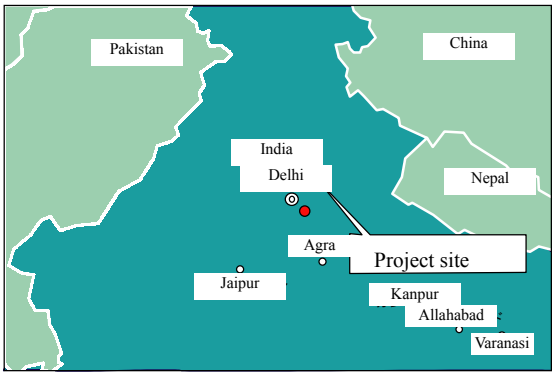
India

Faridabad Gas Based Power Station and Associated Transmission System Project

Report Date: February 2003

Field Survey: November 2002

1. Project Profile and Japan's ODA Loan



Project site

Faridabad Combined Cycle Power Plant

1.1 Background

A total of Rs 4,341 bn was pledged for public sector investment under India's Eighth Five-Year Plan (April 1992 – March 1997), with the largest share of Rs795.9bn (18.3%) to be directed to the power sector. On the power sector, the Eighth Plan emphasized improvements to the capacity operating ratio of installed capacity, efficiency enhancements including reductions to transmission and distribution losses (T&D losses), improvements to the financial status of power suppliers, promotion of the construction of new plants, and the utilization of the private sector, and focused on the utilization of natural gas in the Northern, Western and Eastern regions.

India's Northern region is home to the nation's capital, Delhi, and in FY92 its power demand (GWh) accounted for 30.6% of the nation's total. Peak demand was growing at an average of around 9.1% p.a. , and as in other of the country's regions the demand-supply position was tight, with demand outstripping supply*[1]. Forecasts pointed to further industrialization in the region, primarily in suburban Delhi, with an even greater concentration of the population in the metropolitan area, and it was predicted that demand for power would continue to grow. The modal pattern of the region's installed capacity (public plant operators, March 1992) constituted 65.0% thermal and 30.5% hydel generation and was essentially on a par with the national average.

1.2 Objectives

The project comprised the construction of a natural gas-fired combined cycle gas turbine (CCGT) based power plant and associated transmission and transformer facilities (T&T facilities) in the village of Neemka, Faridabad district, Haryana State, in India's Northern region, targeting the elimination of supply deficits and contributions to living standard improvements and industrial

[1] According to India's Central Electricity Authority (CEA), the trend for shortages in peak requirements in the Northern region began in the early 1990s, and in FY92 the deficit was 28.6%. The demand-supply position was similar with a 7.3% shortage in the same year. This situation was forecast to continue.

development within the region.

1.3 Project Scope

The project scope was as follows:

(1) Power station (approx. output: 400MW)
- Gas turbine generators (140MW×2)
- Steam turbine generators (130MW × 1)
- Heat Recovery Steam Gas Boiler (HRSG) (×2)
- Monitoring and control equipment, water treatment facilities
- Switchyards and related facilities

(2) Transmission & transforming facilities
- 440kV transmission line from the Dadri-Ballabgarh section to the Faridabad Power Station (approx. 5km)
- 440kV transmission line from the Ballabgarh-Jaipur section to the Alwar Substation (approx. 18km)
- Construction of a new substation (at Alwar)
- Expansion of an existing substation (at Ballabgarh)

A yen loan of 56,154 million was scheduled to cover the power plant and T&T facilities costs, excluding the land acquisition costs, project management costs, taxes and part of the costs for the switchyards, however, the portion necessary for the works to be undertaken by the end of FY95 (23,536 million yen) was in fact provided.

1.4 Borrower/Executing Agency

The President of India / National Thermal Power Corporation Ltd. (NTPC),
Powergrid Corporation of India Ltd.: POWERGRID)

1.5 Outline of Loan Agreement

Loan Amount Loan Disbursed Amount	23,536 million yen 19,937 million yen
Exchange of Notes Loan Agreement	December 1993 January 1994
Terms and Conditions -Interest Rate -Repayment Period (Grace Period) -Procurement	 2.6% 30 years (10 years) General untied
Final Disbursement Date	March 2001

2. Results and Evaluation

2.1 Relevance

The project's objectives were to eliminate supply deficits in the Northern region and contribute to living standard improvements and industrial development via the construction of a CCGT power

station*[2] and associated T&T facilities in Haryana State. As stated above supply deficits in the region were manifest, moreover, in policy terms the project had been positioned as part of the Eighth Five-Year Plan.

Initially the entire Northern region was established as the project's beneficiary area, and plant output was projected to be around 800MW so as to be capable of supplying an adequate volume of power. However, an 800MW output scale was found to be excessive in terms of securing fuel*[3]. In addition, with the exception of Haryana State, all other states in the region expressed reservations about future purchases of power from the plant, citing high fuel costs*[4], thus a proposal was made to the Haryana State government regarding the conclusion of a power purchase contract, on condition that the entire volume of power produced at the Faridabad Power Station be supplied to the state. This proposal was accepted by NTPC and approved by the central government, in consequence of which the project's beneficiary area was narrowed down from the entire Northern region to Haryana State alone.

The tables below illustrate the fluctuations in demand-supply volumes for Haryana State, evidencing the straitened demand-supply position at around the time of project implementation (1994).

Table 1: Demand-Supply Balance Haryana State

Fiscal year	1991	1992	1993	1994	1995	1996	2001
Gap (%)	-2.0	-2.3	-9.4	-4.8	-4.4	-5.9	-1.6

Table 2: Peak Supply Deficits Haryana State

Fiscal year	1991	1992	1993	1994	1995	1996	2001
Gap (%)	-20.2	-15.8	-9.6	-3.8	-16.5	-15.9	-3.3

Source: CEA Annual Report (2001-2002)

The "Flare Gas Reduction Project" and "HBJ (Hazira-Bijaipur-Jagdishphur) Gas Pipeline Reinforcement Project" that were instituted as external conditions (the drilling for and supply of natural gas) for the establishment of this project, were respectively completed in 1999 and 1998*[5].

As demonstrated above, the project's relevance at appraisal and the present time may be inferred from its political significance and the fact that it is fulfilling needs in the area.

2.2 Efficiency

2.2.1 Project Scope

Two modifications were made to project the scope as follows. Both changes were deemed relevant in terms of the project's objectives and background.

[2] The selection of gas turbine generation over the comparatively cheaper hydroelectric option was based on the fact (1) that Haryana State is geologically unsuitable for hydel generation, (2) hydroelectric generation facilities take considerable time to construct and have the potential to create environmental problems and resettlement issues, and (3) it was easy to secure gas fuel resources in the region.

[3] The downward revision of output scale has made it possible to secure the 2 million cubic meters of gas per day needed to operate the plant without difficulties.

[4] The power plant obtains its gas supplies from the gas field known as South Bassein (approx. 1,300km distant) in the waters off Mumbai. NTPC pays 75% of the import price (with a cap of $1.7/MMBtu) for crude oil (alternative fuel) plus transport. It should be noted that the Faridabad Power Station electricity tariffs are lower than those formerly paid by Haryana State.

[5] Both projects were jointly funded by JBIC and the World Bank as well as the Asian Development Bank (ADB), and their completion was also a precondition of gas supplies to the Faridabad Power Station. The projects were divided into a number of components; these dates indicate completion of the final components.

Power Plant Output

Due to the comparatively favorable nature of the terms for generation facilities stipulated by the winning contractor, plant output was fixed at 430MW*[6]. Switchyard facilities were also changed from the initial 400kV to 220kV compatibility since with the reduction in plant scale (800MW→400MW) and hence the plant was connected to 220kV power lines.

Transmission & Transformer Facilities

Since the plant turned out to be connected to the 220kV system, the construction / expansion of 400kV substations and the construction of incoming 400kV transmission lines were omitted, and two 220kV transmission line routes were constructed from the plant to existing substations.

2.2.2 Implementation Schedule

(1) Power Station

The power plant was completed in July 2000, two years and seven months behind the initially planned date (December 1997). This delay was caused by approval procedures accompanying the changes to output scale and so on, however, as Table 3 illustrates, construction of the plant per se progressed extremely smoothly.

Table 3: Construction Schedule for Key Power Plant Components

Component	Initial schedule	Actual
No. 1 Gas turbine generator	30 months	23 months
No. 2 Gas turbine generator	32 months	27 months
Steam turbine generator	42 months	36 months

(2) Transmission & Transforming Facilities

For the same reason as cited above, construction started three years behind schedule, but was completed in 16 months, which was essentially as per the plans (14 months).

The delays occurring prior to construction are believed to have been the product of limitations in NTPC's ability to deal, unassisted, with the numerous state governments and related organizations involved in the process. However, given the fact that debate over the changes in output scale linked to hold ups in the approval process, it might have been possible to confirm / verify the prospects for power purchase by each of the states in advance, thereby reducing the duration of the delays. However, it would be beneficial to evaluate how the construction work was completed in less time than initially projected under such circumstances.

2.2.3 Project Cost

(1) Power Station

A comparison of initially planned costs and results reveals on overall underrun, with actual costs being equivalent to around 51% (2,710 million yen) of the planned amount (approx. 5,340 million) in a yen base. This is attributed to a 35%*[7] appreciation in the value of the yen between appraisal and completion, and to substantially lower costs for the following two components.

Main Plant (approx. 54% of initial plan)

[6] The price of the tender was the same as that quoted by other bidders, but the terms were more favorable in functional terms (output scale).

[7] At appraisal (January 1994), the exchange rate was Rs1=3.70 yen against an average Rs1=2.73 yen during project implementation.

The analysis conducted by the executing agency points to the fact that the highly vigorous global market for power station construction and the influence of technical innovations at the time of the bidding meant that plant prices were stable, and moreover, that the successful bidder tendered a competitive price.

Price Escalation (approx. 13% of initial plan)

This is primarily attributed to calm market conditions and the short construction period.

(2) Transmission & Transforming Facilities

The impact of changes to the project scope and the high value of the yen produced an overall underrun in project costs, with the actual figure being approximately 78% (759 million yen) of the initially planned costs (975 million yen).

This served to benefit Haryana State by enabling electricity tariffs to be set at low levels. With regard to the yen loan portion of costs, since a second yen loan was unnecessary, the disbursed amount was approximately 85% (19,937 million yen) of the amount authorized for the Phase 1 loan (23,536 million yen).

2.2.4 Performance of Consultants & Constructors

No consultants were expressly employed for this project in consideration of the performance and technical capabilities of the two executing agencies (NTPC and POWERGRID). The construction contractor was highly evaluated by the executing agencies, something that is further evidenced by the fact that the work was completed ahead of the initially planned schedule.

Since no consultants were engaged on this project a tripartite Project Coordination Committee (PCC) was organized comprising the Ministry of Power (MOP), NTPC and POWERGRID to monitor overall progress. The PCC was convened once every two to three months and site inspections were carried out where necessary.

In the opinion of the NTPC committee representative, in "adapting the power plant construction schedule to the schedules for the construction of the transmission network and the pipeline connecting the HBJ line to the power plant", the PCC made a substantial contribution to project progress, including to the early stage completion of construction work. Specifically, this project had different executing agencies for the power plant and T&T facilities components and there were also a number of overlapping external conditions; the existence of a body aimed at coordinating the various parties involved is considered to have been indispensable to its smooth progress. One of the PCC members was an MOP representative*[8] and this is believed to have bolstered the coordinative capabilities of the committee.

Coincidentally, POWERGRID operates an Integrated Project Management and Control System (IPMCS) independently. The IPMCS checks overall project progress via periodically convened meetings. These meetings comprise representatives from all departments concerned in the project who discuss the extent of progress and any hindering factors, and any necessary measures and/or support are implemented on the basis of the IPMCS reports.

The outcome was that, in spite of delays prior to the start of construction, the efficient functioning of the PCC and the IPMCS helped to secure effective results from the funds injected into the project.

[8] From the MOP, an undersecretary participated in the PCC meetings.

2.3 Effectiveness

2.3.1 Operation Indicators

As the following table of operation indicators shows, overall conditions are quite favorable, with the plant having exceeded initial net electric energy production targets for the past three years and posting capacity factor and forced outage rate that are essentially in line with the target figures. The gas required for firing the plant is being supplied as planned and no particular problems have arisen to date.

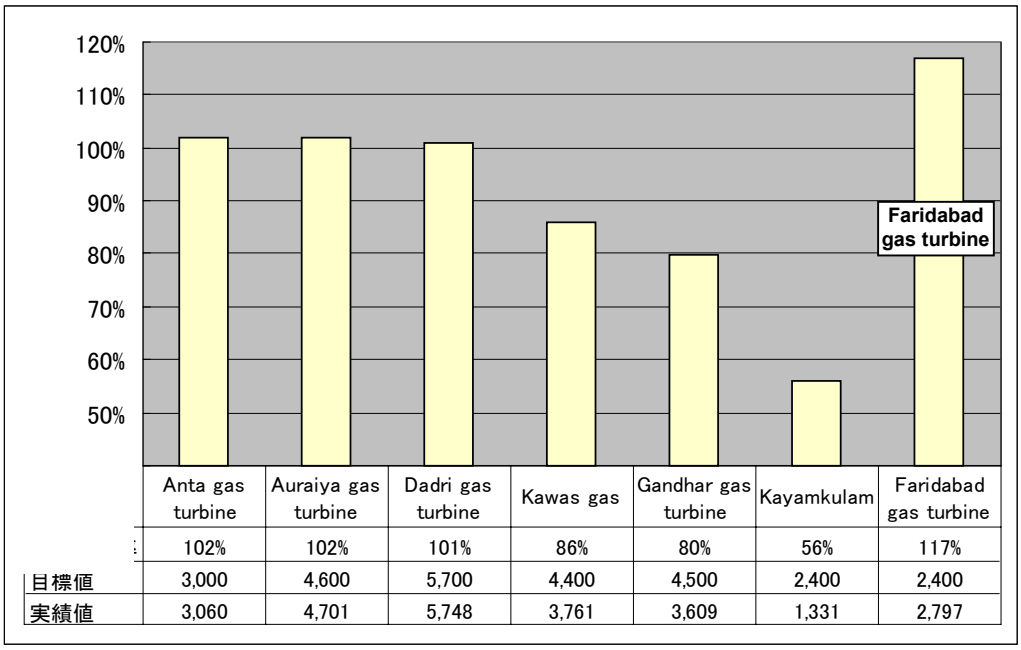
Table 4: Target Attainment Level

Operation indicators \ FY		1999	20000	2001
Net electric energy production (MWh)	Target	800.00	2200.00	2400.00
	Actual	1060.67	2256.13	2796.80
Capacity factor (%)	Target	-	78.82	79.35
	Actual	79.22	74.37	75.65
Forced outage rate (%)	Target	-	-	2.00
	Actual	16.85	12.82	1.54

Source: NTPC

Generally speaking, the operational performance of power plants under NTPC jurisdiction is surpassing the national level, inclusive of other generating companies*[9], however, the Faridabad Power Station is outperforming other NTPC power plants, as the following table shows.

Figure 1: Comparison with other power plant performance (NTPC jurisdiction) (MWh)



	Anta gas turbine	Auraiya gas turbine	Dadri gas turbine	Kawas gas	Gandhar gas turbine	Kayamkulam	Faridabad gas turbine
	102%	102%	101%	86%	80%	56%	117%
目標値	3,000	4,600	5,700	4,400	4,500	2,400	2,400
実績値	3,060	4,701	5,748	3,761	3,609	1,331	2,797

Source: NTPC

[9] Generating companies resembling NTPC include the National Hydroelectric Power Corporation (NHPC) and the North Eastern Electric Power Corporation (NEEPCO).

2.3.2 Recaluculation of Internal Rates of Return (IRR)

(1) Financial Internal Rate of Return (FIRR)

The FIRR was recalculated on the basis of income and expenditure results received from the two executing agencies and more reliable forecasts than made at appraisal, yielding a figure of 16.9%, which eclipses the intial forecast (13.6%). The assumptions used at recalculation are as follows.

Benefits

Power selling price, transmission price:

Respectively pegged at 180 paise/kWh and 5.37 paise/kWh at appraisal.

At recalculation, variable prices based on depreciation costs, etc., were used to synchronize the figures with actual prices.

Installed capacity: Taken as 432MW, which is slightly higher than at appraisal (400MW)

Total generation p.a.: Taken as 2,514 million kWh, which is slightly higher than at appraisal (2,328 million kWh).

Costs

Natural gas: Recalculated at the higher level of Rs4,321/1,000m^3 (appraisal: Rs2,637/1,000m^3). Actual figures used up to FY00, forecasts used for FY01 and beyond.

(2) Economic Internal Rate of Return (EIRR)

The EIRR was calculated as a measure of the project's significance in terms of the "national economy", yielding a figure of 17.3%. The assumptions used to calculate EIRR were as follows.

Volume of Energy Supply

Supply volume: Generated output was based on NTPC data used for FIRR, with 40% being deducted from FY99 results in Haryana State for system losses.

Industry sector based distribution: Average sectorial consumption rates for the state (FY97-FY99) were used.

Benefits

Following the methods used to evaluate a thermal power plant project implemented in India by the ADB (Asian Development Bank)*[10], the Willingness to Pay Approach was utilized to calculate the benefits to industrial, residential and commercial consumers, and the Resource Cost Saving Approach to calculate benefits to the agricultural sector.

Unit benefit costs based on both Willingness to Pay and Resource Cost Savings were applied to the figures actually employed in the aforementioned ADB reference case after inter-annual adjustment.

Operation and Maintenance Costs

For investment and maintenance costs (equivalent to generation and transmission costs), the economic price obtained by multiplying the figures used to calculate the FIRR (financial price) by a conversion factor (0.9) was utilized. Fuel costs were obtained by calculating the required volume of natural gas from the generation volume and multiplying the resultant figure by the unit price of natural gas (0.2426m^3 of natural gas is necessary to generate 1kWh of power, and the price of natural

[10] Project Performance Audit Report on the North Madras Thermal Power Project in India (PPA: IND 18181)

gas is Rs3.4/m^3). International prices referred in World Bank materials were utilized for natural gas prices. Distribution costs were estimated using data relating to the power sector in Haryana State (2001 SEB Report).

2.3.3 Contribution of the Project in Haryana State

The Faridabad Power Station commenced on-grid generation in 1999 and all power produced (100%) at the plant is being supplied to Haryana State. Assuming that the plant had not existed in FY99, the supply deficit in the state would have deteriorated from 2.3% to 9.0%*[11]. Moreover, in a trial calculation for the following year, FY00, the supply deficit would worsen from 2.8% to 15.8%. In fact, the peak supply deficit dropped from 8.3% in FY98 to 3.3% in FY00, a circumstance to which the Faridabad Power Station is believed to making a certain contribution*[12].

The net electric energy production had reached approximately 2,797MWh in FY01. This is roughly equivalent to 16% of total power consumption in Haryana State (17,856MWh). Further, peak demand (FY01) was 3,004MW with the plant supplying 12.7% of the demand during peak times.

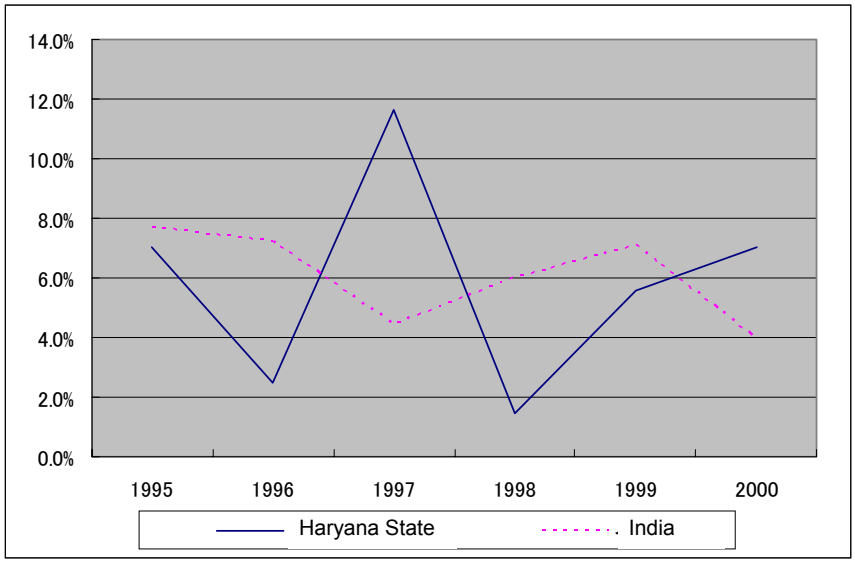
In summary, the plant has attained the initially set targets.

2.4 Impact

2.4.1 Impact on the Haryana State Economy

Figure 2 illustrates the economic growth rates for Haryana State and India as a whole between 1995-2000. The growth rate in Haryana State has been subject to slightly more drastic fluctuations than in the rest of the country, but was 2% higher than the national figure in FY00.

Figure 2: Fluctuations in Real GDP Growth Rate (%)



Source: Haryana State government, International Monetary Fund, etc.

The state's economy is driven by the agricultural and industrial sector, with agriculture

[11] A trial calculation undertaken on the basis of MOP statistics. The figure was not adjusted for T&D loss.
[12] We gathered from a representative of a related organization that the plant is a "lifeline" for Haryana State.

accounting for the largest share of state GDP. However, the GDP share of the agricultural sector has been gradually contracting in contrast to a recent trend toward growth in the industrial sector quota. General outlines of the two sectors are given below.

Agriculture

33% of total GDP in Haryana State comes from agriculture and there have been continuous increases in yields in recent years with the total from all crops reaching 13.25 million tons in FY00. As shown in Table 5 below, the agricultural sector is a comparatively large consumer of electricity, and the project is inferred to be making a certain contribution to promoting this key state industry.

Manufacturing Industry

Growth in Haryana State's manufacturing sector is mainly propelled by the auto industry, which accounted for 21% of state GDP in FY00. Foreign investment and exports are also on the increase, with exports growing from Rs 45 million in 1966 to Rs70bn in 2001*[13]. The IT industry (software) accounts for Rs30bn of this figure, followed by the garment industry and auto components. As shown below, there has been conspicuous growth in (power) consumption in the manufacturing sector during the last two years with developments in the power sector, including this project, bringing such consumption within reach and underpinning the growth in the manufacturing sector.

Table 5: Sectorial Power Consumption (MWh)

FY / Sector	1998	1999	2000	2001
Domestic	2,010	2,088	2,164	2,286
Commercial	351	390	462	552
Manufacturing	**1,877**	**1,888**	**2,102**	**2,467**
Agriculture	**3,888**	**4,420**	**4,602**	**4,384**
Designated irrigation	158	169	162	143
Public works	238	225	241	255
Other	377	417	416	429

Source: CEA

Fluctuations in per capita consumption of power in Haryana State are as shown below. The figures have moved up and down repeatedly since the mid 1990s but are trending very slightly upwards. The figure for FY99 (473kWh) exceeded the national average (350kWh) by 35%. The household electrification rate for the state had already hit 100% in 1970.

Table 6: Per Capita Power Consumption Haryana State (p.a.) (kWh)

1995	1996	1997	1998	1999	2000	2001
458	462	438	450	473	507	521

Source: Planning Commission, Government of India

2.4.2 Other Impacts

(1) Impact on Local Residents (land acquisition, involuntary relocation)

Based on the provisions of India's Land Acquisition Act, a total of Rs252 million was awarded to residents (90 persons)*[14] holding deeds for land within the power plant lot, whilst residential land

[13] Information based on the "The Economic Survey of Haryana" (FY01).
[14] Of the 321.4-acre power plant construction site, 170.5 acres was government owned and 150.9 acres was privately owned.

(50 × 40 feet) was provided at a distance of 1 kilometer for the six persons who were resident on the site. It was not necessary to acquire any land for the T&T facilities.

A Village Development Advisory Committee was established (comprising NTPC personnel and community representatives), which has been implementing community support projects*[15] in the vicinity of the power plant; these were provided apart from the abovementioned compensation. The projects include expansions to school facilities, the construction of an animal hospitals and the digging of wells, with an outlay in the region of Rs19 million to date.

(2) Environmental Impacts

NTPC periodically measures effluent and atmospheric concentrations of environmental pollutants including nitrogen oxide (NOx) and sulfur oxide (SOx), as well as the quality of effluent and water in the river into which said effluent is discharged (suspended particulate matter, heated effluent, etc.). All results to date have been in conformity with the standards governing emissions and the environment established by the national government, and there have been no specific reports of adverse environmental impacts.

2.5 Sustainability

2.5.1 Power Station

(1) Current Status of Facilities

The power station was constructed essentially as per the plans. Further, as mentioned earlier, the various operation indicators (net electric energy production, capacity factor, forced outage rate) would seem to indicate that the operating condition of the facilities, etc., developed via this project is favorable.

(2) Issues currently concerned

Appropriate maintenance tasks are being undertaken in line with the guidelines and manuals compiled by the equipment manufacturers, and no specific problems were confirmed during observations made during this survey.

(3) Operation and Maintenance

Organizational Capability

As was initially planned, NTPC is responsible for the operation and maintenance of the power plant. There have been no major changes in the scope of the organization or its systems since the time of appraisal. Moreover, in order that careful examinations of the plant's impact on the environment may be conducted, an "Environment Management Unit"*[16] has been newly established within the operating department.

Technical Capability

Of the personnel engaged in plant maintenance, there are 52 technicians with a bachelor's degree or diploma, plus an additional 33 engineers. Personnel have an average of 15 years experience, and NTPC reports that it has sufficient staff and technical capability for operation and maintenance.

[15] The committee is convened biannually and conducts on-site inspections where necessary.
[16] Two managers have been assigned to the section, which is primarily undertaking to monitor environmental indicators, check up on legislative requirements, and maintain the Environmental Management System (ISO14001).

Financial Status

The budget for maintenance costs is essentially being secured / disbursed as per the plans (approx. Rs310 million in FY01), and it is forecast that this situation will continue.

According to its financial statements, the company posted after-tax profits of Rs34,245 million for the year ending March 2000 and Rs37,338 for the year ending March 2001, thus the company's overall financial status appears to be sound.

Table 7: NTPC Statement of Earnings (million rupee)

Fiscal year	1991	1999	2000
Operating revenue	39,929	171,841	203,442
Power generation costs	24,215	125,706	151,786
Fuel costs	16,424	96,419	117,952
Operating profit	15,714	46,134	51,656
Ordinary profit	10,071	36,309	40,738
Net income after tax	10,071	34,245	37,338

Table 8: NTPC Balance Sheet (million rupee)

Fiscal year	1991	2000	2001
Current assets	34,494	160,756	171,808
Fixed assets	190,424	222,819	220,888
Capital investment	0	39,915	9,016
Total assets	224,918	423,490	401,712
Current liabilities	22,428	67,324	71,893
Fixed liabilities	97,766	98,047	100,774
Capital	104,744	258,208	229,104

Other

Natural gas (plant fuel) prices have fluctuated stably at around Rs4,000 per 1,000m^3 during the three year period from FY00-FY02*[17].

In addition, retail prices, which form the basis for operational revenue, are subject to a pricing mechanism under which NTPC employs a designated method*[18] to calculate the recommended retail price, which it then files with the Central Electricity Regulation Committee (CERC)*[19] for approval. If this price is approved it becomes the official retail price. The retail price per kilowatt hour has been falling (Rs2.52, Rs2.21, Rs1.64) since 1999*[20].

Power produced at the Faridabad Power Station is purchased by Haryana Vidyut Prasaran Nigam Ltd., (HVPNL), the distribution company that came into being as the result of the unbundling of Haryana State Electricity Board (HSEB).

HVPNL is employing the following measures as a means of assuring its payments to NTPC. In

[17] There are government pricing regulations, which have set a current ceiling of $1.7 on the unit (MMBtu) price of natural gas.

[18] The tariff is calculated by multiplying each of the following factors: the interest on necessary project funds, depreciation costs, maintenance costs, taxes, return on equity, and the interest on working capital by a fixed coefficient factor.

[19] The CERC was established on the basis of the 1998 Electricity Regulatory Commissions Act and is an independent government organization with a quasi-judicial function. Its primary role is to regulate the tariff of power generated in the Central Sector, plus tariffs on inter-state power sales involving multiple states and inter-state tariffs. In passing, the establishment of production and transmission costs within a state is the task of State Electricity Regulatory Commissions (SERC).

[20] The drop in retail prices reflects the rise in the plant's operating efficiency and the gradual contraction of unit (kWh) generation costs.

the first instance, it converted all tariffs arrears accumulated up to 2002 into bonds, and in July of that year it opened a letter of credit for a sum equivalent to 105% of the monthly supply volume. This means that should HVPNL default on its payments NTPC can invoice the Reserve Bank of India (RBI) for the amount concerned, and the RBI will make the payment on behalf of the state government*[21]. However, HVPNL has not been in arrears since July 2002 and is making all payments.

2.5.2 Transmission & Transforming Facilities

(1) Current Status of Facilities

T&T facilities were constructed in line with the aforementioned changes to the project scope. No specific problems have been reported to date.

(2) Issues Currently Concerned

According to POWERGRID, no particular problems have been reported with the maintenance of the T&T facilities developed via this project to date.

(3) Operation and Maintenance

Organizational Capability

POWERGRID is responsible for the maintenance of T&T facilities. There have been no major changes in the scope of the organization or its systems since the time of appraisal.

Technical Capability

There were 11 staff members directly involved in the maintenance of project facilities at the completion of construction work as compared to 13 at the present time. POWERGRID reports that this is a sufficient number for the maintenance of facilities under its jurisdiction. Furthermore, technical staffs receive periodic training.

Financial Status

The budget for maintenance costs is essentially being secured / disbursed as per the plans (approx. Rs8 million in FY01), and it is forecast that this situation will continue.

In terms of the organization's overall financial status, the company has posted after-tax profits of Rs4,444 million, Rs6,009 million and Rs7,425 million for the past three years and its financial status appears to be sound.

Table 9: POWERGRID Statement of Earnings (million rupee)

Fiscal year	1998	1999	2000
Operating revenue	17,703	21,239	26,826
Costs	8,924	10,230	12,597
Operating profit	8,779	11,008	14,229
Ordinary profit	4,970	6,806	8,123
Net income after tax	4,444	6,009	7,425

[21] This is based on a tripartite agreement between Haryana State government, the RBI and NTPC aimed at assuring payment of electricity tariffs.

Table 10: POWERGRID Balance Sheet (million rupee)

Fiscal year	1998	1999	2000
Current assets	16,275	20,422	22,474
Fixed assets	109,820	119,301	129,378
Total assets	126,095	139,722	151,852
Current liabilities	7,143	8,764	9,149
Fixed liabilities	65,311	73,153	80,622
Capital	53,708	59,412	66,285

Other

POWERGRID receives monthly payments for its transmission operations from the power purchaser Haryana State (HVPNL). The state has not fallen behind with its payments, which are being made on schedule. At the time of the current survey, the company's receivables were also at a healthy level, being equivalent to the tariff for 1.21 months (approx. Rs143 million). A letter of credit equivalent to 80-90% of the monthly amount has been opened in connection with state government transmission tariffs, under which POWERGRID can invoice the RBI for any amount in arrears.

2.5.3 Current Status of Haryana State Power Sector

In recent years, structural problems*[22] within India's power sector have led to budget deficits becoming an issue, and Haryana State is no exception. In view of the fact that the financial status of the state government has a major impact on the sustainability of the project's two executing agencies, the following attempts to comprehend current conditions in Haryana State.

Power supply shortages and low capacity operating ratios at power plants within the state during the latter half of the 1990s resulted in severe financial distress for the SEB. In consequence, the state embarked upon in-depth power sector reforms in 1998, unbundling*[23] the integrated utility and tackling a host of measures aimed at improving the profitability of the sector as a whole (promoting the collection of unpaid tariffs, strengthening measures to prevent power theft, personnel reductions, etc.). These efforts resulted in improvements in the efficiency and profitability of the state's power sector, and were sufficient to lead to a current account surplus of approximately Rs1,160 million for power operations in FY02.

These reforms have had a favorable impact on the project in the sense that they have provided even greater assurance of tariff collection, and in fact, neither of the executing agencies has experienced any problems in recovering the relevant tariffs. However, the reforms are still on the way to completion and if the project's sustainability is to be rendered secure, continuous monitoring of the future direction of sector reforms would be desired.

In summary, the power plant constructed via this project is more than fulfilling the functions envisaged for it at appraisal, and there are virtually no physical problems at the present time. The

[22] Various ailments have been pointed out including distortion of the tariff structure, stagnation of facilities operating rates, high levels of T&D loss, and numerous uncollected bills, which have led to budget deficits in all SEBs. The "Common Minimum Action Plan for Power" (CNMAPP) was adopted in December 1996 with the aim of addressing these SEB problems and improving the shortfall in energy supply.

[23] Targeting improved operational efficiency, generation, transmission and distribution functions are all assigned to different operators.

organization, personnel and budget necessary for facilities maintenance are in place and the finances of the executing agencies per se are healthy. Moreover, there are also positive signs that the financial status of the power purchaser, HVPNL, has been improving. Accordingly, the overall sustainability of the project is evaluated as being highly favorable.

3. Feedback

3.1 Lessons Learned

The establishment of Project Coordination Committees (PCC) for similar projects is efficacious.

Members of the PCC established to coordinate the various organizations involved in this project report that the committee produced significant effects on progress monitoring. This type of inter-organization coordination is crucial on projects that involve a number of executing agencies from the outset, and the establishment of a coordinative body like the PCC should, to a certain extent, be a given. Notwithstanding, having a coordinative body that included a representative from the MOP was extremely beneficial for this project in particular, because of external conditions, in the form of separate projects, had a profound impact on the inauguration of the project per se. The establishment of a coordinative body that includes a representative from a high-ranking organization should be actively promoted when planning/undertaking future projects that incorporate several executing agencies, and in cases where it is necessary to coordinate with other government-related projects.

Comparison of Original and Actual Scope

Item	Plan	Actual
1) Project Scope		
Power station	1) Gas turbine generators, 140MW × 2	1) Gas turbine generators, 150MW × 2
	2) Steam turbine generators, 130MW × 1	2) As planned
	3) Heat recovery steam gas boiler × 2	3) As planned
	4) Monitoring /control equipment, water treatment facilities, etc.	4) As planned
	5) Switchyard and related facilities	5) Changed from 400kV to 220kV
Transmission / transformer facilities	1) 400kV Dadri-Ballabgarh transmission line 2) 400kV Ballabgarh-Jaipur transmission line 3) Construction and expansion of substation facilities	1) 220kV Faridabad-Samaypur transmission line 2) 220kV Faridabad-Palla transmission line 3) Only 220kV bay constructed
2) Implementation schedule		
Power plant	Dec. 1994 - Dec. 1997	Jan. 1998 - Jul. 2000
Transmission lines	Aug. 1995 - Sep. 1996	Aug. 1998 - Dec. 1999
Substations	Aug. 1994 - Sep. 1996	Aug. 1998 - Dec. 1999
3) Project costs*[24]		
Foreign currency	37,742 million yen	9,021 million yen
Local currency	27,840 million yen	19,228 million yen
Total	65,582 million yen	28,249 million yen
ODA loan portion	23,536 million yen	19,937 million yen
Exchange rate	1 rupee = 3.70 yen (As of Jan. 1994)	1 rupee = 2.73 yen (As of Mar. 2002)

[24] Total project costs aer what were stipulated at the planning stage, which are based on the 1993-98 financing plan. Of the total yen loan amount, that necessary for the period from 1993-96 was covered.

Third Party Evaluator's Opinion on the next page

Third Party Evaluator's Opinion on
Faridabad Gas Based Power Station and Associated Transmission System Project

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Relevance

Relevance of the project was beyond question at appraisal and it remains so today. Persisting capacity shortages in India's electricity sector are identified as a major obstacle to the country achieving higher rates of economic growth. A relatively well-implemented project like this one is thus a signal contribution to the sector as well as the national and state economies. The capacity utlisation factors achieved by this station attest to the fact that the project objectives are being met. The period over which this project was implemented also saw major reforms in India's power sector and specifically in the beneficiary state (Haryana). 'Unbundling' of vertically integrated state-owned power utilities and setting up of largely autonomous regulatory agencies with the chief responsibility for regulating tariffs are the main features of these reforms. Owing to the efficiency levels attained by the Faridabad plant, this power station has succeeded in meeting the changed beneficiary needs. A forthcoming important sector reform concerns the phased introduction of competition. Given the very satisfactory performance record of this plant, it is favourably placed to adjust to the forthcoming competitive environment as well.

The fuel option of the plant and its design ('CCGT' suited to meet peak hour requirements) are particularly relevant to the plant location in the so-designated 'National Capital Region' that is among the country's most important centres of industry, commerce and emerging 'new economy'.

Impact

That the project has met its overall goal is evident from the fore-going comments. Several favourable factors have contributed to this result. Firstly, the project was executed by an efficient implementing agency – the NTPC – which had actual experience in constructing and operating several gas-based projects earlier. Secondly, project implementation coincided with the review of rigid norms relating to allocation of output of power stations owned by Central Public Sector Undertakings between the states constituting the 'region'. This new flexibility enabled NTPC to negotiate with Haryana state for purchase of all the capacity and output of the plant and led to satisfactory commercial arrangements. Robust economic growth in the northern region of the country is yet another favourable circumstance.

Electricity sector is not identified as having direct impact on poverty reduction. However, availability of electricity facilitates industrial and other economic activity that bring about steady alleviation of poverty. This plant has certainly made a contribution in this respect, as evidenced by the quantifiable reductions it has brought about in electricity shortages in the northern region.

All thermal power generation involves emissions into the environment but these are relatively less in the case of plants using a clean fuel like natural gas. It is seen that in actual operation also, this plant has conformed to the emission norms stipulated by the concerned authorities. As regards project design and scope, limitations imposed by available natural reserves of gas would have influenced the plant scale and design. It is notable that owing to efficient operations, the price per unit of electricity generated by this plant has been coming down. This is added proof of the effectiveness of the plant in achieving the project purpose.