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PERFORMANCE AUDIT REPORT

INDIA

**NATIONAL CAPITAL POWER SUPPLY PROJECT - PHASE I
(LOAN 2844-IN)**

June 26, 1998

Operations Evaluation Department

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Currency Equivalents (annual averages)

Currency Unit = India Rupees (Rs)

1986 (at appraisal)	US\$1.00	Rs. 13.00
1989	US\$1.00	Rs. 17.50
1990	US\$1.00	Rs. 22.74
1991	US\$1.00	Rs. 26.20
1992	US\$1.00	Rs. 31.20
1993	US\$1.00	Rs. 31.46
1994	US\$1.00	Rs. 32.30
1995	US\$1.00	Rs. 34.50

Abbreviations and Acronyms

ADB	Asian Development Bank
CEA	Central Electricity Authority
CIL	Coal India Limited
CEMPDIL	Central Mine Planning and Design Institute
DESU	Delhi Electric Supply Undertaking
FSA	Fuel Supply Agreement
GCV	Gross calorific value
GOI	Government of India
ICR	Implementation Completion Report
IDA	International Development Association
LRMC	Long-run marginal cost
MIS	Management Information System
MOC	Ministry of Coal
NTPC	National Thermal Power Corporation
O&M	Operation and Maintenance
OED	Operations Evaluation Department
PAPs	Project-affected Persons
PAR	Performance Audit Report
PR	President's Report
SAR	Staff Appraisal Report
SEB	State Electricity Board
UHV	Useful heat value

Fiscal Year

Government: April 1 - March 30

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June 26, 1998

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT**SUBJECT: Performance Audit Report on India
National Capital Power Supply Project – Phase I (Loan 2844-IN)**

Attached is the Performance Audit Report prepared by the Operations Evaluation Department (OED) on the above project. The loan, for the amount of US\$485 million equivalent was approved in FY87 and closed in December 1995 after a six-month extension. A total of US\$162.2 million was canceled.

The primary objective of the project was to augment power supplies to the nation's capital, decrease the losses and improve the reliability of its distribution system, and ensure that the Delhi Electric Supply Undertaking (DESU) and the National Thermal Power Corporation (NTPC) were on sound financial footings.

On a technical level, the NTPC components, which included reconstruction of a 4x210 MW power plant at Dadri and rehabilitation of a 720 MW power plant at Badarpur, were satisfactorily implemented by NTPC. However, the component to strengthen DESU's transmission system and its management system was canceled because of the failure of the Government of India (GOI) to present to the Bank an acceptable financial recovery plan for DESU.

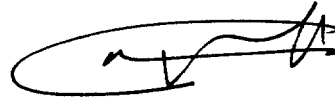
OED rates the overall project outcome as unsatisfactory (as did the ICR), institutional development impact as negligible (ICR rating was partial), and sustainability as unlikely (ICR rating was likely). The lower audit ratings are because OED views the project's two components as an integrated whole. A power generation project cannot be separated from the distribution system that supplies the power to the ultimate consumer. Both systems need to work efficiently for the project to be successful and sustainable. Thus, while the power generation components of this project were implemented effectively by NTPC, and their sustainability is likely, the power that is produced by NTPC is being inefficiently used by DESU, whose distribution system has continued to deteriorate. OED rates Bank and borrower performance as unsatisfactory (as did the ICR). However, it should be noted that borrower performance rating was based on the performance of the GOI, which was unable to meet its covenanted commitment to resolve DESU's financial and institutional problems. The performance of NTPC in implementing its project components was highly satisfactory.

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The major lessons are:

- (a) Because the distribution entity that used the power generated in this project (DESU) was not strengthened, a significant amount of the power produced by this project is not reaching the final consumer. The Bank should not support power generation projects that will supply power to an inefficient, loss-making distribution company, even if the generation entity is itself efficient.
- (b) Proper financial incentives are needed to induce government entities to operate efficiently. For infrastructure investments, particularly in the energy sector, the Bank should encourage governments to introduce market oriented changes in the framework of contractual relationships between project-related buyers and sellers. To improve the quality of coal delivered to NTPC, future loans for thermal power projects in India should include a more market oriented pricing structure for coal. It is with new projects that experimentation is possible because adjustment costs and the potential institutional resistance are lowest.
- (c) Legally enforceable commercial contractual agreements for the provision of goods and services can provide strong financial incentives for state enterprises to operate efficiently in a market-oriented manner. The Bank should assist in introducing market oriented practices by analyzing the commercial implications of contractual relations between the project entity and its suppliers and customers, since these contracts are critical element of the economic and financial success of the undertaking.

Attachment



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Principal Ratings

	<i>Loan 2844-IN</i>	
	<i>Audit</i>	<i>ICR</i>
Outcome	Unsatisfactory	Unsatisfactory
Sustainability	Unlikely	Likely
Institutional Development	Negligible	Partial
Bank Performance	Unsatisfactory	Unsatisfactory
Borrower Performance	Unsatisfactory	Unsatisfactory

Key Staff Responsible

	<i>Loan 2844-IN</i>		
	<i>Task Manager</i>	<i>Division Chief</i>	<i>Country Director</i>
Appraisal	Alfonso Mejia	Ibrahim Elwan	Enrique Lerdau
Completion	Argun Ceyhan	Jean-Francois Bauer	Heinz Vergin

Preface

This is a Performance Audit Report (PAR) on the National Capital Power Supply Project Phase I (Loan 2844-IN) for which the World Bank approved a loan of US\$485 million equivalent on June 17, 1987. One US\$60 million component was canceled on August 1, 1990 because of the Government of India (GOI) failed to present to the Bank an acceptable financial recovery plan for the Delhi Electric Supply Undertaking (DESU). The loan closed on December 31, 1995, after an extension of six months. An additional US\$102.2 million undisbursed balance was canceled at that time, for a total cancellation of US\$162.2 million.

This report is based on the Implementation Completion Report (ICR) prepared by the South Asia Region and issued on September 13, 1996, the Staff Appraisal Report, loan documents, project files, and discussions with Bank staff. In addition, an Operations Evaluation Department (OED) mission visited India in January 1998 to discuss the effectiveness of the Bank's assistance with the government and the various project implementing agencies. The cooperation and assistance of government officials and the management and staff of the National Thermal Power Corporation (NTPC) are gratefully acknowledged.

Following standard OED procedures, the draft of the PAR has been sent to the borrower for comments. These comments have been incorporated into the report and are attached as Annex B.

1. Project Design

1.1 In 1985, power shortages prevailed throughout India. Consumption had grown at about 8 percent per year for the preceding two decades, and construction of new plants had not kept pace. Power shortages were particularly acute in the Union Territory (Delhi), where growth over the previous decade had been close to 10 percent.

1.2 The project's objective was to augment and improve the efficiency and reliability of New Delhi's power supply through:

- (a) constructing an 840 MW (4x210) coal fired generation plant at Dadri, near New Delhi to be owned and operated by the National Thermal Power Corporation (NTPC);
- (b) rehabilitating the 720 MW Badarpur thermal power plant;¹
- (c) constructing a 400 kV transmission ring around Delhi to be owned and operated by the Delhi Electric Supply Undertaking (DESU);
- (d) identifying ways to improve the quality of coal used in power generation; and
- (e) strengthening DESU's institutional and technical capabilities, and making it a financially viable enterprise.

1.3 DESU is an arm of the municipal government of Delhi. Its budget is the responsibility of the central government and it functions as a State Electricity Board (SEB) for the Union Territory and has all the same financial and operational problems as the other SEBs. Its financial insolvency has restricted its transmission/distribution expansion, as well as its plant maintenance program. As a result, distribution losses have been high. In addition, it has had to compete with the states for power from existing and proposed power plants outside its territory. It was hoped that tariff reforms and reorganization under the project would transform DESU into an efficient, financially viable energy distribution enterprise that could set the standard for the transformation of other SEBs.

1.4 NTPC was established in 1975 to bring order to India's thermal power development program, which had been plagued by suboptimal planning and poor performance at the state level. It is responsible for design, construction, and operation of large thermal power stations, and sells its power to the SEBs. By 1989, the Bank had supported NTPC's development through six IDA and ten IBRD operations.

1. DESU (owns) Badarpur, but had contracted NTPC to take over operational management, because it had been unable to operate it efficiently. Under the project, the GOI was to pay for Badarpur's rehabilitation program, and DESU was to continue to be responsible for paying for the coal and operating and maintenance (O&M) costs. However, when the GOI ran into financial difficulties in 1989/90, the Bank agreed to finance the rehabilitation cost with the savings from the Dadri component

2. Project Implementation

2.1 The outcomes of the NTPC project components were highly satisfactory. As documented in the ICR, the physical implementation of Dadri and rehabilitation of Badarpur were completed, essentially as planned, although with extensive delays. Dadri's fourth-generation unit was synchronized in March 1994, some two years behind schedule. Badarpur's generation, which had been as low as 30 percent of capacity when its management was first taken over by NTPC, improved from 64 percent to 74 percent of capacity during project implementation, and availability increased from below 75 percent to above 85 percent. Energy conversion efficiency also improved, and environmental (particulate) pollution has been greatly reduced through the addition of highly efficient electrostatic precipitators.

2.2 NTPC's financial condition has also been improved, through the reduction of accounts receivable, which has helped NTPC to achieve returns well in excess of the 7 percent required under the project's financial covenants. This was accomplished only under Bank pressure, including, a discreet three-month informal suspension of disbursements in early 1994, when accounts receivable had jumped to over seven months.

2.3 The DESU rehabilitation component was a failure. The GOI was unable establish a financial restructuring plan (including needed tariff increases) needed to re-establish DESU as a solvent entity, which was a covenanted condition for the project components to be implemented by DESU. The US\$60 million component for strengthening DESU's transmission system and upgrading its operations was canceled in 1990 without any significant disbursements. DESU has not yet implemented the majority of investments needed to reduce its distribution losses (including the 400 kV transmission ring), and since tariffs have not been increased significantly, DESU's financial condition continues to undermine its ability to carry out its mission. As a result, the power supply situation in the Delhi area continues to be unsatisfactory.

Resettlement

2.4 No relocation was necessary for the Dadri project. NTPC reports that all land claims have been taken care of and rehabilitation programs developed to the satisfaction of the villagers whose land was used by the project. The audit mission visited the village where most of the project-affected persons (PAPs) lived, including the PAP information office, the training program, where village women were learning sewing skills, and the new primary school and school for girls established by the Dadri plant. All facilities were well attended, and those present appeared to not have any complaints about the programs, thereby providing some confirmation for NTPC's claim.

Contribution of the ICR

2.5 The ICR identifies the following areas of project implementation concern:

- (a) Delays in project implementation caused by:
 - (i) an overly long procurement cycle;

- (ii) construction and equipment delivery delays caused by economic shocks and excessive backloging of orders by local manufacturers;
 - (iii) land acquisition delays caused by resettlement and rehabilitation issues that were addressed late in the project; and
- (b) Resettlement issues surfaced early in project implementation. But all cases were eventually resolved in accordance with the decisions of the court. Under a subsequent FY93 loan (L-3632), NTPC revised its resettlement and rehabilitation policy, and initiated socio-economic studies of the project-affected persons (PAPs) for all its projects.

2.6 The key lessons identified in the ICR were:

- (a) NTPC's willingness to follow commercial practices (particularly by limited use of restricting power supply to customers with overdue accounts) has greatly improved its cash flow position;
- (b) The successful rehabilitation of Badarpur shows that plant rehabilitation is economically attractive. Projects such as this should continue to be supported; and
- (c) To minimize delivery delays of key components, when qualifying bidders one needs to evaluate their manufacturing capacity in relation to their existing order book backlogs.

OED concurs with all the above lessons.

3. Issues

The Role of DESU, the Distribution Company

3.1 By the mid 1980s, the financial performance of all of India's state-run power utilities (SEBs) had become a central issue of the Bank's sector policy dialogue. DESU represented a classic example of the problems faced by the SEBs.² The Bank wanted the GOI to reform DESU's operating environment and tariff structure so that it could become a "model" distribution company. DESU could then be used as an example for state governments to follow in reforming their SEBs.

3.2 A financial restructuring package was central to the plan to transform DESU into a viable entity. However, since this restructuring had to include substantial tariff increases, it had to be submitted to the federal parliament for approval. Acknowledging that approval would take considerable time, while the need for additional power generation was growing DESU had already handed over operational management of its Badarpur plant to NTPC because it had run it so poorly rapidly to a critical level, the Bank agreed to separate the generation and distribution components of the project and to slip the restructuring plan from a condition of negotiations to a condition of effectiveness for the project components that were to be carried out by DESU.

3.3 This project design allowed the Bank to provide financing for a generation of power that would be produced by NTPC but used almost exclusively by DESU, even if the GOI could not fulfill its promise to realign DESU's capital structure and establish realistic tariffs and implement other necessary reforms in DESU. However, the design provided some leverage for the Bank to press the GOI to restructure DESU and reform the electricity tariff structure in the greater Delhi area. In fact, as stated in an internal memo: "The inclusion of the DESU component was viewed as an important element in justifying the project, and the financial strengthening of DESU as a key institutional objective."

3.4 Even though it should have been evident that substantial tariff increases were going to be critical to establishing DESU as a financially viable entity, this issue was never seriously pressed with the government during project preparation and appraisal. Instead Bank efforts to resolve DESU's financial problems focused primarily on settlement of outstanding receivables and write-offs of past debt, both of which were originally proposed as conditions of negotiations.³ The financial strengthening requirement was later shifted to a condition of effectiveness. It was not until October 1989 (two years after negotiations) that the Bank took the position that changes in the capital account would be insufficient, and began to concentrate its attention on the need for tariff reform as the central element of an adequate financial plan. The supervision report said:

2. Although it was not strictly an SEB, since it supplied and was controlled by the Federal District, not by a state government.

3. It was, however, not completely neglected. It was referred to in item six of seven measures to be taken for DESU's financial recovery as follows: "appropriate measures to be taken by GOI and DESU, including revision of electricity rates, to enable DESU to achieve, commencing in 1987/88, an annual rate of return on assets of not less than 3%" Bank internal memo, October 24, 1986.

“It is clear that without a substantial increase in tariffs these measures will not allow DESU to improve its financial position, much less to meet the 3 percent rate of return covenanted for 1990/91.” Furthermore, the required tariff increases were greater than 50 percent, which proved to be politically untenable. The following year the DESU component was canceled; but the generation components were implemented.

3.5 This project highlights the dilemma that the Bank has faced in India ever since it shifted its financial support from SEBs to NTPC. The same types of generation and transmission projects were implemented, but the power still went to the SEBs, who distributed it to the final customers. The decision to support an efficient national power generation institution has greatly improved the efficiency of power generation in India and has, as a result, greatly improved the availability of power to the country as a whole. NTPC has grown into a highly efficient power company. But electricity is still being distributed by highly inefficient SEBs, whose losses are well above 25 percent (and in some states may be as high as 50 percent), and who are unable to earn enough to finance the maintenance, expansion and rationalization programs that are essential to reduce losses while they grow their systems.

3.6 The Bank’s intention was to bring about institutional reform that would greatly improve the reliability and availability of power in the Delhi region. Although the Bank designed the project components with this goal in mind, it failed to reach agreement on the specific reforms (including tariff reforms) that needed to be implemented. In the end, it allowed the power generation component to go forward without requiring the Government to demonstrate, through actions, its intention to carry out the necessary distributions reforms. This was the wrong approach. A project dedicated to the improving DESU operations should have come first, followed by the NTPC generation project, once the reform process had started. Instead, by increasing generation capacity, the project allowed DESU to continue functioning with its inefficient and wasteful practices. One result has been that DESU’s distribution system was been unable to absorb all of the increase in generation, so that in October 1997 NTPC had to back down the Badarpur power plant, resulting a 10% generation loss, and the generation loss due to backing down in the northern region as a whole was about 600 MW.⁴

3.7 The economic rationale for supporting a power generation project that supplies power to an inefficient, loss making distribution company, is highly questionable, even if the generation company is, like NTPC, efficient. **OED believes that the Bank should not support such projects.** In addition, when consumption is growing in uneconomic ways because many consumers pay so little for their electricity that they are unconcerned about improving usage efficiency, there is a serious question about the net benefits of new generation. **OED believes that the Bank should reconsider its justification for supporting new generation in systems where tariffs are far out of line with costs for large groups of consumers, because, under these circumstance there is no evidence that, at the margin, the economic value derived from its (wasteful) consumption are greater than costs of supplying it.** In India, it appears that the Bank has taken already taken this proposition to heart. The Region is now focusing all its sector effort on projects that support the reform of SEB. **OED recommends that this policy should be emulated in all regions of the Bank.**

4. See Power in Asia, Vol. 240 page 13.

Coal Quality and Coal Pricing

3.8 The quality of coal for power generation has always been a problem in India. At project appraisal, the quality of steam coal used in power generation had, in addition, been deteriorating because the best coal from existing mines was used-up. The issue of deteriorating quality of the Coal India Limited's (CIL) coal production was raised in the Project Brief, where it was noted that the ash content some coal supplied to NTPC was as high as 50 percent. This problem was not only technical. Contractual arrangements and institutional pricing structures also had a negative impact on coal quality.

3.9 Coal prices had been based on six broad grades of coal, where each grade covers a large range of calorific values, moisture and ash/rock content. In the case of G-grade coal, the acceptable range is 3,110 to 3,870 kcal/kg, or about 24 percent of the lower limit. Within such large ranges CIL has had no financial incentive to improve (or even maintain) coal quality, especially since it was the monopoly supplier. CIL had little incentive to improve coal quality. Coal was in short supply and was allocated by a central board rather than by a market mechanism. Furthermore payments from most SEBs (CIL's primary customers) were always in arrears. To further exacerbate the problem, coal prices had not been based on measurements of the actual quality of each coal delivery. Instead, prices were generally set for each mine on the basis of the mines "tested" average quality at the beginning of the production cycle (at the same time that the cost of mining the coal was calculated). However, quality often deteriorated beyond preliminary estimates because of inadequate attention to good mining practices and lack of financial incentives to meet agreed quality levels.

3.10 This pricing system has had a perverse effect on coal quality. Mines received no benefit from improving their coal quality, and were not penalized for declining quality or for increasing the non-coal content of their deliveries. Without incentives to do otherwise, whenever they were pressed for funds or were behind on production targets they could cut corners with impunity. During the initial years of Dadri's operations, coal quality was highly variable because of multi-sources of supplies, and at Badarpur coal quality sometimes declined enough to be classified two grades below its invoiced level.

3.11 Bank staff recognized that India's coal pricing framework was one of the basic causes of this problem, and held numerous discussions with GOI, CIL, and coal consumers about the importance of changing it to one where prices would be a linear function of the calorific value of the coal (and therefore its real value as a fuel) rather than setting prices in broad step increments. During the preparation of this project, the GOI had in fact accepted the principal of a new coal contracting formula, and had agreed to provide the Bank with a timetable to implement a revised contract. However, having won the point in principle, management failed to follow through. Instead, during negotiations management decided that they need not press the issue further, since the GOI had agreed in principle to change the pricing formula. This was an unfortunate mistake. Ten years later the CIL has still not been able to reach agreement with its major customers on a way to structure coal prices that would provide an incentive for coal companies to improve coal quality.⁵ All countries with market economies use delivered energy content (calories) and specific coal quality measures as the basis for coal pricing because this

5. In the last two years, GOI has decontrolled prices of grades A, B, C and D coals, while grades E to G are to be decontrolled by January 2001. CIL is also now empowered to fix/negotiate its prices for decontrolled coals. Further, the MOC/GOI has invited comments/suggestions from SEBs to change pricing system from one presently based on UHV to one to be based on GCV in future.

framework produces the most efficient coal markets; there is no economic reason for India to do otherwise.

3.12 Clearly, the Bank should have pressed much harder to get the GOI to introduce a revised coal supply system framework, if not for the whole sector, at least for the specific coal purchasing project to be financed under the loan.⁶ For this project, all parties would know the rules at an early stage, and could therefore design their projects to maximize their benefits from the new pricing system.

3.13 In general, the Bank should make more effort to use new investments as the place to introduce systematic changes in contractual relationships between buyers and sellers. These changes should be implemented and their impact evaluated before they are made mandatory for the entire sector. For the coal sector in India, in particular, **OED recommends for future loans for thermal power projects should include a new coal purchasing framework that close ties the price to the quality actually delivered. There is no excuse for not introducing new procedures in new projects, since the costs of adjustment are minimal.**

Coal Supply Contracting

3.14 The Bank did not review the fuel supply contract for Dadri. It did recognize that adequacy of coal supply was an important issue, and insisted on reviewing the development program of the coal mine that the government had assigned to supply Dadri before negotiations. However, it did nothing to ensure that the coal supply contract met minimum commercial conditions. Instead of insisting on also reviewing the commercial aspects of the contract before negotiations, the Bank stipulated only that the contract should be signed at least a year before the commissioning of Dadri's first unit.⁷

3.15 OED finds it difficult to understand why the completion of this contract should not have been made a condition of loan disbursement. Surely a long-term (20-year) supply contract can and should be negotiated before the mine is built, since pricing policies would (or at least should) have some impact on the decision about what technology to use in the mine, which quality of coal should be focused on in the investment planning stage, or what special measures might be needed to avoid penalties for not completing the mine development in program in time. One year before the power plant is completed, there is little margin for changing a mining development program or any broader design parameters to take into account incentives (or lack of incentives) for maintaining an agreed coal quality.

3.16 One result of this lack of a commercial contract was that the mine was not completed in time. Lacking a firm contract on quality requirements and penalties, CIL instead supplied coal from 12 different mines, during the first two years of Dadri's operation. The ensuing low and variable coal quality had a significant negative impact on plant operation, since it required day-

6. NTPC provided new information on this issue as follows: new fuel supply agreements (FSAs) being negotiated between NTPC and CIL are intended to move to such a framework. FSAs being now concluded between CIL and NTPC would be for a period of 10 years. For greenfield power projects, FSAs would be concluded before release of capital funding to be provided by NTPC to CIL, or its subsidiary to develop mine capacity (see Annex B).

7. NTPC commented that new FSAs for power plants being supplied by rail would be signed after FSAs for pit-head power stations, being currently worked out, have been finalized with CIL (see Annex B).

to-day, shipment-by-shipment adjustments to boiler operation. It was only when the mine whose output had been allocated to Dadri was opened that this coal quality problem was mitigated.⁸

3.17 The problem of coal deliveries at Badarpur was even worse. DESU was in desperate financial condition and was often unable to pay for its coal, and CIL's policy was to ship coal only when payment was made, or when it was forced to by order of the central government. Since DESU owned the plant and used the power, DESU was fully responsible for providing the coal. NTPC, as the operator but not the owner, was unable to ensure adequate coal supplies if DESU did not pay its bills, since it was only the operations service provider to DESU. As late as 1996 DESU owed about \$50 million to CIL and another \$100 million to the railroads. In addition to coal deliveries being frequently delayed, coal quality was highly variable, sometimes declining to as low as 1,300 kcal/kg. Given the problems that DESU was facing, a commercial contract would have had to include a clause requiring the opening of a bank letter of credit for future supplies, as was introduced a few years later for all SEB/CIL delivery contracts. It would also have included a clause establishing an acceptable method for measuring the calorific value of shipped coal, a pricing formula related to the calorific value of the coal, and appropriate penalties for delivering below-grade coal that would take into account the costs of using this below-grade coal.⁹

3.18 OED recommends that the Bank take the same interest in the details of supply contracts as would a commercial lending institution, since such contracts can be critical for the economic success of the undertaking. It is in this area of commercial interaction among quasi-governmental institutions that the Bank could be of greatest assistance to introducing market-oriented practices.

Coal Benefication

3.19 Identification of ways to improve the quality of coal used in power generation was explicitly identified as a project goal. Coal quality can be improved by improving quality control in the mining process, to reduce the amount of rubble mined with the coal, or by washing the coal before shipping it (benefication). In this latter process, the coal floats to the top while the heavy non-coal materials sink to the bottom. At the Bank's request, the central mine planning and design institute (CEMPDIL) undertook a study on coal benefication in the late 1980s. On the basis of the study results and in the interest of reducing transport requirements and improving power plant efficiency, the GOI introduced national regulations requiring that all coal shipped for more than 1,000 km should be processed so as reduce its ash level to no more than 34 percent. The first such benefication plant was built for the coal for delivery to Dadri, at a price of 160 Rs. per ton. At the time of the audit mission, the ash content of the coal being delivered had been brought down from 42 to about 37-38 percent, and NTPC had disputed the payment because this was appreciably less than the stipulated reduction.¹⁰

8. The Dadri plant is now being supplied with coal by Central Coalfields Limited (CCL) and this coal is beneficiated in the Piparwar washery.

9. Due to stipulations of the Ministry of Environment and Forestry (GOI) on control of particulate emissions in the Delhi area, the Badarpur plant is now being partly supplied with washed coal from CCL, and D grade coal from the Raniganj fields of Eastern Coalfields Limited. To reduce disputes on coal quality, the MOC has issued directions for starting joint sampling of coal at the power station.

10. According to new information provided OED in June 1998 by NTPC, the Piparswar washery has recently been able to reduce ash content of coal being supplied to the Dadri plant to a level of 34.2%.

3.20 The major problem with coal beneficiation technology is that its efficacy is determined by the physical nature of the coal. In Indian coal most of the ash is in the form of finely dispersed materials that cannot be separated from the coal through water based gravity processes. Moreover, even if the ash content can be successfully reduced to 32 percent, it is questionable whether the potential benefits will outweigh the costs. Benefits vary considerably from case to case, depending on the configuration of the power plant. Thus, one plant might find it economically justifiable to pay a significant premium for washed coal, because its boilers are designed to take advantage of a high-quality coal and its high-cost dry ash disposal system puts a premium on minimizing ash, while another might find that the benefits did not justify paying the same premium.

3.21 The cost of reducing the ash content will vary with each type of coal, as will the benefits that the consumer gets from the ash reduction. *Therefore, the GOI policy of requiring a fixed reduction in coal ash content is, in OED's view, a misguided attempt to set rules by administrative fiat, rather than allowing the market to play an active role in determining the appropriate technological choices.* Rather than establish an *a priori* "appropriate" ash content by regulation, and then requiring the user to pay the cost, whatever it may be, **OED recommends that the GOI establish a coal pricing system which includes ash content as well as actual heat value available from its combustion calorific content in the pricing mechanism, in a sliding-scale price formula. This pricing system would then allow the actual prices used in the formula to be negotiated between the producer and consumer.** The establishment of such a pricing structure would allow the seller to determine his supply curve (offer price) for each possible level of ash reduction, and would allow the buyer to use his demand curve to decide whether his savings from using the lower ash coal (including transport, wear and tear, and coal consistency) was worth the asking price. If the benefits are not sufficient to make up for the higher costs, the coal user should be free to contract for unwashed instead of washed coal.

Least-Cost Power Planning

3.22 The Bank never satisfactorily explored the question whether the project was consistent with the least-cost of the Northern Region's power grid system. And locating a plant 1200 km away from its coal supply is highly questionable on least-cost grounds. The government's primary concern was the maximization of power supply reliability for the nation's capital, and it believed that to achieve this end it had to locate the power plant within its physical jurisdiction.

3.23 In response to a headquarters suggestion that a study be undertaken to compare the economics of alternatives, especially the mine-mouth plant alternative, the Bank's field staff telexed on December 11, 1984: "[We] should warn you that the Central Electricity Authority (CEA) and NTPC have admitted that they are likely to find it very difficult to justify the NCR project on economic grounds. They are aware of the problems this creates for us and may therefore approach the Bank at a higher level." Instead the GOI argued that locating the plant at the demand center would reduce logistical, organizational, and managerial problems that could arise from excessive concentration of generation in a few locations, far away from the ultimate consumer and would also strengthen the local grid.

3.24 No serious economic analysis was done of rail transport of coal versus direct transmission of power. The SAR states in para 5.1: "CEA has, with the aid of the optimization model WASP II, prepared a least cost system expansion plan for the Northern Region" and that "the power station forms an integral part of the least-cost plan meeting the constraints outlined in

para 3.2.” But in para 3.2 it explains: “the acute shortages of power mean that areas with proportionately less generation are unable to maintain reasonable power supplies. Under these circumstances the only feasible way to maintain an adequate power supply to Delhi is to build more capacity in the area.” The only logical way to translating this tautological reasoning is: if the model is constrained to only one possibility, a power plant near Delhi, then this one possibility is the optimum solution. It should be noted, in addition, that since coal costs only Rs. 550 per ton at the loading platform in Bihar and costs about Rs. 2,300 per ton delivered at Dadri (including beneficiation costs), the transportation cost alone adds US\$.02-.03 per KWh to the cost of power generation. **OED therefore concludes that the Bank agreed to finance this project for “relationship” reasons, rather than because it was consistent with a least-cost power development program, and questions whether the method used to justify the project to the Board was appropriate.**

Environmental Issues

3.25 **Use of Fly Ash.** The high ash content of coal used for power generation makes ash disposal a major environmental issue for all thermal power plants. The land required to store the ash generated over a 30 or 40 year period is often substantially greater than that required for the plant itself, and is a big contributor to subsequent resettlement problems. To reduce this problem, the Dadri plant introduced a dry ash transport and disposal system for the first time in India. The advantages of dry disposal over wet disposal are, first, that there is no liquid effluence to be processed, and second, because the solid ash can be easily compacted, the ash mound can be built up to a height of 55 meters through a series of plateaus. Since the highest liquid ash dike settling ponds are currently less than 20 meters high, the dry system is capable of substantial land savings.

3.26 Dadri’s ash handling system had not been completed at the time of the ICR. The audit mission found that the system required about a year of adjustments before problems of excessively high wear were resolved, but once these problems were resolved it has worked essentially as planned. The result is environmentally sound. Seepage hazards into the groundwater are eliminated because the porosity of the ash is so low that even in the rainy season water penetrates no more than two meters. Dadri has also developed an effective ground-cover program to minimize dust dispersion in the dry season, and it is experimenting with various types of trees and bushes to see how they take to the novel environment. The purpose of this program is to provide medium-term ground-cover for parts of the mound that will be further heightened, and thereby minimize the need to cover the mounds with fresh soil before establishing an adequate long-term ground-cover.

3.27 Dadri management is also exploring new ways to make productive use of the ash. In addition to offering to use the ash as land fill to convert waterlogged swampland to agriculturally productive land, it is experimenting with technologies to use the ash in the manufacture of building materials. At one point when it found that there would be a substantial cost under-run (due to devaluation of the rupee), it proposed using about \$4 million to finance a commercial plant that would use the fly ash to make bricks, similar to one operating, presumably profitably, in the United States. The Bank approved the proposal in principal and requested that a feasibility study be made and submitted for review. The Bank never received a feasibility study, and the proposal was dropped.

3.28 OED found that the proposed brick plant was dropped because, on further investigation Dadri management found that the local market was not yet ready to accept non-traditional building materials. They therefore decided to establish small-scale demonstration plants to slowly introduce ash-based products, and to use the bricks to build some local buildings to demonstrate their effectiveness. It plans to offer the ash to private sector entrepreneurs willing to establish larger-scale manufacturing facilities to use it.

3.29 OED strongly supports this approach. It would be inadvisable for NTPC to try to start a subsidiary business for which they have no expertise, and where the private sector should be capable of operating once the products meet the test of market acceptability. ***OED recommends that the Bank be more careful about approving new uses for a project's "surplus" funds, even if the cost of such new subcomponents is small relative to the size of the original project. The Bank should be particularly cautious in providing its support for activities that are not part of the core business of the implementing agency and which could, without much difficulty, be implemented by the private sector.***

4. Ratings

4.1 *OED rates project outcome as unsatisfactory (as did the ICR).* While the power generation components of the project were implemented effectively by NTPC, the generated power is still being inefficiently used by DESU, whose distribution system has continued to deteriorate and whose losses appear to have continued to rise. We believe that it is not possible to judge a power generation project separately from the distribution system that supplies the power to the ultimate consumer.

4.2 *OED rates the project's institutional development impact as negligible.* Most of the project's institutional development gains were expected to improve the sector's capacity to efficiently distribute energy, but the distribution activities, which were under the DESU were never implemented. As a result, the project's overall impact on the sector was negligible and DESU's losses continue to increase. The ICR rates institutional development as partial because it finds that the narrow project objective of reducing NTPC's receivables was accomplished. OED believes that although it was important for the project to achieve its narrow objective of reducing receivables, this success had a negligible long-term sector impact because it was not accompanied by a sustainable method for keeping the problem from reoccurring. A long-term solution, which included establishing commercial contracts and bank letters of credit, was finally agreed to during negotiations for the NTPC Power Generation Project in 1993 and was implemented in 1996/97, after this project was closed.

4.3 *OED rates the project's sustainability as unlikely.* The ICR rates sustainability as likely because NTPC is an competent generation company which will maintain and run the project financed power plants efficiently. OED agrees with this assessment of NTPC. However, as with the previous ratings, OED believe that sustainability is a function of the entire system to efficiently deliver power to the final consumer, which depends on the capability of both the generation and the distribution entities. OED believes that unless major changes are implemented, DESU's will continue to financially unstable and its system losses will continue to increase. The Government will have to pay more of the electricity bill for DESU customers. And, with increasing losses there will have to be more power generated (and subsequently more pollution) for every KWh sold. OED therefore concludes that efficient utilization of the project's output is unlikely.

4.4 *OED rates overall borrower performance as unsatisfactory (as did the ICR).* This rating is based on the inability of the GOI and DESU to meet their commitments to resolve DESUs financial and institutional problem. The ICR rates NTPC's overall performance as satisfactory, with the exception of its covenant on accounts receivable, on which it was in default for several years. OED concurs with this assessment.

4.5 *OED rates Bank performance as unsatisfactory (as did the ICR).* The Bank accepted the project as presented because it was important to the GOI, which was responsible for the Delhi area. Knowing the political difficulty of resolving DESU's financial problems, the Bank should have insisted on a satisfactory solution before presenting the project to the Board.

5. Major Lessons and Recommendations

5.1 *Because DESU, the distribution entity that used the power generated in this project, was not strengthened, a significant amount of the power produced by this project is not reaching the final consumer.* The Bank should not support power generation projects that will supply power to an inefficient, loss-making distribution company, even if the generation company is itself efficient. When, in addition, tariffs paid by large consuming groups are far below costs of generation and distribution, there is no evidence that, at the margin, the economic value derived from the (wasteful) consumption of power from a new generation plant is greater than costs of supplying it. In these situations rehabilitation of the distribution system might provide much higher rates of return. Expanding power generation may be easier to accomplish, but it should not be a substitute for improving the efficiency of the distribution system. Additional investment in generation is likely to be a “second best,” and unjustifiable alternative. The Bank, therefore, needs to reevaluate the justification it uses to support generation projects in such circumstances.

5.2 *Proper financial incentives are needed to induce government entities to operate efficiently.* For infrastructure investments, particularly in the energy sector, the Bank should encourage governments to introduce market oriented changes in framework for contractual relationships between project-related buyers and sellers. Such changes could be limited to the project-related entities and their impact evaluated to see if they could be implemented on a sector-wide basis. In particular, future loans for thermal power projects in India should include establishment of a new, more efficient pricing structure for coal. It is with such new projects that change is possible because adjustment costs and the potential institutional resistance are lowest. The Bank should assist in introducing market oriented practices by analyzing the commercial implications of contractual relations between the project entity and its suppliers and customers, since these contracts are critical element of the economic and financial success of the undertaking.

5.3 *Commercial relations among quasi-governmental institutions is an important area where the Bank could assist in introducing market-oriented practices.* The Bank needs to undertake detailed analysis of the contractual interface between the project entity and its suppliers and consumers, as do commercial lending institution, who understand the critical nature of these contracts for the economic and financial success of the undertaking.

Annex A**Basic Data Sheet****National Capital Power Supply Project - Phase I
(Loan 2844-In)****Key Project Data** (amounts in US\$ million)

	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
Total project costs	1542.1	714.7	46
Loan amount	425.0	322.8	76
Cancellation	--	162.2	--
Economic rate of return	11%	18.7%	--

Cumulative Estimated and Actual Disbursements

<i>FY</i>	<i>88</i>	<i>89</i>	<i>90</i>	<i>91</i>	<i>92</i>	<i>93</i>	<i>94</i>	<i>95</i>	<i>96</i>
Appraisal estimate (US\$M)	34.0	80.0	153.0	238.0	314.0	369.0	408.0	425.0	
Actual (US\$M)	38.5	75.6	125.5	185.7	245.3	270.1	295.5	296.7	322.8
Actual as % of appraisal	113	80	68	71	78	45	65	7	
Date of final disbursement:	May 3, 1996								

Note: Appraisal disbursement estimates correspond to Bank FY July through June.

Out of US\$425 million for the NTPC Component, US\$102.2 million was canceled as not required.

US\$60.0 million for DESU component was canceled in 1990 as GOI and DESU were in default of their commitments.

Project Dates

	<i>Original</i>	<i>Actual</i>
Identification	--	1983
Preparation	--	6-7/84
Preappraisal	--	11-12/84
Appraisal	--	5/86
Negotiations	--	2/87
Board approval	--	6/87
Signing	--	12/87
Effectiveness	11/87	3/88
Cancellation of DESU Component	--	8/90
Project Completion	--	12/31/95
Closing date	6/30/95	12/31/95

Annex A

Staff Inputs (staff weeks/US\$)

<i>Stage of Project Cycle</i>	<i>Planned</i>		<i>Revised</i>		<i>Actual</i>	
	<i>Weeks</i>	<i>US\$('000)</i>	<i>Weeks</i>	<i>US\$('000)</i>	<i>Weeks</i>	<i>US\$('000)</i>
Through appraisal					26.5	61.8
Appraisal - Board					83.9	163.4
Board - Effectiveness					6.3	14.7
Supervision					56.9	160.4
Completion	8.5	30.8	6.5	22.7	9.0	23.3
Total					182.6	423.6

Mission Data

	<i>Date (month/year)</i>	<i>No. of persons</i>	<i>Staff days in field</i>	<i>Specializations represented^a</i>	<i>Performance rating^b</i>	<i>Rating trend</i>	<i>Types of problems^c</i>
Identification/ Preparation							
Appraisal							
Supervision	2/88	5	4	E, FA, PR	1	HS	I, IN
	5/88	3	3	E, FA, EN	2	S	I
	10/88	4	3	E, FA, EC	2	S	I
	8/89	4	3	E, FA, EC	2	S	PR
	9/90						
	2/91	1	2	E	2	S	PR
	7/91	3	3	E, FA, EN	2	S	I
	2/92						
	10/92	2	3	E, FA	2	S	I
	6/93	4	3	E, FA, EN	2	S	I
	9/93	7	5	E, FA, EC, EN	2	S	I
	1/94	5	3	E, FA, EN	2	S	I
	6/94	5	3	E, FA, EN	2	S	I
	10/94	4	3	E, EN	2	S	I
	11/95	1	4	E	2	S	I
Completion	11/95&2/96	1	6	E	2	S	I

a. E=Engineer; FA=Financial Analyst; EC=Economist; EN=Environmental Specialist; S=Specialist

b. 1=No or minor problems; 2=Moderate problems; 3=Major problems.

c. I=Implementation delays; IN=Institutional problems; PR=Procurement delays.

Annex A**Other Project Data**

Borrower/Executing Agency:

FOLLOW-ON OPERATIONS

<i>Operation</i>	<i>Loan no.</i>	<i>Amount (US\$ million)</i>	<i>Board date</i>
Talcher Thermal	2845-IN	375	6/17/87
NTPC Power Generation	3632-IN	400	6/29/93

Annex B



नेशनल थर्मल पावर कॉर्पोरेशन लिमिटेड
(एन एन डी एन)
National Thermal Power Corporation Ltd.
(A Government of India Enterprise)

केन्द्रीय कार्यालय
CORPORATE CENTRE

S.L. KAPUR
Executive Director (Corp. Planning)

01/CP/5.103
June 23, 1998

Dear Mr. Berney,

I want to thank you for sending a copy of the Draft audit report for the National Capital Power Project (LOAN 2844-IN). The report brings forth the overall performance of the project based on critical analysis of performance of the project components such as a) Construction of Dadri Thermal Power Project, b) R&M of BTPS, c) Construction of 400 KV ring main around Delhi d) Improvement of quality of Coal used in Power generation e) Making DESU a financially viable enterprise.

For the components at (a) and (b) NTPC is the implementing agency and for c), d) and e) the implementing agencies are DESU/GOI/CIL etc.

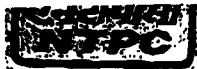
The report labels NTPC project components at (a) and (b) as highly satisfactory (para 2.1, 2.2 and 2.4). But the overall performance of the project earns unsatisfactory rating because of failure of other components of the project.

Although the ICR rating of NTPC performance as satisfactory has been concurred by OED in the report (para 4.4) the principal ratings on page 3 does not reflect the same. The rating of NTPC has been blurred, in spite of the overall satisfactory performance, due to unsatisfactory performance of other components of the project (performance of DESU in particular) as brought at in para 4.1, 4.2 and 4.4.

The project's overall objective, as mentioned in para 1.2, was to augment and improve the efficiency and reliability of New Delhi's power supply through its various components which grossly remained unfulfilled due to failure of some of the components. This has been brought out in the para 4.1 as "OED rates the project outcome as unsatisfactory. While the power generation components of the project were implemented effectively by NTPC, the generated power is still being inefficiently used by DESU, whose distribution system has continued to deteriorate and whose losses appear to have continued to rise. We believe that it is not possible to judge a power generation project separately from the distribution system that supplies the power to the ultimate consumer."

While agreeing with the mission in its approach to have a holistic assessment of overall project rating, the performance of its individual components cannot be ignored. NTPC, as a growing and performing organisation, draws inspiration from its achievements and deserving assessments made by esteemed organisation such as World Bank. **It is unfortunate that NTPC, in spite of its best performance in its component of the project, is also rated as unsatisfactory because of reason attributable to other agencies.**

Annex B



केन्द्रीय कार्यालय
CORPORATE CENTRE

Hence, it would be our suggestion that along with Principal Ratings in page 3 rating of individual project components are also mentioned separately so that the report reflects the performance of the overall project as well as its components thus conveying a more transparent and clear analysis.

We are faxing these comments to you for suitable inclusion in the text of the report.

With regards,

Yours sincerely,

(S. L. KAPUR)
Executive Director (CP)

Mr. Richard Berney,
Principal Evaluation Officer,
Sector and Thematic Evaluation Group,
Operation Evaluation Department
The World Bank
1818 H Street N.W.
Washington D.C. 20433, U.S.A.

Additional Comments on Draft Audit Report for NCPP (LOAN 2844-IN)

Coal quality and Coal Pricing :

Para 3.9 Payment of coal is made on the basis of UHV corresponding to a particular grade on rake-wise/source-wise basis. However, because of large range of UHV in a grade there is little scope for incentive to Coal Company for effecting further improvement of quality. The range of UHV in a grade should be small so that coal co. is encouraged to improve upon quality by putting in extra efforts/precautions.

Para 3.10 Coal quality at NCPP in the initial stages was very much varying because of multisources of supply. This is not so now and NCPP/Dadri is getting consistent supply of washed coal from CCL/NK with improvement in quality.

Para 3.11 MOC/GOI has invited comments/suggestions from SEB's to change the present pricing system based on UHV to GCV basis. GOI has already decontrolled prices of A,B,C, & D grades coal and other grades too would be decontrolled from Jan 2001 and Coal India has been empowered to fix the prices. Negotiations for fuel supply contracts are in advanced stage which would incorporate necessary clauses for incentive/penalty for quantity and quality both.

Para 3.12 This is being taken care of in New Fuel Supply Agreements.

Coal Supply Contract

Para 3.14 Fuel Supply agreement for Rail Fed Power stations like Dadri and FGUTPP would be signed with CIL after finalisation of Pit Head Power stations agreements.

Para 3.10 Fuel Supply agreement now being concluded would be a period of 10 years. In new projects fuel supply agreements would be concluded before releasing of capital funding by NTPC to CIL/its subsidiary.

Para 3.16 NCPP is getting now sustained supply of washed coal from CCL / NK coalfield.

Para 3.17 Because of MOEF stipulations, BTPS is now being supplied partly washed coal from NK/CCL and some 'D' Grade coal from Raniganj/ECL. To reduce the disputes on account of quality, MOC have issued directives for starting joint sampling of coal both at power stations and by the same agency.

Annex B

Coal Beneficiation

Para 3.19 NCPP is linked with Piparwar Washery of CCL. Ash content has come down in the beneficiated coal to 34.12% ash. MOEF has laid down stipulations that power stations located beyond 1000 km. Should use coal with not more than 34% ash.

Para 3.21 Pricing system should be based on-actual heat value available for combustion so that extra moisture getting its way due to washing may be taken care of. The range of heat value for pricing purpose in different grades should be small so as to give incentive to motivate Coal Co. for effecting improvement in quality. Penalty clause may be introduced if the quality goes below a particular level.

CATALOGUERS/FILE *OEDST*

Report No.: 18115
Type: PPAR