried out by SWCEPDI. Overall consulting services will be provided by a local consultant, China International Engineering Consulting Corporation (CIECC), and the China Power Engineering Consulting Corporation (CPECC) in Beijing. These two entities will:

(a) review the conceptual design, including plot plan, general arrangement drawings, line diagrams, and basic plant parameters prepared by SWCEPDI;

(b) review bid documents prepared by SWCEPDI on the island concept;

(c) assist in the prebidding meeting; and

(d) assist in the evaluation of bids.

Foreign Consultant

4. A foreign consulting firm will provide the following support to CIECC/CEPCC

Stage I Services

(a) assist in the review of bidding documents; and

(b) assist in procurement including prebidding meeting, bid evaluation, and preparation of a bid evaluation report.

Stage II Services

(a) assist in the interfacing of engineering and design of different islands;

(b) assist in the review of critical vendors' drawings and design calculations, such as turbine-generator pedestal design, major structure design, layouts for major equipment, etc.; and

(c) provide any other consulting assistance that may be requested by the local consultant.

Time Schedule

5. Consulting services should be completed within the following time frame:

Scope of services	Scheduled date of completion
Review bidding documents (for balance of plant equipment)	May 1992
Assist in bid evaluation	November 1992
Assist in interfacing	June 1993
Assist in review of suppliers' drawings	March 1994

Local Support

6. HPEPB will provide the following local support for the project activities:

(a) Make available to the consultants all the basic data, information, and documents needed to carry out their services;

(b) Provide all the services required for the consultants to carry out their work efficiently while working in China. These services include office space, facilities and supplies, communication, local transportation, counterpart professionals and technicians, and interpretation, translation and secretarial services.

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Project Cost Estimates
(US$ million)

Item	Local cost	Foreign cost	Total
Power Plant (I)			
Site preparation	10.6	-	10.6
Pile foundation	1.6	-	1.6
Civil construction	31.9	6.4	38.3
Boiler	17.6	66.1	83.7
Turbine-generator	7.2	69.3	76.5
Coal conveying system	4.2	-	4.2
Oil system	0.1	-	0.1
Ash disposal system	3.9	4.4	8.3
Water treatment system	4.4	0.8	5.2
Water supply system	3.5	-	3.5
Electrical equipment	13.9	4.9	18.8
220 kv switchgear	0.4	0.6	1.0
Instrument and control system	2.2	10.3	12.5
Construction equipment	-	3.5	3.5
Environmental protection	0.2	0.1	0.3
Training	1.3	1.0	2.3
Tariff study	0.5	-	0.5
Engineering and construction management	17.0	1.2	18.2
Base Cost	120.5	168.6	289.1
Physical contingency	12.0	8.4	20.4
Subtotal	132.5	177.0	309.5
Associated Transmission (II)			
Base cost	26.1	-	26.1
Physical contingency	2.6	-	2.6
Subtotal	28.7	-	28.7
Price Contingencies (I and II)	13.8	3.0	16.8
Total Project Cost	175.0	180.0	355.0
Interest During Construction			
IBRD loan	-	48.1	48.1
Local loan	56.5	-	56.5
Total Financing Required	231.5	228.1	459.6

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Procurement Schedule

No. Item	I Boiler & Turbine	II I & C	III Electrical	IV 200 kv Switchyard	V Civil Work Materials	VI Construction Equipment	VII Ash Disposal	VIII Water Treatment
Preparation for Bid Document			Oct. 01, 1992	Jun. 01, 1992	Jan. 30, 1992	Dec. 15, 1991	May 01, 1992	Mar 15, 1992
Approval by Chinese Government			Nov. 01, 1992	Jul. 01, 1992		Jan. 15, 1992	Jun. 01, 1992	Jun. 15, 1992
Review by World Bank			Dec. 01, 1992	Aug. 01, 1992		Feb. 15, 1992	Jul. 01, 1992	Jul. 15, 1992
Bid Document Issue	Jan. 26, 1989 (completed)	Nov. 01, 1991	Dec. 15, 1992	Aug. 15, 1992	Mar. 10, 1992	Mar. 01, 1992	Jul. 15, 1992	Aug. 01, 1992
Clarification Meeting		Dec. 01, 1991						
Bid Opening	May 04, 1989 (completed)	Feb. 01, 1991	Feb. 01, 1993	Oct. 15, 1992	May 10, 1992	Apr. 15, 1992	Sep. 01, 1992	Sep. 15, 1992
Bid Evaluation		Apr. 30, 1992	Mar. 01, 1993	Nov. 15, 1992	Jun. 10, 1992	May 01, 1992	Oct. 01, 1992	Oct. 15, 1992
Approval by Chinese Government		May 30, 1992	Apr. 01, 1993	Dec. 15, 1992		Jun. 01, 1992	Nov. 11, 1992	Nov. 01, 1992
Confirmation by World Bank		Jun. 20, 1992	May 01, 1993	Jan. 15, 1993		Sep. 01, 1992	Dec. 01, 1992	Dec. 15, 1992
Bid Awarding	May 25, 1990 (completed)	Jun. 25, 1992	May 10, 1993	Feb. 28, 1993	Jul. 10, 1992	Jul. 10, 1992	Dec. 10, 1992	Dec. 25, 1992
Contract Signing	Apr. 15, 1992	Jul. 30, 1992	Jul. 10, 1993	Apr. 30, 1993	Aug. 10, 1992	Aug. 10, 1992	Jan. 10, 1993	Mar. 01, 1993

Note: All above-mentioned dates are completion dates.

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Key Dates of Project Implementation

A. Procurement of Major Plant Equipment	
Revision of bidding documents for boiler and turbine generator	Nov. 30, 1988
Review by IBRD	Dec. 31, 1988
Issue of bid documents	Jan. 26, 1989
Bid opening	May 04, 1989
Bid evaluation	May 25, 1990
Contract negotiation and signing	Apr. 15, 1992
B. Project Implementation	
Start excavation	Aug. 01, 1992
Start foundation piling	Sep. 01, 1992
Start boiler steel structure erection	Aug. 15, 1993
Oil flushing of turbine generator	Feb. 15, 1995
Hydraulic test of boiler	Oct. 15, 1994
Acid cleaning of boiler	Mar. 15, 1995
Blow-out of boiler	Apr. 15, 1995
Trial operation	
First unit	June 30, 1995
Second unit	June 30, 1996
Commercial operation	
First unit	Dec. 31, 1995
Second unit	Dec. 31, 1996
Project completion	June 30, 1997

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Disbursement Schedule

Bank fiscal year and semester	Semester (US$ million)	Cumulative (US$ million)	Project (%)	Bank profile /a (%)
1993				
First	16.7	16.7	9.2	3.0
Second	27.5	44.2	24.5	10.0
1994				
First	34.9	79.1	43.9	18.0
Second	45.0	124.1	68.9	30.0
1995				
First	25.6	149.7	83.1	46.0
Second	15.0	164.7	91.5	58.0
1996				
First	3.4	168.1	93.4	70.0
Second	3.2	171.3	95.2	78.0
1997				
First	2.0	173.3	96.3	82.0
Second	3.3	176.6	98.1	90.0
1998				
First	3.4	180.0	100.0	94.0
Second	-	-	-	100.0

/a Bankwide standard disbursement profile for all sectors in China issued on April 25, 1990.

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Air Pollution Characteristics of Yanshi Thermal Power Plant
Air Quality Analysis (μ/m^3)

	World Bank Standard		Chinese Standard /a		Background level (1)		(2)		(3) /b		Background and Phase I /c		Background and Phases I-II /d		Background and Phases I-II /e	
	SO2	dust	SO2	dust	SO2	dust	SO2	dust	SO2	dust	SO2	dust	SO2	dust	SO2	dust
Annual average	100	100	100	-	6	61	4	95	16	115	8/6/20	66/98/127	11/9/24	69/100/129	11/10/25	67/98/126
Daily maximum	500	500	150	300	32	167	14	255	87	337	40/30/94	186/265/374	59/40/107	197/271/375	59/41/109	192/268/369
Once maximum	-	-	500	1,000	99	464	38	408	276	500	282	572	301	580	303	564

World Bank (Phase II Only)		Chinese Standard (Total of all phases)		Emissions (Units as Indicated) Phase I /g		Phases I /h		Phase II		Total All Phases /i		Total All Phases /j	
SO2(t/h)/f	Dust(mg/m³)	SO2	Dust	SO2	Dust	SO2	Dust	SO2	Dust	SO2	Dust	SO2	Dust
							(t/h)						
	150												
20	100	17.557		3.02	2.17 852mg/m³	3.55	0.43 136mg/m³	4.95	0.58 136mg/m³	7.97	2.75 422mg/m³	8.55	1.01 136mg/m3

/a GB-3095-82, Yanshi area declared class II air category by Henan provincial Environmental Protection Bureau.
/b (1)-Sen Hua Xang /(2)-Si Li Bei /(3)Re Li Tao.
/c Venturi Water-filmed type of precipitator efficiency of 95%.
/d Venturi Water-filmed type of precipitator for Phase I and ESP efficiency of 99.2% for Phase II.
/e ESP efficiency of 99.2% for Phase I and ESP efficiency of 99.2% for Phase II.
/f Tons per hour.
/g Venturi Water-filmed type of precipitator for Phase I.
/h ESP for Phase I.
/i Venturi Water-filmed type of precipitator for Phase I and ESP for Phase II.
/j Phase I and Phase II all use ESP.

Note: Plant statistics:

	Phase I	Phase I and Phase II
Coal		
Sulfur (%)	0.94	0.94
Ash (%)	28.45	24.20
Stack Height (m)	210	210/240

Notes: Monitory Point 1 is located 20 km due East of Yanshi.
Monitory Point 2 is located 20 km virtually due West of Yanshi.
Monitory Point 3 is located 11.5 km Southwest of Yanshi.
Louyan is 27 km Northwest of Yanshi.

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Summary of Environmental Mitigating Measures 1/

Air Quality Control	
Sulfur Dioxide:	Use low sulfur coal (less than 0.95 percent); use high chimney dispersion (240 meters) for local environment.
Dust:	Use high efficiency (99.4 percent) electrostatic precipitators (ESP) to meet an exit concentration standard of 150 mg/m^3 for total suspended particulates (TSP).
NOx:	Low NOx burners, will be used in the boilers of Phase II Project.
Waste Water Control	
Circulating Cooling Water Blowdown:	No chrome chemicals are to be used. Blowdown is to be sent to ash pond after neutralization.
Chemical Waste Water and Boiler Blowdown:	Neutralization by acid or alkaline prior to discharge.
Boiler Cleaning Wastewater:	Discharge after treatment in ash water quick reaction clarifier, resultant sludge disposal in ash yard (mineral acid), or inject wastewater into boiler furnace for incineration (organic acid).
Oil Contaminated Wastewater:	Use flat flow oil scraping pond and air flotation pond in two stages.
Sanitary Wastes:	Secondary treatment system currently available. Expand if necessary to meet effluent discharge standards.
Coal Yard Runoff:	Collect and settle. Sludge sent to ash disposal site, effluent discharged.

1/ Recommended in the Environmental Impact Assessment.

Ash Sluice Water:	Settled and adding H_2SO_4 (acidification) and sent to the Yellow River.

Solid Waste

Fly Ash:	Sluiced to the Xi-Jia-Gou Ash Yard. Surface to be maintained wet. Rainwater from surrounding areas directed to drainage systems. Sides planted with trees to contain dust. After useful life, ash yard is to be revegetated.
Bottom Ash:	Ground and Trucked to the Xi-Jia-Gou Ash Yard.

Noise

Allowable noise level of less than 90 db (A) to be specified for main and auxiliary equipment.

Noise isolating covers, walls or closets shall be provided where necessary.

Silencers shall be provided for boiler safety valves, piping, blowout, and forced draft fans.

CHINA

YANSHI THERMAL POWER PROJECT

Environmental Monitoring Program

1. Two 300 MW coal-fired steam generating units will be installed in the Phase II development of the Yanshi Thermal Power Station. In accordance with the requirements of the Environmental Protection Act of PRC (Provisional) and the Regulations for Fossil-Fired Power Plant Environmental Monitoring (Provisional) of MOE. Henan Electric Power Bureau will perform environmental monitoring for the discharge, ambient, and ash disposal areas in accordance with the programs presented in Tables 1 (air), 2 (water), and 3 (noise).

2. In order to successfully implement this program, it is necessary to make up the deficiency of instruments in the environmental monitoring station which was established in 1969, and provide trained staff to operate and maintain the equipment

3. The monitoring program is to be under the direction of the plant director; it should include a station leader and eight technicians, including environmental, chemical and thermal mechanical specialists or engineers. The station leader should report directly to the plant director.

4. Summary reports of the program should be prepared on a regular basis and made available to the World Bank upon request.

5. Additional equipment needed from local and foreign sources and the associated training requirements are presented in Tables 4 and 5. In brief terms, these resources are as follows:

	US $ equivalent
Local equipment	$ 200,000
Imported equipment	$ 100,000
Total	$ 300,000

Table 1: AIR AND GAS ENVIRONMENTAL MONITORING PROGRAM

Monitoring Point	Parameters or Pollutants	Equipment to be used	Frequency of sampling	Sampling point	Monitoring period
Flue stack	SO2, NOx, TSP	M1,000-type single chimney monitoring system	SO_2, NOx; continuously TSP:2-3 times/year	In the middle of the stack	All year
Electrostatic precipitator	Dust removal efficiency	Isokinetic probe,	After overhaul and after every fuel change (at least 2 times/year)	Standard procedures as manufacturer specified	-
Residential area	SO_2, NOx, CO, TSP	Mobile wagon automatic system	Five-day intervals	Prevailing wind direction, inside plant fence	ALl year, three to four times/year
Ash disposal yard	TSP	Mobile wagon automatic system	Three to four times per year	At edge of site, several locations	All year

Source: 87-Notification No. HE 299, Thermal Electric Power Plant Monitoring Regulation (Ministry of Energy).

Table 2: WATER AND WASTEWATER MONITORING PROGRAM

Parameter	Discharge at ash disposal site	Total combined plant industrial waste effluent	Boiler water demineralizer discharge (after treatment) & boiler blowdown	Sanitary wastewater treatment plant effluent	Oil contaminated wastewater effluent (after treatment)	Coal yard settling tank discharge	Ash yard groundwater (including local wells)	Cooling tower blowdown	Luo & Yi River tributary and upstream/downstream of junction	Boiler cleaning wastewater	Analytical procedure specification
PH	Automatic	Once in 10 days	Once/month	Once/month	Once/month	When water is present	Four times/year	Once in 10 days	Twice/year	Before discharge	GB-6920-86
Suspended matter	Once/month	Once in 10 days	-	Once/month	-	When water is present	Four times/year	-	Twice/year	Before discharge	PS-2-85
		Once in 10 days	-	Once/month	-	When water is present	-	-	Twice/year	Before discharge	PS-7-85
Arsenic and arsenide	Once/season	Once/season	-	-	-	Twice/year	Four times/year	-	Twice/year	Before discharge	GB-7485-87
Fluorine and fluoride	Once/month	Once/month	-	-	-	-	-	-	-	-	GB-7484-87
Sulfide	Once/month	Once/month	-	-	-	-	-	-	-	-	PS-5-85
Nitrite and nitrate	-	Once/season	-	Once/season	-	-	-	-	Twice/year	-	GB-7479-87
Oil and grease	-	-	-	-	Twice/month (minimum)	When water is present	-	-	-	-	PS-9-85
Volatile phenol	-	-	-	-	Once/month	When water is present	Four times/year	-	Twice/year	-	GB-7490-87
BODs (at 20°C)	-	-	-	Once/week	-	-	Four times/year	-	-	-	GB-7488-87
Residual chlorine	-	-	-	Once/month	-	-	-	Once/month	Twice/year	-	GB-5754-85
Bacterial count	-	-	-	-	-	-	Acoli. four times/year	-	-	-	-
Phosphate	-	-	Once/month	-	-	-	-	Once in 10 days	-	-	-
Dissolved solids	-	-	-	-	-	-	-	Four times/year	Twice/year	-	-
Heavy metals	Cd.Hg.Pb: Once/season Cr.+6 once/month	Cd.Hg.Pb: Once/season Cr.+6 Once/season	-	-	-	Cd.Hg.Pb: Cr.+6 twice/year	Cd.Hg.Pb Cr.+6 minimum: Four times/year	-	Cd.Hg.Pb. Cr.+6 Twice/year	Cd.Hg.Pb Cr +6: GB-7467-87 Cr.+6, Cu Cd.Pb. GB-7475-87 before discharge Hg: GB-7468-87	
Standard applicable	GB-8978-88	GB-8978-88	GB-8978-88 (except Cu)	GB-8978-88	GB-8978-88	GB-8978-88	GB-5749-85	GB-8978-88	GB-3838-88	GB-8978-88	

Table 3: NOISE MONITORING PLAN

Monitoring point	Noise source	Location of monitor	Monitoring standard & measurement method
Inside main building and miscellaneous plant buildings on-site	Various pieces of rotating machinery: - Turbine - Feed water pump - Forced draft fan - MPS Mills	Monitor is to be located 1 meter from large equipment. Number of points decided by test person. For small equipment, monitor is located at a distance of ½ the equipment length	GB-7441-87 "Measurement Method of Power Plant Noise"
Outside plant fence and residential areas	General monitoring of ambient noise	Area is divided into 500 m x 500 m grid. The center of each square will be the monitoring point. Number of locations depends on area	GB-3222-87 "Measurement Method of Community Noise"
	Road traffic	Mid-point of two intersections, 50 meters from roadside	GB-3222-87 "Measurement Method of Community Noise"
	Administration building, plant from area, worker residences		Gb-3222-87 "Measurement Method of Community Noise"

Table 4: LIST OF INSTRUMENTS AND EQUIPMENT TO BE PURCHASED LOCALLY

Instrument/device type	Code	Number	Remarks
1/1,000 precision analytical balance	TG328A	1	
Type 751 spectroscopic meter	751G	1	
pH meter	PXJ-RA	1	
Polarograph	MEC-RA	1	
Precision integrated sound level meter	ND-2	1	
Dust measuring instrument	SYC-1	1	
Velocity meter	LS-10	2	
Wind direction and speed meter	-	2	
Suspended particle sampler	fC-A3	4	
Air sampler	KB_6A	4	
Electronic calculator	IBM-550	1	
Conductivity meter	DDS-11a	1	

Table 5: INSTRUMENTS, EQUIPMENT AND TRAINING NEEDS
FOREIGN EXCHANGE REQUIREMENTS

Instrument/device type	Number	Remarks
Continuous automatic flue gas analyzer (SO_2, NOx)	1	Including sampler, analyzer and printer
Flue gas automatic monitor for TSP	1	Including sampler, analyzer and printer
pH continuous automatic monitor	1	Including sampler, analyzer and printer
COD measurement equipment	1	
BOD_1 measurement equipment	1	
Oil measuring meter	1	
Dust measurement apparatus for work area in the main power house	1	

CHINA

YANSHI THERMAL POWER PROJECT

HENAN PROVINCIAL ELECTRIC POWER BUREAU

Financial System Followed by Chinese Power Bureaus

1. Power companies such as HPEPB may accumulate capital from three separate and distinct sources. These include funds for fixed assets, funds for working capital, and a number of special funds.

(a) Funds for fixed assets. These funds are obtained from the State in large enough amounts to permit implementation of approved projects according to agreed schedules. Until 1980, these funds were provided almost entirely as grants; since then, the Government has decided to make these funds available as loans obtained from the banking system or from official sources. The funds under this category are used exclusively to finance works classified as capital expenditures. Most Chinese enterprises are not expected to finance any portion of capital expenditure from operations; rather, they are expected to remit all surplus income to the Government through payment of taxes;

(b) Funds for working capital. These funds are also received from the State. They are based on a fixed amount established by regulation and subject to review at intervals of about 10 years. These funds make up only a minor part of the power bureaus' capital and, because most of the bureaus have drawn their entire allocations since the last review, these funds have been used only as a minor source of capital in recent power projects proposed for Bank financing. Because current obligations both to and from the power bureaus are settled almost as accrued, the working capital funds have been used primarily to finance operating inventory; and

(c) Special funds. These funds are earmarked for distinct purposes and are funded from net operating revenues or cash receipts in amounts established according to regulations. The power bureaus' accounts contain four separate categories of special funds, including those for: (i) maintenance; (ii) renovations; (iii) employee benefits; and (iv) distribution improvements. The special funds for maintenance are financed by allocations charged as operating expenses in determining net operating income before Income Tax. The special funds for renovations are financed by charges against Government Funds (the balance sheet account showing the Government's equity investment in a power bureau) equal to the portion of depreciation provisions not used for debt repayment. The special funds for employee benefits are financed using distributions from Net Income after Income Tax but prior to the Adjustment Tax. Receipts and withdrawals from the special funds associated with distribution

improvements are passed through the Flow of Funds statement and are specifically excluded from the Income Statement. All other allocations to the special funds appear or are reflected on the Income Statement as though they are operating costs or distributions from earnings, regardless of whether corresponding cash expenditures have been incurred. Under more traditional accounting systems, the moneys expended from the special funds would largely be classified as operating costs or working capital. However, items charged to the Special Funds for both renovations and distribution improvements would be capitalized as fixed assets once the underlying work is completed. Thus, when the renovations or distribution improvements are completed, their value is deducted from the special funds balance and added to the Government Funds account. The power bureaus have only one way to channel tariff revenues into cash since all operating revenues must either be expended; distributed to cover cash outflows, debt service or taxes; invested in renovations or distribution improvements; or retained for future expenditure chargeable to the special funds.s The bureaus channel revenues into cash by using the excess of special fund allocations over the sum of (i) Special Fund Expenditures; (ii) completed renovations and distribution improvements; and (iii) increases in Special Fund Assets. In turn, cash generated through the Special Funds may be interchanged with other operating cash; however, allocations to particular special funds create an ultimate obligation for a power bureau to use the accumulated cash only for certain categories of expenditures.

2. Until 1983, the power bureaus paid remittances to MOE equal to operating revenues less the sum of cash expenditures charged directly to operations, all allocations to special funds, and debt service. Since 1983, the power bureaus pay MOF an Income Tax, assessed at 55% of operating revenues less the sum of costs (including depreciation) charged directly to operations, all allocations to special funds that are treated as expenses, and debt service in excess of the portion of depreciation provision specifically allocated for debt repayment. From the residual after Income Tax, the power bureaus must cover the special fund allocations that are treated as distributions from earnings and the amount of debt repayment and capitalized interest during construction to be met from net income, and remit the remainder to MOE as an Adjustment Tax.1/ MOE has some flexibility in controlling the power bureaus' liquidity. It can do this either by changing their allocations to the special funds, making grants for allocation to the special funds, or relieving the power bureaus of a portion of the Adjustment Tax. The power bureaus appear to have adequate liquidity and MOE has not shown any inclination to adjust the procedures that affect their liquidity.

3. Under the existing financial system, the Government does not intend for the power bureaus to retain a surplus. However, tariff revenues must meet debt service requirements and repayment *per se* does not represent a charge

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1/ From an accounting point of view, the Adjustment Tax is treated in a manner similar to a dividend.

against earnings. Regulations provide that certain stipulated amounts of repayment shall be met from cash that has been generated by depreciation; however, the remainder of the cash generated by depreciation must be added to a bureau's operating cash and a corresponding allocation must be made to the Special Funds for renovations. As a result, the remainder of repayment, which must be met from an earmarked increment of tariff revenues, creates an accumulation of equity in the form of a corresponding undistributed earnings.

4. Most power bureaus have units which engage in construction management and subsidiaries which function as contractors. As a rule, the accounts of the construction management units are consolidated with those of the power bureau's operating units; however, the accounts of subsidiaries acting as construction contractors are, as a rule, not consolidated with those of the operating units. As a result, when investments were financed through grants, the power bureau's consolidated accounts may have routinely understated gross fixed assets and certainly did not reflect adequately construction in progress. Also, in the past, only about 85% of the value of government grants used to finance new fixed assets was transferred from the books of the construction subsidiaries functioning as contractors to the power bureau's consolidated accounts. The residual was considered to have been expended in purchasing moving assets, which remained with those construction subsidiaries upon the completion of construction. The change to using loans rather than grants to finance power sector investments has caused investment funds to be channelled from the Government through the power bureaus for payment to construction units acting as contractors. Thus, in the future, the consolidated accounts of the power bureau should more accurately reflect the value of gross fixed assets and construction in progress.

5. Given the existing financial system, the power bureaus have little financial incentive to increase tariffs at the present time. Once a power bureau has sufficient revenues to meet the costs charged directly to operations and all special fund allocations and debt service, any additional revenues are remitted to the State through income or adjustment taxes. Thus, once expenses and required distributions have been met, even a large tariff increase would not increase a power bureau's financial viability, except to improve debt service coverage. Therefore, the familiar indicators of financial performance such as rate of return and self-financing ratio have very limited application to the financial analysis of a Chinese power bureau.

CHINA

YANSHI THERMAL POWER PROJECT

HENAN PROVINCIAL ELECTRIC POWER BUREAU

Annual Financial Statement

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CHINA
YANSHI POWER PROJECT
HENAN PROVINCIAL ELECTRIC POWER BUREAU
KEY FINANCIAL INDICATORS 1991-2000

(Yuan Million)

Year Ended December 31	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Energy Sales (GWh)	25152	27017	28961	31090	33638	37173	40569	43341	47416	53361	
Average Price/kWh (fen)	13.50	15.38	17.23	19.01	21.00	22.46	24.24	27.05	28.80	28.80	
Operating Revenue	3396	4155	4991	5910	7065	8350	9835	11723	13654	15366	
Operating Income	441	766	1120	1593	2180	2714	3543	4581	5400	5923	
Remittances to Government	34	93	138	286	326	438	509	564	616	834	
Annual Capital Expenditure	1330	1414	2333	2749	3048	3577	4125	4494	4603	4648	
Rate Base	4877	5901	7114	8298	10101	12606	14834	17381	22565	27651	
Long-term Debt	2952	3834	5359	7248	8959	11062	13192	15098	16489	17905	
Debt Service	262	404	661	697	1191	1442	2135	3054	3834	3919	Projected
Cash in Banks	313	314	294	348	351	408	440	523	665	1045	Average 1991-2000
Rate of Return											
Historically Valued Assets (%)	9.0	13.0	15.7	19.2	21.6	21.5	23.9	26.4	23.9	21.4	19.6
Notionally Revalued Assets (%)	5.8	8.1	9.6	11.7	13.5	14.0	15.7	17.4	16.4	14.9	12.7
Self Financing Ratio (%)	24.5	22.4	22.2	24.0	25.7	25.0	26.8	25.5	26.2	30.0	25.2
Operating Ratio (%)	87.0	81.6	77.6	73.1	69.1	67.5	64.0	60.9	60.4	61.5	70.3
Debt/Total Capital (%)	44.2	49.2	55.2	60.7	62.6	64.5	64.9	63.2	60.2	58.4	58.3
Debt Service Coverage	2.6	2.2	1.9	2.2	1.8	1.8	1.6	1.5	1.4	1.5	1.8

CHINA

YANSHI THERMAL POWER PROJECT

HENAN PROVINCIAL ELECTRIC POWER BUREAU

Income Statements 1985-1990
(Yuan million)

Year ended December 31	1985	1986	1987	1988	1989	1990
Sales Increase (%)	5.0	6.3	9.5	10.6	6.9	7.9
Energy Sales (GWh)	16,992	18,062	19,773	21,870	23,392	23,892
Average Price (Fen/kWh)	6.5	7.1	7.4	7.7	10.0	10.7
Operating Revenue	1,110	1,289	1,464	1,680	2,330	2,545
Operating Costs						
Fuel	363	433	483	591	786	885
Purchased power	90	110	96	132	362	208
Operation & Maintenance	86	118	170	196	279	358
Administration	41	53	55	70	79	111
Sales tax	283	314	359	403	457	499
Depreciatior	76	99	149	188	205	246
Total Operating Costs	939	1,127	1,312	1,582	2,168	2,307
Operating Income	172	162	152	98	162	238
Other income	0	0	0	0	0	0
Net Income Before Income Tax	172	162	152	98	162	238
Income Tax	95	75	70	44	76	84
Net Income	77	87	82	54	86	154
Distribution of Net Income						
Remittances to Government	31	40	37	23	32	27
Transferred to Gov't Funds	14	20	20	20	20	76
Employee Benefits SF	32	27	25	11	35	51
Net Income	77	87	82	54	86	154
Rate Base	1,793	2,564	3,031	3,630	3,951	4,500
Rate of Return (%)	12.0	7.4	5.7	2.7	4.1	5.3

CHINA
YANSHI POWER PROJECT
HENAN PROVINCIAL ELECTRIC POWER BUREAU
INCOME STATEMENT

(Yuan Million)

Year Ended December 31	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Sales Increase (%)	5.3	7.4	7.2	7.4	8.2	10.5	9.1	6.8	9.4	12.5
Energy Sales (GWh)	25152	27017	28961	31090	33638	37173	40569	43341	47416	53361
Average Price/kWh (fen)	13.50	15.38	17.23	19.01	21.00	22.46	24.24	27.05	28.80	28.80
Operating Revenue	3396	4155	4991	5910	7065	8350	9835	11723	13654	15366
Operating Costs										
Fuel	1095	1287	1560	1722	1964	2414	2708	3085	3510	3889
Purchased Power	231	251	280	277	282	268	262	249	218	200
Operation & Maintenance	454	548	654	765	892	1052	1233	1411	1645	1999
Administration	126	148	170	193	219	248	282	319	362	411
Sales Tax	747	798	784	869	940	935	964	1090	1270	1429
Depreciation	301	357	424	492	589	719	844	987	1248	1516
Total Operating Costs	2954	3389	3871	4317	4885	5636	6292	7142	8253	9443
Operating Income	441	766	1120	1593	2180	2714	3543	4581	5400	5923
Interest Charged to Operations	42	136	195	256	333	470	658	907	1128	1289
Net Income Before Income Tax	399	630	925	1337	1847	2244	2886	3674	4273	4634
Income Tax	125	231	313	575	649	848	976	1077	1173	1559
Net Income	275	399	611	762	1199	1396	1910	2597	3099	3076
Distribution of Net Income										
Enterprise Development Fund	15	40	59	122	140	188	218	242	264	358
Remittances to Government	34	93	138	286	326	438	509	564	616	834
Transferred to Govt. Funds	137	185	330	292	603	674	971	1597	2063	1800
Chargeable IDC	35	24	25	0	65	29	140	120	76	0
Employee Benefits Spec. Funds	53	56	59	62	65	68	72	75	79	83
Net Income	275	399	611	762	1199	1396	1910	2597	3099	3076

CHINA

YANSHI THERMAL POWER PROJECT

HENAN PROVINCIAL ELECTRIC POWER BUREAU

Balance Sheets 1985-1990
(Yuan million)

As at December 31	1985	1986	1987	1988	1989	1990
Current Assets						
Cash	93	120	142	380	324	344
Inventories	92	103	101	160	257	225
Receivables	108	116	117	305	369	228
Total Current Assets	292	339	360	845	950	797
Fixed Assets						
Plant in Service	2,915	3,868	4,041	4,783	5,295	6,130
Less Accum. Depreciation	778	877	971	1,158	1,377	1,630
Operating Plant	2,137	2,991	3,070	3,625	3,918	4,500
Const. work in progress	879	864	499	197	305	324
Total Fixed Assets	3,016	3,855	3,569	3,822	4,223	4,824
Special Fund Assets	103	144	181	210	316	306
Total Assets	3,411	4,337	4,110	4,877	5,489	5,927
Current Liabilities						
Accounts Payable	140	147	121	347	357	58
Due to Government	42	62	73	138	158	179
Total Current Liab.	182	208	194	485	515	237
Long-term debt	409	1,071	1,104	1,573	1,746	2,067
Consumers' deposit	1	1	1	1	1	10
Government Funds	2,607	2,783	2,465	2,437	2,737	3,113
Working Capital Funds	67	90	102	70	89	91
Special Funds	1445	183	244	311	401	409
Total Liabilities	3,411	4,337	4,110	4,877	5,489	5,927
Debt as % of Debt & Equity (%)	13.0	26.5	29.0	36.4	35.8	37.0
Current Ratio (times)	1.6	1.6	1.9	1.7	1.8	3.4

CHINA
YANSHI POWER PROJECT
HENAN PROVINCIAL ELECTRIC POWER BUREAU
BALANCE SHEET
(Yuan Million)

Year ended December 31	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Assets										
Current Assets										
Cash	313.3	313.6	294.1	348.4	351.2	407.7	439.8	522.9	664.6	1044.7
Inventories	254.4	302.8	363.9	408.2	478.2	586.7	662.3	767.9	922.1	1031.1
Receivables	359.1	421.5	490.2	565.8	660.7	766.3	888.4	1043.6	1202.2	1342.9
Total Current Assets	926.8	1037.9	1148.2	1322.3	1490.0	1760.7	1990.5	2334.3	2788.9	3418.7
Fixed Assets										
Plant in Service	7185.8	8835.2	10393.9	12118.3	15078.3	18436.9	21097.0	25362.9	33701.2	38298.6
(less) Accum. Depreciation	1931.2	2288.4	2712.0	3203.5	3792.0	4511.3	5355.2	6342.5	7590.7	9106.6
Net Plant in Service	5254.6	6546.9	7681.9	8914.8	11286.3	13925.6	15741.7	19020.4	26110.5	29192.0
Construction WIP	576.5	339.3	1088.9	2059.9	2079.7	2225.7	3612.2	3840.2	105.0	155.2
Total Fixed Assets	5831.1	6886.2	8770.8	10974.7	13366.1	16151.3	19353.9	22860.6	26215.5	29347.2
Special Fund Assets	346.3	369.0	371.4	380.1	362.7	367.4	347.3	344.9	364.7	292.2
Total Assets	7104.1	8293.2	10290.4	12677.0	15218.8	18279.4	21691.6	25539.7	29369.2	33058.2
Liabilities										
Current Liabilities										
Accounts Payable	132.7	151.6	172.4	191.3	214.8	245.8	272.4	307.8	350.3	396.3
Due to Government	184.4	189.9	195.6	201.5	207.5	213.7	220.1	226.8	233.6	240.6
Total Current Liabilities	317.0	341.5	368.0	392.8	422.3	459.6	492.6	534.5	583.8	636.9
Enterprise Development Fund	14.5	54.5	113.7	236.2	375.9	563.4	781.4	1023.0	1287.2	1644.9
Consumers Deposits	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Working Capital Funds	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2
Long-term Debt	2952.4	3834.1	5358.5	7248.0	8959.3	11062.1	13191.7	15098.5	16489.4	17904.8
Government Funds	3199.4	3347.1	3657.1	3917.5	4464.4	5045.4	5940.9	7421.3	9309.0	11025.3
Special Funds	520.5	615.8	692.9	782.3	896.8	1048.8	1184.9	1362.3	1599.5	1746.2
Revaluation Reserve	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Liabilities	7104.1	8293.2	10290.4	12677.0	15218.8	18279.4	21691.6	25539.7	29369.2	33058.2
Debt as % of Debt & Equity	44.2	49.2	55.2	60.7	62.6	64.5	64.9	63.2	60.2	58.4
Current Ratio	2.9	3.0	3.1	3.4	3.5	3.8	4.0	4.4	4.8	5.4

CHINA
YANSHI POWER PROJECT
HENAN PROVINCIAL ELECTRIC POWER BUREAU
FUNDS FLOW STATEMENT
(Yuan Million)

Year ended December 31	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Internal Sources of Funds										
Net Income	274.5	398.7	611.0	762.1	1198.7	1396.3	1910.0	2597.2	3099.4	3075.6
Depreciation	301.2	357.2	423.6	491.5	588.5	719.3	843.9	987.3	1248.2	1515.9
Maintenance Special Funds	116.1	142.5	183.8	222.7	265.8	339.8	423.8	490.3	596.9	805.4
Distribution Imprv. Spec. Fds.	55.3	55.9	56.6	57.3	58.0	58.7	59.4	60.1	60.8	61.5
Total Internal Sources	747.1	954.3	1275.0	1533.6	2111.0	2514.1	3237.1	4134.9	5005.3	5458.5
Borrowings										
Proposed IBRD Loan	0.0	89.3	470.6	272.3	88.1	27.8	20.3	0.0	0.0	0.0
Yanshi Project Related Loans	21.8	116.2	384.3	449.3	318.3	213.1	89.4	0.0	0.0	0.0
Other Loans	1019.6	900.8	1068.2	1493.0	1970.9	2624.8	3292.6	3857.8	4001.0	4026.6
IDC Borrowed	30.3	21.1	67.3	169.6	194.9	252.9	142.5	76.7	20.3	19.1
Total Borrowings	1071.6	1127.4	1990.3	2384.2	2572.2	3118.6	3544.8	3934.5	4021.2	4045.7
Government Funds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Sources of Funds	1818.7	2081.7	3265.3	3917.8	4683.3	5632.7	6781.9	8069.3	9026.6	9504.2
Capital Expenditures										
Proposed Yanshi Project	21.8	200.9	830.4	663.9	324.0	146.4	55.3	0.0	0.0	0.0
Other Construction	1019.6	907.2	1117.8	1604.6	2121.2	2791.7	3384.1	3857.8	4001.0	4026.6
Interest During Construction	65.6	45.1	92.2	169.6	260.3	282.0	282.8	196.2	96.6	19.1
Completed Renovations	209.1	223.3	248.2	266.0	296.5	310.5	355.7	392.5	457.6	553.4
Distribution Improvements	14.1	37.6	44.7	45.2	45.7	46.3	46.8	47.4	48.0	48.5
Total Capital Expenditure	1330.1	1414.0	2333.3	2749.3	3047.8	3577.0	4124.7	4493.9	4603.1	4647.6
Operational Requirements										
Inc/dec in Working Capital	81.3	86.4	103.3	95.0	135.3	176.9	164.7	218.8	263.6	196.7
Inc/dec in Special Fund Assets	40.3	22.7	2.4	8.7	-17.3	4.7	-20.2	-2.4	19.8	-72.5
Loan Repayment	164.4	244.0	440.8	440.8	793.1	943.5	1336.9	2027.7	2630.3	2630.3
Remittances to Government	33.9	93.2	138.2	285.7	326.0	437.7	508.6	563.8	616.5	834.5
Special Fund Expenditures	164.2	197.1	241.9	283.9	330.2	407.4	494.8	564.8	675.2	887.5
Chargeable IDC	35.3	24.0	25.0	0.0	65.4	29.1	140.3	119.5	76.3	0.0
Total Operational Requirements	519.3	667.4	951.5	1114.2	1632.6	1999.2	2625.0	3492.3	4281.7	4476.5
Total Applications of Funds	1849.4	2081.4	3284.8	3863.5	4680.4	5576.2	6749.8	7986.2	8884.8	9124.1
Increase/Decrease in Cash	(30.7)	0.3	(19.5)	54.3	2.8	56.5	32.1	83.1	141.7	380.0
Annual Debt Service Coverage	2.6	2.2	1.9	2.2	1.8	1.8	1.6	1.5	1.4	1.5

DERIVATION OF AVERAGE TARIFF

AUTHORIZED POWER PRICING	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Energy Sales (GWh)	25152.0	27017.0	28961.0	31090.0	33638.0	37173.0	40569.0	43341.0	47416.0	53361.0
Domestic										
Inter grid transfers	2164.0	861.0	265.0	570.0	500.0	0.0	0.0	0.0	0.0	0.0
Nondomestic retail	23088.4	25196.3	28985.1	30796.7	33829.6	37179.4	40129.7	44834.0	49081.0	52226.0
Average Revenue (fen/KWh)	10.98	11.39	11.91	12.28	12.73	13.25	13.72	14.23	14.69	15.07
Base Revenue (Yuan/MWh)	103.15	106.25	109.44	112.72	116.10	119.58	123.17	126.87	130.67	134.59
Inter grid transfers	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Auth. Coal Adjustments										
Transfers (Current Prs.)										
Nondom. Ret. (Const. Prs.)	7.20	7.20	7.92	7.92	8.32	9.15	9.60	9.60	9.60	9.60
Nondom. Ret. (Curr. Prs.)	7.20	8.24	9.64	10.13	11.16	12.89	14.22	14.93	15.67	16.46
Operating Revenue (mln Y)	2760.8	3078.1	3448.9	3816.3	4283.1	4924.7	5567.5	6167.8	6965.3	8041.5
Total energy	2594.5	2870.5	3169.4	3504.5	3905.4	4445.3	4997.0	5498.5	6196.0	7182.0
Inter grid transfers	108.2	43.1	13.3	28.5	25.0	0.0	0.0	0.0	0.0	0.0
Coal price adj.										
--- Inter grid transfers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
--- Nondomestic retail	166.2	207.5	279.5	311.9	377.7	479.4	570.5	669.3	769.3	859.5

BREAKEVEN COAL ADJ. INCREMENT

Revenue - Auth. Coal Pr. Adjs.	166.2	207.5	279.5	311.9	377.7	479.4	570.5	669.3	769.3	859.5
CPA Revenue Net of Sales Tax	141.3	176.4	237.6	265.1	321.0	407.5	484.9	568.9	653.9	730.6
Cost of Coal Price Increment	52.2	162.0	278.9	388.8	538.0	701.5	878.3	1100.1	1359.2	1619.2
Coal Adj. Surplus/Deficit	89.1	14.4	(41.3)	(123.7)	(217.0)	(294.0)	(393.4)	(531.3)	(705.3)	(888.7)
Additional Req. Req. (fen/kWh)	0.0	0.0	0.2	0.5	0.8	1.0	1.2	1.6	1.9	2.1
Adjusted Oper. Rev. (Y mln.)	2760.8	3078.1	3490.2	3940.1	4500.1	5218.7	5960.9	6699.1	7670.6	8930.2
Energy Sales (GWh)	25152.0	27017.0	28961.0	31090.0	33638.0	37173.0	40569.0	43341.0	47416.0	53361.0
Adj. Avg. Sale Price (fen/kWh)	11.0	11.4	12.1	12.7	13.4	14.0	14.7	15.5	16.2	16.7

General Tariff Revision	23%	35%	43%	50%	57%	60%	65%	75%	78%	70%
Revised Price (fen/kWh)	13.5	15.4	17.2	19.0	21.0	22.5	24.2	27.0	28.8	28.5
AVERAGE SALES PRICE (fen/kWh)	13.5	15.4	17.2	19.0	21.0	22.5	24.2	27.0	28.8	28.8
memo item: ave price in 1991 rea	13.5	14.1	14.9	15.6	16.4	16.7	17.2	18.3	18.5	17.6
self fin. ratio (%)	24.5	22.4	22.2	24.0	25.7	25.0	26.8	25.5	26.2	30.0

INVESTMENT PROGRAM

CAPITAL EXPENDITURES	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
LOANS											
PCBC loans											
Yongcheng Power Plant						0.0	222.0	310.8	734.3	771.0	2038.2
Sanmenxia Power Plant I	2.1	244.8	691.7	709.6							1648.2
Qinbei Power Plant					201.4	634.3	1036.9	1554.1	905.7		4331.6
Yaomeng Power Plant IV					201.4	352.4	814.1	512.9			1880.7
Jiaozuo Power Plant III	241.5	76.6									615.0
Sanmenxia Power Plant II						0.0	0.0	233.1	815.9	2056.1	3105.1
Hebi Power Plant	262.5	143.0									700.5
Zhengzhou Thermal	287.7	297.4									704.4
Luoyang Thermal				63.9	335.6	563.9	518.0				1481.5
Yaheko Power Plant			304.4	639.3	1141.1	775.3					2860.2
other power lants						70.5	296.0	466.2	815.9	1199.4	2848.1
220kv line completed with Yongcheng Power Plant						0.0	0.0	69.9	106.1		176.0
500kv Yaozheng line I						0.0	0.0	0.0			0.0
220kv line completed with JZ PP	136.5	42.3									210.9
220kv line completed with Sanmenxia Power		57.2	121.8	127.9							306.8
220kv line completed with HB PP	57.8	11.4									107.6
220kv line completed with ZZ The	31.5	34.3									65.8
220kv line completed with YHK PP				63.9	201.4	141.0					406.3
220kv line completed with SMX PP II							74.0	233.1	326.4		633.5
220kv line completed with Qinbei Power Plant						64.1	201.8	353.2	296.7		915.8
220kv line compl. with YS PP II		8.0	17.1	80.8	66.0						171.8
220kv line completed with Luoyang Power Plant					40.3	91.6	74.0				205.9
220kv line completed with Yaomeng IV						98.7	148.0	124.3			371.0
Other Transmission Line & S/S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yanshi Power Plant II (for inves	21.8	97.3	300.2	245.7	98.1	44.3	0.0				807.3
Yanshi Power Plant II (IDC & C/F)		6.3	42.5	65.2	71.9	74.3	35.0				295.1
IBRD loan											0.0
Yanshi Power Plant II		89.3	470.6	272.3	88.1	27.8	20.3				968.4
											0.0
GRANTS											0.0
	0.0										0.0
Total	1041.4	1108.1	1948.2	2268.5	2445.2	2938.1	3439.4	3857.8	4001.0	4026.6	23829.3

INVESTMENTS (INCLUDING IDC)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
LOANS											
PCBC loans											
Yongcheng Power Plant						0.0	231.2	342.8	773.5	771.0	2118.4
Sanmenxia Power Plant I	2.1	255.1	716.6	709.6							1683.5
Qinbei Power Plant					209.7	678.0	1152.5	1670.8	905.7		4616.6
Yaomeng Power Plant IV					209.7	384.4	855.5	512.9			1962.5
Jiaozuo Power Plant III	259.0	76.6									636.5
Sanmenxia Power Plant II						0.0	0.0	242.8	842.9	2056.1	3141.7
Hebi Power Plant	280.3	143.0									722.7
Zhengzhou Thermal	309.7	321.4	0.0								752.5
Luoyang Thermal				66.6	355.0	593.0	518.0				1532.6
Shekou Power Plant		0.0	317.0	692.0	1206.5	775.3					2990.9
other power plants						70.5	296.0	469.1	826.3	1218.5	2880.5
220kv line completed with Yongcheng Power Plant								69.9	106.1		176.0
500kv Yaozheng line I						0.0	0.0	0.0			0.0
220kv line completed with JZ PP	140.7	42.3									216.2
220kv line completed with Sanmenxia Power		59.6	126.8	127.9							314.2
220kv line completed with HB PP	60.6	11.4									111.1
220kv line completed with ZZ The	32.8	36.4	0.0								69.2
220kv line completed with YHK PP				66.6	208.3	141.0					415.8
220kv line completed with SMX PP II						0.0	77.1	249.2	346.6		672.8
220kv line completed with Qinbei Power Plant					0.0	66.7	215.7	372.2	296.7		951.4
220kv line completed with YS PP II		8.4	18.5	86.3	72.0						185.2
220kv line completed with Luoyang Power Plant					41.9	95.3	74.0				211.2
220kv line completed with Yaomeng IV						102.8	155.3	124.3			382.4
Other Transmission Line & S/S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yanshi Power Plant II		6.6	44.8	72.1	85.1	94.6	48.3				351.5
Yanshi Power Plant II (for investment)		101.3	321.0	290.8	161.2	118.5					992.8
											0.0
IBRD loan											0.0
Yanshi Power Plant II		89.3	470.6	272.3	88.1	27.8	20.3				968.4
											0.0
GRANTS											0.0
											0.0
Total	1085.1	1151.4	2015.3	2384.2	2637.6	3147.8	3644.0	4054.0	4097.6	4045.7	25011.0

LOAN PARAMETERS

INTEREST	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
Yongcheng Power Plant											
PCBC loans						0.0	9.2	32.0	77.9	119.6	238.8
Sanmenxia Power Plant I											
PCBC loans		10.3	49.9	93.4	109.0	95.3	81.5	67.8	54.1	40.3	601.7
Qinbei Power Plant											
PCBC loans					8.3	43.6	116.4	233.3	283.9	284.1	969.7
Yaomeng Power Plant IV											
PCBC loans					8.3	32.0	82.9	118.6	123.9	108.0	473.7
Jiaozuo Power Plant III											
PCBC loans	34.9	42.6	40.7	35.5	30.4	25.3	20.2	15.0	9.9	4.8	263.4
Sanmenxia Power Plant II											
PCBC loans						0.0	0.0	9.7	53.9	146.2	209.7
Hebi Power Plant											
PCBC loans	35.7	46.2	46.3	40.5	34.7	28.8	23.0	17.1	11.3	5.5	293.5
Zhengzhou Thermal											
PCBC loans	22.0	48.0	52.3	46.3	40.2	34.2	28.2	22.1	16.1	10.1	321.5
Luoyang Thermal											
PCBC loans				2.6	19.4	58.3	88.8	97.8	85.3	72.9	425.0
Yaokou Power Plant											
PCBC loans		0.0	12.6	52.7	130.8	180.5	188.4	164.2	139.9	115.7	984.8
other power plants											
PCBC loans						1.3	7.9	21.9	40.7	73.0	144.8
220kv line completed with Yongcheng Power Plant											
PCBC loans						0.0	0.0	2.9	10.4	19.1	32.4
500kv Yaozheng line I											
PCBC loans						0.0	0.0	0.0	0.0	0.0	0.0
220kv line completed with JZ PP III											
PCBC loans	8.4	14.0	14.0	12.2	10.4	8.7	6.9	5.2	3.4	1.7	85.9
220kv line completed with Sanmenxia Power PlantI											
PCBC loans		2.4	10.0	17.6	20.3	17.7	15.2	12.6	10.0	7.5	113.2
220kv line completed with HB PP											
PCBC loans	5.6	7.5	7.1	6.2	5.3	4.4	3.5	2.6	1.7	0.8	45.7
220kv line completed with ZZ Thermal											
PCBC loans	1.3	4.1	4.9	4.3	3.8	3.2	2.7	2.1	1.6	1.0	29.0
220kv line completed with YHK PP											
PCBC loans				2.6	13.8	24.4	26.9	23.5	20.1	16.7	128.1
220kv line completed with SMX PP II											
PCBC loans					0.0	0.0	3.1	16.0	40.5	57.7	117.3
220kv line completed with Qinbei Power Plant											
PCBC loans					0.0	2.7	13.9	38.0	55.8	60.4	170.8
220kv line completed with YS PP II											
PCBC loans		0.3	1.4	5.6	12.1	13.1	11.9	10.4	8.8	7.2	70.7
220kv line completed with Luoyang Power Plant											
PCBC loans					1.7	7.3	12.3	13.6	11.9	10.2	56.9
220kv line completed with yaomeng IV											
PCBC loans						4.1	14.6	27.1	27.6	24.6	98.1
Other Transmission Line & S/S											
PCBC loans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yanshi Power Plant II											
IBRD loan		1.7	25.2	53.9	67.9	72.4	74.3	70.0	65.0	60.0	490.5
PCBC loans		0.3	2.3	7.0	13.2	20.3	26.6	21.9	19.4	16.9	127.8
PCBC loans (for investment)		4.0	20.8	45.1	63.1	74.2	82.2	58.0	50.9	43.8	442.1
Total	107.9	181.5	287.4	425.6	592.9	751.7	940.3	1103.4	1224.2	1307.8	6933.1

INTEREST DURING CONSTRUCTION	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
Yongcheng Power Plant											
PCBC loans							9.2	32.0	39.0		80.17
Sanmenxia Power Plant I											0.00
PCBC loans		10.3	25.0								35.28
Qinbei Power Plant											0.00
PCBC loans					8.3	43.6	116.4	116.6			284.99
Yaomeng Power Plant IV											0.00
PCBC loans					8.3	32.0	41.4				81.74
Jiaozuo Power Plant III											0.00
PCBC loans	17.5										21.46
Sanmenxia Power Plant II											0.00
PCBC loans							0.0	9.7	26.9		36.59
Hebi Power Plant											0.00
PCBC loans	17.8										22.23
Zhengzhou Thermal											0.00
PCBC loans	22.0	24.0									48.07
Luoyang Thermal											0.00
PCBC loans				2.6	19.4	29.1					51.18
Yaheikou Power Plant											0.00
PCBC loans			12.6	52.7	65.4						130.72
other power plants											0.00
PCBC loans								2.9	10.4	19.1	32.44
220kv line completed with Yongcheng Power Plant											0.00
PCBC loans						0.0	0.0				0.00
500kv Yaozheng line I											0.00
PCBC loans						0.0	0.0				0.00
220kv line completed with JZ PP III											0.00
PCBC loans	4.2										5.30
220kv line completed with Sanmenxia Power PlantI											0.00
PCBC loans		2.4	5.0								7.35
220kv line completed with HB PP											0.00
PCBC loans	2.8										3.51
220kv line completed with ZZ Thermal											0.00
PCBC loans	1.3	2.1									3.37
220kv line completed with YHK PP											0.00
PCBC loans				2.6	6.9						9.57
220kv line completed with SMX PP II											0.00
PCBC loans						0.0	3.1	16.0	20.3		39.36
220kv line completed with Qinbei Power Plant											0.00
PCBC loans					0.0	2.7	13.9	19.0			35.54
220kv line completed with YS PP II											0.00
PCBC loans		0.3	1.4	5.6	6.1						13.35
220kv line completed with Luoyang Power Plant											0.00
PCBC loans					1.7	3.6					5.30
220kv line completed with Yaomeng IV											0.00
PCBC loans						4.1	7.3				11.40
Other Transmission Line & S/S											0.00
PCBC loans	0.0	0.0	0.0	0.0							0.00
Yanshi Power Plant II											0.00
IBRD loan		1.7	25.2	53.9	67.9	72.4	37.1				258.26
PCBC loans		0.3	2.3	7.0	13.2	20.3	13.3				56.34
PCBC loans (for investment)		4.0	20.8	45.1	63.1	74.2	41.1				248.42
Total	65.6	45.1	92.2	169.6	260.3	282.0	282.8	196.2	96.6	19.1	1502.81

REPAYMENT	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
Yongcheng Power Plant											
PCBC loans									207.9	207.9	415.9
Sanmanxia Power Plant I											
PCBC loans			165.9	165.9	165.9	165.9	165.9	165.9	165.9	165.9	1326.8
Qinbei Power Plant											
PCBC loans								450.0	450.0	450.0	1350.0
Yaomeng Power Plant IV											
PCBC loans							192.1	192.1	192.1	192.1	768.4
Jiaozuo Power Plant III											
PCBC loans	61.9	61.9	61.9	61.9	61.9	61.9	61.9	61.9	61.9	61.9	619.0
Sanmenxia Power Plant II											
PCBC loans									311.5	311.5	623.0
Hebi Power Plant											
PCBC loans	70.5	70.5	70.5	70.5	70.5	70.5	70.5	70.5	70.5	70.5	704.9
Zhengzhou Thermal											
PCBC loans		72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.9	655.7
Luoyang Thermal											
PCBC loans						150.4	150.4	150.4	150.4	150.4	751.8
Yahekou Power Plant											
PCBC loans					292.5	292.5	292.5	292.5	292.5	292.5	1755.3
other power plants											
PCBC loans								110.5	110.5	110.5	331.6
220kv line completed with Yongcheng Power Plant											
PCBC loans									17.9	17.9	35.8
500kv Yaozheng line I											
PCBC loans							0.0	0.0	0.0	0.0	0.0
220kv line completed with JZ PP III											
PCBC loans	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	212.0
220kv line completed with Sanmenxia Power PlantI											
PCBC loans			30.9	30.9	30.9	30.9	30.9	30.9	30.9	30.9	247.4
220kv line completed with HB PP											
PCBC loans	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	108.3
220kv line completed with ZZ Thermal											
PCBC loans		6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	60.4
220kv line completed with YHK PP											
PCBC loans					40.9	40.9	40.9	40.9	40.9	40.9	245.4
220kv line completed with SHX PP II											
PCBC loans									65.3	65.3	130.5
220kv line completed with Qinbei Power Plant											
PCBC loans								93.2	93.2	93.2	279.7
220kv line completed with YS PP II											
PCBC loans					18.9	18.9	18.9	18.9	18.9	18.9	113.4
220kv line completed with Yaomeng IV											
PCBC loans							20.8	20.8	20.8	20.8	83.0
220kv line completed with Luoyang Power Plant											
PCBC loans						0.0	0.0	37.1	37.1	37.1	111.3
Other Transmission Line & S/S											
PCBC loans				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yanshi Power Plant II											
IBRD loan							64.6	64.6	64.6	64.6	0.0
PCBC loans							30.5	30.5	30.5	30.5	121.9
PCBC loans (for investment)							85.6	85.6	85.6	85.6	342.2
Total	164.4	244.0	440.8	440.8	793.1	943.5	1336.9	2027.7	2630.3	2630.3	11651.7

FIXED ASSET FORMATION

FIXED ASSET ADDITIONS	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
LOANS											
Yongcheng Power Plant									1006.2	1006.2	2012.5
Sanmenxia Power Plant I			799.6	799.6							1599.3
Qinbei Power Plant								2192.9	2192.9		4385.8
Yaomeng Power Plant IV							932.2	932.2			1864.3
Jiaozuo Power Plant III	302.3	302.3									604.7
Sanmenxia Power Plant II									1492.3	1492.3	2984.7
Hebi Power Plant	343.3	343.3									686.6
Zhengzhou Thermal		357.4	357.4								714.9
Luoyang Thermal						728.0	728.0				14[illegible].0
Yahekou Power Plant					1420.7	1420.7					2[illegible].3
other power plants									1368.2	1368.2	2736.5
220kv line completed with Yongcheng Power Plant									100.77		100.8
500kv Yaozheng line I							0.0				0.0
220kv line completed with JZ PP III		205.4									205.4
220kv line completed with Sanmenxia Power PlantI				298.5							298.5
220kv line completed with HB PP	105.5										105.5
220kv line completed with ZZ Thermal		65.7									65.7
220kv line completed with YHK PP					395.0						395.0
220kv line completed with SNX PP									639.2		639.2
220kv line completed with Qinbei Power Plant									903.8		903.8
220kv line completed with YS PP II				175.9							175.9
220kv line completed with Luoyang Power Plant						90.50					90.5
220kv line completed with Yaomeng IV								118.11			118.1
Other Transmission Line & S/S	81.42	114.38	108.68	139.18	163.49	124.07	137.37	122.84	129.30	128.73	1249.4
Yanshi Power Plant II					638.54	638.54					1277.1
Yanshi Power Plant II (IBRD loans)							459.99	459.99			920.0
Capitalized Borrowings	832.6	1388.6	1265.8	1413.2	2617.8	3001.8	2257.5	3826.0	7832.7	3995.5	28431.5
GRANTS											
Completed Renovations	209.1	223.3	248.2	266.0	296.5	310.5	355.7	392.5	457.6	553.4	3312.8
Completed Dist. Extensions	14.1	37.6	44.7	45.2	45.7	46.3	46.8	47.4	48.0	48.5	424.3
Capitalized Grants	223.2	260.8	292.9	311.2	342.3	356.8	402.5	439.9	505.6	601.9	3737.1
TOTAL CAPITALIZATIONS	1055.8	1649.4	1558.6	1724.4	2960.0	3358.6	2660.0	4265.9	8338.3	4597.4	32168.6
CUMULATIVE CAPITALIZATIONS	1055.8	2705.2	4263.9	5988.3	8948.3	12306.9	14967.0	19232.9	27571.2	32168.6	

CONSTRUCTION WIP	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CWIP at beginning of year	324.0	576.5	339.3	1088.9	2059.9	2079.7	2225.7	3612.2	3840.2	105.0
Construction during year	1085.1	1151.4	2015.3	2384.2	2637.6	3147.8	3644.0	4054.0	4097.6	4045.7
Work completed during year	832.6	1388.6	1265.8	1413.2	2617.8	3001.8	2257.5	3826.0	7832.7	3995.5
CWIP at end of year	576.5	339.3	1088.9	2059.9	2079.7	2225.7	3612.2	3840.2	105.0	155.2

ANNUAL DEPRECIATION	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Annual Fixed Asset Additions	1055.8	1649.4	1558.6	1724.4	2960.0	3358.6	2660.0	4265.9	8338.3	4597.4
Cum. Incremental Fixed Assets	1260.8	2910.2	4468.9	6193.3	9153.3	12511.9	15172.0	19437.9	27776.2	32373.6
Incremental Depreciation	55.2	111.2	177.6	245.5	342.5	473.3	597.9	741.3	1002.2	1269.9
Annual Depreciation	301.2	357.2	423.6	491.5	588.5	719.3	843.9	987.3	1248.2	1515.9
Cumul. Historic Depreciation	1931.2	2288.4	2712.0	3203.5	3792.0	4511.3	5355.2	6342.5	7590.7	9106.6

REVALUATION OF ASSETS

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
GROSS FIXED ASSETS										
Historical Cost:										
Opening Balance	6130	7186	8835	10394	12118	15078	18437	21097	25363	33701
Additions	1056	1649	1559	1724	2960	3359	2660	4266	8338	4597
Closing Bal. - Historical Cost	7186	8835	10394	12118	15078	18437	21097	25363	33701	38299
Revaluation										
Opening Balance	8684	10476	13256	15937	18502	22461	27027	31104	37032	47431
Additions	1056	1649	1559	1724	2960	3359	2660	4266	8338	4597
Revaluation Factor	1.08	1.10	1.08	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Revalued Gross Fixed Assets	10476	13256	15937	18502	22461	27027	31104	37032	47431	54514
GROSS FIXED ASSETS	7186	8835	10394	12118	15078	18437	21097	25363	33701	38299
Cumulative Depreciation(Revalued):										
Opening Balance	1784	2174	2659	3252	3958	4817	5849	7037	8452	10266
Depr. on Inherited Assets	347	419	530	637	740	898	1081	1244	1481	1897
Depr. on Incremental Assets	42	66	62	69	118	134	106	171	334	184
ACCUMULATED DEPRECIATION(Revalue	2174	2659	3252	3958	4817	5849	7037	8452	10266	12348
NET FIXED ASSETS(Revalued)	8302	10597	12686	14544	17644	21177	24068	28581	37164	42167
REVALUATION RESERVE	3048	4050	5004	5629	6358	7252	8326	9560	11054	12975

Yanshi Power Plant II

IBRD Loan	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Annual disbursement in US $		16.6	87.5	50.6	16.4	5.2	3.8			
Foreign Base Cost		16.5	86.3	49.6	16.2	4.9	3.4			
Annual disbursement in RMB		89.3	470.6	272.3	88.1	27.8	20.3			
Cum disbursement		89.3	559.9	832.1	920.2	948.1	968.4	968.4	968.4	968.4
Cum disbursement (mid-year)		44.6	324.6	696.0	876.2	934.1	958.2	968.4	968.4	968.4
Undisbursed (subject to c/f)		923.8	643.8	272.4	92.2	34.3				
Commitment fee 0.75%		3.5	4.8	2.0	0.7	0.3				
Cum commitment fee		3.5	8.3	10.3	11.0	11.3				
Annual repayment							64.6	64.6	64.6	64.6
Cum repayment				0.0	0.0	0.0	64.6	129.1	193.7	258.2
Subject to interest		44.6	324.6	696.0	876.2	934.1	958.2	903.8	839.3	774.7
Interest @ 7.75%		1.7	25.2	53.9	67.9	72.4	74.3	70.0	65.0	60.0
Cum interest		1.7	26.9	80.8	148.7	221.1	295.4	365.4	430.5	490.5

Yanshi Power Plant II Costs (US$	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Foreign Base Cost(incl physical con)		16.5	86.3	49.6	16.2	4.9	3.4			
Escalated Foreign Cost (FE Inf)		16.6	87.5	50.6	16.4	5.2	3.8			
(Dom.Inf)		16.8	89.8	52.3	17.0	5.5	3.4			
Local Base Cost	4.1	18.8	53.3	52.2	25.0	7.9	0.0			
Escalated Local Cost (FE Inf)	4.1	18.3	53.9	54.8	27.3	8.9	0.0	0.0		
(Dom.Inf)	4.1	19.6	59.0	60.7	30.5	10.1	0.0			

PCBC loans									
IBRD Interest	1.7	25.2	53.9	67.9	72.4	74.3			
IBRD Commitment Fee	3.5	4.8	2.0	0.7	0.3	0.0	0.0		
Com. Banks Fee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unmet Foreign Cost	6.3	42.5	65.2	71.9	74.3	35.0			
Annual disbursement	6.3	42.5	65.2	71.9	74.3	35.0			
Cum disbursement	6.3	48.8	114.0	185.9	260.1	295.1	295.1	295.1	295.1
Repayment						30.5	30.5	30.5	30.5
Cum repayment						30.5	60.9	91.4	121.9
Subject to interest	3.2	27.8	84.0	159.4	245.7	320.7	264.7	234.2	203.7
Interest @ 8.28%	0.3	2.3	7.0	13.2	20.3	26.6	21.9	19.4	16.9
Cum interest	0.3	2.6	9.5	22.7	43.1				

PCBC loans (for investment)										
Annual Investment (Constant)	21.8	93.5	271.2	211.4	80.4	34.6				
Annual Investment (Current)	21.8	97.3	300.2	245.7	98.1	44.3	0.0			
Cum investment		97.3	397.5	643.1	741.3	785.5	785.5	785.5	785.5	785.5
Repayment							85.6	85.6	85.6	85.6
Cum repayment							85.6	171.1	256.7	342.2
Subject to interest		48.6	251.4	545.1	762.2	896.5	992.8	700.0	614.4	528.9
Interest @ 8.28%		4.0	20.8	45.1	63.1	74.2	82.2	58.0	50.9	43.8
Cumulative interest		4.0	24.8	70.0	133.1	207.3				

FUEL, PURCHASES & OPER. EXPS.

FUEL COST CALCULATION	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cost of Coal (Exc. Yanshi)										
Electricity generated (GWh)	26732.0	29132.0	33532.0	35632.0	39132.0	42982.0	46382.0	50877.6	55697.1	59266.1
Consumption (ton/GWh)	383.0	379.0	375.0	371.0	367.0	365.0	363.0	361.0	359.0	357.0
Standard (000 ton)	10238.4	11041.0	12574.5	13219.5	14361.4	15688.4	16836.7	18366.8	19995.3	21158.0
Std coal price (Constant Y)	101.88	101.88	101.88	101.88	101.88	101.88	101.88	101.88	101.88	101.88
Std coal price (Current Y)	106.97	116.55	124.06	130.26	136.78	143.61	150.79	158.33	166.25	174.56
Cost of coal (mln Y)	1095.2	1286.8	1560.0	1722.0	1964.3	2253.1	2538.9	2908.1	3324.2	3693.4
Yanshi II										
Electricity generated (GWh)				1500.0	3300.0	3500.0	3500.0	3500.0	3500.0	3500.0
Consumption				320.0	320.0	320.0	320.0	320.0	320.0	320.0
Standard coal ('000 ton)				480.0	1056.0	1120.0	1120.0	1120.0	1120.0	1120.0
Cost of coal (mln Y)						160.8	168.9	177.3	186.2	195.5
TOTAL FUEL COST	1095.2	1286.8	1560.0	1722.0	1964.3	2413.9	2707.8	3085.4	3510.4	3888.9
** Coal price adj. (Yuan)	5.09	14.67	22.18	28.38	34.90	41.73	48.91	56.45	64.37	72.68
Coal cost adj. (mln Y)	52.2	162.0	278.9	388.8	538.0	701.5	878.3	1100.1	1359.2	1619.2

POWER PURCHASES	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Purchased power (GWh)	3700	3550	3860	3760	3710	3560	3460	3260	3060	2850
From Sanmengxia Hydro-elec.	1050	1050	1360	1360	1360	1360	1360	1360	1360	1350
From CCEPA	1700	1500	1500	1500	1500	1500	1500	1400	1400	1300
From NWEPA	0	0	0	0	0	0	0	0	0	0
From Local Power Plant	950	1000	1000	900	850	700	600	500	300	200
Purchase Price (Yuan)										
From Sanmengxia Hydro-elec.	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
with escalation	34.65	37.75	40.18	42.19	44.30	46.52	48.84	51.29	53.85	56.54
From CCEPA	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
with escalation	36.75	40.04	42.62	44.75	46.99	49.34	51.80	54.39	57.11	59.97
Auth. Coal Adjustments										
From NWEPA	70.40	70.40	70.40	70.40	70.40	70.40	70.40	70.40	70.40	70.40
with escalation	73.92	80.54	85.73	90.01	94.51	99.24	104.20	109.41	114.88	120.63
From Local Power Plant	132.40	132.40	132.40	132.40	132.40	132.40	132.40	132.40	132.40	132.40
with escalation	139.0	151.5	161.2	169.3	177.7	186.6	196.0	205.8	216.1	226.9
Cost of purchased (mln Y)										
From Sanmengxia Hydro-elec.	36.4	39.6	54.7	57.4	60.3	63.3	66.4	69.7	73.2	76.3
From CCEPA	62.5	60.1	63.9	67.1	70.5	74.0	77.7	76.2	80.0	78.0
From NWEPA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
From Local Power Plant	132.1	151.5	161.2	152.4	151.1	130.6	117.6	102.9	64.8	45.4
Total	230.9	251.2	279.8	276.9	281.8	267.9	261.7	248.8	218.0	199.7

MAINTENANCE	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Incremental Maintenance	5.1	31.5	72.8	111.7	154.8	228.8	312.8	379.3	485.9	694.4
Annual Maintenance Expense	116.1	142.5	183.8	222.7	265.8	339.8	423.8	490.3	596.9	805.4

OPERATION & MAINTENANCE	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Water & Material	166.1	191.0	215.8	243.8	275.5	303.1	333.4	366.8	403.4	443.8
with escalation	174.4	218.5	262.8	311.8	369.9	427.3	493.5	570.0	658.3	760.4
Number of Employees (000)	49.0	49.5	50.0	50.5	51.0	51.5	52.0	52.5	53.0	53.5
Average Wage (Yuan/Year)	3339	3773	4151	4566	5022	5524	6077	6685	7353	8088
Wages	163.6	186.8	207.5	230.6	256.1	284.5	316.0	350.9	389.7	432.7
Maintenance	116.1	142.5	183.8	222.7	265.8	339.8	423.8	490.3	596.9	805.4
Total	454.1	547.8	654.1	765.1	891.9	1051.6	1233.3	1411.2	1645.0	1998.5

ADMINISTRATION	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Base Cost	119.9	129.5	139.8	151.0	163.1	176.1	190.2	205.5	221.9	239.6
Administration Expense	125.9	148.1	170.3	193.1	219.0	248.3	281.6	319.3	362.1	410.6

SPECIAL FUNDS CALCULATIONS

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Renewal & Renovation Fund										
Annual allocation	274.1	298.6	312.4	342.7	398.0	449.4	478.4	556.4	681.2	686.0
Annual expenditure	219.3	238.9	249.9	274.1	278.6	314.6	334.9	389.5	476.8	480.2
Balance at year end	350.0	425.3	489.5	566.1	667.5	806.4	929.1	1093.0	1316.5	1449.2
Completed Renovations	209.1	223.3	248.2	266.0	296.5	310.5	355.7	392.5	457.6	553.4
Maintenance Fund										
Annual allocation	116.1	142.5	183.8	222.7	265.8	339.8	423.8	490.3	596.9	805.4
Annual expenditure	116.1	142.5	183.8	222.7	265.8	339.8	423.8	490.3	596.9	805.4
Balance at year end	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
Employee Benefits Fund										
Annual allocation	53.5	56.2	59.0	62.0	65.1	68.4	71.8	75.4	79.2	83.1
Annual expenditure	48.1	54.6	58.1	61.2	64.3	67.6	71.0	74.5	78.2	82.1
Balance at year end	12.0	13.6	14.5	15.3	16.1	16.9	17.7	18.6	19.6	20.5
Distribution Extensions Fund										
Annual allocation	55.3	55.9	56.6	57.3	58.0	58.7	59.4	60.1	60.8	61.5
Annual expenditure	44.2	44.7	45.3	45.8	46.4	46.9	47.5	48.1	48.6	49.2
Balance at year end	152.9	171.2	183.1	195.2	207.4	219.8	232.3	245.0	257.8	270.8
Completed Dist. Extensions	14.1	37.6	44.7	45.2	45.7	46.3	46.8	47.4	48.0	48.5
Total Special Funds										
Annual allocation	498.9	553.2	611.8	684.6	786.9	916.3	1033.3	1182.1	1418.0	1636.1
Annual expenditure	427.6	480.7	537.1	603.9	655.1	768.9	877.1	1002.3	1200.6	1417.0
Balance at year end	520.5	615.8	692.9	782.3	896.8	1048.8	1184.9	1362.3	1599.5	1746.2
Special Funds Outflows	387.4	457.9	534.7	595.2	672.4	764.2	897.3	1004.7	1180.8	1489.5

BREAKEVEN PRICING

Components of Gross Revenue	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Operating Costs	2954.4	3388.9	3871.3	4317.3	4885.1	5636.3	6292.1	7142.3	8253.5	9442.6
Interests	77.6	160.4	220.2	256.0	397.9	498.8	797.8	1026.7	1204.0	1288.7
Amortization met by Net Income	137.3	185.4	329.6	291.9	602.5	673.5	971.4	1596.8	2063.3	1800.4
Income Tax	65.4	68.7	72.1	75.8	79.6	83.6	87.8	92.2	96.8	101.6
Employee Benefits Special Funds	53.5	56.2	59.0	62.0	65.1	68.4	71.8	75.4	79.2	83.1
Net Working Capital Increase	81.3	86.4	103.3	95.0	135.3	176.9	164.7	218.8	263.6	196.7
Gross Operating Requirement	3369.4	3946.0	4655.5	5098.0	6165.6	7137.4	8385.6	10152.2	11960.2	12913.1
Sales Volume (GWh)	25152	27017	28961	31090	33638	37173	40569	43341	47416	53361
MINIMUM AVERAGE TARIFF	13.4	14.6	16.1	16.4	18.3	19.2	20.7	23.4	25.2	24.2

SELF FINANCING RATIO	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Annual Capital Expenditures	1330.1	1414.0	2333.3	2749.3	3047.8	3577.0	4124.7	4493.9	4603.1	4647.6
Internally Generated Cash	747.1	954.3	1275.0	1533.6	2111.0	2514.1	3237.1	4134.9	5005.3	5458.5
(less) Operational Requirements	519.3	667.4	951.5	1114.2	1632.6	1999.2	2625.0	3492.3	4281.7	4476.5
(less) Increased Cash Balances	(30.7)	0.3	(19.5)	54.3	2.8	56.5	32.1	83.1	141.7	380.0
Cash Available for Investment	258.5	286.6	343.0	365.2	475.6	458.3	579.9	559.5	581.9	601.9
Remittances to Government	33.9	93.2	138.2	285.7	326.0	437.7	508.6	563.8	616.5	834.5
EARNED CASH	292.4	379.8	481.2	650.9	801.5	896.0	1088.5	1123.3	1198.4	1436.4
SELF FINANCING RATIO (%)	24.5	22.4	22.2	24.0	25.7	25.0	26.8	25.5	26.2	30.0

CHINA

YANSHI THERMAL POWER PROJECT

HENAN PROVINCE ELECTRIC POWER BUREAU

Assumptions to Financial Projections

A. Income Statement

1. Average Price is derived in the attached table entitled, "Derivation of Average Tariff" (page 8 of this Annex).

2. Operating Revenue is the product of energy sales in GWh multiplied by the average price.

3. Fuel Costs are derived in the table entitled, "Fuel, Purchases and Operating Expenses" (page 17 of this Annex).

4. Purchased Power is derived in the table entitled, "Fuel, Purchases and Operating Expenses" (page 18 of this Annex).

5. Operating Expenses are derived in the table entitled, "Fuel, Purchases and Operating Expenses" (page 18 of this Annex).

6. Maintenance Costs represent the specific year's allocation to the Maintenance Special Fund. The allocation represents about 2.5% of gross fixed assets in services. Activity of the Maintenance Special Fund is derived in the table entitled, "Special Fund Calculations" (page 19 of this Annex).

7. Sales Tax is assumed at the following percentage of each year's operating revenues:

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
19.6	22.0	19.2	15.7	14.7	13.3	11.2	9.8	9.3	9.3	9.3

8. Depreciation is assumed at 4.73% of gross fixed assets.

9. Interest. HPEPB's borrowings will be obtained from three sources: (a) the onlent proceeds of World Bank loans, at 7.75% p.a.; (b) direct loans from People's Construction Bank of China, at 8.28% p.a.; and (c) local loans from the Henan Provincial Government, also at 8.28% p.a. Interest is derived on a project-by-project basis in the subtable entitled, "Interest" within the table entitled, "Loan Parameters" (page 11 of this Annex).

10. Income Tax represents 55% of net income less debt repayments which must be met from distributions of net income. (This item is entitled, "Transferred to Government Funds" on the income statement.)

11. Remittances to Government represents net income after income tax and after authorized distributions. These funds are remitted in cash partly to MOE and partly to MOF.

12. Employee Benefit Special Fund represents the annual allocation to this particular special fund; this allocation is met as a distribution from net income. The operation of that special fund is summarized in the table entitled, "Special Fund Calculations" (page 19 of this Annex). Allocations to this special fund per one employee are assumed to increase by 4% each year.

13. Chargeable IDC represents interest during construction which, according to regulations, must be met by distributions from net income. Annual amounts are derived in the table entitled, "Loan Parameters" (page 11 of this Annex).

B. Fund Flow Statement

1. Distribution Improvements Special Funds represent the receipts of this particular special fund. That fund's operation is summarized in the table entitled, "Special Fund Calculations" (page 19 of this Annex). The allocation (or for this fund, receipts) is expected to increase by 1.2% per year.

2. All Borrowings are derived in the table entitled, "Investment Program" (page 9 of this Annex).

3. Capital Expenditures, other than Interest During Construction, Renovations and Distributions Improvements, are also derived in the Table entitled, "Investment Program" (page 9 of this Annex).

4. Interest During Construction is derived in the subtable carrying that name which is included in the main table, "Loan Parameters" (page 12 of this Annex).

5. Renovations represents 85% of the previous year's and 15% of the year prior to the previous year's expenditures from the Special Fund for Renovations, the operation of which is summarized in the table entitled, "Special Funds Calculations" (page 19 of this Annex).

6. Distribution Improvements represent 85% of the previous year's and 15% of the year prior to the previous year's expenditures from the Distribution Improvements Special Funds, the operation of which is summarized in the table entitled, "Special Funds Calculation" (page 19 of this Annex).

7. Increase in Working Capital represents the excess of the current year's current assets (net of cash) over current liabilities, less

the excess of the previous year's current assets (net of cash) over current liabilities.

8. Special Fund Expenditures represents aggregate amounts actually spent from the various special funds in a particular year. In general, expenditures from the special fund are assumed at 80% of the previous year's and 20% of the year before the previous year's allocations (excluding those from the Maintenance Special Funds, which are assumed at 100% of the particular year's allocation). This relationship is derived in the table entitled, "Special Funds Calculations" (page 19 of this Annex).

C. Balance Sheet

1. Inventories are derived at 1% Gross Fixed Assets and 2 month's fuel.

2. Accounts Receivable are assumed at 30 days' sales amount plus 80 million Yuan.

3. Plant in Service is derived in the table entitled, "Fixed Asset Formation" (page 14 of this Annex). Any revaluation of fixed assets would be derived in the table entitled, "Revaluation of Assets" (page 15 of this Annex).

4. Construction Work in Progress is also derived in the table entitled, "Fixed Asset Formation" (page 14 of this Annex).

5. Special Fund Assets represents renovations and distribution improvements under construction. The renovations are financed by expenditures from the Special Fund for Renovations. The distribution improvements are financed from the Distribution Improvements Special Funds. Operations of these funds is derived in the table entitled, "Special Funds Calculations" (page 19 of this Annex).

6. Accounts Payable are assumed to increase by the same rate as cash operating expenses.

7. Due to Government is projected to increase by 3% per year.

8. Long-Term Debt is expected to increase each given year by the amount of the investment program being financed with loans less repayments. The amount of the investment program is derived in the table entitled, "Investment Program" (page 9 of this Annex). The amount of repayment is derived in the subtable entitled, "Repayments", included within the table entitled, "Loan Parameters" (page 13 of this Annex).

9. Government Funds includes all paid in equity, plus transfers to Government for loan repayment and chargeable IDC, less depreciation.

10. Special Funds represents the cumulative balance remaining in the special funds at the end of the given year. This figure is derived in the table entitled, "Special Funds Calculations" (page 19 of this Annex).

CHINA

YANSHI THERMAL POWER PROJECT

Calculation of Economic Rate of Return

Costs

Capital Costs

1. Costs were based on end 1991 price levels. Shadow pricing was applied as follows: (a) taxes and duties were excluded; (b) a shadow exchange rate of US$1 = Y 5.5 was used to convert foreign currencies to Yuan; (c) border prices were used for net imported items such as steel and timber; (d) all state subsidies were removed from labor costs to reflect the economic cost of labor to the country; and (e) a conversion factor of 1.23 was used to calculate the cost of transmission and distribution facilities.

2. Summarized below are annual disbursements of project costs, including generation, transmission and distribution for both units after shadow-pricing:

Year	Generation /a	Transmission	Distribution /b	Total
	(Y million)			
1991	21.8	9.5	-	31.3
1992	184.3	18.9	-	203.2
1993	745.8	85.5	-	831.3
1994	484.2	64.4	110	658.6
1995	169.5	9.5	110	289.0
1996	61.4	-	110	171.4
1997	31.4	-	-	31.4
Total	1,698.4	187.8	330	2,216.2

/a For the plant only, the unit cost per kW after shadow-pricing is Y 2,830. This compares to Y 2,710 estimated for the thermal units under the Ertan Hydroelectric Project.

/b Distribution cost is taken as 20% of the generation cost.

O&M Costs

3. The O&M costs were based on the actual cost analysis on a system basis for HPEPB's grid including generation, transmission, distribution and sales at Y 0.0137/kWh.

Other Costs

4. This was calculated at about Y 0.0046/kWh for administration, etc.

Fuel Cost

5. The fuel cost was estimated using a long-run marginal cost of coal of Y 110 per ton and a unit consumption of 0.325 kg/kWh of standard coal of 7,000 Kcal/kWh.

Benefits

6. Quantifying the benefits of power projects is difficult in all countries and particularly so in China, where tariffs and most other prices are not subject to economic pressures and where most power is allocated administratively. It is generally accepted, however, that shortages of electricity are constraining China's industrial production (causing undercapacity utilization in industry) and will continue to do so in the near future. This suggests that the economic benefits of increasing power supply will be substantial. A recent Bank report suggests the net value of electricity not served is about Y 0.5/kWh.

7. A conservative estimate of the value of electricity is obtained by using the projected tariffs for HPEPB's system by 1995-2000, adjusted to end-1991 price levels at 16.4, 16.7, 17.2, 18.3, 18.5 and 17.6 fen/kWh respectively (page 8 of Annex 25) and used as the minimum proxy for the economic value of electricity. In addition, other charges were also included to reflect surplus benefits. These charges include the 10% local government surcharge, the connection charge for large consumers, and the recently applied surcharge of 2 fen/kWh for new power station construction to all consumers except lighting, agricultural uses, and industries operating at a loss, totally amounting to 1.4 fen/kWh.

Economic Rate of Return

8. The IERR of the project, the discount rate which equalizes the present value of economic costs and benefits, is estimated at 15.7% (see Table 1 for details).

9. The economic rate of return was also calculated based on HPEPB's overall expansion program for the period 1991-2000. On this basis the economic rate of return of HPEPB's expansion program, including the proposed project, is 13.4%. The LRMC of the system on a program basis was estimated at 17.7 fen/kWh at a discount rate of 12 percent. This demonstrates that the system tariff in the late 1990s will reach the level of LRMC.

Sensitivity

10. The sensitivity of the IERR of the project with respect to a 10% increase in investment cost, a one-year delay in commissioning and a cost

price of Y 130 per ton, is presented below. These figures represent the upper limit of possible cost overruns or delays in implementing the project.

	IERR (%)
Base case	15.7
10% cost overrun	14.7
One-year delay in commissioning	14.1
Coal prices increase from Y 120/ton to Y 130/ton	14.7

Table 1: YANSHI THERMAL POWER PROJECT

Economic Rate of Return

Year	Capital Investment: Plant	Capital Investment: Trans-mission	Capital Investment: Distr-bution	O&M cost	Fuel cost	Other costs	Total cost	Generation	Sales	Benefits	Cash flow
1991	21.8	9.5	-	-	-	-	31.3	-	-	-	-31.3
1992	184.3	18.9	-	-	-	-	203.2	-	-	-	-203.2
1993	745.8	85.5	-	-	-	-	831.3	-	-	-	-831.3
1994	484.2	66.4	110	-	-	-	660.6	-	-	-	-660.6
1995	169.5	9.5	110	12.3	32.2	3.6	337.1	900	792	141.0	-196.1
1996	61.4	-	110	37.0	96.5	10.9	315.8	2,700	2,376	430.1	114.3
1997	31.4	-	-	51.4	134.1	15.2	232.1	3,750	3,300	613.8	381.7
1998	-	-	-	53.4	139.4	15.8	208.6	3,900	3,432	676.1	467.5
1999	-	-	-	53.4	139.4	15.8	208.6	3,900	3,432	683.0	474.4
2000-2020	-	-	-	53.4	139.4	15.8	208.6	3,900	3,432	652.1	443.5
2021	-	-	-	26.7	69.7	7.9	104.3	1,950	1,716	326.0	221.7

Economic Rate of Return = 15.7%

Notes: (1) Fuel costs: fuel cost is estimated at a unit consumption of 0.325 kg of standard coal per kWh.

(2) Generation: 6,000 hours for the first year of operation; 6,500 hours for the remaining years.

(3) Sales: using a system loss factor of 12.0% for plant use and transmission and distribution losses.

ANNEX 27

CHINA

YANSHI THERMAL POWER PROJECT

Selected Documents and Data Available in the Project File

A. Selected Reports and Studies Related to the Sector

A.1 Statistical Brief of the Electric Power Industry in China (1987).

B. Selected Reports and Studies Related to the Project

B.1 Yanshi Power Plant Phase II Extension Feasibility Study Report (May 1987)

B.2 Environmental Impact Report (September 1988)

B.3 Conceptual Design Report of Yanshi Thermal Power Project, 1988

B.4 Economic Analysis of Yanshi Power Plant Based on Optimization of Henan System (February 1987)

B.5 Information on Yanshi Thermal Power Project Vol. I & II by HPEPB (July 1987)

B.6 Statistical Data of Electric Power Industry in Henan (1986, 87)

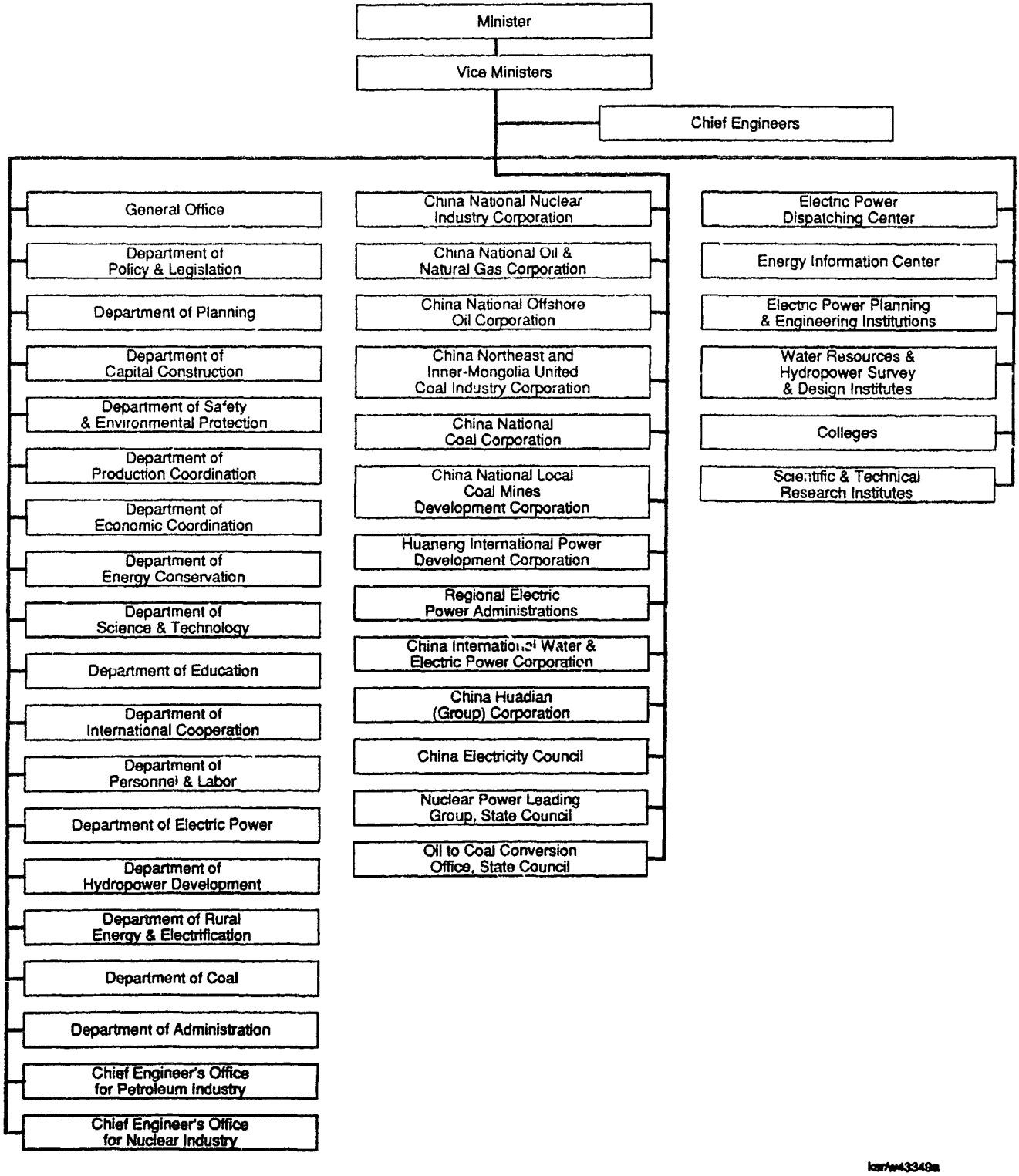
C. Selected Work Sheets

C.1 Working Sheets for Economic Analysis

C.2 Working Sheets for Financial Forecasts.

Chart 1

CHINA
YANSHI THERMAL POWER PROJECT
Organization Chart of the Ministry of Energy



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CHINA
YANSHI THERMAL POWER PROJECT
Organization Chart of the State Energy Investment Corporation

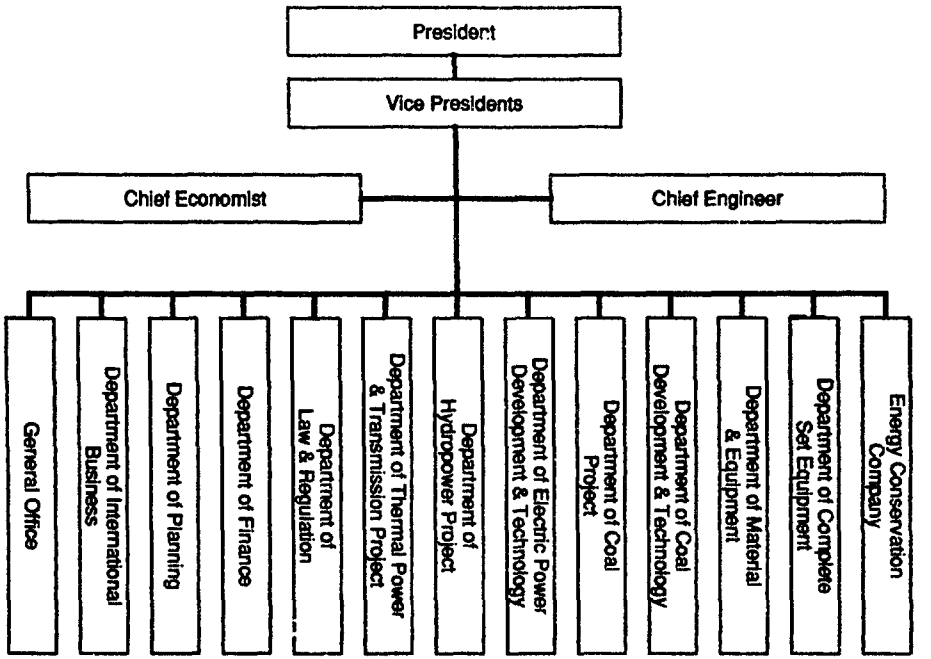

Chart 3

CHINA
YANSHI THERMAL POWER PROJECT
Organization Chart of Henan Provincial Power Bureau

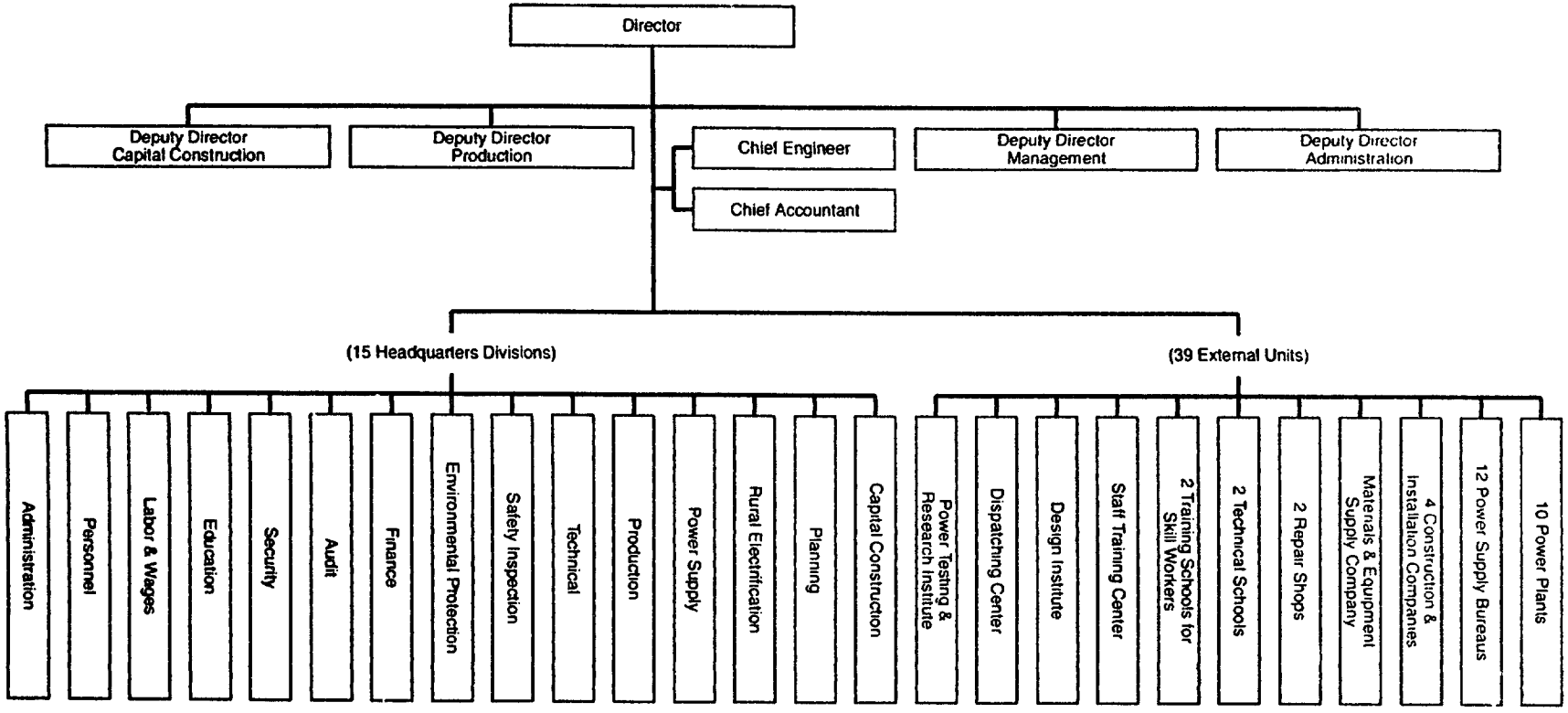

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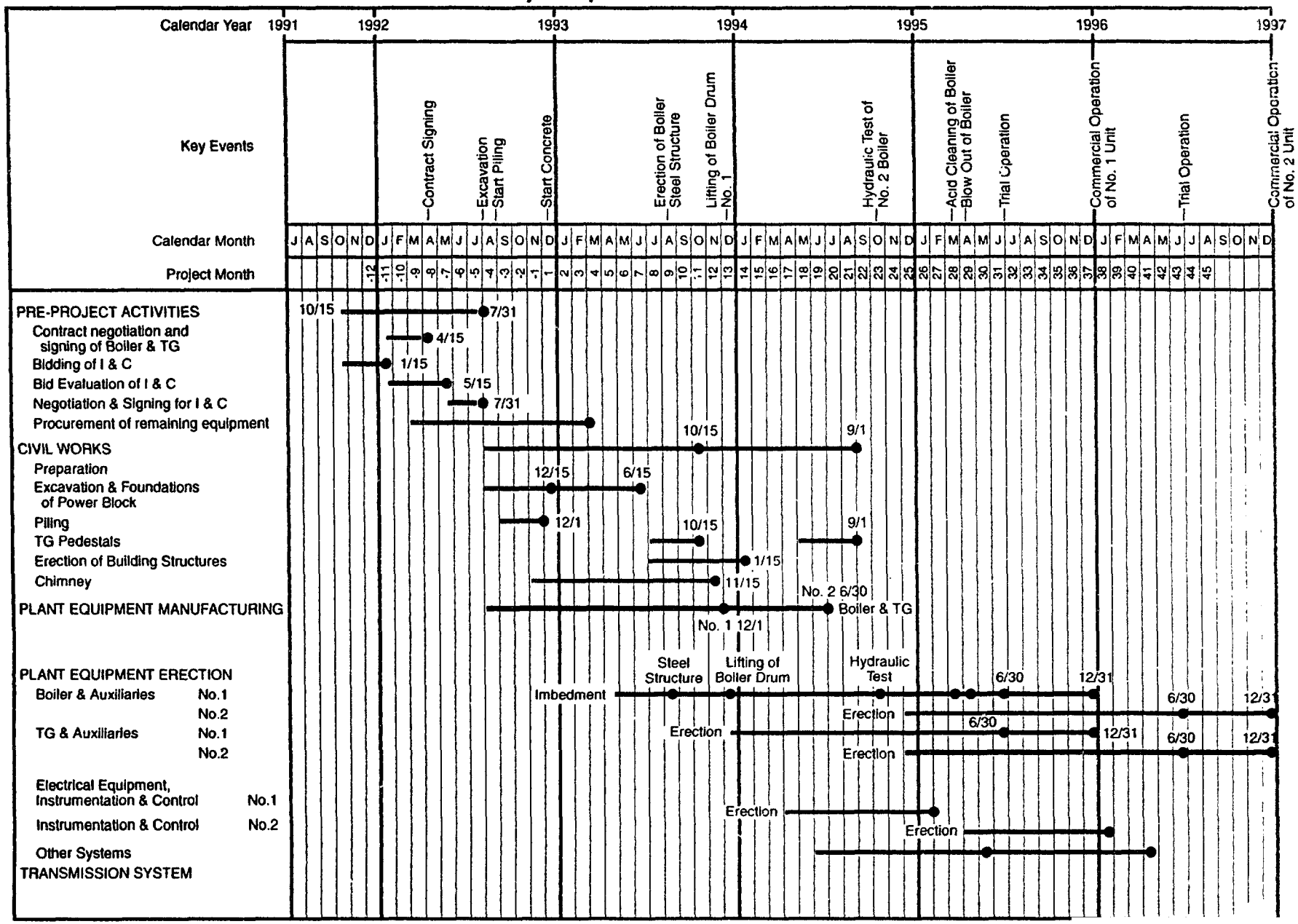
Chart 4

CHINA
YANSHI THERMAL POWER PROJECT
Project Implementation Schedule



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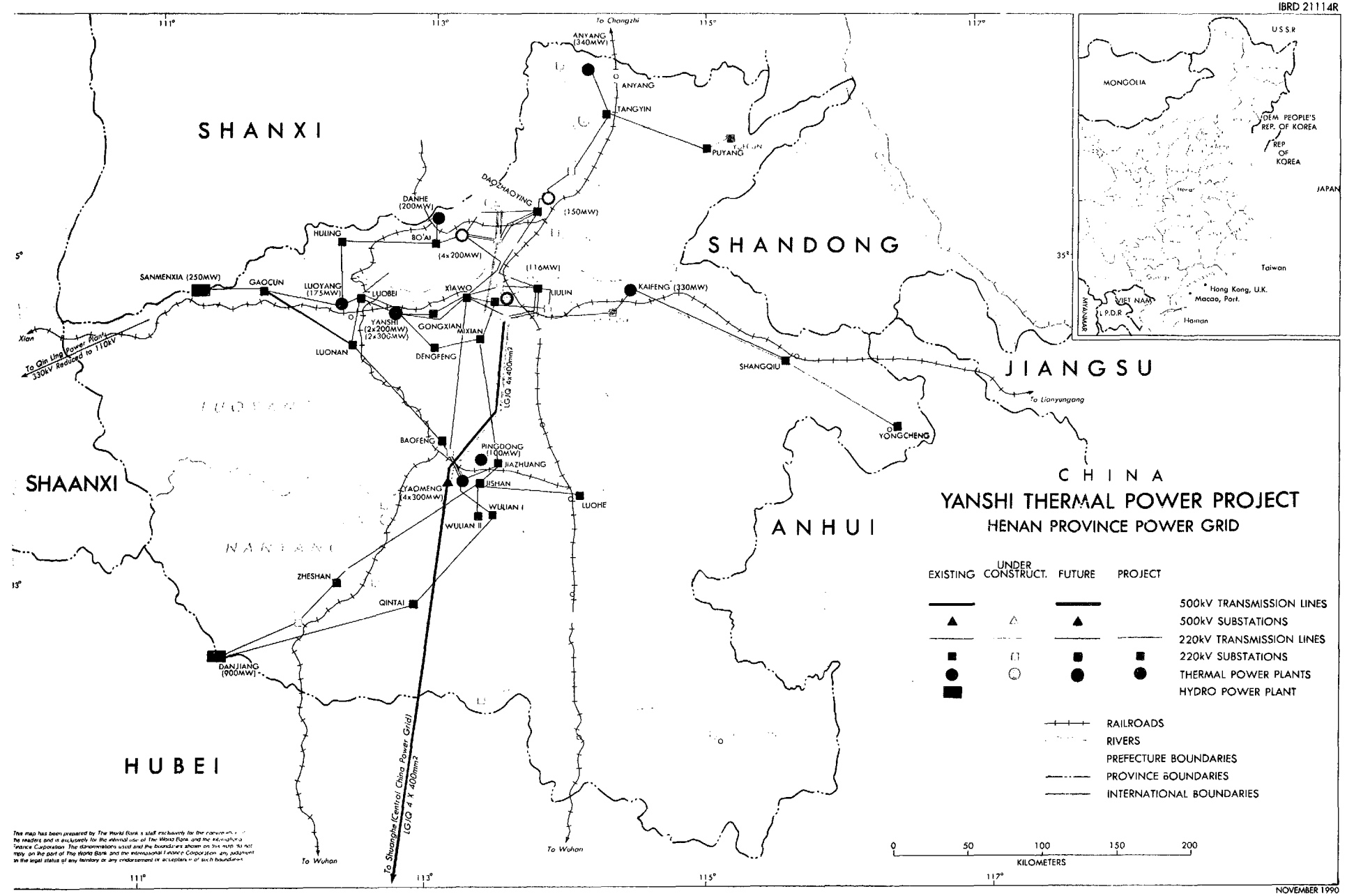

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