INDIA

Chandrapur Thermal Power Station Expansion Project

Report Date: July, 2002
Field Survey: September, 2001

1. Project Profile and Japan's ODA Loan

Location Map of the Project

Chandrapur Thermal Power Station

1.1 Background

The State of Assam, located in the northeastern part of India, was at the time of project appraisal one of the most economically backward states in the country. As of 1979, Assam had an area of 78,500 km^2 and a population of 1.8 million. Power consumption per capita was 33 kWh and the state's electrification rate was 26%, far below the respective averages of 135 kWh and 42% nationwide. Demand for power far exceeded supply within the state, causing the state government to implement a power-demand restraint policy, to execute load shedding[*1] and to purchase power from Meghalaya State. This power shortage was also a serious hindrance to the development of the state.

Chandrapur thermal power station (hereafter Chandrapur TPS), commissioned in December 1972, was located in the vicinity of the state capital (the state capital of Dispur City and adjacent Gauhati City), the largest industrial area in Assam State. The power station was run on LSHS and LSFO[*2] and had generation capacity of 30 MW. Since its commissioning, the power station had played an important role in providing power to the state capital region, and consequently the state had an enormous need for the present expansion project. In addition, this project was listed as one of the state's most important power development projects in its sixth five-year plan (1980/81-1984/85).

1.2 Objectives

To install a thermal power generation unit of 30MW in the existing Chandrapur Thermal Power Station in Kampur District, Assam State, and meet power demand in the state

1.3 Project Scope

As part of the project, an additional generation unit, with a capacity of 30 MW, was added to Chandrapur TPS. The project scope was comprised of the following 3 components:

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[1] Load Shedding: Removal of pre-selected demand from a customer's electric system to maintain electric load below a certain level.

[2] LSHS: Low Sulphur Heavy Stock Oil. LSFO: Low Sulphur Furnace Oil

- Installation of boiler and appurtenance, control equipment, electrical facility (paid for in foreign currency)
- Installation of turbine generator and auxiliaries (paid for in local currency)
- Engineering works for facility expansion (paid for in local currency)

Total project cost was 5,819 million yen equivalent, of which 1,420 million yen was covered by a Japanese ODA loan.

1.4 Borrower/Executing Agency

The President of India / Assam State Electricity Board (ASEB)

1.5 Outline of Loan Agreement

Loan Amount Loan Disbursed Amount	1,420 million yen 1,416 million yen
Exchange of Notes Loan Agreement	March 1981 June 1981
Terms and Conditions Interest Rate Repayment Period (Grace Period) Procurement	 2.75 % p.a. 30 years (10 years) Partially Untied
Final Disbursement Date	June 1986

2. Results and Evaluation

2.1 Relevance

Originally, planners designed Chandrapur TPS to accommodate increasing of power demand and ensure stable power supply in Assam State. The power station was built with one 30 MW generation unit and had been operating since December 1972. At the time of appraisal, Assam was facing a serious power shortage. In view of the region's inability to meet peak power demand, and in order to gain maximum benefit from valuable oil resources in the state, the Planning Commission of the Government approved this expansion project in July 1979 as a part of the state's sixth five-year power development plan (1980/81-1984/85). The installation of the additional 30 MW power generation unit at Chandrapur TPS was consistent with development policy as it was then delineated.

Due to the recent rapid growth of oil consumption, the Government of India currently is attempting to limit its dependence on oil imports by expanding domestic exploration and reducing domestic oil consumption. India has decided to abolish subsidies for and to deregulate several oil products as well. While the central government's deregulation policy resulted in the exorbitant escalation of fuel oil prices, the state government has not been able to raise its electricity tariff for political reasons. As a result, Chandrapur TPS has been forced to suspend operations; it can not recover the fuel costs with the low electricity tariff and is no longer financially viable. Assam still faces a serious power shortage, so the project objective remains relevant. However, the project becomes less consistent with central and state government policies. (Details will be discussed in 2.3.2)

2.2 Efficiency in Project Implementation

2.2.1 Project Scope

The project scope was actualized without any major deviation from the design adopted at appraisal.

2.2.2 Implementation Schedule

The project was completed in January 1989, five years after the originally scheduled completion date of February 1984. The project was started in the final quarter of 1981. However, the civil work and installment

of equipment were suspended in 1982, after drastic increases in fuel oil prices stemming from the Second Oil Crisis raised concerns about the escalating cost of power generation. Work on the project was put on hold until fuel oil prices decreased and resumed on 13th July 1984. In addition, there was subsequently a conflict between the Government of India and the supplier of the equipment over a suspension charge, which resulted in procurement delays directly related to the project facilities.

The site of excavation work for the project facilities was situated next to the existing generation unit. Thus blasting work was carried out with scrupulous care. In addition, the use of blasting materials was strictly regulated by the State Government. Accordingly, the excavation work took much more time than originally scheduled. These delays were prolonged by a contractor strike over lack of payment from ASEB and a flood, which adversely affected progress in transporting the equipment/ facilities to the project site.

2.2.3 Project Cost

Regarding the Japanese ODA portion, 1,416 million yen was disbursed, accounting for 99.7% of the approved amount of 1,420 million yen. Given the amount of time that has passed since completion of the project, ASEB no longer has reliable records of the project's local cost portion and there is no other reliable means of determining the actual total project cost. However, according to the most up-to-date records, project costs were substantially higher than the estimated budget, owing to the following factors:

- Customs duties on items imported from Japan doubled as a result of the appreciation of the Japanese yen vis-à-vis the Indian rupee.
- Delays in starting the project caused ASEB to make additional payments for suspension charges to the suppliers amounting to 22.5 million rupees.
- The tendered prices exceeded estimates for certain items, such as the generator transformer, unit auxiliaries, transformer, reserve power transformer, control panel, cooling water pump, switchgear and fire fighting system.

The revised cost estimation was approved by the Government of India, which financed the additional expenditures.

2.3 Effectiveness

2.3.1 Operational Performance of the Project Facility (Unit 2)

Under the project, a generation unit with capacity of 30 MW, namely Unit 2, was constructed within the existing site of the Chandrapur TPS and commissioned in January 1989.

However, Unit 2 did not operate well after commissioning owing to abnormal vibration of its turbine. This problem was resolved with the help of the equipment supplier, and the unit started commercial operation on 4th May 1989. However, in November 1991 the unit was forced to shut down a second time, again due to unusual vibrations of the turbine and to subsequent leakage of lubricant oil from the bearing of the turbine. The repair of the turbine took 2 years and 11 months because of an insufficient budget and a lack of spare parts. As a result of frequent problems[*3] , the unit has operated at a suboptimal and, consequently, failed to achieve the target levels outlined at appraisal (see the Figure-1 and the Table-1). In addition, as the existing unit- Unit 1- ages, its operational performance has also deteriorated since the middle of 1990's.

[3] Including a problem with the generator's motor (8th May 1997 – 19th Oct. 1997), and a fire in the pre-heater of the boiler (24th May 1997 – 15th July 1998)

The design adopted for Unit 2 was almost the same as Unit 1[*4]. However, when a comparison is made between the operational performance of Unit 1 and that of Unit 2, the latter is obviously inferior, mainly due to the above-mentioned problems.

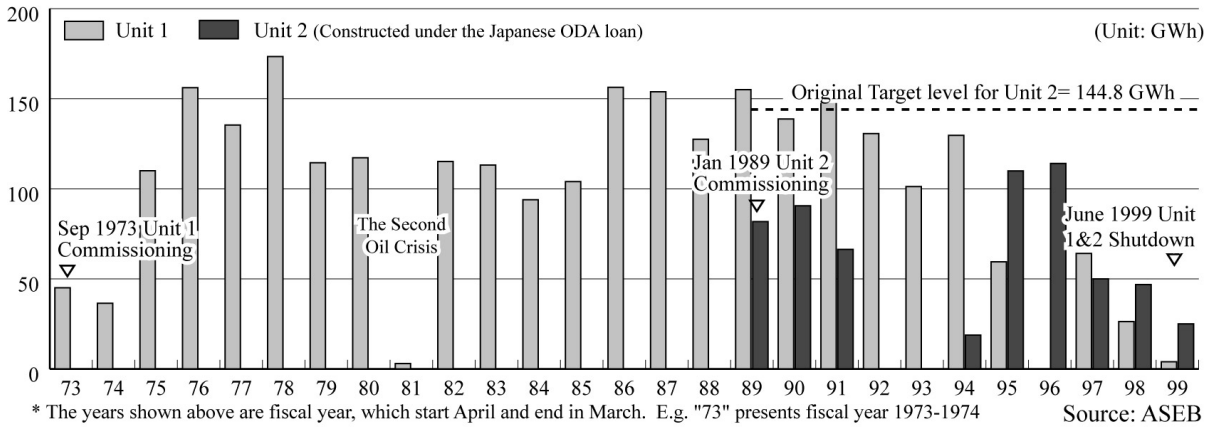

Figure-1: Net Energy Production of Unit 1 & 2

Table-1: Operational Indicators and Target Levels of the Unit 2

	Target*	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00
Maximum Output (MW)	30.0	29.5	30.0	30.0	0.0	0.0	30.0	24.0	21.0	26.0	25.0	26.0
Plant Load Factor[*5] (%)	58.0	33.4	37.1	27.7	0.0	0.0	8.0	45.8	47.7	21.3	20.2	10.6
Fuel Consumption Rate (liter /kWh)	0.34	0.352	0.339	0.347	-	-	0.369	0.373	0.365	0.367	0.370	0.371
Heat Rate[*6] (kcal/kWh)	2,600	3,254	3,134	3,208	-	-	3,365	3,452	3,220	3,243	3,267	3,429
Availability Factor[*7] (%)	-	36.20	45.20	34.80	0.00	0.00	11.50	70.70	75.90	39.10	39.40	19.00

Note: Target level is quoted from the appraisal report of the project Source: ASEB

To rehabilitate the deteriorated conditions of the power station, the Central Electricity Authority (CEA) decided to carry out a Renovation and Modernization (R&M) program[*8] for the Chandrapur TPC in July 1998. Under the scheme, a loan of 4.26 million rupees was readied by the Power Finance Corporation[*9] (PFC) for the program's execution[10].

2.3.2 Suspension of Operations due to Soaring Fuel Oil Prices

Fuel oil prices had increased with the deregulation of oil product prices, as explained below. As a result, the operation of the power station was restricted; the station operated only when power demand could not be met from other, cheaper sources, particularly during dry season, when the availability of hydro power as an alternative was uncertain. The executing agency stopped the two units at Chandrapur TPS in June 1999,

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4 The boiler, turbine and generator of Unit 1 as well as the boiler of the Unit 2 were constructed by the Japanese supplier, while the turbine and generator of Unit 2 was constructed by a domestic supplier in India.

5 Plant Load Factor: The ratio of the electrical energy produced by a generating unit for a year to the electrical energy that could have been produced at continuous full-power operation during the year.

6 Heat Rate: A measure of thermal efficiency, which is computed by dividing the total calorie content of fuel burned for electric generation by the resulting gross kilowatt-hour generation. A smaller figure indicates higher efficiency.

7 Availability Factor: The factor is worked out by dividing the unit's operation hours for a year by total hours of the year.

8 In order to improve the performance of the existing thermal power stations, an R&M Programme phase II was launched by the Government of India in the year 1990-91. Under this programme, 44 thermal power stations consisting of 198 units aggregating to a total capacity of 20869.435 MW are covered. The total sanctioned cost of all the schemes is 23.8 billion Rs.

9 Power Finance Corporation: The corporation was established in July 1986 as a Development Financial Institution dedicated to the Power Sector. It is a public sector company wholly owned by Government of India. Main objectives of the corporation are to finance, facilitate, and promote power sector development in the country.

10 Although necessary parts had already been procured for R&M program, the rehabilitation works have been postponed because Chancrapur TPS has suspended its operations since June 1999 due to the increases in fuel oil prices (The details will be discussed in the subsequent section).

with the intention of reactivating them during the following dry season. But fuel oil prices increased rapidly from June 1999 to January 2000 (see the Table-2), forcing the power station to suspend operations and ASEB had to execute further load shedding because of less power availability. Since then the power station has been stopping operations.

The Units of the Chandrapur TPS are run on two kinds of fuel oils, LSFO and LSHS. Fuel oil for the Chandrapur TPS was supplied from the Narengi refinery, in Gauhati, and from the Digboi refinery[11] , by the Indian Oil Corporation Ltd.[*12] (IOC), at a concessionary rate, as per the agreement of the year 1967. When the 25 -year contract between ASEB and IOC expired on September 2, 1997,[*13] the concessional price was invalidated. As a result, the basic price of LSHS and LSFO rose suddenly, by 127% and 123%, respectively.

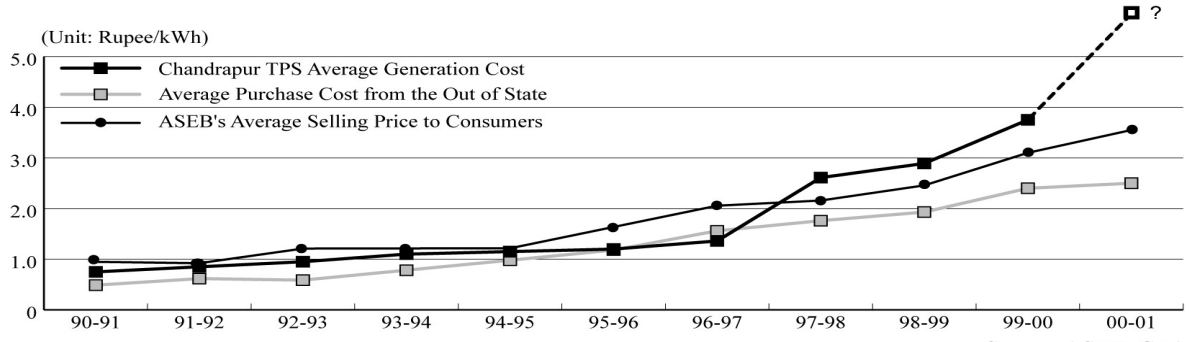
Originally, oil prices in India had been regulated under an administrated pricing mechanism. The price was decided by the Oil Cost Review Committee under supervision of the Ministry of Petroleum and Natural Gas. And refineries were protected by the retention pricing mechanism. However, since the 1st April 1998 deregulation of oil product prices[14], the pricing principle has used on import parity. The Government has also stopped using the retention price mechanism for refineries. As a result, refineries have to purchase crude oil at import parity. Thus, IOC has started claiming enhanced prices of the fuel from 2nd September 1997. In addition, the price of international crude oil increased rapidly during 1998-2000. Soaring crude oil prices were reflected directly in the domestic fuel oil price. The basic and gross[*15] price of LSFO and LSHS before and after expiration of the contract, deregulation and time-to-time rise of prices, is shown in Table-2.

Table-2: LSHS and LSFO Prices (Unit: Rupee/MT)

Effective from		1st Jan. 1997	2nd Sep. 1997	1st Dec. 1998	1st May. 1999	1st Jun. 1999	21st Sep. 1999	1st Nov. 1999	1st Dec. 1999	10th Oct. 2000
LSFO	Basic	2,504.1	5,142.5	5,350.0	5,250.0	5,500.0	7,120.0	8,436.0	8,840.0	9,520.0
	Gross	3,106.9	5,768.3	6,510.2	6,458.5	6,748.0	8,797.2	10,907.5	11,383.1	12,241.0
LSHS	Basic	2,682.5	6,089.2	5,730.0	5,630.0	5,090.0	8,170.0	9,030.0	9,470.0	10,200.0
	Gross	3,045.9	6,793.2	6,399.0	6,289.0	5,984.0	9,083.0	10,716.8	11,236.1	11,643.0

Source: ASEB

As a consequence of the rapid increase in the fuel price, the unit generation cost at Chandrapur TPS reached 3.75 rupees/kWh in 1999-00, 170.0% higher than 1996-97 (1.39 rupees/ kWh). Since 1997-98, the generation cost has been higher than the state's average selling price to consumers. When taking transmission, distribution, and administration expenses into consideration, it is clear that the generation was far from financially viable. Further, fuel oil prices doubled after shutdown of the power station. If ASEB had been operating the power station on 10th October 2000, generation costs would have reached 6.12 rupees/ kWh. Although international crude oil price has, currently, fallen back to year 1999 levels, generation is still far from affordable.



Source: ASEB, CEA

Figure-2: Rapid Increase in the Average Generation Cost of the Chandrapur TPS

[11] Digboi refinery is located 350 km west-northwest of Gauhati, capital city of the Assam State.

[12] The Indian Oil Corporation Ltd. was established in 1959 as a state owned oil refining and marketing company. As of 2000, the corporation had 8 refineries with capacity of 35.6 million ton per annum, and accounted for 56% of oil market in the country.

[13] The contract took effective from September 1972 or three months prior to the commissioning of the Chandrapur TPS.

[14] Oil accounts for about 30% of India's total energy consumption. The majority of India's roughly 4.8 billion barrels in oil reserves are located in the Bombay High, Upper Assam, Cambay, Krisha-Godavari, and Cauvery basins. India had net oil imports of over 1.1 million barrels per day (bbl/d) in 2001. Future oil consumption in India is expected to grow rapidly, to 3.4 million bbl/d by 2010, from 1.9 million bbl/d in 2001[14]. Given conditions, the Government of India is attempting to limit its dependence on oil imports somewhat by expanding domestic exploration and reducing domestic oil consumption. Given conditions, the Indian decided to abolish subsidy for several oil products, and to deregulate several oil products. Such policy coupled with the recent soaring of international crude oil price resulted in sharp increase in fuel oil (LSFO and LSHS) price for the power station.

[15] Gross Price includes basic price of oil product, state surcharge, delivery charge, Assam Government sales tax, central excise duty, etc.

2.3.3 Re-evaluation of the Financial Internal Rate of Return (FIRR)

At the time of appraisal, the FIRR was estimated at 6%. For this calculation, the project's benefit was defined as the incremental revenue generated by the project. According to the estimation at that time, Unit 2 was supposed to operate at 58% of plant load factor and to generate 144.8 GWh per annum. However, as mentioned in 2.3.1, the project outcome was far below the target levels, while the project cost exceeded the targets. Based on these circumstances, the re-evaluated project's benefit is thought to be lower than the project's costs. Thus, the re-evaluated FIRR is negative.

2.4 Impact

2.4.1 Positive Socio-Economic Impacts

a) Contribution to the demand-supply balance in Assam State

Gauhati, the premier city of the Northeastern Region, is 30 km from the Chandrapur TPS. Most of the power produced by the power station was consumed in this city. Also, a paper mill company, situated at a distance of 30km from the project site, used to get uninterrupted power from the power station, even during load shedding. In light of the severe imbalance of demand and supply in the state, the project made a certain contribution to minimizing the severity of imbalances, which adversely affected consumers. However, the contribution of Unit 2 was, for such consumers, far below expectations.

Currently, ASEB has six power stations with a total installed capacity of 574 MW, against a peak demand of 503.5 MW. However, some are actually not in operational condition due to aged deterioration and economic reasons. Therefore, the supply capability of ASEB's power stations is only 130 MW. In order to meet demand, the state purchases electricity from the Meghalaya State Electricity Board, the NTPC[*16] and the NEEPCO[*17].

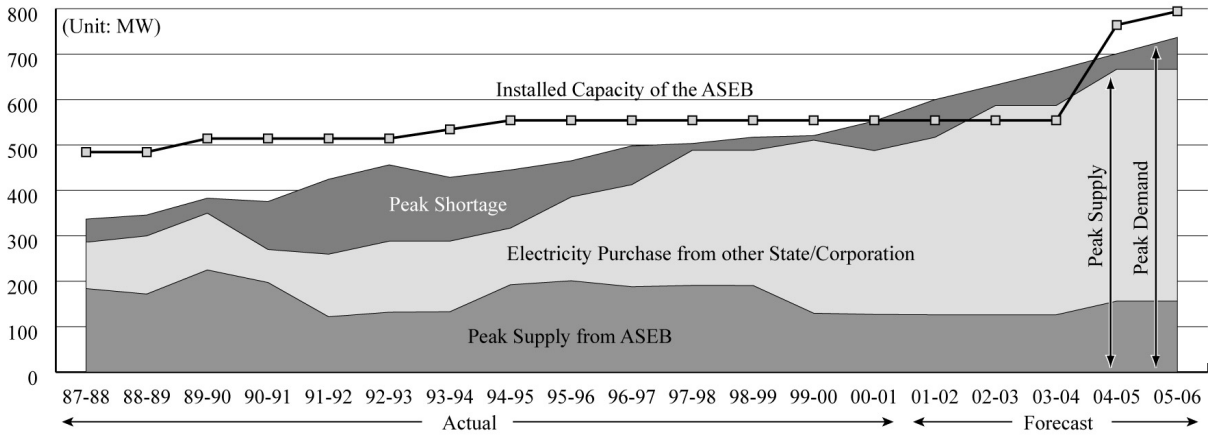


Figure-3: Demand-Supply Balance in Assam

Source: ASEB

During 2000-01, a total of 936 GWh of power was generated in the state, and 1,740 GWh of power was imported. Even so, peak demand met during the period for the state was 488 MW with a shortfall of 65 MW. Accordingly, the state constantly carries out load shedding. In addition, in order to control peak load, the state has enforced the power-demand restraint policy within the state. In line with this policy, stores and other commercial facilities[*18] have to close between 17:00 to 5:00 and factories[*19] are required to stop operations from 17:00 to 23:00. This policy, coupled with load shedding, has depressed the state's economy. In 1998-99, the amount of power consumption per capita, 122.51 kWh, was still far below the

[16] The National Thermal Power Corporation: The corporation is the largest thermal power generating company of the country, and is a public sector company wholly owned by Government of India. It was incorporated in the year 1975 to accelerate power development in the country.

[17] The North Eastern Electric Power Corporation: The corporation was incorporated in 1976 as a wholly government owned enterprise to exploit, utilize and develop the inherent power generation capability of the North East for the benefit of the Region and the country at large.

[18] With exceptions such as hotels, restaurants, tobacconist's shops, movie theaters and drug stores.

[19] With exceptions such as refineries, newspaper printing offices, railway related factories, and fertilizer factories.

national average of 359.57 kWh.

b) Promote of the Employment in Vicinity Area

Assam State, bordered on the south by Bangladesh, houses many refugees from Bangladesh. Most residents living near the project site are refugees, and their per capita income is said to be very low. After the project, the number of employees in the power station nearly doubled. The power station also generated new employment of refugees; approximately 70 refugee youths were hired, directly or indirectly, to work in the power station.

2.4.2 Negative Socio-economic Impacts

The land for the Unit 2 had been acquired in the 1960's (prior to the construction of Unit 1). Accordingly, land acquisition and resettlement/ relocation was not involved in this project.

2.4.3 Environmental Impact

Although the power station has not established an environmental monitoring system, monitoring of effluent water from the power station and stack emissions was carried out twice a year by the Assam State Pollution Control Board (ASPCB). The fuel oils used in the power station -- LSHS and LSFO -- contain little sulphur (0.45%) and even less ash (0.05%). Thus, the emission of sulphur oxide, SPM[*20] is considerably less than with conventional fuel oil. According to ASEB, monitoring results showed stack emissions and effluent water were within the environmental standards prescribed by ASPCB.

The power station is situated on the bank of the river Kalang, and the nearest village is located 0.5 km away from the project site. So far there have been no reports of noise or vibration.

2.5 Sustainability

2.5.1 Profile and Current Conditions of ASEB

a) Profile of ASEB

The operation and maintenance of the power station is overseen by the Assam State Electricity Board. ASEB was originally constituted on 1st June 1958 under the Electricity (Supply) Act of 1948. But the existing ASEB was reconstituted in 1975 when the original territory of Assam State was divided into Assam, Meghalaya and Mizoram states. ASEB is responsible for generation, transmission and distribution of electricity in the state of Assam.

b) Financial Viability of ASEB

According to the Electricity Supply Act of 1948, the State Electricity Board (SEB) is required to earn a minimum rate of return (ROR) of 3% on net fixed assets in service, after providing for depreciation and interest charges. The State Government can prescribe a higher return if necessary. However, most of the SEBs have yet to comply with this statutory stipulation. According to the CEA, during the 1997-98 period, ROR of the SEBs was -11.8% on average, while the ROR of ASEB in the same year was -42.5%.

Table-3 shows profit and loss records for ASEB over the last five years. In 1996-97, ASEB still sustained its gross operating surplus. However, as a result of the soaring fuel prices and insufficient tariff increases, ASEB has run deficit since 1997-98. In order to cover the deficit and to obtain some profit, the electricity tariff in the state has progressively been increased since 1998-99. In 1999-00, the average electricity tariff in the state, 3.12 rupees/ kWh, was the highest among the SEBs. However, an incremental electricity tariff was still not enough to cover the incredibly high production cost. Taking highest electricity tariff among the SEBs and the state's economically underdeveloped condition into account, further rapid tariff increases were deemed to be difficult.

The unit cost of power supply at ASEB in 1999-00 was 5.11 rupees/ kWh, which was considerably higher than the SEB's average of 2.49 rupees/ kWh and the highest among the SEB's. These high production costs resulted from surplus manpower[*21], high transmission costs and distribution losses. Furthermore, ASEB's numerous interest payments, accounting for 22% of total expenditures in 2000-01,

[20] SPM (Suspended Particulate Matter): Small particles of solids or solids suspended in air.

[21] The number of employees per thousand consumers in the ASEB was 26.6 in 1997-98, which was considerably higher than the SEB's average of 10.4 in same year. Moreover, the number of employees per kWh of electricity sold in the ASEB was 10.77, which was more than three times the SEB's average of 3.32.

have been a heavy burden.

Table-3: Resent Five-Years Profit and Loss of ASEB (Unit: million rupees)

	1996-97	1997-98	1998-99	1999-00	2000-01
Total Revenue	417.14	419.01	464.98	600.80	738.04
Revenue Expenditure	373.84	531.05	496.07	666.79	771.98
Gross Operating Surplus	43.30	-112.04	-31.09	-65.99	-33.94
Depreciation	60.98	77.82	78.91	85.83	90.04
Total Interest Payable	226.47	249.19	216.53	205.7	242.96
Commercial Profit/ Loss	-244.15	-439.05	-326.53	-357.52	-366.94

Source: CEA

c) Restructuring of the Power Sector of the Assam State

In order to improve the financial conditions of ASEB, various measures, including restructuring of the power sector, are being implemented. In line with the policy, the Assam State Electricity Regulatory Commission was established in August 2001 to determine a reasonable tariff. In addition, the Assam Power Corporation, distribution companies and the Assam Rural Electrification Corporation will be established.

The Assam Power Corporation will take over the generation and transmission functions of ASEB. Subsequently, generation management will become the responsibility of one or more companies, and eventually be privatized. Meanwhile, the transmission function will remain in the domain of the public sector. The state will set up distribution companies to handle this. Selective urban areas may be leased out to private entrepreneurs. Moreover, in order to reduce transmission and distribution losses at all voltage levels, an energy audit will be undertaken covering: i) installation of metering at all 11 kV feeders by 31st July 2001, ii) 100% metering of all consumers by 31st December 2001, and iii) on line billing for all major towns through computerization by 31st March 2002. The Government of Assam shall also take measures, including rationalization of existing manpower and restricting recruitment to essential needs, in order to reduce the state's cost of power supply, one of the highest in the country.

2.5.2 Prospect of Resuming Operation

a) Current Condition of the Project Facility

Normal maintenance for the upkeep of the Units is still carried out regularly. The turbine, generators and auxiliaries are maintained daily and are tested every 15 days. Boiler tubes are maintained every three days to prevent corrosion. Further, in order to keep the boilers in good condition, they are ignited and pressurized to 20 kg/cm^2 for 20 minutes. This task is performed every three months.

Both Units have some mechanical trouble with the blades of their turbines and with the HP heaters. However, since spare parts for rehabilitation of the units were already procured under the R&M program, these problems are expected to be solved rather easily.

b) Supply of Feasible Fuel for the Power Station

ASEB has requested that IOC reduce fuel oil prices, but these efforts have not yielded any fruitful result so far. The matter has also been taken up by the Assam State Government, and the state government has appealed repeatedly to the Ministry of Petroleum and Natural Gas, but with no result to date.

In order to find an alternative supplier, ASEB requested the supply of fuel oil to the Numligarh Refinery Ltd (NRL). However, the NRL's refinery in Assam was designed with the basic objective of maximization of middle distillates while minimizing fuel oil production, with a view to maximizing value addition to Assam crude. Thus, NRL sounded out ASEB, regarding exploring the possibility of using naphtha for fuel oil. However, since the subsidy for naphtha was also withdrawn by the Government, naphtha couldn't be a credible alternative.

Though ASEB has made efforts to find comparatively cheaper fuel (natural gas, LNG, coal), it has not yet found a technologically and economically feasible alternative.

c) Importance of the Chandrapur TPS in the Future

As previously mentioned, the demand-supply situation in the state is still serious. Nevertheless, according to ASEB, the power supply situation is expected to improve in the coming years, with the materialization of the Lower Kopili Hydro Electric Power project (150 MW) in 2005 and the Lakwa Waste

Heat project (45.50 MW) in 2006. Furthermore, in order to fill the demand-supply gap, two IPP[*22] projects have been identified by the Assam Government. These are: the Amguri combined cycle power plant project (90 MW) and the Borgoloi coal-fired power plant project (120 MW). Already, a draft Memorandum of Undertaking, to be signed with the central government, has been cleared by the Assam Cabinet. Further, the Government of India will assist the state in exploiting its hydro potential through projects with the private sector and/or a joint venture of the Government of Assam and the CPSUs[*23]. These efforts have been carried out with the objective of finding a solution to the demand-supply problem using alternative energy sources. If all of the aforementioned plans materialize as envisioned, the need for Chandrapur TPS will be further reduced.

3. Lessons Learned

Under a regime where strong price controls are imposed having critical bearings on project's financial viability, possible future changes in prices especially of feedstock and product prices should be carefully assessed. When project FIRR is estimated at a relatively low level from the onset (which was 6 % in this case), such an approach takes on added importance. At the same time, to eliminate in the course of viability assessment the impacts of price controls, EIRR should be calculated, which would represent project's benefits in national economic context net of price distortions.

4. Recommendations

Since the operation of Chandrapur TPS has been suspended and plans for a series of new power plants have reduced the need for the station, it is recommended that ASEB and the Government of India study alternatives for using Chadrapur TPS, including the possibility of operating it with alternative fuels.

[22] IPP (Independent Power Producer)

[23] Central Power Supply Utilities (CPSUs): The utilities consist of 9-generation companies, and were constituted under the 100% central governments equity for supporting the SEBs power development.

Comparison of Original and Actual Scope

Item	Original Plan	Actual
(1) Project Scope		
1) Boiler	No. of Unit: 1	As Planned
Type	Outdoor, two drum, reheat type	
Capacity (max)	150ton/hour	
Fuel	LSHS/LSFO	
Efficiency	84.5% (75% MCR)	
2) Turbine	No. of Unit: 1	As Planned
Type	Single Cylinder, Impulse Turbine	
Capacity (max)	33MW	
Capacity (rated)	30MW	
3) Generator	No. of Unit: 1	As Planned
Capacity (max)	38,825kVA	
Capacity (rated)	35,295kVA	
Revolving Speed	3,000rpm	
4) Cooling water system	1unit	As Planned
5) Main Transformer		As Planned
Type	Single phase	
Capacity	13.33MVA × 3 (40MVA)	
No. of Units	3 + 1	
Voltage	11/76.2kV	
6) 132KV Switch Gear	145kV, 1200A Oil Type	As Planned
3.3KV Switch Gear	Metal-clad, 1200A	
7) Cables	11kV, 3.3kV, 1100kV, etc.	As Planned
8) Procurement of Spare parts	5years	As Planned
(2) Implementation Schedule		Project was commenced in final quarter of 1981. Completion of each items were as follows:
1) Civil Works	Jun 1981 – Jun 1983	Oct 1987
2) Boiler	May 1982 – Aug 1983	Nov 1988
3) Turbine & Generator	Jun 1982 – Feb 1984	Jan 1989
4) Transformer & Switch Gear	Aug 1982 – Dec 1983	Jan 1988
5) Control equipment	Jun 1982 – Dec 1983	Dec 1988
6) Other equipment	Aug 1981 – Sep 1983	Oct 1987
(3) Project Cost		
Foreign currency	1,420 million yen	N.A. million yen
Local currency	1,629 million rupees	N.A. million rupees
Total	2,155 million yen	N.A. million yen
ODA loan portion	1,420 million yen	1,416 million yen
Exchange Rate	1.0 rupees = 27 yen (As of 1981)	N.A.

Independent Evaluator's Opinion on
Chandrapur Thermal Power Station Expansion Project

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Assam, as the principal state in the Northern East of India, presents a real contradiction between extremely rich resources availability and poor utilization and management. Economically it is a backward state and has receiving special treatment from the Planning Commission as one of the "Special Category States"

Relevance

The Chandrapur Thermal Power Station Expansion Project (Unit II - 30 MW) was conceived as a supplemental facility to Chandrapur Thermal Power Station (CTPS), Unit I which was commissioned in 1973. Looking at the total power availability situation of Assam and the location of the Power Plant in the vicinity of the State Capital, the project had great relevance. With feedstock potentially available in the same state, the relevance of the project was even greater. Obviously, installation of this Unit was consistent with the socio-economic development policy of Assam State and the Government of India.

Impact

The impact, unfortunately, was rather limited. In the first phase, there was a serious time over-run: at least five years. Completion as per the projected schedule would have meant less capitalized costs and quick returns on investment. The delay affected its economics. Secondly, the operations have been below par. against the targeted plant load factor of 58% (which itself was low in the context of a hydro carbon facility) the actual plant load factor was as low as 8.0% in 1994-95 and 10.6% in 1999-2000. Thirdly, the per unit cost of supply, naturally, has become unviable. In short, the expected advantages of a strategic location and ready availability of feedstock have been lost.

In the light of the aforesaid, there is a question mark on the sustainability of the Project. In fact the average cost of supply of the power in Assam and the average tariff is itself skewed as will be seen from the following table:

	1999-00 (Actual)	2000-01 (Actual)	2001-02 (Revised Estimate)	2002-03 (Estimate)
Average Cost of Supply (Paisa/ kWh)	513.23	504.49	490.20	635.82
Average Tariff (Paisa/ kWh)	307.74	323.97	338.17	338.65

Within the above parameters, Unit II of the Chandrapur will have to strive much harder if it seeks to be relevant: otherwise it will remain unsustainable as of new. Nonetheless, even with some more projects on the anvil, this Unit can make its impact given its location, easy access to feedstock source and environmentally friendly operation.

The evaluation report is analytical and precise. What could really be suggested now is that such evaluation should be got done earlier, even concurrently. Secondly, the social impact of such projects should be studied, post facto, in greater depth.