

China

Shanxi Hejin Thermal Power Plant Project (I) (II)

Report Date: January 2003

Field Survey: October/November 2002

1. Project Profile and Japan's ODA Loan



1.1 Background

Forecast increases in average annual demand for power in Shanxi Province were 9.9% for 1991-1995 and 10.0% for 1996-2000, and with power demand for 2000 predicted at 66,000GWh against a supply of 61,600GWh, it was estimated that there would be a shortfall of 4,400GWh for the year. Moreover, these forecast increases in demand were essentially consistent with predicted increases for the industrial production zone (9.0% annual average for 1991-1995, 10% annual average for 1996-2000).

Given the above circumstances, Shanxi Province planned to promote investment in power targeting annual growth of around 10%, however, the plan was unable to guarantee installed capacity necessary to meet the growth in demand and it was predicted that the shortages would continue in the short term. Specifically, the southern section of the province's power grid revolved around small-scale power plants in the Yuncheng district and the region lacked large power plants like those forming the core of the power grid in the north of the province, thus it was deemed necessary to alleviate the north-south disequilibrium in supply capacity.

1.2 Objectives

To construct a coal-fired thermal power plant with two 300MW generators to be fueled using domestically produced coal on the eastern bank of the Yellow River on the outskirts of Hejin City in the Yuncheng district, which is located in the southwest of Shanxi Province, as a means of alleviating power shortfalls in the province and of easing the north-south disequilibrium in the supply capacity of the power grid.

1.3 Project scope

- (i) Construction of a coal-fired thermal power station comprising two generation units of 300MW capacity.
- (ii) Consulting services.

The yen loan covered all foreign currency funds necessary for the above work.

1.4 Borrower/Executing Agency

1.5 Outline of Loan Agreement

	Construction Project (1) (CXVI-P67)	Construction Project (2) (CXVII-P67)
Loan Amount	10,948 million yen	13,652 million yen
Loan Disbursed Amount	10,084 million yen	11,693 million yen
Exchange of Notes	January 1995	October 1995
Loan Agreement	January 1995	November 1995
Terms and Conditions		
-Interest Rate	2.6%	2.3%
-Repayment Period (Grace Period)	30 years (10 years)	30 years (10 years)
-Procurement	General Untied	General Untied
Final Disbursement Date	February 2002	December 2002

2. Results and Evaluation

2.1 Relevance

Forecast increases in average annual demand for power in Shanxi Province were 9.9% for 1991-1995 and 10.0% for 1996-2000, and with power demand for 2000 predicted at 66,000GWh against a supply of 61,600GWh, it was estimated that there would be a shortfall of 4,400GWh for the year. Accordingly, there was deemed to be a compelling need to secure power resources at the time of appraisal.

Especially, forecast increases in power demand for the southern regions of Shanxi Province, the area targeted by the project, were higher than for the province as a whole, with average annual demand in the Yuncheng district predicted to grow by an average 14.0% during 1995-2000. The Shanxi Province power grid is connected to the coastal regions of the metropolitan area, including Beijing, and since there is a tendency to prioritize supply to these areas, supplies to the southern regions of the province were restricted. Transmission capacity from the north to the south of the province had also reached its limits. Consequently, when the appraisal was conducted there was deemed to be a powerful need to ensure power supply resources in the southern regions of the province targeted by this project.

Although average annual demand for power increased by 9.3% during 1991-1995 and was thus virtually in line with predictions, between 1996-2000 it only grew by 4.7% per annum, falling well below the growth forecasts for the period. This is considered to be attributable to the effects of economic stagnation that were brought about by the Asian currency crisis of 1997. However, once the currency crisis had blown over and the economic climate had revived, growth in power demand also rallied, posting annual increases of upwards of 10.0% in and after 2000 (Table 1), thus there continues to be a compelling need to guarantee supply capacity in the region.

As the above demonstrates, the plans devised for this project continue to correspond to the needs of the beneficiaries and remain relevant.

Additionally, this project is in line with both the "Eighth Five-Year Plan" and the "Ninth Five-Year Plan" to promote aggressive investment in the power sector, and was thus in accordance

¹ The current Ministry of Foreign Trade and Economic Cooperation. As of 1999, the borrower was changed to the government of the People's Republic of China (Ministry of Finance).

with national government policies.

Table 1: Power demand forecasts and results for Shanxi Province

Item	Predicted average annual growth	Actual average annual growth
1991-1995	9.9%	9.3%
1996-2000	10.0%	4.7%
2000	—	10.0%
2001	—	11.2%
up to Sep. 2002	—	11.4%

Source: Shanxi Province Regional Power Corporation data

2.2 Efficiency

2.2.1 Project Scope

Despite slight modifications to the detailed design, the scope was implemented essentially as planned and the changes had no major impact on either the construction schedule or costs.

2.2.2 Implementation schedule

The project was completed roughly two years behind the initial schedule. The main reason for the delay was that more time was required for equipment tender procedures and the tender implementation, evaluation and approval stage than it was initially anticipated. However, once the equipment had been procured, the plans moved ahead fairly smoothly and the generators went into commercial operation in February 2001 (generator 1) and May 2001 (generator 2). During construction the transformer for generator 1 malfunctioned in March 2000 as the result of a design error, it was replaced with a new transformer but broke down again in May, after which it was again replaced. Nevertheless, the project was completed virtually on schedule.

2.2.3 Project Cost

The foreign currency portion of project costs amounted to 21,777 million yen. There was a cost underrun of around 14% against the planned project costs of 25,243 million yen, mainly due to the fact that the contract price was less than the planned tender price. Moreover, the local currency portion of project costs actually amounted to 1,540 million yuan, which was essentially consistent with the revised figure of 1,528 million yuan planned during Phase II of the project. The slight inflation of costs was caused by price increases.

2.3 Effectiveness

2.3.1 Operational status of the facilities

Since commercial production commenced in February (generator 1) and May (generator 2) 2001, respectively, the two generators have been operating favorably with a capacity factor of 70%+ and an availability factor of around 90% (Table 3), and annual generating capacity has surpassed planned levels (Table 2).

Table 2: Actual Annual Power Generation (GWh)

Item	Planned (at appraisal)	Planned (by Hejin Power Plant)	Results
2001	2,087	N.A.	3,843
2002 ^{Note}	3,578	3,083	3,206

Note: The figure is for the period up to September

Additionally, although routine inspections in 2002 resulted in an increase in downtime (Table 4), this

also included downtime for an overhaul of generator 1, and the result of more time being spent on routine inspections is that there were no reports of downtime due to breakdowns when the field survey was conducted in November 2002 (Table 4). The failure rate was 0.0% up to September 2002 and operations at the plant are being safely conducted (Table 3)

Table 3: Capacity factors, availability factors, failure rates

Item		2001	2002 (Jan.-Sep.)
Capacity factor (%)	Generator 1	71.5	78.2
	Generator 2	71.9	77.4
Availability factor (%)	Generator 1	93.3	87.3
	Generator 2	95.2	93.2
Failure rate (%)	Generator 1	0.3	0.0
	Generator 2	2.0	0.0

Table 4: Operational downtime (hours)

Item	2001	2002 (up to Oct.)
Downtime for routine inspections	820.5	1,544.7 (1)
Downtime due to breakdowns	182.4	0.0

Note 1) Includes downtime to overhaul generator 1

Source Tables 1-3: Hejin Power Plant data

2.3.2 Alleviation of power shortages

Despite the fact that overall growth in power demand in Shanxi Province (see Table 5: Power generated (actual)) shrank in the latter half of the 1990s due to the effects of economic stagnation produced by the Asian currency crisis, demand has picked up since 1999 as the impact of the currency crisis has waned and the economy has recovered. In response to this, supply capacity (see Table 5: Installed capacity) has been increasing steadily year on year, resulting in an improved balance between demand and supply. In 2001, the year the Hejin Power Plant commenced commercial operation, demand for power surged by 9,015GWh (14.5%) over the previous year, rendering the increased supply capacity indispensable.

Growth in power demand in Yuncheng City, the area targeted by the project located in southern Shanxi Province, was 15.4% in 2000 and 23.9% in 2001, outstripping the growth rate for the province as a whole (Figure 1), from which it may be inferred that the increases in supply capacity achieved through this project have played a major role in alleviating power shortages in the region.

Figure 1: Yuncheng City - Power demand (planned/actual) and supply volumes

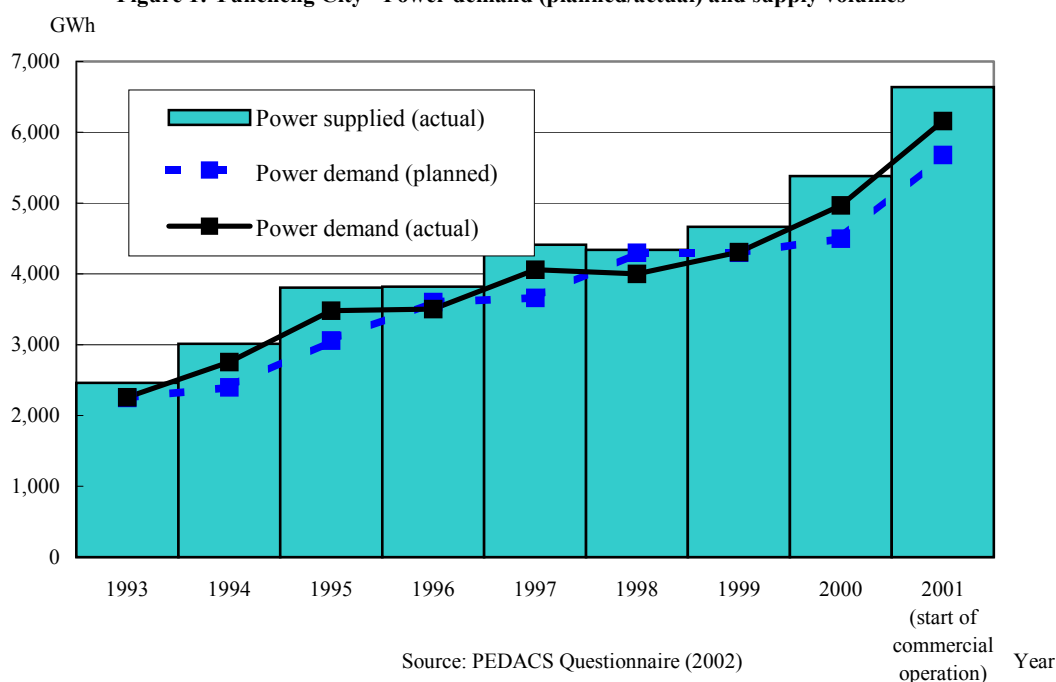


Table 5: Power indicators for Shanxi Province

Item		1993	1994	1995	1996	1997	1998	1999	2000	2001 (start of commercial operation)
Installed capacity (MW)	Planned	6,950	7,250	7,700	8,500	9,290	10,090	11,190	12,550	N.A
	Actual	8,474	8,923	9,112	9,558	9,911	10,918	11,806	13,019	14,162
Maximum load (MW)	Planned	6,240	6,960	7,680	8,640	9,480	10,320	11,280	12,360	N.A
	Actual	6,142	6,704	7,344	7,800	8,701	8,282	8,237	9,189	10,018
Power generated (GWh)	Planned	33,000	37,300	41,000	45,100	49,600	54,600	60,000	66,000	N.A
	Actual	41,749	45,660	50,520	52,644	54,511	55,153	56,698	62,070	71,085
Power exported to outside the region (GWh)	Actual	1,079	1,287	1,238	1,230	1,229	1,174	1,109	1,191	1,538
Power received from outside the region (GWh)	Actual	228	313	145	200	226	36	4	5	5

Source: Hejin Power Plant data and appraisal materials

2.3.3 Easing of north-south disequilibrium in the power grid

The power grid was formerly concentrated around large-scale power plants in the northern regions of the province, whilst the distribution network for the south, and particularly for Yuncheng City (Yuncheng district at appraisal) was solely reliant upon scattered, small-scale power plants. Nevertheless, the construction of the Hejin Power Plant, a large-scale plant with two 300MW generators, installed generating capacity in Yuncheng City reached 1,100-1,200MW (including 200MW of power generated by large factories) in November 2002, thereby alleviating the north-south disequilibrium in the province's power grid.

2.3.4 Recalculation of Financial Internal Rate of Return (FIRR)

When the FIRR for the project was calculated using the factors listed below, as estimated at appraisal, the figure was 13.74%. However, recalculated on the basis of evaluation results and forecasts for the future, the figure is 12.32%. The main reason for the drop is that selling prices are lower than anticipated, whilst fuel costs have outstripped forecasts.

Project life: 25 years from start of operation

Benefits: Revenue from power sales

Costs: Project investment costs, fuel costs, operation and maintenance costs, and taxes

2.4 Impact

2.4.1 Contributions to socioeconomic development in the region

In recent years, the economic growth rate (=GDP growth rate) for Yuncheng City has exceeded that for Shanxi Province as a whole (Table 6), and this has been accompanied by exponential increases in load (Figure 2). Load increases have been particularly marked in the industrial sector (chemical industry corporations such as Nanfeng Chemical Industry Group Co., Ltd. & Fengxi Fertilizer Industries Co., Ltd. are major customers), which accounts for 70-80% of total supply, from which it may be inferred that in stabilizing the power supply the project has played a major role in supporting industrial development.

Additionally, the region has traditionally diverted a comparatively large volume of electricity to agricultural irrigation pumps (approx. 15% of total supply), and with a power plant now located closer to the supply areas, the reliability of power to the agricultural sector has increased. The power supply stability realized through this project has also made a substantial contribution to supplies for residential use, since summers in Yuncheng City are extremely hot and the increased prevalence of air-conditioners in general households in recent years has led to heightened demand for power.

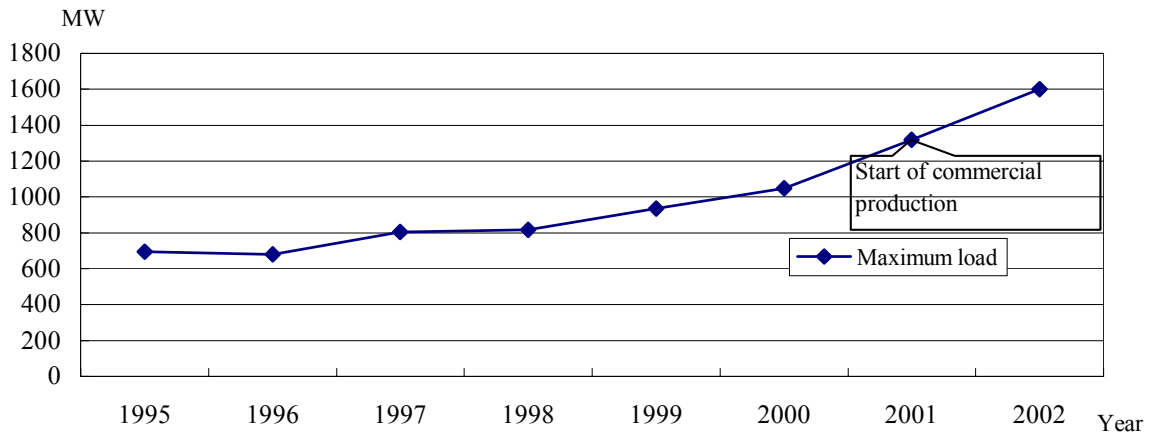
It is hoped that readers will also make reference to the boxed section on "The Voices of the Heijin Power Plant Beneficiaries" when evaluating the project's contribution to socioeconomic development in the region.

Table 6: GDP Growth Rates (with 1996 taken as the base rate of 100)

Region	1996	1997	1998	1999	2000	2001
Shanxi Province	100.00	110.08	110.74	113.88	123.74	132.66
Yuncheng City	100.00	105.15	117.17	120.50	131.95	148.93

Source: Calculated using figures from the Shanxi Province statistical yearbook in reference to the national consumer price index.

Figure 2: Yuncheng City - Maximum Power Loads



Source: Shanxi Province Regional Power Corporation data

The Voices of the Hejin Power Plant Beneficiaries

User 1: Mr. Li Wen Ting (Yang Cun Xiang Xi Xin Feng Village on the outskirts of Hejin City, Shanxi Province, farmer)

Our village is predominantly involved in agricultural production; we cultivate wheat, corn, cotton and a small volume of vegetables.

Before the Hejin Power Plant was constructed, of the 124 households in the village, 90% were engaged in farming. The village had a total of 352 furrows of agricultural land (1 furrow = 667m²), of which 146 furrows were paddy and 206 furrows were fields. The paddy fields were irrigated using the village's three electrically pumped wells, however, we had to pray that the rains would water the other fields. Crops were good when the rains were plentiful, but when the rains dried up and supplies of electricity were insufficient (normally supplied for 5 hours per day or on alternate days), it had a substantial impact on irrigated crops and food production dwindled. Also, because we were working under a limited supply of electricity it was necessary to fight for the right to priority access to irrigation, which sometimes led to trouble between farming families.

After the power plant was constructed, electricity supplies were sufficient enabling us to dig an additional five electrically pumped deep-water wells in the village. I'm satisfied with supplies of irrigation water to the paddy fields and we've had no power outages so far. What's more, the laborers in the village have broken out of the simple farm laborer structure and are working in businesses related to the construction of the plant.

The construction of the Hejin Power Plant has benefited our village in a number of ways. New houses have been built for all the farming families in the village and some have even built small outhouses, allowing us to bid farewell to our shabby old homes. There are also plans to renovate the old village in the future.

The construction of the plant has meant that we are able to receive sufficient supplies of electricity, so we've been able to stop using kerosene lamps and candles and are able to buy electrical household equipment like televisions, refrigerators and electric fans and our lives have become more convenient.

I hope that many power plants will be constructed and that electric utility rates will become even cheaper.

User 2: Mr. Dong Hai Shui (Chairman, Shanxi Fengxi Fertilizer Industries Co., Ltd. (group))

Shanxi Fengxi Fertilizer Industries Co., Ltd. is a large corporate group that was established in June 1998 as the result of the merger of 山西省臨猗化工總工場、聞喜縣化工總工場、広靈縣化学肥料工場、新降縣化工總工場、稷山県化工鑄造工場 etc. The corporation's lot area is 150 hectares and it employs 8,000 staff, 13% of all personnel are university or technical high school graduates, or have technical qualifications. As of the end of 2001, total assets were 1.32 billion yuan, annual sales were in excess of 1 billion yuan, and the company posted gross profits of 90 million yuan and net profits of 60 million yuan.

Prior to the construction of the Hejin Power Plant, power supplies were insufficient and unstable, which not only affected production but also had an adverse impact on the image of our corporation.

Since the plant became operational in 2000, we are guaranteed a sufficient supply of electricity and by the end of 2001, our plants had achieved overall production capacity of 500K tons/year composite ammonia, 520K tons/year urea, 300K tons/year ammonia hydrogen carbonate, 100K tons/year compound fertilizer, 30K tons/year ammonia nitrate, 80K tons/year methanol, 30K tons/year formaldehyde, 40K tons/year liquid ammonia, 10K tons/year nitric acid, and 10K tons/year nitrate salt. The power load for the plants was 140MW and reached 170MW during peak times.

The construction of the Hejin Power Plant has radically improved the supply of electricity and provided sufficient guarantee of supply, which has in turn enabled us to furnish a protective warranty on deliveries. At the same time, the company has been able to get its various plans on the right track.

That said, as the company has developed, the tendency for supply shortages has become increasingly pronounced. In order to satisfy the demand of all power users, there is an extremely pressing need for the construction of more power plants.

In terms of prospects for the future, we are aiming to improve the company's overall potential by the end of 2005, via technological improvements, development of new products, and adjustments to the production structure, etc, and are targeting fixed assets of 3 billion yuan, overall production capacity of composite ammonia of 680K tons/year, a line up of at least 25 products, annual sales of 3 billion yuan, and gross profits of at least 600 million yuan. The mainstay of the Fengxi Group is chemical fertilizers and we are working toward the formation of a modern, large-scale consolidated chemicals industry group corporation that is capable of integrating chemical engineering of raw materials and construction materials and chemical engineering machinery. Moreover, as one of Shanxi Province's core corporations we are endeavoring to become one of the nation's top 500 industry corporation groups.

At present, power supply capacity in the Yuncheng district is approaching its limit, but our company will need an even greater supply of power in order to realize its policy of expanding new businesses. It is hoped that new power sources will be constructed at the earliest possible opportunity and that our future production plans will receive support.

User 3: Mr. Cheng Zeng Qing (Nanfeng Chemical Industry Group Co., Ltd. Vice President)

The Nanfeng Chemical Industry Group is a major corporate group that straddles three major industries, namely the chemicals industry, light industry, and the pharmaceuticals industry, in eight of the nation's provinces. It was established in April 1996, and listed as a state-owned joint stock corporation in 1997, its total assets reach 3.2 billion yuan.

Our group is mainly involved in the series product manufacture of three major products, namely inorganic chemicals engineering, daily use chemicals engineering, and calcium fertilizer chemicals engineering, and its power load is 20MW, reaching 50MW during peak periods. Annual production of sulfur trioxide sodium is 1.35 million tons/year, of compound detergents is 500K tons/year, of potassium sulfate is 150K tons/year, and of compound fertilizers is 100K tons/year. The above-mentioned products respectively account for 60%, 20% and 30% of the domestic market and the group is currently China's largest producer of mineral salts, detergents and potassium fertilizers. Annual sales are currently 2.5 billion yuan, and the group has realized annual gross profits of 250 million yuan. The group is one of 520 corporations receiving special governmental support. Sales volumes of daily use chemical products and industrial chemical products are the nation's highest. Sales of the washing powder brand "奇強" have ranked among the nation's highest for four years running, and the brand ranks highly in terms of price and performance. It has been evaluated as a "Product Exempt from Inspection" by the National General Administration of Quality Supervision, Inspection and Quarantine.

Power supplies to the group appear have approved remarkably since the construction of the Hejin Power Plant. The number of outages has dropped dramatically and the quality of the supply is markedly better. Supply stability and favorable improvements in the various power supply indicators have enabled us to guarantee power demand for production, and the quality of the electricity is satisfying our product requirements.

Of course, for various reasons the electric utility rates remain high and this has some effect on production within the group. It is hoped that many power plants will be constructed and that the rates will be brought down.

2.4.2 Social and Environmental Impacts

The implementation of this project necessitated the relocation of fifteen households (initial plans were for 5 households but the number increased prior to construction) and the acquisition of 3,231.453 furrows (approx. 215 hectares, of which 43% was cultivated and the remainder fallow). The outlay for relocation costs, etc., amounted to 300 thousand yuan, however, the executing agency has reported no specific problems.

There is a business attached to the power plant, which supervises the residences of plant employees and welfare facilities located contiguously, leases shop buildings and undertakes management of the market. It absorbs some 400 redundant workers annually and plays a role in promoting the employment of local residents and have improving their earnings.

In terms of the environmental impact, during the course of the field survey it was confirmed that the matters outlined below raised by JBIC and the executing agency during the appraisal of the project had been adhered to:

- That the plant should be fired using good quality, low sulfur coke with an annual average sulfur content not exceeding 0.550%
- That routine inspections should be based on the "Thermal Power Plant Environment Measurement Ordinance"
- That high-performance electric ash collectors and low NO_x burners should be employed
- That a site should be secured for future desulfurization facilities

In connection with the disposal of coal ash generated as waste, a tour was made of the coal ash disposal site located some 4km from the plant, during which it was confirmed that greening is being undertaken and that the site is being effectively maintained. In geographical terms, the region has numerous valleys of adequate depth for ash disposal and the capacity of the present site is sufficient for another seventeen years, however, there are plans to construct a cement plant in order to promote reuse of the ash. Moreover, in a bid to keep the amount of dust raised during transit to a minimum, the coal ash is sprayed with water before and after transit, and speed restrictions are enforced when the vehicles pass through residential areas. The Heijin Power Plant also cleared national emissions standards in a power plant environment data survey conducted by the Shanxi Province Environmental Protection Agency in July 2001.

In addition, regular monitoring of data on air and water quality from a number of ducts has been undertaken since the project was completed and the results submitted to the Environmental Protection Agency. A review of measurement data from the start of commercial production through the present reveals that the plant is conforming to national emissions standards (Table 7). Measurement results for air and environment monitoring conducted in the vicinity of the plant were verified for the period covering 2000 to the present (Table 8) and whilst some values, for Total Suspended Particles (TSP), etc., were in excess of national environmental standards, given that duct measurement results for the plant are below the threshold (Table 7), this may be attributed to neighboring aluminum plants and so forth, which are serious sources of pollution. All equipment installed at the Hejin Power Plant has performed well in technological terms, thus emissions of SO₂, NO_x and TSP are being maintained at low levels (Table 7).

Table 7: Measurement results for air/water quality emissions (annual averages)

	Item measured	Appraisal specification	PRC National Environment Protection Agency Limit Threshold ¹⁾	2001	2002 (as of Nov.)
Air	SO ₂	—	2,100mg/N m ³ (Installed processing capacity = <1,500 mg/Nm ³)	736 mg/N m ³	868 mg/N m ³
	NO _x	<400ppm	650mg/N m ³ (Installed processing capacity = <500 mg/Nm ³)	399 mg/N m ³	432 mg/N m ³
	TSP	100mg/N m ³	200mg/Nm ³ (Installed processing capacity = <100 mg/Nm ³)	74 mg/N m ³	93 mg/N m ³
Water	ph	—	6-9	8.4	8.4
	BOD	—	60mg/l	8.5mg/l	8.4 mg/l
	COD	—	150mg/l	19.4 mg/l	19.2 mg/l
	SS	—	200 mg/l	25.7 mg/l	34.3 mg/l

Source: Hejin Power Plant data

Note ¹⁾: Atmospheric SO₂ and dust conform to Level 2 of GB13223-1996, NO_x conforms to Level 3 of GB13223-1996. Wastewater conforms to the GB8978-1996 threshold.

Table 8: Air and environment monitoring results for the plant area (annual averages)

	Item measured	PRC National Environment Protection Agency Limit Threshold ¹⁾	2001	2002 (as of Nov.)
Air and environment in the plant area	SO ₂ (mg/N □)	0.15	0.018	0.051
	NO _x (mg/N □)	0.1	0.025	0.052
	PM ₁₀ (mg/N □)	0.15	0.003	0.008
	TSP (mg/N □)	0.3	0.280	0.604

Source: Hejin Power Plant data

Note ¹⁾: GB3095-1996 Level 2 and 3 threshold values.

2.5 Sustainability

2.5.1 Organizational Capability

This project was mainly implemented by Shanxi Province Regional Power Corporation, however, since the completion of construction in February 2002, plant ownership and management has been undertaken by Shanxi Zhangze Electric Power Company Limited. Shanxi Province Regional Power Corporation owns a 41% stake in Shanxi Zhangze Electric Power Co., Ltd. (Shanxi Local Power Corporation owns 31% of the remainder), and in addition to the Hejin Power Plant, Shanxi Zhangze Electric Power also owns the Zhangze Power Plant (from which it takes its name; it began managing the plant when it was inaugurated in 1992), which is located in the southeast of the province, as well as an inspection and repairs company (repairs and maintenance company) and an equipment management company (head office facilities services only).

A total of 533 workers are assigned to the Hejin Power Plant and there are 22 key departments (Figure 3); routine and periodic maintenance is predominantly undertaken by plant employees. An organizational chart of the departments involved in equipment operation and maintenance is shown in Figure 4.

Figure 3: Hejin Power Plant Organizational Chart

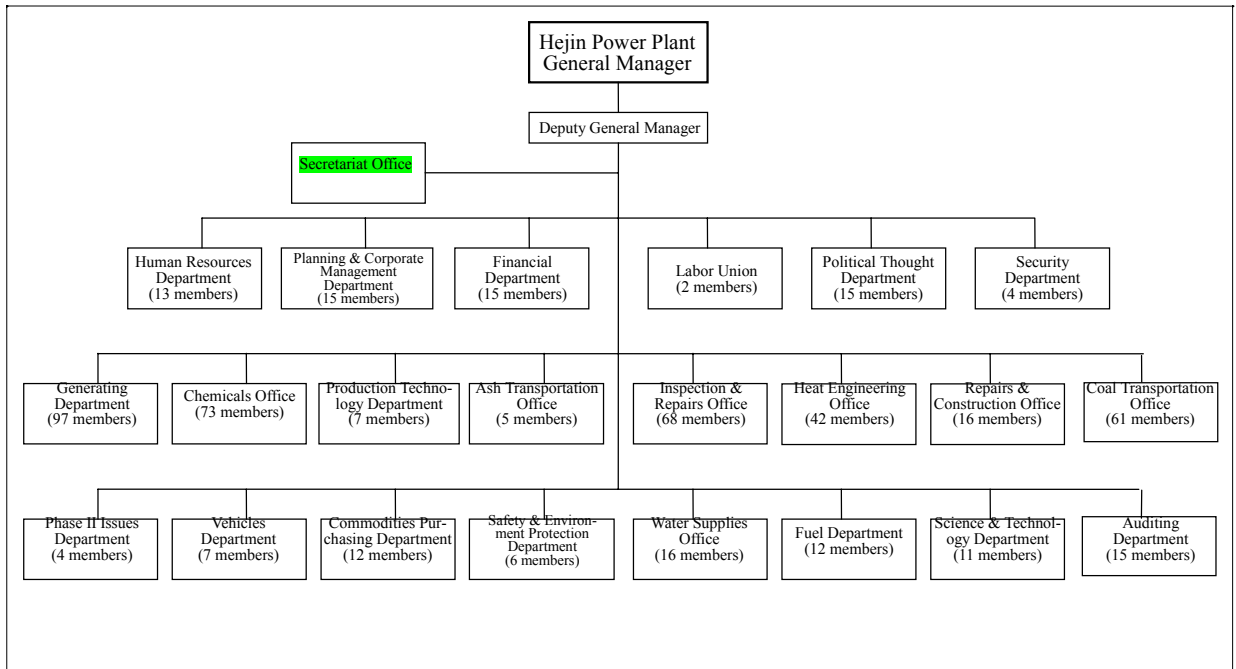
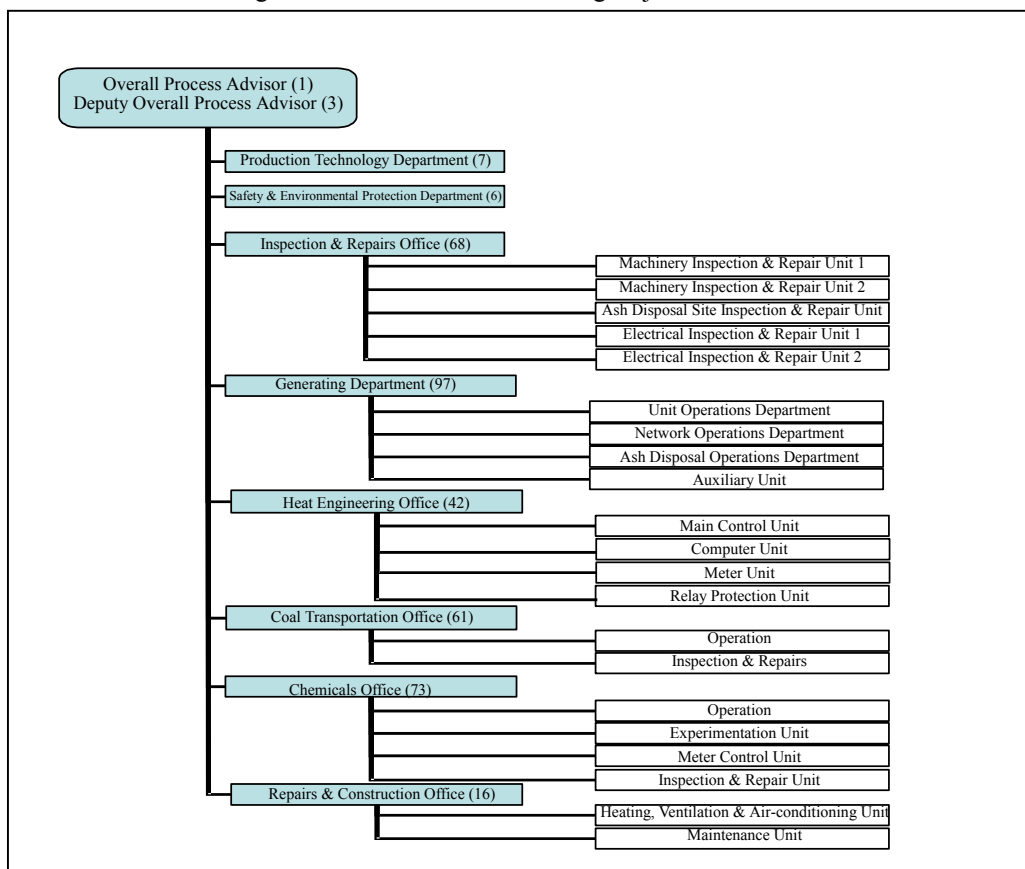


Figure 4: Organizational Chart showing Departments responsible for Operation and Maintenance

Source: Figures 3 and 4 were created using Hejin Power Plant data



2.5.2 Technological Capability

Besides worker dispatch training programs to other thermal power plants both within China and overseas, employee training is undertaken in line with annual plans, and there are no technical problems with the basic operation and maintenance work that is being undertaken at the plant. In addition, the assignment of workers is in conformity with national thermal power plant technician level workers standards, and according to an internal assessment, the plant has already attained the necessary basic technological capability to undertake operation and maintenance. Arguably, given that this is a new facility, there will be a need to improve the level of technical ability in the future, however, since 95% of all workers are under 45 and section chief level personnel are relatively young, there is a sense that workers are aware of and motivated to absorb new technologies, and that attitudes toward future improvements are favorable.

2.5.3 Financial Status

Shanxi Zhangze Electric Power Co., Ltd. was listed as a joint-stock corporation in 1997 and posted net profits of 96 million yuan in 2000 and 148 million yuan in 2001. The Hejin Power Plant alone earns sufficient revenue from power sales to cover business operation costs. Although the current selling price is being held at the low rate of 0.16 yuan/kWh, the pricing policy for electric utility rates is currently under review, and if this results in an increase in the selling price of power then the company's financial status is expected to become even more stable.

3. Feedback

3.1 Lessons Learned

Nothing particular to report.

3.2 Recommendations

Nothing particular to report.

Comparison of Original and Actual Scope

Item	Original Plan (Phase 1)	Original Plan (Phase 2)	Actual
1. Project scope (1) Construction of a coal-fired thermal power plant (300MW × 2)	<ul style="list-style-type: none"> • Boiler, steam turbine generator (2 each) • Transformers, electrical equipment, measuring instruments, and control devices • Coal transport equipment, ash disposal equipment • Main and auxiliary buildings • Concrete stack with concentric internal cylinders • Railway branch line • De-mineralizing equipment, waste water processing equipment, oil tank • Construction equipment, various testing equipment and plant workers, special industrial tools, spare parts, etc. 	As left	As planned
(2) Consulting services	Foreign consultants 55M/M		
2. Implementation schedule <ul style="list-style-type: none"> • Consultant selection • Tender preparation – tender – tender evaluation – contract approval • Preliminary design – approval – D/D • Installation of generating equipment • Start of commercial operation 	<p style="text-align: center;">Aug. 1994 – Jan. 1995 Feb. 1995 – Jan. 1996</p> <p style="text-align: center;">Mar. 1996 – Aug. 1998</p> <p style="text-align: center;">Oct. 1996 – Oct. 1999 (Generator 1 & 2)</p> <p style="text-align: center;">Dec. 1998 – Nov. 1999 –</p>	As left	<p style="text-align: center;">Jan. 1995 Jan. 1995 – Oct. 1997</p> <p style="text-align: center;">Apr. 1997 – Feb. 1999</p> <p style="text-align: center;">Feb. 1998 – Jan. 2001 (Generator 1) Apr. 1998 – May 2001 (Generator 2) Feb. 2001 – May 2001 –</p>
3. Project cost Foreign currency Local currency Total ODA yen loan portion Exchange rate	<p style="text-align: center;">25,243 million yen 12,861 million yen (1,081 million yuan) 38,104 million yen 25,243 million yen 1US\$ = 103 yen, 1 yuan = 11.9 yen (1994 rate)</p>	<p style="text-align: center;">24,600 million yen 17,877 million yen (1,528 million yuan) 42,478 million yen 24,600 million yen 1US\$ = 100 yen, 1 yuan = 11.7 yen (1995 rate)</p>	<p style="text-align: center;">21,777 million yen 22,486 million yen (1,540 million yuan) 44,263 million yen 21,777 million yen 1 yuan = 14.6 yen (average rate for 1997-2002)</p>

Third Party Evaluator's Opinion on Shanxi Hejin Thermal Power Project (I)(II)

Professor Yushi MAO
Executive Board
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Relevance

China's power market has been fluctuating, declining in the years 1997 and 1998, thriving again since 1999. The elasticity of power consumption to GDP had been around 0.8, but decreased to 0.55 and 0.36 in 1997 and 1998, resumed to 0.87 and 1.17, 1.26 in succeeding years. The local power market experienced a serious shortage before the construction of the Hejin power plant. Even after the commissioning of the Hejin Power Plant, which almost doubled the local capacity, there are still some outages of power supply, though much fewer than before. The local people are expecting the next project of 2X300MW power plant, which started construction early this year.

Power shortage is the bottleneck of the local economy. Because of the additional power supplied by Hejin Power plant, some power consuming factories have expanded their production capacity, such as Guanlu Aluminum Electrolysis Factory, Haixin Steel Making Factory, Fengxi Chemical Fertilizer Factory, and Hejin Yangguang Group, Zhenxing Coking Factory. Less power outages improve the day-to-day life of the local people, and also raise the quality of products, lower the cost of other industries.

Hejin Power Plant not only supports the local economy, but also generates profit and value added by its own. Before the adjustment of power price, Hejin Power plant was running marginally at loss, as the price of power was RMB0.164/kWh and the cost without capital interest payment was 0.14/kWh. When the yen appreciated relative to RMB during 2002, the remaining surplus is not enough to pay the interest. At the end of 2002 power price was adjusted to 0.225/kWh, a 37% increase and close to national average, thus the profit is much more than enough to pay capital interest. Hejin Power Plant paid RMB72 million yuan tax in the year 2002.

Hejin Power Plant is indirectly connected to north China grid, so the strengthening of local grid will help ease the recent power supply shortage in north China.

In general, the Hejin Power Plant is a very good project in terms of local and national economic development.

Impact

Hejin Power plant generates not only power but also job opportunities, especially for the ordinary non-skilled labor. The daily consumption of coal is 6,500 ton, mostly come from small coal mines, for which more than two thousand miners are employed. To transport the coal 150 trucks are required, which supports loading and unloading, maintenance, catering, and other related industries. For tree planting and greening hundreds of workers were employed at the ash deposit field and in the Plant. A cement factory using coal ash as raw material was put into production recently, which employed hundred workers as well.

Though low sulfur coal is used, about 10,000 ton of sulfur is added to the atmosphere every year. CO₂ emitted by the Plant adds green-house-gas too. These negative environmental impacts produce limited damage to the local people, but it is a social cost at large.

The Power Plant consumes a large amount of water, which comes from deep water well of more than 100 meters. Competing for water consumption caused the underground water level goes deeper, that is also a social cost.

In the light of serious shortage of power supply in Yuncheng District, Hejin Power Plant should have been constructed earlier. But in fact, the construction was lagged behind schedule for two years.