

Martha Berta

P2199

Document of  
The World Bank

FOR OFFICIAL USE ONLY

**FILE COPY**

Report No. 1788b-IN

STAFF APPRAISAL REPORT

INDIA

THIRD TROMBAY THERMAL POWER PROJECT

March 28, 1978

Regional Projects Department  
South Asia Regional Office

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

### CURRENCY EQUIVALENTS

|                  |   |                          |
|------------------|---|--------------------------|
| Currency Unit    | = | Rupee                    |
| Rupee 1          | = | Paise 100                |
| Rupee 1          | = | US\$0.1163               |
| Rupees 1,000,000 | = | US\$116,279.06           |
| US\$1            | = | Rupees 8.6 <sup>1/</sup> |
| US\$1,000,000    | = | Rupees 8,600,000         |

### ABBREVIATIONS AND ACRONYMS

|                 |   |                                                               |   |                                  |
|-----------------|---|---------------------------------------------------------------|---|----------------------------------|
| kV              | = | kilovolt                                                      | = | 1,000 volts                      |
| kWh             | = | kilowatt-hour                                                 | = | 1,000 watt-hours                 |
| GWh             | = | Gigawatt-hour                                                 | = | 1,000,000 kilowatt-hours         |
| TWh             | = | Terawatt-hour                                                 | = | kilowatt-hours x 10 <sup>9</sup> |
| kVa             | = | kilovolt-ampere                                               | = | 1,000 volt-amperes               |
| MVA             | = | Megavolt-ampere                                               | = | 1,000 kilovolt-amperes           |
| MW              | = | Megawatt                                                      | = | 1,000 kilowatts                  |
| km              | = | kilometer                                                     |   |                                  |
| °C              | = | Degrees centigrade                                            |   |                                  |
| m <sup>3</sup>  | = | Cubic meters                                                  |   |                                  |
| SO <sub>2</sub> | = | Sulphur dioxide                                               |   |                                  |
| GOI             | = | Government of India                                           |   |                                  |
| NTPC            | = | National Thermal Power Corporation Ltd.                       |   |                                  |
| CEA             | = | Central Electricity Authority                                 |   |                                  |
| SEB             | = | State Electricity Board                                       |   |                                  |
| CWPC            | = | Central Water and Power Commission                            |   |                                  |
| TEC             | = | Tata Electric Companies                                       |   |                                  |
| TCE             | = | Tata Consulting Engineers                                     |   |                                  |
| BSES            | = | Bombay Suburban Electricity Supply Undertaking                |   |                                  |
| BEST            | = | Bombay Electric Supply and Transport Undertaking              |   |                                  |
| TESCO           | = | Thana Electric Supply Company                                 |   |                                  |
| MSEB            | = | Maharashtra State Electricity Board                           |   |                                  |
| GSEB            | = | Gujarat State Electricity Board                               |   |                                  |
| KfW             | = | Kreditanstalt fur Wiederaufbau                                |   |                                  |
| ICICI           | = | Industrial Credit and Investment Corporation of India Limited |   |                                  |

### TEC's FISCAL YEAR ENDS MARCH 31

---

<sup>1/</sup> Until September 24, 1975, the Rupee was officially valued at a fixed Pound Sterling rate. Since then it has been fixed against a "basket" of currencies. As these currencies are floating, the US Dollar/Rupee exchange rate is subject to change. Conversions in this report have been made at US\$1 to Rs 8.6.

INDIATHIRD TROMBAY THERMAL POWER PROJECTSTAFF APPRAISAL REPORTTable of Contents

|                                                         | <u>Page No.</u> |
|---------------------------------------------------------|-----------------|
| I. <u>THE POWER SECTOR</u> .....                        | 1               |
| Background .....                                        | 1               |
| Previous Bank Involvement in the Power Sector .....     | 1               |
| Energy Resources .....                                  | 2               |
| The Indian Power Sector .....                           | 2               |
| Maharashtra State Power Sector .....                    | 4               |
| Operation of the Power Sector .....                     | 5               |
| Existing Facilities .....                               | 6               |
| Future Development .....                                | 7               |
| Rural Electrification .....                             | 9               |
| II. <u>THE BORROWER - TATA ELECTRIC COMPANIES</u> ..... | 9               |
| Security Arrangements .....                             | 10              |
| Organization and Management .....                       | 11              |
| Training .....                                          | 11              |
| Audit .....                                             | 12              |
| III. <u>DEMAND AND MARKET ASPECTS</u> .....             | 12              |
| The Power Market .....                                  | 12              |
| IV. <u>THE PROGRAM AND THE PROJECT</u> .....            | 15              |
| The Program .....                                       | 15              |
| The Project .....                                       | 15              |
| Estimated Cost .....                                    | 16              |
| Basis for Estimates .....                               | 17              |
| Engineering and Construction .....                      | 17              |
| Procurement .....                                       | 18              |
| Disbursements .....                                     | 19              |
| Ecological Aspects .....                                | 20              |
| Completion Report .....                                 | 21              |

This report is based on information provided by the Tata Electric Companies, the Maharashtra State Electricity Board, and the Central Electricity Authority and upon an appraisal by Messrs. A.E. Bailey, S.S. Scales and C. Taylor in July/August 1977.

|                                         | <u>Page No.</u> |
|-----------------------------------------|-----------------|
| V. <u>FINANCIAL ANALYSIS</u> .....      | 22              |
| Introduction .....                      | 22              |
| Earnings .....                          | 23              |
| Debt Control .....                      | 26              |
| Future Finances .....                   | 26              |
| VI. <u>JUSTIFICATION</u> .....          | 27              |
| Comparison of Alternatives .....        | 28              |
| Return on Investment .....              | 29              |
| Project Risks .....                     | 29              |
| VII. <u>SUMMARY OF AGREEMENTS</u> ..... | 30              |

LIST OF ANNEXES

|          |   |                                                                          |
|----------|---|--------------------------------------------------------------------------|
| ANNEX 1  | - | Projections of Peak Demand and Installed Capacity -<br>Maharashtra State |
| ANNEX 2  | - | Statement of Secured Loans                                               |
| ANNEX 3  | - | Organization Chart - TEC                                                 |
| ANNEX 4  | - | Project Cost Estimates                                                   |
| ANNEX 5  | - | Implementation and Construction Schedule                                 |
| ANNEX 6  | - | TEC's Combined Income Statements FY1973-1985                             |
| ANNEX 7  | - | TEC's Combined Forecast Sources and Application of Funds<br>FY1977-1985  |
| ANNEX 8  | - | TEC's Combined Balance Sheets FY1975-1985                                |
| ANNEX 9  | - | TEC's Estimated Clear Profit FY1977-1985                                 |
| ANNEX 10 | - | TEC's Forecast Capital Base and Reasonable Return FY1977-1985            |
| ANNEX 11 | - | Assumptions Used for Financial Projections                               |
| ANNEX 12 | - | Project Justification                                                    |
| ANNEX 13 | - | Related Data and Documents Available in Project File                     |

MAPS

## INDIA

### THIRD TROMBAY THERMAL POWER PROJECT

#### I. THE POWER SECTOR

##### Background

1.01 Power shortages which have been a constant feature in India during the 1970s are a constraint on the economies of several of the States, particularly Maharashtra, which has suffered from power cuts of up to 30%. This is likely to be a continuing problem for some years which, hopefully, will be progressively alleviated as the large new Central thermal generating stations come on stream to augment the States generation development programs and as a national interconnected transmission system, which will optimize generating facilities, comes into operation. The 500 MW Trombay development, which is the subject of this report, is needed to augment the Maharashtra State generation development program and help alleviate power shortages in the State.

##### Previous Bank Involvement in the Power Sector

1.02 The Bank has made seven loans to India for power projects amounting to US\$179.5 million and IDA nine credits totalling US\$596 million. US\$315.5 million financed, or is financing, the construction of generating plant, US\$23 million financed the purchase of construction equipment for the Beas hydro-electric project, US\$380 million was for high voltage transmission and US\$57 million was for rural electrification. All the loans and credits for the generating plant (excluding the Singrauli Thermal power project (Credit 685-IN)), the Beas project (Credit 89-IN) and the first and second transmission projects (Loan 416-IN and Credit 242-IN) have been fully disbursed. The Singrauli project is still in the preliminary implementation stage and no disbursements have yet been made. In the case of the Rural Electrification project (Credit 572-IN) disbursements to February 28, 1978 were US\$10.3 million. Of the finance made available for the third and fourth transmission projects (Credit 377-IN of May 1973 - US\$85 million and Credit 604-IN of January 1976 - US\$150 million), funds have been fully committed in the case of Credit 377-IN and in the case of Credit 604-IN approximately US\$44 million had been committed by December 31, 1977 in respect of contracts awarded or under issue.

1.03 The ongoing power transmission projects and the rural electrification project are proceeding satisfactorily notwithstanding delays in initial implementation and in preparation of specifications for the more sophisticated load despatch equipment. The Singrauli thermal power project, which is in the early implementation stage, is also proceeding satisfactorily. The issue of invitations to tender for the major items of plant and equipment is currently in hand.

1.04 With regard to previous Bank involvement in financing the Trombay thermal power station, a Bank loan of US\$16.2 million (Loan 106-IN) was made

in November 1954 to the Tata Electric Companies (TEC) to finance the construction of a 125 MW thermal power station comprising two 62.5 MW generating units, boilers and ancillary plant together with transmission facilities. A second Bank loan of US\$9.8 million (Loan 164-IN) was made in May 1957 to finance a third 62.5 MW generating unit and associated plant.

### Energy Resources

1.05 India's main commercial energy resources are coal, oil and natural gas and hydropower. There are also resources of nuclear fuels, principally uranium and thorium, and India's power program includes the construction of further "CANDU" type heavy water reactors using domestically produced natural uranium as fuel. Two nuclear power stations have been constructed to date and a third is under construction. There are also some geothermal energy sites, but the potential appears to be limited.

1.06 Coal is by far the most extensive indigenous fossil fuel; reserves are estimated at 83 billion tons, of which some 21 billion tons have been proven. Additionally, total reserves of lignite at the Neyveli field in Tamil Nadu are estimated at around 2 billion tons. If generally unworkable coal, e.g. coal with high ash and moisture content, is excluded, this estimate of recoverable and saleable coal and lignite is reduced to something like 24 billion tons which, on a forecast country-wide usage, would be adequate for some 50 years on current assumptions of economic growth.

1.07 By comparison with coal, proven reserves of oil in India are presently small. Exploratory and drilling activities to date have proven an estimated 230 million tons on shore and recent major new off-shore strikes west of Bombay in the Arabian Sea have led to delineation of fields with proven recoverable reserves of about 250 million tons of crude oil and 30 billion cubic meters of natural gas. Other reserves of natural gas, which is found in India both alone and in association with crude oil, are estimated at over 100 billion cubic meters.

1.08 The firm power potential of hydro-electric power reserves is estimated at 41,000 MW which, at a load factor of 60%, is equivalent to an annual output of 216 TWh, of which some 8,000 MW will have been developed by March 1979. Some 30% is in the North Eastern Region with the balance spread over the Northern (25%), Southern (20%), Western (18%) and Eastern (7%) regions.

1.09 Oil and natural gas have important alternative uses and it is improbable they will be a significant factor in the generation of power. Development of generating facilities for the foreseeable future, therefore, will be based on coal or lignite burning thermal stations and hydro-electric power stations with a small but gradually developing nuclear program.

### The Indian Power Sector

1.10 The manner in which the electricity supply industry is at present organized was broadly determined by the provisions of the Electricity (Supply) Act, 1948. In particular, the Act provided for the establishment of what are now the principal agencies in the industry, the State Electricity Boards

(SEBs) including the Delhi Electricity Supply Undertaking. The SEBs were assigned responsibility for the generation, transmission and distribution of electricity within each State, and for the control and regulation of other supply undertakings which were private licensees. This responsibility includes the construction of new power stations and the operation and extension of the systems within each State. Private licensees operate mostly in urban areas and their relative importance in the sector is expected to diminish over time. At present, the SEBs effectively own or control the sources of well over 90% of electricity supply by utilities; in addition, their sanction is required for the installation of all captive plants within their borders.

1.11 As originally conceived, the SEBs were to be autonomous public corporations, responsible for running their own operations subject only to broad instructions and guidance in policy matters from State Governments. In practice, the SEBs have been very much under the control of the State Governments, rather along the lines of the Public Works Departments in which most of them have their origins.

1.12 The Indian power sector is complex because electricity supply is within the concurrent jurisdiction of the Central Government and the State Governments, according to the Constitution and to the Electricity (Supply) Act, 1948. Thus, while the Act assigned extensive responsibilities to the State authorities, it also provided for broad guidance and coordination from the Center. These were to be supplied by a Central Electricity Authority (CEA), which was to be responsible for developing a national policy for power development and for coordinating the activities of the various planning agencies involved in electricity supply.

1.13 The CEA was formally created in 1950. At that time it came under the Power Wing of the Central Water and Power Commission (CWPC) which in turn was under the Ministry of Irrigation and Power. As a result of administrative changes introduced in October 1974, responsibility for power was transferred to the Ministry of Energy, which was created at that time to bring together ministerial responsibility for coal and power. This involved the transfer of the Power Wing of the former CWPC to CEA, which now comes under the Department of Power of the Ministry of Energy. For atomic energy, and hence for nuclear power generation, there was, and remains, a separate Department of Atomic Energy which comes directly under the Prime Minister.

1.14 The Electricity (Supply) Act, 1948 has been suitably amended to enlarge the scope and the functions of the CEA. In addition to its general duty of developing a sound, adequate and uniform national power policy and coordinating the activities of the planning agencies in relation to the control and utilization of national power resources, new functions have been assigned to it, e.g. formulation of short-term and perspective plans for power development, training of personnel, interconnected system operations and research and development.

1.15 Other agencies at the Center are also concerned in the decisions relating to the planning and financing of electric power. In particular, the Ministry of Finance and the Planning Commission are involved in the appraisal

and sanction of major power projects and in the financial provisions for investment in electricity supply.

1.16 In view of the immense task of providing sufficient generating capacity to meet the requirements of the Indian economy through the 1980s, the Government of India (GOI) is supplementing the efforts of the States by constructing a number of large generating stations. For this purpose, two Central generating companies, one for hydro and the other for thermal plant, have been established. These have been registered under the Companies Act and are accountable to the GOI through the Ministry of Energy for the construction, ownership and operation of large Central thermal and hydro generating facilities which will provide bulk power to neighboring States. Power will be transferred over an interconnected 400 kV transmission system. It is believed that these new large facilities will help to speed attainment of meaningful regional integrated operation. Also likely to help accelerate the integration of regional operations is a US\$1.6 million equivalent UNDP-assisted project designed to help the CEA establish a system operations organization capable of meeting the future coordination and control needs of the Indian electricity supply system, and to provide modern training in the field of load despatching.

1.17 As a means of improving collaboration between the SEBs and establishing power systems on a regional rather than a State basis, five Regional Electricity Boards were formed during the period 1964-66. The general functions of the Boards are to review the progress of regional power development schemes, plan the integrated operation of the constituent power systems for the maximum benefit of the regions as a whole, coordinate overhaul and maintenance programs, determine generation schedules to be followed and the power available from time to time for transfer between States and determine a suitable tariff structure to govern exchanges of power within the region. The ultimate aim is the establishment of a national power system with a central system operations organization, under the direction of which the Regional Boards would operate. The technical, commercial and economic policies for the operation of the future national power system are matters which are still to be decided. GOI is obtaining advice in these matters but it is certain that the rapid expansion envisaged will involve further strengthening of CEA to meet its expanding responsibilities in the power sector. These matters are dealt with more fully in the Staff Appraisal Report No. 17336-IN for the Korba Thermal Power Project.

#### Maharashtra State Power Sector

1.18 Prior to 1954 the more populous areas of Maharashtra State were supplied by private electricity undertakings operating under license. The Bombay State Electricity Board, which was formed in 1954, took over supplies in Gujarat and part of Bombay. In 1956 the Bombay SEB area was extended to include parts of Madhya Pradesh, Hyderabad and Kutch; then in 1960 the Board was split in two to form the Gujarat State Electricity Board (GSEB) and the Maharashtra State Electricity Board (MSEB). During this time the individual private electricity undertakings were gradually taken over and the principal undertakings now left in Maharashtra are:



- (a) Tata Electric Companies (TEC);
- (b) Bombay Suburban Electric Supply Undertaking (BSES);
- (c) Bombay Electric Supply and Transport Undertaking (BEST); and
- (d) Thana Electric Supply Company (TESCO).

There are a few other small areas in Maharashtra State served by private distribution companies but these will be taken over by MSEB as their licenses expire. Generating facilities in the State are operated by MSEB and TEC.

#### Operation of the Power Sector

1.19 The major licensees described above operate within their concession areas and MSEB generates and distributes electricity throughout the rest of Maharashtra State. With the exception of TEC, the licensees are all distribution authorities and buy power in bulk from MSEB and TEC. TEC, which is by far the largest licensee and operates generating plant with an aggregate installed capacity of 622 MW, is unable to meet the demand on its system and purchases up to 500 MW of additional power from MSEB. The power is purchased at three points: Trombay, Kalwa and Borivli.

1.20 TEC supplies energy in bulk to textile mills and other large industries, distributing licensees and local authorities in Bombay and surrounding areas. It also supplies power within the areas of other licensees and MSEB to individual consumers whose demands exceed the limits specified below, where these are within TEC's overall licensed areas of supply. Map IBRD 13117 illustrates the areas of supply of the licensees listed in paragraph 1.18. TEC also supplies about 60 MW of power to the Indian Railways system.

| <u>Licensee</u> | <u>Limit of Supply</u>        |
|-----------------|-------------------------------|
| BSES            | All consumers up to 1,000 kVa |
| BEST            | All consumers up to 250 kVa   |
| TESCO           | All consumers up to 300 kVa   |
| MSEB            | All consumers up to 5,000 kVa |

1.21 The Indian Railways system is interconnected with the TEC system at Kalijan. Chola, which is an old, inefficient power station owned by Indian Railways and which has an effective capacity of 40 MW, provides about 25 MW to the Railways and the balance of 15 MW is sold to a group of consumers who, in the light of current power restrictions, are prepared to pay the higher prices for Chola power, which is wheeled over the Tata system. Charges are collected by the Mill Owners' Association (consumers are mainly textile manufacturers) and passed to Indian Railways via TEC which applies a "wheeling charge" of 6%.

1.22 The TEC system is solidly interconnected with the MSEB system, which in turn is interconnected with the Gujarat system and, via a weak interconnection, with the Madhya Pradesh system. Future planning provides for all three State systems to be interconnected at 400 kV. TEC operates a load despatch

center at Trombay which is equipped with the latest technological developments. MSEB operates load despatch centers at Kalwa and Ambasari which presently function on a telephone communication basis, but these are being equipped with more sophisticated equipment and reconstruction should be completed by early 1978. The regional load despatch center which will be part of the national system will ultimately be established in Bombay. Equipment for these load despatch centers is currently on order.

1.23 The connection of new consumers with a demand of up to 1,000 kW is within the authority of the State. The licensing of large industry is within the authority of the Central Government, from whom authority must be obtained for the provision of supplies to new consumers with a demand exceeding 1,000 kW.

#### Existing Facilities

1.24 MSEB's and TEC's existing generating facilities are shown in Table 1.1 below. As of March 31, 1977, MSEB had twelve power stations (five hydro and seven thermal) with a total installed capacity of 1,879 MW including Koyna and other hydro power stations leased to the Board by the State Government for operation and maintenance. TEC has four power stations (three hydro and one thermal) with a total installed capacity of 622 MW. Additionally, there is the Tarapur nuclear power station with a capacity of 400 MW, which is shared by MSEB and GSEB, and Chola (40 MW) which is connected to the TEC system (see paragraph 1.21).

Table 1.1: MSEB - Installed Capacity at March 31, 1977

| <u>Hydro</u>                    | <u>MW</u>  | <u>Thermal</u> | <u>MW</u>      |
|---------------------------------|------------|----------------|----------------|
| Koyna I & II                    | 540        | Nasik          | 280            |
| Koyna III                       | 160        | Koradi         | 480            |
| Vaitana                         | 60         | Bhusawal       | 62.5           |
| Eldari                          | 20         | K'Kheda        | 90             |
| Bhatgar                         | 16         | Parli          | 60             |
|                                 |            | Ballarshah     | 18             |
|                                 |            | Paras          | 92.5           |
| Total                           | <u>796</u> |                | <u>1,083.0</u> |
| <u>TEC - Installed Capacity</u> |            |                |                |
| Khopoli                         | 72         | Trombay        | 337.5          |
| Bhirpur                         | 72         |                |                |
| Bhira                           | <u>140</u> |                |                |
| Total                           | <u>284</u> |                | <u>337.5</u>   |

1.25 The total length of medium and high voltage transmission lines and underground cable (11 kV and above) operated by MSEB at March 31, 1977 was about 80,000 circuit km, and by TEC about 2,200 circuit km. The aggregate capacity of transformers of 11 kV and above operated by MSEB was around 7,500

MVA and by TEC was about 3,500 MVA. The TEC system, which comprises 110 kV, 132 kV and 220 kV transmission lines, is tied in with MSEB's 220 kV network at three points with an aggregate stepdown capacity of 1,250 MVA comprising ten auto transformers each of 125 MVA. The supply is generally reliable but losses and power unaccounted for on the MSEB system at around 25% of units sent out (excluding bulk sales to licensees) are high. Losses in the TEC system at around 3% are low, but the two figures are not comparable because TEC provides high tension supplies only to 214 consumers, while MSEB supplies mainly at low tension to over two million consumers.

#### Future Development

1.26 The overall strategy of the State Government for development of the sector is to eliminate restrictions (see para. 3.06) by the end of the 1970s. To meet this target an installed capacity of 4,730 MW would have been required by the end of 1978/79 and the Board's program of development envisaged a program of expenditure of about US\$1.5 billion. However, these proposals were drastically curtailed and expenditures for the period 1974/75 through 1978/79 were subsequently fixed at about US\$610 million equivalent. This has resulted in a reduced target for extending the generating plant and transmission system. Installed capacity by 1978/79 is unlikely to exceed 3,600 MW and load restrictions will likely continue into the early 1980s.

1.27 Major developments now under implementation or approved are described below:

#### Generation

- (a) The Koradi power station which presently comprises 480 MW is being extended with a further three 210 MW units, the first of which was scheduled to go into commercial operation by January 1978 and the last by June 1981;
- (b) Nasik power station (presently 280 MW) is being extended with a further two 210 MW units;
- (c) Bhusawal power station (presently 62.5 MW) is being extended with a further 210 MW unit;
- (d) Gas turbine plant aggregating 240 MW is scheduled near Bombay with commissioning due by the end of 1978;
- (e) The hydro power station at Koyna (presently 540 MW) is being augmented with another station comprising four 80 MW units which will use the tailrace waters. Construction of this power station, which will be peaking only, is well advanced; and
- (f) Trombay Power Station which belongs to TEC is being extended (actually another installation in proximity to the existing) with the 500 MW unit constituting the Project, feeding directly into the existing 220 kV network.

### Transmission

- (a) MSEB is constructing 750 km of double circuit 400 kV line from Koradi to Bhusawal and Kalwa (Bombay), principally for the transfer of power from the Koradi area. Work on this line has started and substantial progress has been made. The section to Bhusawal is expected to be completed by mid 1978 and to Kalwa by January 1980. Initially it will be energized at 220 kV; and
- (b) Other major transmission extensions are being financed under IDA Credit 604-IN.

1.28 The above generation developments, together with other currently approved generation developments which are scheduled for commissioning by 1983/84, are shown in Table 1.2 below. These are, in aggregate, insufficient to meet the capacity shortfall during this period and, unless further developments are approved, power restrictions will continue into the late 1980s. The projected situation is illustrated in the chart at Annex 1 which shows the forecast increase in capacity and the capacity which will be required to meet the peak demand through 1983/84.

Table 1.2: Approved Developments Scheduled for Commissioning by 1983/84

| <u>Hydro</u>              | <u>MW</u> | <u>Scheduled Commissioning Date</u> | <u>Thermal</u>         | <u>MW</u> | <u>Scheduled Commissioning Date</u> |
|---------------------------|-----------|-------------------------------------|------------------------|-----------|-------------------------------------|
| Koyna III<br>(Nos. 3 & 4) | 160       | 1982                                | Gas Turbines 4 x 60 MW | 240       | December 1978                       |
|                           |           |                                     | Koradi III No. 1       | 210       | January 1978                        |
|                           |           |                                     | Nasik Ext I            | 210       | December 1978                       |
|                           |           |                                     | Bhusawal No. 2         | 210       | February 1979                       |
| Koyna Dam                 | 40        | January 1980                        | Nasik Ext II           | 420       | February 1980                       |
| Pench                     | 52        | June 1981                           | Parli                  | 210       | March 1980                          |
| Tillari                   | 60        | June 1981                           | Koradi III No. 2       | 210       | February 1981                       |
| Bhira                     |           |                                     | Chandrapur No. 1       | 210       | December 1981                       |
| Tailrace                  | 80        | October 1982                        | Koradi III. No. 3      | 210       | June 1981                           |
|                           |           |                                     | Chandrapur No. 2       | 210       | February 1982                       |
| Total                     | 392       |                                     | Trombay                | 500       | June 1982                           |
|                           |           |                                     | Total                  | 2,840     |                                     |

1.29 Other developments, all thermal, for construction and commissioning during the period ending 1983/84 which have yet to be sanctioned are shown in Table 1.3 below:

Table 1.3: Developments yet to be Sanctioned Which are Scheduled  
for Commissioning by 1983/84

|            |       | <u>MW</u>    | <u>Date to be<br/>commissioned</u> |
|------------|-------|--------------|------------------------------------|
| Bhusawal   | No. 3 | 210          | October 1982                       |
| Ojari      | No. 1 | 210          | December 1982                      |
| Ojari      | No. 2 | 210          | April 1983                         |
| Parli      | No. 4 | 210          | June 1983                          |
| Chandrapur | No. 3 | 210          | December 1983                      |
| Chandrapur | No. 4 | 210          | February 1984                      |
|            | Total | <u>1,260</u> |                                    |

### Rural Electrification

1.30 Maharashtra is one of the more progressive States in the promotion of rural electrification. During the 1970s an average of some 1,500 villages and 44,000 irrigation pumpsets/tubewells have been energized every year. There are just over 26,000 towns and villages in the State and the number of these electrified had increased from 853 in 1961 to just over 20,000 by 1976. The Project which will provide another 500 MW of power for the Maharashtra system, will contribute to the continuing program of rural electrification.

## II. THE BORROWER - THE TATA ELECTRIC COMPANIES

2.01 The Borrower of the proposed Bank loan would be TEC and GOI would be the Guarantor.

2.02 TEC consist of three Companies:

- (a) the Tata Hydroelectric Power Supply Company Limited, formed in 1910;
- (b) the Andhra Valley Power Supply Company Limited, formed in 1916; and
- (c) the Tata Power Company Limited, formed in 1919.

These Companies are separate publicly owned entities in the private sector but operate as a group under the same management. They form a part of the Tata group of enterprises which have substantial financial resources, an excellent credit rating, first-class managerial ability and a long and successful history of operations in many industrial and other fields in India.

2.03 The three Tata Companies function as an interconnected grid; the three hydroelectric power stations are owned by the Companies individually, and the Trombay thermal power station together with the transmission and sub-stations are owned jointly in the ratio of 20:30:50 by Tata Hydro, Andhra Valley and Tata Power, respectively.

2.04 Each of the three Tata Companies operates under individual licenses, (Bombay Hydro Electric License 1907, the Andhra Valley Hydro Electric License 1919 and the Nila Mula Valley Hydro Electric License 1921) and the Trombay Thermal Power Electric License 1953 is granted jointly to all three. MSEB has the option to purchase the undertakings covered by the licenses, and the earliest date on which the option to purchase can be exercised is June 30, 1980.

2.05 TEC's licenses have been the subject of a series of meetings between TEC, MSEB and the Government of Maharashtra (GOM) during 1977 and a satisfactory settlement of the whole question of license extension and rationalization of distribution facilities was reached in principle, in September 1977. This settlement, which has still to be formalized, provides for an extension of TEC's licenses and franchise for a period coterminous with the last repayment against the proposed Bank loan, contingent upon meeting under Phase I of the settlement (i) specified requirements regarding rationalization of distribution, and (ii) specified pollution requirements in respect of the Project and existing Trombay plant. The agreement with regard to rationalization of distribution does not affect TEC's financial operations since they will still sell power to MSEB in the areas taken over. With regard to pollution requirements TEC intends to carry out a study of pollution control at the Trombay complex to determine the actions which need to be taken. Under Phase II of the settlement, TEC and MSEB have agreed to commence discussions on July 1, 1984 to arrive at a mutually acceptable agreement for further delimitation, with effect from July 1, 1985, of TEC's licensed area, the guiding principle being that TEC would be allowed to retain such distribution rights and loads in their area as warranted by their surplus generating capacity. This matter was discussed during negotiations and GOI agreed to take all steps necessary to secure undertakings from the State of Maharashtra that no action, including delimiting TEC's area of supply, would be taken which would interfere with TEC's performance or adversely affect its financial position. The formal extension of TEC's licenses is a condition of disbursement of the proposed loan.

#### Security Arrangements

2.06 Annex 2 shows existing liens on TEC's property as at March 31, 1977. Outstanding debentures are secured by a concurrent first mortgage and first charge on immovable properties, plant and licenses of TEC and a floating charge on all its other assets subject to prior first mortgage charge and floating charge in favor of the US Agency for International Development, and until recently of IBRD, in respect of TEC's holdings under the Trombay Thermal License. The first two Bank loans have now been paid up and this security, as far as the Bank is concerned, has now lapsed. TEL has agreed, as security for the proposed loan, (i) a first specific mortgage on the properties provided under the Project and those subsequently added, pari passu with the Indian financial institutions in respect of their share of co-financing; (ii) a first floating charge on all existing immovable and movable assets held under the Trombay Thermal License pari passu with other lenders and (iii) assignment to the Bank by way of mortgage of the Trombay License including extensions and/or renewals thereof. Completion of these security arrangements is a condition of effectiveness of the proposed Bank loan.

## Organization and Management

2.07 TEC's organization is shown in Annex 3. The three Tata Companies are well managed utilities and are operated in accordance with sound commercial principles. Each Company has a separate Board of Directors and four officials are common to each Board: the Chairman, the Managing Director and two other directors including the Director of Finance. The other members, are representatives of leading industrial and banking interests in India. There is one State Government member on each Board. The technical and managerial services of the Companies have been integrated into one common system.

2.08 The staff of the Companies numbered 2,645 on July 31, 1977, of whom 50 are senior management, 100 are senior engineers, 570 are assistant engineers, operators/technicians, etc. and the balance of 1,925 are skilled and semi-skilled (1,300) and non-technical/administrative (625). This is considered reasonable for the operation of TEC's facilities.

2.09 The present management and staff are fully experienced and competent to operate the Companies efficiently. They are also competent to carry out the Project with the assistance of consultants (see paragraph 4.09) and to carry out other works covered by TEC's development program.

## Training

2.10 TEC's training program is principally focused on the training of power plant operators. The rationale for this is that the efficiency and availability, and indeed the life, of the advanced type of generating plants which are now being installed, depend to a large extent on the ability of the operating staff to understand and perform the necessary plant control operations quickly and in accordance with stipulated sequences during normal and emergency conditions.

2.11 Training of power plant operators comprises some classroom lectures on theory and practical in-plant observations but the most important part of the training is on the analogue simulator, designed and constructed by TEC, which simulates the 150 MW generating unit at Trombay power station. This simulator, which will be modified to simulate the 500 MW machine in its dynamic responses, interlocks and operational sequences, gives the trainee operator experience in handling abnormalities encountered in the actual operation of the plant. This facility is being used for training not only TEC's personnel, but also the thermal station operators of the various SEBs as well as trainees from the training schools operated by CEA.

2.12 On-the-job training is provided for transmission and distribution personnel and ample external facilities exist for classroom training of this category of staff and also for administrative and clerical staff. No training program for accounting staff is necessary as requirements are normally met from the large reservoir of locally trained accounting staff.

2.13 TEC has also commissioned a modern digital process computer system for load control which provides instant-by-instant control of the entire process of power generation, and the load despatch center is staffed by well trained engineers.

2.14 Load despatch centers such as TEC's are now being planned by the States and Regions as part of the planning for a future national power system. TEC is planning to introduce training courses for selected SEB engineers to acquire on-the-job training in load despatch.

2.15 Another area of training in which TEC can play an important role is the expertise which can be passed on in the design and construction of a 500 MW installation which is the Project described in Chapter IV of this Report. This will be the first unit of this size to be installed in India and, since the National Thermal Power Corporation (NTPC) will be installing similar units in the second stage of construction of its large Central thermal power stations, it is important that the Project should be used as far as possible as a training ground. The conditions laid down by GOI in approving the 500 MW development included, inter alia, that TEC would provide necessary information and data on operating experience to CEA as may be required by GOI and would make available, facilities for training a reasonable number of persons, selected by GOI, in the construction, operation and maintenance of the 500 MW unit.

#### Audit

2.16 The audit of the books of the three Companies which form TEC would be made by independent auditors appointed by the Companies at their annual general meetings in accordance with the Companies Act 1956. The auditors appointed would normally be members of the Indian Institute of Chartered Accountants and qualified within the meaning of the Chartered Accountants Act 1949. Messrs. A.F. Ferguson and Co. and Messrs. S.B. Billimoria and Co. of Bombay were reappointed auditors of the Companies at the Annual General Meeting in September 1976 to examine and audit the accounts of the Companies for FY1977. They were again retained for a further year by resolution of the Annual General Meeting on September 20, 1977. These auditors are acceptable to the Bank.

### III. DEMAND AND MARKET ASPECTS

#### The Power Market

3.01 When examining the power market in Maharashtra State the combined TEC and MSEB system must be considered, since all consumers are supplied from this system. The maximum demand on the interconnected TEC and MSEB system in 1976/77 was 1,950 MW, and energy sent out and purchased aggregated about 13,200 million GWh. These figures are derived from statistics provided by TEC and MSEB and there may be inaccuracies due to difficulty in adjusting



for imports and exports of power and cross transfers between TEC and MSEB. Details of such transfers for 1975/76 (details for 1976/77 were not available at the time of appraisal) are shown in Table 3.1 below.

Table 3.1: Transfers of Energy 1975/76

|                                      | <u>GWh</u> |
|--------------------------------------|------------|
| <u>Energy Purchases by MSEB</u>      |            |
| From - Tarapur Nuclear Power Station | 968.5      |
| - Gujarat SEB                        | 66.1       |
| - TEC                                | 401.5      |
| <u>Energy Sales by MSEB</u>          |            |
| To - Karnataka                       | 22.7       |
| - Madhya Pradesh                     | 3.6        |
| - TEC                                | 2,692.0    |

3.02 The total number of consumers connected to the MSEB system at March 31, 1977 was 2,025,527. TEC, which supplies large industrial consumers and other licensees, had 214 consumers at March 31, 1977. The maximum demand on the TEC system in 1976/77 was about 1,000 MW. With a total installed capacity of only 622 MW, TEC is currently purchasing some 500 MW from MSEB to meet the demand of its consumers.

3.03 Approximately 28% of all industry in India is concentrated in the Greater Bombay area and this category of consumer accounts for about 68% of the demand in Maharashtra State. Industrial demand is developing rapidly with the local load in the Trombay (port) area of Bombay forecast to increase from a present demand of 160 MW to around 400 MW by 1980/81 with the establishment of industrial developments including fertilizer, chemical and refining complexes. Similarly, considerable load growth is expected in the area between Tarapur and Bombay, which includes growing load centers like Tarapur Industrial Estates, where about 400 industrial units are expected to be established with an aggregate demand rising to 200 MW. Considerable load growth is also expected in Southern and South Eastern Maharashtra which include developing load centers such as Poona, Ratnagiri, Kolhapur, Khopoli, etc. The development of rural electrification is also proceeding rapidly (see paragraph 1.30).

3.04 Sales of KWh by MSEB, with a breakdown between the different consumer categories for the year 1976/77 and a forecast for the period 1977/78 through 1979/80, are shown in Table 3.2 below.

Table 3.2: Sales of kWh by MSEB

|                                      | <u>Actual /a</u><br><u>1976/77</u> | <u>1977/78</u> | <u>Forecast</u><br><u>1978/79</u> | <u>1979/80</u> |
|--------------------------------------|------------------------------------|----------------|-----------------------------------|----------------|
| Energy Generated and Purchased (GWh) | 10,359                             | 11,550         | 13,310                            | 15,670         |
| Energy Sent Out (GWh)                | 10,090                             | 11,328         | 12,687                            | 14,455         |
| Energy Sold (GWh)                    | 8,375                              | 9,402          | 10,530                            | 11,998         |
| Installed Capacity (MW)              | 1,879                              | 2,368          | 2,848                             | 3,620          |
| <u>Sales in GWh</u>                  |                                    |                |                                   |                |
| Domestic and Commercial              | 510                                | 560            | 640                               | 800            |
| Industrial LT                        | 390                                | 450            | 540                               | 637            |
| Industrial HT                        | 3,050                              | 3,788          | 4,585                             | 5,451          |
| Street Lights                        | 55                                 | 60             | 80                                | 100            |
| Irrigation                           | 840                                | 924            | 1,015                             | 1,210          |
| Public Water Works                   | 180                                | 200            | 220                               | 280            |
| Licensees                            | <u>3,350</u>                       | <u>3,420</u>   | <u>3,450</u>                      | <u>3,520</u>   |
| Total Sales                          | <u>8,375</u>                       | <u>9,402</u>   | <u>10,530</u>                     | <u>11,998</u>  |

/a Provisional.

3.05 Sales of energy by TEC and by the combined TEC/MSEB system for 1976/77 and a forecast for the period 1977/78 through 1979/80 are shown in Table 3.3 below.

Table 3.3: Energy Sent Out and Sold (GWh)

|                 |                   | <u>TEC System</u>  |             | <u>Combined Maharashtra State System</u> |             |
|-----------------|-------------------|--------------------|-------------|------------------------------------------|-------------|
|                 |                   | <u>Sent Out /a</u> | <u>Sold</u> | <u>Sent Out</u>                          | <u>Sold</u> |
| <u>Actual</u>   | 1974/75           | 6,009              | 5,793       | 11,206                                   | 9,031       |
|                 | 1975/76           | 5,938              | 5,726       | 11,469                                   | 9,629       |
|                 | 1976/77 <u>/b</u> | 6,567              | 6,382       | 13,201                                   | 10,560      |
| <u>Forecast</u> | 1977/78           | 6,755              | 6,350       | 15,000                                   | 12,500      |
|                 | 1978/79           | 6,785              | 6,350       | 16,400                                   | 13,600      |
|                 | 1979/80           | 6,855              | 6,540       | 17,800                                   | 15,000      |

/a Includes energy purchased from MSEB.

/b Provisional

3.06 The Maharashtra State has had to undergo heavy energy and demand shortages for the past five years, arising initially from poor monsoons but during the last three years because of shortage of on-line capacity. The forecast load growth shown in Tables 3.2 and 3.3 is based on productive capability of currently planned plant availability and implies a continuation of the power restrictions, the major brunt of which has been, and still is being, taken by the industrial consumers. The magnitude of the power cuts is shown in Table 3.4.

Table 3.4: Magnitude of Power Restrictions 1976/77

| <u>Category of Industry</u> | <u>Restriction in Maximum Demand</u> | <u>Restriction on Energy</u> |
|-----------------------------|--------------------------------------|------------------------------|
| Essential                   | 15%                                  | 15%                          |
| Textiles                    | 30%                                  | 25%                          |
| Continuous Process          | 30%                                  | 30%                          |
| General Industries          | 40%                                  | 30%                          |
| Services Industries         | 40%                                  | 20%                          |

3.07 Because of these cuts it is estimated that the load and energy sales for 1976/77 were some 400 MW and 2,000 GWh lower than would have been the case without restrictions.

#### IV. THE PROGRAM AND THE PROJECT

##### The Program

4.01 Although developed by the private sector, the proposed Trombay 500 MW single unit extension is part of the Maharashtra State generation development program which is described in paragraphs 1.26 through 1.29.

##### The Project

4.02 The Project which comprises a 500 MW single unit installation with boiler, electrical and mechanical plant including pollution control equipment, and associated civil works, will be erected on reclaimed land (ash disposal area) owned by TEC, adjacent to the existing Trombay power station. The boiler would be designed for triple firing (coal, gas or oil). The infrastructure facilities (coal, water, transmission) are already available adjacent to the site and will be extended to meet the requirements of the Project. In effect, therefore, the 500 MW unit, although comprising a separate installation, is an extension of the existing Trombay thermal power station.

4.03 The Project will feed into the Maharashtra State system which is interconnected with the Gujarat and Madhya Pradesh State systems. The combined capacity of these three State systems by the time the 500 MW unit is commissioned (1982) will be about 10,000 MW with an aggregate estimated peak demand of about 7,500 MW. The unit will then constitute only 5% of the

installed capacity of the combined system (about 10% of the capacity of the TEC/MSEB system). System stability studies have been carried out under varying conditions and these demonstrate that the TEC/MSEB system should be capable of withstanding a disturbance due to tripping of a unit of this size.

4.04 Load flow and transient stability studies of the TEC/MSEB system with the 500 MW unit in service have also been carried out for different operating conditions. These proved the adequacy of the proposed transmission network to handle the demand under all conditions, even with unit outage.

#### Estimated Cost

4.05 The estimated cost of the Project as defined in paragraph 4.02 is Rs 1,800 million (US\$209.4 million), excluding interest during construction estimated at approximately US\$40 million equivalent. The foreign currency component is estimated at Rs 781 million (US\$90.8 million). The estimated costs of the principal features of the Project are shown in Table 4.1 and in more detail in Annex 4.

Table 4.1: Estimated Cost of Project

| <u>Description</u>           | <u>Rupee Millions</u> |                |              | <u>US\$ Millions</u> |                |              |
|------------------------------|-----------------------|----------------|--------------|----------------------|----------------|--------------|
|                              | <u>Local</u>          | <u>Foreign</u> | <u>Total</u> | <u>Local</u>         | <u>Foreign</u> | <u>Total</u> |
| Preliminary Works            | 23.0                  | -              | 23.0         | 2.7                  | -              | 2.7          |
| Civil Works                  | 113.5                 | -              | 113.5        | 13.2                 | -              | 13.2         |
| Elec. & Mech. Works          | 579.4                 | 601.6          | 1,181.0      | 67.3                 | 69.9           | 137.2        |
| Coal Handling                | 56.7                  | -              | 56.7         | 6.6                  | -              | 6.6          |
| Switchyard                   | 48.5                  | 34.8           | 83.3         | 5.7                  | 4.0            | 9.7          |
| Construction Equipment       | 18.0                  | -              | 18.0         | 2.1                  | -              | 2.1          |
| Sub-Total                    | 839.1                 | 636.4          | 1,475.5      | 97.6                 | 73.9           | 171.5        |
| Contingency (Physical)       | 45.5                  | 31.7           | 77.2         | 5.3                  | 3.7            | 9.0          |
| Contingency (Price)          | 96.0                  | 91.3           | 187.3        | 11.2                 | 10.7           | 21.9         |
| Engineering & Admin.         | 38.6                  | 21.4           | 60.0         | 4.5                  | 2.5            | 7.0          |
| Project Cost                 | 1,019.2               | 780.8          | 1,800.0      | 118.6                | 90.8           | 209.4        |
| Interest during Construction | 156.8                 | 183.6          | 340.4        | 18.2                 | 21.3           | 39.5         |
| Total Financing Required     | 1,176.0               | 964.4          | 2,140.4      | 136.8                | 112.1          | 248.9        |

4.06 The proposed Bank Loan of US\$105 million is equivalent to 50% of the cost of the Project, excluding interest during construction. This will be applied to consultants costs and to cif and/or ex-factory costs of all plant and equipment with the exception of the turbogenerator and specified items of equipment associated therewith for which Germany through Kreditanstalt fur Wiederaufbau (KfW) is providing the foreign currency. Civil works, inland transportation costs and any other costs not financed from the Bank loan would be financed by debt and equity capital to be raised by TEC.

### Basis for Estimates

4.07 The estimated costs of the major components of the Project, the 500 MW generating unit and boiler, are based on information supplied by TEC and on information obtained by the appraisal mission from Taiwan Power Company through its consultants, Gibbs and Hill of New York, concerning bids received in May 1977 for the supply of two 500 MW units and boilers for Anping steam power station. Costs of associated electrical, mechanical, anti-pollution and switchyard equipment are based upon estimates received from overseas manufacturers and Indian manufacturers where such equipment is manufactured in India and also, where available, upon costs of similar equipment recently purchased for other developments in India. A physical contingency of 10% has been allowed on civil works and 5% has been allowed on all plant costs. In assessing price contingency, it has been assumed that, based on recent experience, fixed price contracts will be obtainable for all plant and equipment with the exception of the sulphur dioxide (SO<sub>2</sub>) removal system. Base 1977 costs for such plant, excluding the SO<sub>2</sub> removal system, plus physical contingency have been escalated at 7% a year to date of placing contract, and erection costs have been escalated at 7% a year throughout the erection period. On the assumption that major contracts will be placed by mid-1978 and erection will be substantially completed by the end of 1981, this gives an overall price contingency in the neighborhood of 10%. Civil works costs have been escalated at 7% annually through the construction period. In view of the difficulty in estimating the cost of the SO<sub>2</sub> removal system until the consultants recommendations are available (see paragraph 4.17(a)), a flat price contingency of 25% has been allowed.

4.08 The breakdown between foreign and local costs assumes that the 500 MW turbo-generator and the high pressure parts of the boiler will be procured overseas with most of the contracts for the other components of the Project being won by Indian suppliers under international competitive bidding procedures.

### Engineering and Construction

4.09 During negotiations TEC agreed to employ engineering consultants whose qualifications, experience and terms and conditions of employment would be satisfactory to the Bank. The Project is being engineered by Tata Consulting Engineers (TCE) and TEC has also engaged a firm of consultants (Ebasco Services of the USA) who are experienced in 500 MW design to assist TCE in the more sophisticated areas such as instrumentation and controls and to review TCE's specifications and designs as required by TEC and the Bank. TCE and Ebasco Services are satisfactory to the Bank. TEC also agreed to employ an experienced consultant satisfactory to the Bank to carry out a study to determine the measures, if any, which might be necessary to remove SO<sub>2</sub> from the stack gases at Trombay power station to meet environmental quality standards (see paragraph 4.17(a)).

4.10 Preliminary design work is already in hand and soil tests have been carried out at the proposed site to establish bearing capacity and foundation levels. A number of preliminary studies have been made relative to the cooling water intake and discharge systems, substructure and superstructure, chimney, plant and boiler foundations and extensions to the existing infrastructure. Because of the urgent need for the additional capacity, TEC proposes to proceed immediately with preparation of specifications and tender documents for the main plant, with a view to award of contracts by June/July 1978; in the meantime preliminary works will be carried out. Preparation of specifications for civil works will be completed as soon as the information relative to foundation design can be provided by the successful plant contractors and it is hoped the main civil works contract will be placed by late 1978. The implementation and construction schedule shown in Annex 5 indicates a period of five years from commencing preparation of specifications to putting the 500 MW unit into commercial operation. On this basis the unit is scheduled to go into commercial operation by December 1982. This timetable is reasonable.

4.11 The source of supply of fresh water for the existing Trombay thermal power station is the Bombay Municipal Corporation, which has confirmed that it will be in a position to meet the enhanced demand when the 500 MW unit is commissioned.

4.12 The estimated annual coal requirement of the 500 MW unit is 1.35 million tonnes. Trombay is presently receiving coal at the rate of about 0.54 million tonnes annually which indicates total annual requirements of just under two million tonnes when the Project is commissioned. At present coal is transferred by rail from Central India coal fields. The Indian Railways have confirmed that they are in a position to step up coal deliveries to Trombay and it was confirmed during negotiations that coal for Trombay would continue to be supplied from Central India coal fields. Assurances were obtained during negotiations that GOI will take all necessary steps to ensure adequate coal and rail transportation facilities to supply two million tonnes per annum for Trombay power station by the time the Project is completed.

#### Procurement

4.13 Procurement of all equipment to be financed from the proposed Bank loan would be on the basis of international competitive bidding in accordance with the Bank's guidelines. All bidding documents, including recommendations for award of contracts, would be prepared by TEC with the assistance of its consultants and approved by the Bank. Local manufacturers are expected to bid for all categories of equipment. A domestic preference of 15% or the import duty, whichever is less, would be applied in bid evaluation. Local manufacturers are likely to win the majority of contract awards, but to prevent procurement delays assurances were obtained from GOI during negotiations that, in the event the lowest evaluated bidder for any contract is a foreign manufacturer, permission to import will be forthcoming without further review by any agency of the Government. In the case of minor items of equipment not exceeding US\$100,000 equivalent, contracts may be awarded, where appropriate, on the basis of competitive bidding advertised locally.

4.14 The turbo-generator will be procured from Kraftwerk Union of Germany, the firm with which the Indian manufacturer, Bharat Heavy Electricals Limited has recently concluded a cooperation agreement for the ultimate construction of large generating units in India. There are competent local contracting firms in India and manufacturing facilities covering most of the remaining equipment for the Project, and work not financed wholly or in part from the Bank loan would be subject to local procurement procedures which are satisfactory.

#### Disbursements

4.15 Disbursements would be made against the cost of consultants retained to assist in the design of the Project and against the cost of the plant and equipment, excluding items earmarked for financing under the KfW loan, on the following basis.

- (a) 100% of the ex-factory cost of equipment procured in India after international competitive bidding; and
- (b) the c.i.f. cost of equipment procured abroad.

4.16 Because of the need to expedite work if the target date for completing the Project (December 1982) is to be met, consultants expenditures of about US\$0.25 million equivalent will be incurred prior to signing the Loan Agreement. These costs have been included in the cost estimates and will be eligible for disbursement under the Bank loan. Any balance of the loan not used after commitments have been made for plant, equipment and consultants costs may be used to finance plant and equipment erection contracts other than for the turbo-generator. The estimated schedule of disbursements is shown in Table 4.2.

Table 4.2  
Schedule of Disbursements  
US\$ million

| <u>IBRD Fiscal Year<br/>and Half Year</u> | <u>Cumulative Disbursement<br/>at End of Each Half Year</u> |
|-------------------------------------------|-------------------------------------------------------------|
| <u>1978/79</u>                            |                                                             |
| December 31, 1978                         | 10.0                                                        |
| June 30, 1979                             | 11.0                                                        |
| <u>1979/80</u>                            |                                                             |
| December 31, 1979                         | 18.0                                                        |
| June 30, 1980                             | 35.0                                                        |
| <u>1980/81</u>                            |                                                             |
| December 31, 1980                         | 56.0                                                        |
| June 30, 1981                             | 80.0                                                        |
| <u>1981/82</u>                            |                                                             |
| December 31, 1981                         | 86.0                                                        |
| June 30, 1982                             | 100.0                                                       |
| <u>1982/83</u>                            |                                                             |
| December 31, 1982                         | 103.0                                                       |
| June 30, 1983                             | 105.0                                                       |

#### Ecological Aspects

4.17 TEC agreed during negotiations to take all necessary steps in the design, construction and operation of the Project to ensure compliance with the environmental quality standards prescribed by the relevant national, state and local authorities. The actions presently proposed to deal with the principal environmental problems are described below.

##### (a) Location and Air Pollution

The location is in an industrial area on the outskirts of Bombay on coastal reclaimed land adjacent to the existing Trombay power station. There are no residential properties in the near vicinity and no resettlement problems are involved. Prevailing winds are usually offshore. The 500 MW unit will be equipped with an electrostatic precipitator with an efficiency of 99.5% and a stack which will be designed for a height of 500 feet to ensure greater dispersion of pollutants and particulate matter. Space is being left for the installation, if necessary, of an SO<sub>2</sub> removal system to remove sulphur dioxide from the stack gases. Such systems are usually considered for installation in power stations burning coal containing 3% or more sulphur, and they are designed to remove up to 80% of the sulphur dioxide from the stack gases; this is equivalent to burning coal with around 0.7% sulphur without an SO<sub>2</sub> removal system. The Singrauli coal which is being used in Trombay has a sulphur content of 0.3-0.6%. Thus, the emission level is not likely to provide an environmental hazard. Nevertheless, provision has been included in the Project, at the specific request of the Maharashtra State Government, for the



installation of an SO<sub>2</sub> removal system. The installation of this system should be contingent upon the findings of a study which should be carried out to determine the measures, if any, which might be necessary to remove SO<sub>2</sub> from the stack gases in order to meet environmental quality standards (see paragraphs 2.05 and 4.09).

(b) Water Pollution

Hot water from the condenser will be discharged into the sea. The water discharge is estimated to be approximately 60,000 m<sup>3</sup>/hr of hot water 10° C above the intake temperature. The flood and ebb currents will assist in dissipating the rejected heat and with such a large dilution factor no significant effect is likely on marine life.

(c) Noise Control

The plant and equipment will be designed to ensure the noise level will be below 90 decibels, which is well under the maximum accepted threshold for a normal 8 hour day for shift workers.

(d) Ash Disposal

The estimated quantity of ash to be disposed of from the proposed 500 MW unit is about 472,000 tonnes per year; another 175,000 tonnes comes from the existing units. Adequate low lying areas (mud-flats) are available for this purpose approximately 3 km away from the power station, along the coast line. These areas, which can be reclaimed for beneficial use, provide an average depth fill of about 3 meters and would be adequate for about 23 years of plant life. Ash storage dykes and skimmer arrangements are proposed to ensure no ash carryover to the sea.

4.18 With regard to the safety and occupational health of employees, safety regulations for power stations, to which all operating personnel must conform, will be strictly enforced.

Completion Report

4.19 In order to inform the Bank and the Borrower about the performance of the Project, and the lessons learned during its execution, a completion report is required following the closing date of the loan. TEC has agreed not later than six months after the closing date, or such later date as may be agreed for this purpose between the Borrower and the Bank, to prepare and furnish to the Bank a report, of such scope and in such detail as the Bank shall reasonably request, on the execution and initial operation of the Project, its cost and impact, the performance by the Borrower and the Bank of their respective obligations under the Loan Agreement and the accomplishment of the purposes of the loan.

## V. FINANCIAL ANALYSIS

### Introduction

5.01 TEC has a successful financial record within the limitations of the licences and regulations under which the three companies operate. They have consistently earned profits, and dividends have been paid regularly on all share capital.

5.02 The three Companies together would be the borrower of the loan. For this reason, the financial statements (Annexes 6-10) have been prepared by consolidating the working results of the three Tata Companies from FY1973 through FY1977. Future forecasts through FY1985 have been made on a consolidated basis. Annex 11 details the assumptions used. Accounts of the three companies are audited regularly by independent auditors. During negotiations TEC agreed to submit, within six months of the close of each financial year, audited accounts for each of the three Companies.

5.03 TEC's earnings are regulated by the Sixth and Seventh Schedules of the Electricity (Supply) Act 1948. The Sixth Schedule provides, among other things, that "the licensee shall so adjust his charges for the sale of electricity, whether by enhancing or reducing them, that his "clear profit" in any year shall not, as far as possible, exceed the amount of reasonable return". "Clear profit" represents the income from the sale of energy, rentals and other utility receipts, less admissible expenses, i.e. operating expenses, interest on money borrowed, income tax, certain appropriations to statutory reserves, and other special appropriations permitted by the State Government. "The amount of reasonable return" is defined as the sum of (a) 7% of that part of the capital base equal to the capital base as on March 31, 1965, (b) a percentage on the balance of the capital base equal to 2% over the Reserve Bank Rate ruling at the beginning of the year (currently 9%), and (c) additional sums equal to one half of 1% on capital borrowed (i) from institutions approved by the State Government and (ii) by the issue of debentures. The forecast clear profit statement (Annex 9) sets out the admissible expenses which, together with a margin for clear profit, form the basis for determining the average sale price of power each year. In the event TEC would earn clear profit in excess of the amount of reasonable return for the year, provision is made in the Act for its disposal. The forecast clear profit estimated for FY1977 and FY1978 as shown in Annex 9 is greater than the reasonable return, but in subsequent years clear profit margin and amount of reasonable return are assumed to be equal. The items which make up the capital base each year from FY1977 through FY1985 are set out in Annex 10.

5.04 An upward adjustment of charges may be made only after the expiry of a notice in writing of no less than 60 clear days given to the State Government and to the MSEB. However, tariff increases are not allowed more than once in any financial year.

### Earnings

5.05 TEC's combined financial operations for each of the five years FY1973 to FY1977, together with forecasts for subsequent years to FY1985 are set out in Annex 6. The main points which emerge from examination of the financial operations to FY1977 are:

- (a) sales stagnated during the first four years FY1973 - FY1976, due to power restrictions (see paragraphs 3.06 and 3.07) followed by an 11% increase in the fifth year FY1977;
- (b) the average selling price of energy increased at an annual rate of 25% from 8.8 paise/kWh in FY1973 to 21.2 paise/kWh in FY1977 to meet rising costs of operation. These included increases in unit costs at annual rates of:
  - (i) 42% for fuel for generation from 4.9 paise/kWh to 19.6 paise/kWh;
  - (ii) 24% for energy purchased by TEC from the MSEB, from 7.45 paise to 17.9 paise/kWh;
  - (iii) 15% for other operations and maintenance from 1.4 paise to 2.4 paise/kWh; and
- (c) annual revenues have been sufficient each year to meet all operating expenses and interest, provide for taxes and statutory reserves, and pay dividends.

5.06 Forecast earnings during the period FY1978 through FY1985 cover the six-year period of construction of the Project to FY1983 together with an additional two years to FY1985. The new power generating station would reach its full commercial operation in FY1985.

5.07 TEC's average selling price of power would rise from 21.23 paise per kWh (US 2.47 cents equivalent) in FY1977 to 25.79 paise per kWh (US 3.00 cents) by FY1982 before falling to 23.34 paise per kWh (US 2.71 cents) by FY1985. The forecast price rise is attributable mainly to the inclusion of interest during construction as an expense when assessing tariffs.

5.08 TEC's operating income (Annex 6) based on the admissible expenses and a margin for clear profit (Annex 9), is normally insufficient to meet current interest and dividends, and any shortfall is covered by TEC's non-operating income. If TEC's performance were measured by expressing net operating income (before interest) as a rate of return on a capital base of average net fixed assets in service, as used in covenants with other Bank Group borrowers, the company's forecast rates of return would be 15.7% in FY1978 rising to 49% in FY1982 before falling to a little below 13% in 1984

and 1985. These rates of return are overstated partly because the assets which form the rate base are recorded at historic costs, and partly because interest on loans during the construction of the plant is a permissible expense which will be taken into account in the calculation of the tariffs each year. Even so, the average wholesale price of energy would only be US\$0.03 per kWh. In view of the method of regulation of TEC's finances by the Sixth Schedule of the Electricity (Supply) Act, a rate of return earnings covenant would not be appropriate and has not been sought for the purposes of this project.

5.09 With the additional tariff referred to in para. 5.07 TEC's operating ratio, which was 87% during each of the 4 years through FY76, would rise to 94% in FY1978 before reducing gradually to 82% in FY1984.

5.10 Annex 7 shows that TEC's capital expenditure (including the cost of the project) would be Rs 1,984.0 million during the six years FY1978-1983. A reasonably firm financing plan submitted by TEC, which appears below (Table 5.1), was accepted during negotiations.

Table 5.1

| <u>Source of Funds</u>                                         | <u>---- FY1978 - FY1983 ----</u> |                     | <u>%</u>   |
|----------------------------------------------------------------|----------------------------------|---------------------|------------|
|                                                                | <u>Rs million</u>                | <u>US\$ million</u> |            |
| Internal Cash Generation<br>(available for construction)       | 49.6                             | 5.8                 | 3          |
| Capital to be Raised                                           |                                  |                     |            |
| To Finance the Project                                         |                                  |                     |            |
| Equity Share Issue                                             | 175.0                            | 20.4                | 9          |
| IBRD Loans                                                     | 903.0                            | 105.0               | 45         |
| 13% Local Loans                                                | 550.0                            | 64.0                | 28         |
| Consumers Security Deposits/and<br>Maharashtra Government Loan | 172.0                            | 20.0                | 9          |
| To Finance Other Investment                                    |                                  |                     |            |
| 13% Local Loans                                                | 37.7                             | 4.3                 | 2          |
| Debenture and Cash Credits                                     | 89.7                             | 10.4                | 4          |
| Capital Receipts                                               | 7.0                              | 0.8                 | -          |
| Total - Sources of Funds                                       | <u>1,984.0</u>                   | <u>230.7</u>        | <u>100</u> |
| <u>Application of Funds</u>                                    |                                  |                     |            |
| Trombay Project                                                | 1,800.0                          | 209.4               | 91         |
| TEC's Other Investment                                         | <u>184.0</u>                     | <u>21.3</u>         | <u>9</u>   |
| Total - Application of Funds                                   | <u>1,984.0</u>                   | <u>230.7</u>        | <u>100</u> |

TEC's financing plan covers its investment program for the six years FY1978 - FY1983, and provides Rs 1,800 million (US\$209.4 million) for the project and Rs 184 million (US\$21.3 million) for other investment. The plan shows that

internal cash generation would provide funds only equal to 3% of the total investment. However, since interest during construction, estimated at Rs 340 million (US\$40 million), would not be capitalized, tariffs would be suitably adjusted each year to meet this interest liability. The proportion of the investment which would be financed from revenue during the project construction period would thus be raised effectively from 3% to 17%. This would be satisfactory.

5.11 Capital to finance the project costing Rs 1,800 million would come from the proposed Bank loan (Rs 903 million), local financing institutions (Rs 550 million) Maharashtra Government/and Consumers Security Deposits (Rs 172 million) and Equity share capital (Rs 175 million).

5.12 The proposed Bank loan with a maturity of 20 years (including a grace period of five years) would be repayable in equal half-yearly installments of principal together with interest assumed at the Bank's standard interest rate on outstanding balances. As guarantor of the loan, GOI would charge TEC a guarantee fee to make the effective rate of interest for TEC equal to 10.25% per annum which is similar to that of public sector corporations to whom Bank Group assistance is being given.

5.13 As a step towards firming up the loans of Rs 550 million (US\$64 million) from local financial institutions (a consortium led by ICICI), TEC has arranged for the Institutions to submit letters of unqualified commitment in support of their intentions to lend. The receipt of these letters in a form satisfactory to the Bank is a condition of effectiveness of the loan. In connection with the proposal to raise additional equity capital, planned for FY1981 and FY1982, new shares will in the first instance, be offered to existing holders of ordinary and preference share capital. Shares which may not be taken up by the existing shareholders along with the balance of Rs 2.8 million of the total of Rs 175 million will then be offered for public issue. The issue would be underwritten. During negotiations TEC agreed that the equity share capital of Rs 175 million would be raised by March 31, 1982. For the balance of new capital requirements, the Maharashtra Government has indicated that it would provide, together with security deposits to be collected by TEC from its consumers, an amount up to Rs 172 million. Consumer security deposits, which would carry interest at 5.5% per annum, could provide Rs 150 million so that the Maharashtra State's contribution could be up to Rs 22 million. The foregoing arrangements are acceptable to the Association.

5.14 GOI intends to borrow DM 85 million (US\$37 million) from Germany, acting through the Kreditanstalt fur Wiederaufbau (KfW) to assist in financing the foreign currency involved in purchasing the turbogenerating unit and its associated equipment for the Project. This loan would not be relent to TEC.

5.15 From FY1984, TEC's forecast internal cash generation will be required to meet an additional annual repayment of loans amounting to Rs 98 million (based on 15 years repayment) whereas the additional cash flow provided by depreciation on the project (based on a life span of 30 years) would only amount to Rs 51 million. During negotiations it was agreed that commencing from April 1, 1983, for purposes of determining tariffs under section

XVII(2)(c) of the Sixth Schedule of the Electricity (Supply) Act 1948, TEC would make provision each year for such special appropriation as may be necessary to meet the cash shortfall for debt redemption. The giving of this permission to TEC by the Government of Maharashtra to enable it to make these provisions will be a condition of effectiveness of the loan.

#### Debt Control

5.16 The Companies Act 1956 (Section 293) provides that the Board of Directors of a public company shall not, except with the consent of such public company in general meeting, borrow money where the money to be borrowed together with the money already borrowed would exceed the paid up capital and "free reserves" i.e. those reserves not set apart for any specific purpose.

5.17 To enable the Directors to borrow funds to finance construction of the project which would necessarily exceed the paid up capital and free reserves, TEC, at their Annual General Meetings on September 20, 1977 agreed to raise the borrowing ceiling to Rs 2,379.3 million. During negotiations TEC undertook not to incur any new debt, without prior consultation with the Bank, if it would require revising the ceiling still further. The purpose of this limitation is not to prevent further borrowing but to alert the Bank to any proposed borrowing which would exceed the forecast borrowings until the project is completed. Thereafter, the forecast level of annual capital expenditure falls to Rs 30 million.

#### Future Finances

5.18 With the assumed additional revenues to meet interest during construction up to FY1983 and thereafter, and the additional revenues to meet the cash shortfall for debt redemption, TEC would continue to have small annual amounts of retained earnings each year. Its internally generated fund would effectively finance 17% of the investment program in the period FY1978 to FY1983.

5.19 TEC's capital structure would remain satisfactory throughout the period to FY1985, although new loans are expected to finance 89% of the investment program during the construction period FY1978-FY1983. This would raise the ratio of unpaid debt to capitalization to 49% (FY1979), 64% (FY1980), 72% (FY1981) and 73% in FY1983 before falling to 67% by FY1985.

5.20 TEC has a deferred tax liability as of March 31, 1978 of Rs 124 million which is equal to the imputed tax on the difference between the accelerated depreciation allowed as a deductible for tax purposes under the Income Tax Act 1961 (based on the declining balance method) and the depreciation in the books at rates prescribed in the Seventh Schedule to the Electricity (Supply) Act of 1948 (based on the straight line method).

5.21 The Sixth Schedule of the Act permits TEC taxes to be admissible expenses for rate making purposes. This means that the sum equivalent to the reduction in income taxes obtained by taking the accelerated depreciation reported in the books, is omitted from the calculation of prices charged for

power during the first half of the life of an asset. In theory, assuming the rate of tax remains constant, the reduction in tax resulting from the higher depreciation allowances during the first half of an asset's life should equalize the additional tax in the second half. But TEC is a licensed company whose license is due to expire in FY1999, i.e., after TEC has repaid the Bank's loan. By that time, TEC would have a forecast liability of Rs 456 million for deferred taxes which had not been provided for in the tariffs of the company. The question to be resolved in due course is whether or not any unpaid deferred tax liability, when the license terminates, would then crystallize to become a debt to be liquidated by TEC.

## VI. JUSTIFICATION

6.01 The justification for the additional capacity which will be provided by the Project is based primarily upon the demand for power in Maharashtra. The shortage of capacity since the early 1970s leading to power cuts of up to 30% and the possibility of a continuation of this situation through the 1980s which has already been discussed in Chapter III, demonstrates that, even with additional capacity provided by the Project, the presently approved development program will be inadequate to meet the forecast annual load growth of around 10% in Maharashtra State. The expected deficit is such that only a 7% growth rate can be fully accommodated until 1983/84. In fact, even if demand were to grow at only 3% annually after 1983/84, all the planned base load investments, including the Project, would be needed. While demand projections 10 years or so ahead are uncertain, these figures suggest that it is most unlikely the extra 500 MW of capacity provided by the Project would be underutilized.

6.02 Many factors were taken into consideration when deciding that the additional capacity should be installed as an extension to the existing Trombay power station. The initial motivating factor was that the demand of TEC's consumers had been exceeding its firm generating capacity for some years and had necessitated a bulk purchase of power from MSEB which by 1976/77 was in excess of 500 MW. MSEB is also suffering from a capacity shortage and, to the extent that the capacity provided by the Project will decrease TEC's dependence upon purchased power, MSEB's capacity thus released will be available to meet its own expanding demand. Also the expertise built up by TEC's organization over a long period of time along with that of Tata Consulting Engineers, justifies the selection of this organization for the construction and operation of India's first 500 MW generating unit.

6.03 In summary, the prime considerations for installing this unit as an extension to the existing Trombay power station are:

- (a) comparatively short completion time of 4-1/2 to 5 years against 7 to 8 years for a new site and 6 to 7 years for expansion at an undeveloped site;

- (b) proximity of loads and a well developed integrated and reliable power system which ensures negligible investment in transmission and distribution of power;
- (c) development of some 250 MVA of additional load in the Trombay area during the next five years which will be captive demand for Trombay generating plant;
- (d) availability of multiple fuels including the possible availability of gas from Bombay High;
- (e) ample availability of cooling water at economical cost;
- (f) ease of transportation of heavy equipment required for an extension of this size.

#### Comparison of Alternatives

6.04 The justification for the Trombay development is based on the needs of the Western Region and other alternatives for providing this power were examined. These were: (a) hydro-electric; (b) nuclear; and (c) pithead generation.

6.05 The development of hydro-electric potential was ruled out because the most readily available and economic hydro sites that could supply the Western Region are to be developed in parallel anyway; they are supplements and not alternatives to the Trombay development. There is one large undeveloped potential of about 1,000 MW on the River Narmada in Gujarat but this involves several dams, is an expensive development with a long gestation period, and would be subject to agreement between three States on sharing the waters (a time consuming process) before feasibility studies could commence. The nuclear alternative was eliminated because of the long gestation period (8-10 years for the first unit).

6.06 The conventional thermal alternative which was considered was the installation of the 500 MW unit at a pit head. This alternative is, to some extent, academic since the Project will largely be supplying a captive industrial load in the Trombay area and from a technical viewpoint, apart from security of supply with local generation, power generated at pithead some 700 km distant would never reach Bombay but would merely supply intermediate load centers, releasing power generated by nearer power stations for transmission to the Bombay area. Nevertheless, this is the most realistic alternative and it was examined in some detail.

6.07 The construction of the 500 MW power station at the pithead would involve substantial associated 400 kV transmission and additional infrastructure and civil work costs. Also, since the site would be undeveloped, construction would be over a longer period and benefits would be delayed by at least two years. On the other hand higher fuel costs associated with the Trombay 500 MW extension (Rs 160 per ton compared with a pithead price of around Rs 77 per ton) would largely offset these additional costs. The



comparison between the pithead alternative and the Project shows that at market prices using a discount rate of 10%, the present worth of the cost streams of the Trombay 500 MW extension is the lower, with a difference of Rs 286 million. This decreases slightly to Rs 248 million if labor and foreign exchange are shadow priced. The equalizing discount rate at market prices is 6%, and at any rate greater than this the present worth of the Project cost streams are less than those of the pit-head alternative because the Project is less capital intensive. These results demonstrate that installation of the 500 MW unit at Trombay is the more economic of the two alternatives. A detailed discussion of these estimates is given in Annex 12.

6.08 The alternatives of extending an existing power station in Maharashtra and constructing a new power station with smaller (200 MW) units were also examined. However the higher capital and operating costs compared with the Trombay 500 MW extension, together with the cost of associated transmission, indicated that neither of these were realistic alternatives.

#### Return on Investment

6.09 In estimating the internal rate of return, revenues were based on financial requirements. For the purposes of this calculation, which equates the present worth of project costs with the present worth of attributable revenues, both costs and revenues are at 1977 prices. On this basis the return on the investment is just over 14%. Shadow pricing foreign exchange and local labor has no significant effect on this result. These results were subjected to sensitivity tests. A reduction in revenues of 10% reduces the return to about 12% and a 10% increase in capital and operating costs reduces it to 13%. If the cost increase and reduction in revenues coincide, the return would be just under 11%, which is still satisfactory. The methodology underlying these calculations is described in Annex 12.

#### Project Risks

6.10 With the commissioning of India's first 500 MW generating unit, the only real risk is the possibility of pre- and post-commissioning problems, with consequent heavy outage during the early years after commissioning. However, the first unit will be almost entirely manufactured in Germany by Kraftwerk Union, the firm with which Bharat Heavy Electricals Limited has concluded a cooperation agreement, and, bearing in mind the long experience of this firm in the manufacture of 500 MW units and larger, teething troubles may not prove a serious problem. The same comment applies equally to the steam generator, as the contract award would go to a firm with broad experience in this size of equipment, or to a firm associated through a cooperation agreement with a manufacturer with such experience. Additionally, TCE's system designs and plant specifications are subject to review by Ebasco Services who are experienced in the design and supervision of construction of projects of this size. In other respects the project risks are no greater than can be expected with other developments of this nature.

## VII. SUMMARY OF AGREEMENTS

7.01 During negotiations the following issues were discussed with GOI and satisfactory agreement or assurances obtained with regard to:

- (a) availability of adequate coal and rail transportation facilities for up to two million tons of coal per annum for Trombay power station by the time the Project is completed (para 4.12);
- (b) permission to import without further review by any agency of the Government in the event the lowest evaluated bidder for any contract to be financed through the Bank loan is a foreign manufacturer (para 4.13); and
- (c) taking all steps necessary to secure undertakings from the State of Maharashtra that no action, including delimiting TEC's area of supply, would be taken which would interfere with TEC's performance or adversely affect its financial position (para 2.05).

7.02 During negotiations the following issues were discussed with TEC and satisfactory agreement or assurances obtained with regard to:

- (a) the employment of consultants satisfactory to the Bank to assist in the design, preparation of specifications and bidding documents and supervision of construction of the Project (para 4.09).
- (b) compliance with environmental quality standards prescribed by relevant national, state and local authorities (para 4.17);
- (c) the preparation of a Completion Report (para 4.19);
- (d) the submission to the Bank within six months of the close of each financial year, of audited financial statements for each of the three Tata Companies, together with certified copies of the independent auditors' reports (para 5.02);
- (e) the receipt of letters of unqualified commitment for Rs 550 million in loan funds from local financial institutions in support of their intention to lend to TEC (paragraph 5.13);
- (f) the raising of additional share capital amounting to Rs 175 million not later than March 31, 1982 (paragraph 5.13);

- (g) the provision of special appropriations for debt redemption to be made annually commencing from April 1, 1983 (para 5.15); and
- (h) the incurrence of new debt without prior consultation with the Bank, if the debt to be incurred together with the debt already incurred would require revising the ceiling of borrowing above Rs 2,379.3 million (para 5.17).

7.03 Completion of security arrangements satisfactory to the Bank (para 2.06), receipt of letters of unqualified commitment for Rs 550 million specified in paragraph 7.02(e) and permission by the Government of Maharashtra for TEC to make the provisions specified in paragraph 7.02(g) are conditions of effectiveness of the proposed Bank loan; and formal extension of TEC's licences is a condition of disbursement of the proposed Bank loan (para 2.05).

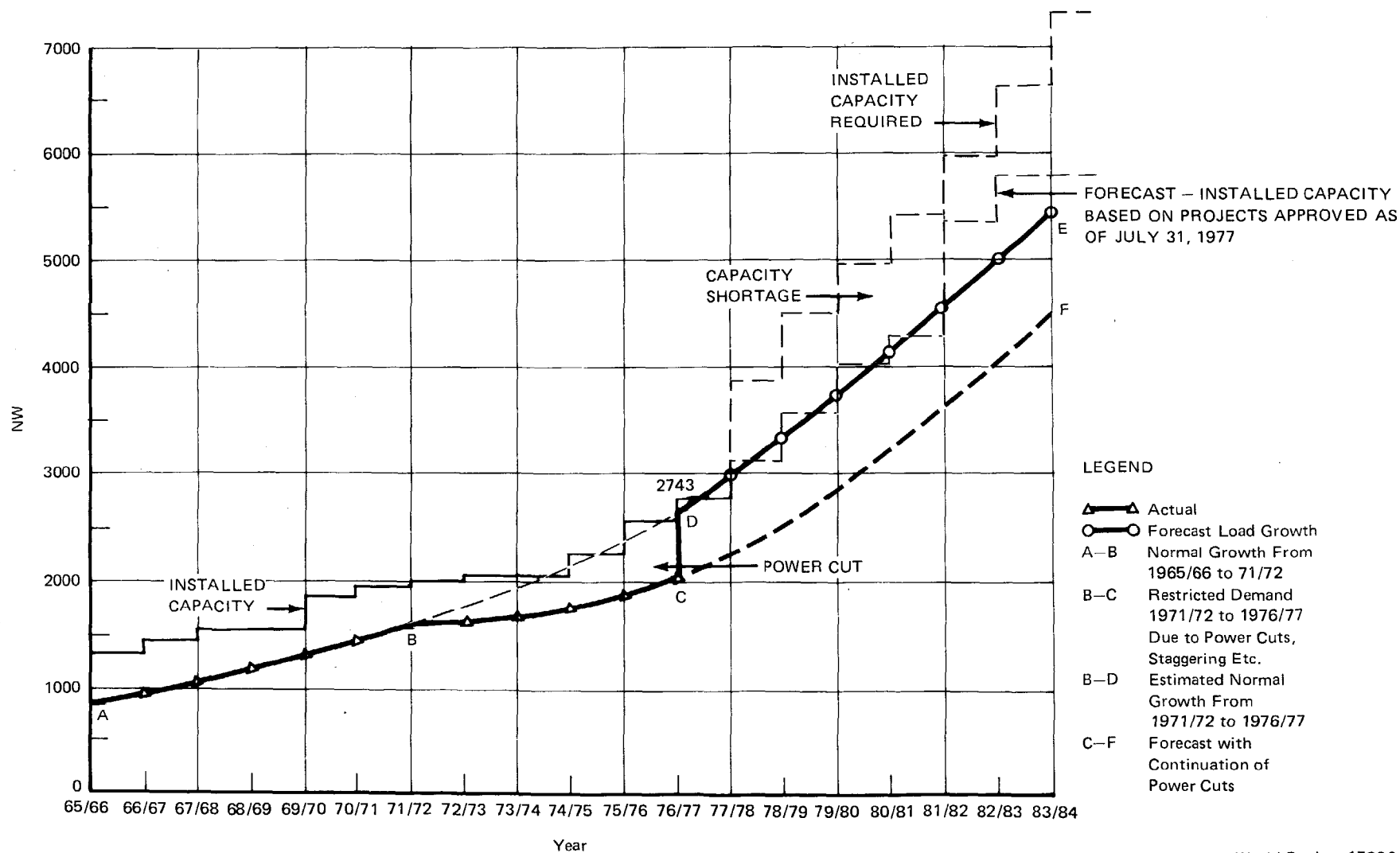
7.04 Subject to the foregoing assurances, the Project will be suitable for a Bank Loan of US\$105 million for 20 years including a grace period of 5 years.



# INDIA

## THIRD TROMBAY THERMAL POWER PROJECT

### Projections of Peak Demand and Installed Capacity Showing Capacity Required To Meet Peak Demand, Maharashtra State



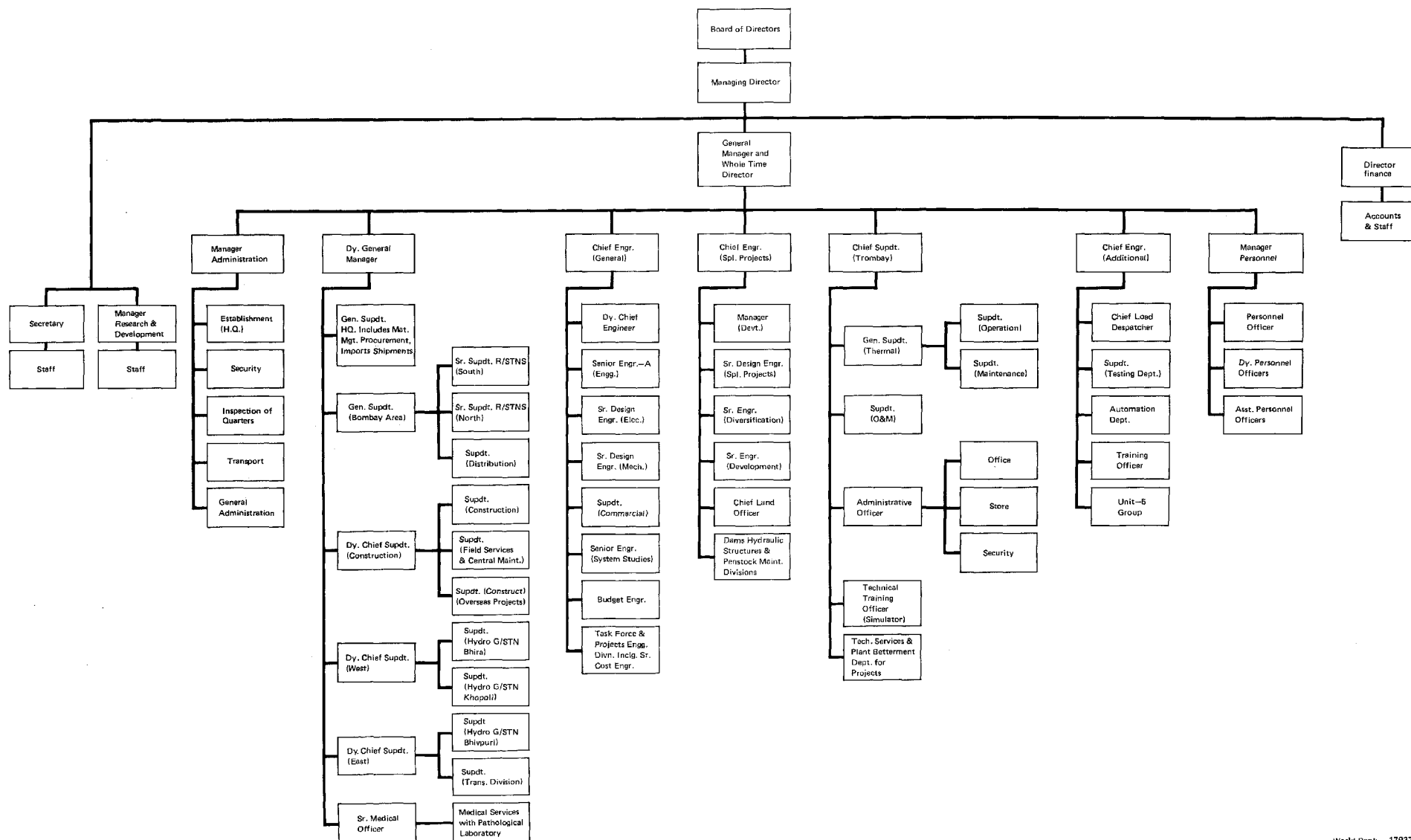
INDIA  
THIRD TROMBAY THERMAL POWER PROJECT  
TATA ELECTRIC COMPANIES

Combined Statement of Secured Loans as at March 31, 1977

| Secured Loans                                                                                                            | TATA hydro<br>Power Company Ltd. | Andhra Valley<br>Power Company Ltd. | TATA Power<br>Company Ltd.- | Total<br>1977 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------|-----------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Secured Loans</u>                                                                                                     |                                  |                                     |                             |               | <u>Security</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| (a) 7-3/4% First Debentures (1978-80)                                                                                    |                                  |                                     |                             |               | (1) The Debentures mentioned in (a) to (f) in respect of each company are secured by a concurrent first mortgage and first charge on the immovable properties, plant and licences of the Company and a floating charge on all its other assets, subject, however, in the case of the joint undertakings of one Company with the other two Companies held under the Trombay Thermal Licence (including the Licence) and the Carnac Receiving Station, to a prior first mortgage, charge and a floating charge in favor of The International Bank for Reconstruction and Development (amount of loan outstanding as on March 31, 1976 Rs. Nil) and The U.S. Agency for International Development in respect of such assets and also subject to a prior charge in respect of the hypothecation mentioned in (h). |
| - Secured by Trust Deed December 12, 1957 (Pledged with State Bank of India for Cash)                                    | -                                | -                                   | -                           | -             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| - Secured by Trust Deed September 25, 1940 (Issued for Cash)                                                             | -                                | 10.8                                | -                           | 16.6          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| - Secured by Trust Deed August 22, 1940 (Issued for Cash)                                                                | -                                | -                                   | 5.8                         | -             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| (b) 7-3/4% "B" Second Debentures (1978-80)                                                                               |                                  |                                     |                             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| - Secured by Trust Deed June 7, 1963 (Issued for Cash)                                                                   | 10.0                             | -                                   | -                           | -             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| - Secured by Trust Deed January 9, 1958 (Issued for Cash)                                                                | -                                | 13.0                                | -                           | 47.5          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| - Secured by Trust Deed June 29, 1949 (Issued for Cash)                                                                  | -                                | -                                   | 24.5                        | -             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| (c) 7-3/4% Third Debentures (1978-80)                                                                                    |                                  |                                     |                             |               | (2) Loans from IBRD and USAID are secured by a first mortgage, charge and a floating charge over the joint undertakings of one Company with the other Companies, held under the Trombay Thermal Licence (including the Licence) and the Carnac Receiving Station, in terms of a Trust Deed dated November 4th, 1955, as a subsequently modified).                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| - Secured by Trust Deed April 30, 1969 (Issued for Cash)                                                                 | 15.0                             | -                                   | -                           | -             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| - Secured by Trust Deed April 6, 1961 (Pledged with State Bank of India for Cash Credit) - Amount Drawn                  | -                                | 4.7                                 | -                           | 39.7          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| - Secured by Trust Deed December 12, 1957 (Issued for Cash)                                                              | -                                | -                                   | 20.0                        | -             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| (d) 7-3/4% Fourth Debentures (1978-80)                                                                                   |                                  |                                     |                             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| - Secured by Trust Deed April 6, 1961 (Pledged with State Bank of India for Cash Credit Arrangement - Amount Drawn)      | -                                | -                                   | -                           | -             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| - Secured by Trust Deed September 26, 1967 (Issued for Cash)                                                             | -                                | 11.0                                | -                           | 11.0          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| (e) 7-3/4 "B" Fifth Debentures (1978-80)                                                                                 |                                  |                                     |                             |               | <u>Redemption</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| - Secured by Trust Deed June 7, 1963 (Issued for Cash)                                                                   | -                                | -                                   | 8.4                         | 8.4           | (3) The Debentures mentioned in (a) to (e) in respect of each Company are redeemable at par on April 1, 1980, the Company having the option to redeem them earlier on April 1, 1978 or on any interest payment date thereafter by giving to the debentureholders three calendar months' notice. The Debentures mentioned in (f) are redeemable at par in four equal annual instalments commencing from September 30, 1984 and ending on September 30, 1987.                                                                                                                                                                                                                                                                                                                                                   |
| (f) 8-1/2% Debentures (1984-87) - (Issued for Cash)                                                                      | 10.0                             | 10.0                                | 20.0                        | 40.0          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| (g) (i) IBRD Loans                                                                                                       | 35.0                             | 49.5                                | 78.7                        | 163.2         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| (ii) USAID                                                                                                               | 7.7                              | 11.5                                | 19.2                        | 38.4          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| (h) Cash Credit Arrangement with State Bank of India Against hypothecation of Stores, Spare Parts, Coal and Fuel (Drawn) | 2.3                              | 5.7                                 | 12.1                        | 20.1          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Totals                                                                                                                   | 45.0                             | 66.7                                | 110.0                       | 221.7         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

November 4, 1977.

INDIA  
THIRD TROMBAY THERMAL POWER PROJECT  
Organization Chart  
Tata Electric Companies







## INDIA

## THIRD TROMBAY THERMAL POWER PROJECT

## Project Cost Estimates

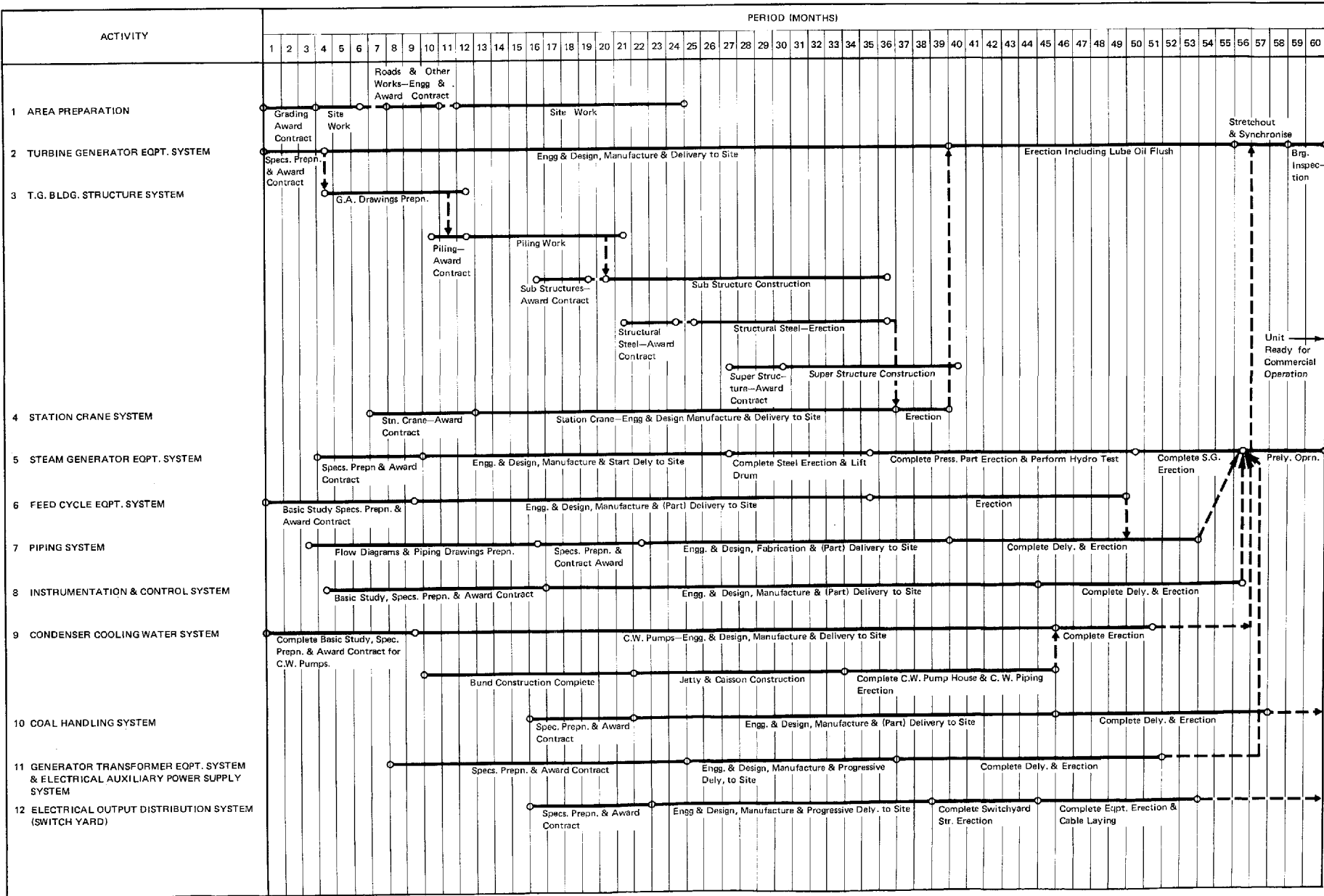
| Description                                                                                                                 | Rupee Million |         |         | US\$ Million |         |       |
|-----------------------------------------------------------------------------------------------------------------------------|---------------|---------|---------|--------------|---------|-------|
|                                                                                                                             | Local         | Foreign | Total   | Local        | Foreign | Total |
| <b>1. Preliminary Works</b>                                                                                                 |               |         |         |              |         |       |
| Road & Railway                                                                                                              | 7.6           | -       | 7.6     | 0.9          | -       | 0.9   |
| Miscellaneous                                                                                                               | 15.4          | -       | 15.4    | 1.8          | -       | 1.8   |
| Total                                                                                                                       | 23.0          | -       | 23.0    | 2.7          | -       | 2.7   |
| <b>2. Civil Works</b>                                                                                                       |               |         |         |              |         |       |
| Buildings, Foundations etc.                                                                                                 | 113.5         | -       | 113.5   | 13.2         | -       | 13.2  |
| Sub-total                                                                                                                   | 113.5         | -       | 113.5   | 13.2         | -       | 13.2  |
| Contingency (Physical) 10%                                                                                                  | 11.3          | -       | 11.3    | 1.3          | -       | 1.3   |
| Contingency (Price) 10%                                                                                                     | 12.5          | -       | 12.5    | 1.5          | -       | 1.5   |
| Total                                                                                                                       | 137.3         | -       | 137.3   | 16.0         | -       | 16.0  |
| <b>3. Electrical and Mechanical</b>                                                                                         |               |         |         |              |         |       |
| (a) Turbo-generator (TG)                                                                                                    | 66.0          | 235.0   | 301.0   | 7.7          | 27.3    | 35.0  |
| (b) TG Associated Equipment                                                                                                 | 46.7          | 36.0    | 83.3    | 5.4          | 4.3     | 9.7   |
| (c) Steam Generator (SG)                                                                                                    | 180.0         | 170.0   | 350.0   | 20.9         | 19.7    | 40.6  |
| (d) SG Associated Equipment                                                                                                 | 170.0         | 48.0    | 218.0   | 19.7         | 5.6     | 25.3  |
| (e) SO <sub>2</sub> Removal System                                                                                          | 30.0          | 90.0    | 120.0   | 3.5          | 10.5    | 14.0  |
| (f) Electrical Equipment                                                                                                    | 58.3          | 17.6    | 75.9    | 6.8          | 2.0     | 8.8   |
| (g) Miscellaneous E&M Plant                                                                                                 | 28.4          | 4.4     | 32.8    | 3.3          | 0.5     | 3.8   |
| Sub-total                                                                                                                   | 579.4         | 601.6   | 1,181.0 | 67.3         | 69.9    | 137.2 |
| Contingency (Physical) 5%                                                                                                   | 29.0          | 30.0    | 59.0    | 3.4          | 3.5     | 6.9   |
| Contingency (Price)                                                                                                         |               |         |         |              |         |       |
| (a) Turbo-generator 12%                                                                                                     | 7.9           | 29.6    | 37.5    | 0.9          | 3.4     | 4.3   |
| (b) Steam Generator 15%                                                                                                     | 27.0          | 25.5    | 52.5    | 3.1          | 3.0     | 6.1   |
| (c) SO <sub>2</sub> Removal System 25%                                                                                      | 7.5           | 22.5    | 30.0    | 0.9          | 2.7     | 3.6   |
| (d) Other Plant and Equipment 10%                                                                                           | 30.0          | 10.0    | 40.0    | 3.5          | 1.2     | 4.7   |
| Total                                                                                                                       | 680.8         | 719.2   | 1,400.0 | 79.1         | 83.7    | 162.8 |
| <b>4. Coal Handling &amp; Transportation</b>                                                                                |               |         |         |              |         |       |
| Wagons Conveyor System                                                                                                      | 32.6          | -       | 32.6    | 3.8          | -       | 3.8   |
| Crusher House Equipment                                                                                                     | 5.0           | -       | 5.0     | 0.6          | -       | 0.6   |
| Bulldozers                                                                                                                  | 2.1           | -       | 2.1     | 0.2          | -       | 0.2   |
| Ash Handling Equipment                                                                                                      | 17.0          | -       | 17.0    | 2.0          | -       | 2.0   |
| Total                                                                                                                       | 56.7          | -       | 56.7    | 6.6          | -       | 6.6   |
| Contingency (Physical) 5%                                                                                                   | 2.8           | -       | 2.8     | 0.3          | -       | 0.3   |
| Contingency (Price) 10%                                                                                                     | 6.0           | -       | 6.0     | 0.7          | -       | 0.7   |
| Total                                                                                                                       | 65.5          | -       | 65.5    | 7.6          | -       | 7.6   |
| <b>5. Switchyard</b>                                                                                                        |               |         |         |              |         |       |
| Main transformers and<br>Circuit Breakers CT & PT<br>Busbars Isolators, Distri-<br>bution Transformers and<br>Substructures | 48.5          | 34.8    | 83.3    | 5.7          | 4.0     | 9.7   |
| Sub-total                                                                                                                   | 48.5          | 34.8    | 83.3    | 5.7          | 4.0     | 9.7   |
| Contingency (Physical) 5%                                                                                                   | 2.4           | 1.7     | 4.1     | 0.3          | 0.2     | 0.5   |
| Contingency (Price) 10%                                                                                                     | 5.1           | 3.7     | 8.8     | 0.6          | 0.4     | 1.0   |
| Total                                                                                                                       | 56.0          | 40.2    | 96.2    | 6.6          | 4.6     | 11.2  |
| <b>6. Construction Equipment</b>                                                                                            | 18.0          | -       | 18.0    | 2.1          | -       | 2.1   |
| <b>7. Engineering &amp; Administration</b>                                                                                  | 38.6          | 21.4    | 60.0    | 4.5          | 2.5     | 7.0   |
| <b>8. Total Cost of Project</b>                                                                                             | 1,019.2       | 780.8   | 1,800.0 | 118.6        | 90.8    | 209.4 |

**Note:** The foreign costs of plant and equipment under 3(a) & (b) plus related contingencies will be financed through the KfW loan to GOI.

February, 1978.



**INDIA**  
**THIRD TROMBAY THERMAL POWER PROJECT**  
**Implementation and Construction Schedule**





## INDIA

## THIRD TROMBAY THERMAL POWER PROJECT

## TATA ELECTRIC COMPANIES

Combined Income Statements for FY1973 to 1976 (Actual) and FY1977 through FY1985 (Forecast)  
(in millions of Rupees, except where otherwise stated)

| March 31                                                                  | Actual  |         |         |         | Estimated Actual | Forecast |         |         |         |         |         |         |         |
|---------------------------------------------------------------------------|---------|---------|---------|---------|------------------|----------|---------|---------|---------|---------|---------|---------|---------|
|                                                                           | 1973    | 1974    | 1975    | 1976    | 1977             | 1978     | 1979    | 1980    | 1981    | 1982    | 1983    | 1984    | 1985    |
| <b>Energy Generated and Sold</b>                                          |         |         |         |         |                  |          |         |         |         |         |         |         |         |
| Hydro Generation GWh                                                      | 1,197.0 | 1,205.0 | 1,216.0 | 1,363.0 | 1,333.0          | 1,250.0  | 1,250.0 | 1,200.0 | 1,200.0 | 1,200.0 | 1,200.0 | 1,200.0 | 1,200.0 |
| Thermal Generation GWh                                                    | 2,265.0 | 1,583.0 | 1,899.0 | 2,020.0 | 1,989.0          | 1,900.0  | 1,900.0 | 1,900.0 | 1,800.0 | 1,800.0 | 2,550.0 | 4,000.0 | 4,800.0 |
| Power Purchases GWh                                                       | 2,581.0 | 3,320.0 | 3,024.0 | 2,693.0 | 3,406.0          | 3,605.0  | 3,605.0 | 3,878.0 | 4,165.0 | 4,385.0 | 3,910.0 | 2,800.0 | 2,240.0 |
| Total - Generated and Purchased GWh                                       | 6,043.0 | 6,108.0 | 6,139.0 | 6,076.0 | 6,728.0          | 6,755.0  | 6,755.0 | 6,990.0 | 7,165.0 | 7,385.0 | 7,660.0 | 8,000.0 | 8,240.0 |
| Use in Station, and Transmission Loss GWh                                 | 334.0   | 355.0   | 346.0   | 350.0   | 346.0            | 405.0    | 405.0   | 410.0   | 430.0   | 445.0   | 515.0   | 640.0   | 660.0   |
| Sales of Energy GWh                                                       | 5,709.0 | 5,753.0 | 5,793.0 | 5,726.0 | 6,382.0          | 6,350.0  | 6,350.0 | 6,540.0 | 6,735.0 | 6,940.0 | 7,145.0 | 7,360.0 | 7,580.0 |
| Average Price (paise/kWh)                                                 | 8.8     | 11.0    | 15.2    | 18.7    | 21.23            | 22.25    | 22.53   | 23.40   | 24.83   | 25.79   | 24.16   | 23.41   | 23.34   |
| Average Price (US cents/kWh equivalent)                                   | -       | -       | -       | 2.17    | 2.47             | 2.59     | 2.62    | 2.72    | 2.89    | 3.00    | 2.81    | 2.72    | 2.71    |
| <b>Operating Revenue</b>                                                  |         |         |         |         |                  |          |         |         |         |         |         |         |         |
| Sale of Energy                                                            | 501.0   | 641.0   | 878.0   | 1,068.0 | 1,354.7          | 1,412.8  | 1,430.6 | 1,530.1 | 1,672.6 | 1,790.0 | 1,726.4 | 1,783.1 | 1,769.0 |
| <b>Operating Expenses</b>                                                 |         |         |         |         |                  |          |         |         |         |         |         |         |         |
| Cost of Fuel                                                              | 111.0   | 118.0   | 220.0   | 328.0   | 389.2            | 368.3    | 368.3   | 368.3   | 358.9   | 358.9   | 501.3   | 654.9   | 654.9   |
| Other Operating Maintenance                                               | 81.0    | 92.0    | 118.0   | 143.0   | 154.5            | 164.1    | 173.1   | 178.6   | 184.1   | 189.3   | 229.3   | 235.8   | 242.3   |
| Power Purchases                                                           | 188.0   | 291.0   | 362.0   | 417.0   | 609.0            | 740.5    | 740.5   | 793.0   | 855.5   | 892.5   | 681.0   | 411.0   | 460.5   |
| Depreciation                                                              | 22.0    | 22.0    | 22.0    | 23.0    | 24.3             | 24.3     | 25.2    | 25.7    | 26.0    | 26.3    | 25.6    | 86.3    | 86.6    |
| Tax on Sales                                                              | 24.0    | 24.0    | 24.0    | 24.0    | 26.3             | 26.4     | 26.4    | 27.1    | 27.9    | 28.7    | 29.6    | 30.5    | 31.4    |
| Write off - Misc. Exp.                                                    | 10.0    | 14.0    | 20.0    | -       | 0.3              | 0.3      | 0.3     | 0.2     | -       | -       | -       | -       | -       |
| Total - Operating Expenses                                                | 436.0   | 561.0   | 766.0   | 935.0   | 1,202.9          | 1,323.9  | 1,333.8 | 1,392.9 | 1,452.4 | 1,495.7 | 1,466.8 | 1,418.5 | 1,475.7 |
| Operating Income                                                          | 65.0    | 80.0    | 112.0   | 133.0   | 151.8            | 88.9     | 96.8    | 137.2   | 220.2   | 294.3   | 259.6   | 304.6   | 293.3   |
| Non Operating Income                                                      | 10.0    | 10.0    | 14.0    | 14.7    | 19.7             | 9.0      | 9.1     | 9.2     | 9.3     | 9.4     | 9.5     | 9.7     | 10.1    |
| Total Income                                                              | 75.0    | 90.0    | 126.0   | 147.7   | 171.5            | 97.9     | 105.9   | 146.4   | 229.5   | 303.7   | 269.1   | 314.3   | 303.4   |
| Deduct Interest on Debt                                                   | 26.0    | 28.0    | 27.0    | 30.2    | 32.8             | 30.9     | 49.2    | 78.8    | 140.9   | 189.0   | 212.6   | 208.7   | 196.5   |
| Foreign Exchange - Write off                                              | -       | -       | -       | 7.7     | 4.9              | 4.6      | 4.4     | 4.4     | 2.0     | -       | -       | -       | -       |
| Provision for Taxation                                                    | 28.0    | 37.0    | 65.0    | 68.2    | 67.8             | 27.1     | 22.6    | 33.7    | 49.2    | 64.4    | -       | -       | -       |
| Total - Deductions                                                        | 54.0    | 65.0    | 92.0    | 106.1   | 105.5            | 62.6     | 76.2    | 116.9   | 192.1   | 253.4   | 212.6   | 208.7   | 196.5   |
| Profit                                                                    | 21.0    | 25.0    | 34.0    | 41.6    | 66.0             | 35.3     | 29.7    | 29.5    | 37.4    | 50.3    | 56.5    | 105.6   | 106.9   |
| Less Contingencies Reserve                                                | 2.0     | 2.0     | 6.0     | 3.0     | 3.5              | 2.4      | 1.3     | 1.2     | 1.3     | 1.2     | 7.2     | 7.2     | 7.3     |
| Investment Allowance Reserve                                              | -       | 2.0     | -       | 5.0     | 9.6              | 6.4      | 4.1     | 3.5     | -       | -       | -       | -       | -       |
| Tariff and Other Reserve                                                  | -       | -       | -       | 5.2     | 1.8              | 2.6      | -       | -       | -       | -       | -       | -       | -       |
| Loan Redemption Fund                                                      | -       | -       | -       | -       | -                | -        | -       | -       | -       | -       | -       | 47.5    | 47.9    |
| Deferred Tax Reserve                                                      | -       | -       | -       | -       | 27.0             | -        | -       | -       | -       | -       | -       | -       | -       |
| Total Statutory Appropriations                                            | 2.0     | 4.0     | 6.0     | 13.2    | 41.9             | 11.4     | 5.4     | 4.7     | 1.3     | 1.2     | 7.2     | 54.7    | 55.2    |
| Profit (after tax and Appropriations)                                     | 19.0    | 21.0    | 28.0    | 28.4    | 24.1             | 23.9     | 24.3    | 24.8    | 36.1    | 49.1    | 49.3    | 50.9    | 51.7    |
| Adjustments from previous years                                           | 2.0     | (1.0)   | (1.0)   | 2.1     | -                | -        | -       | -       | -       | -       | -       | -       | -       |
| Distributable Profits                                                     | 21.0    | 20.0    | 27.0    | 30.5    | 24.1             | 23.9     | 24.3    | 24.8    | 36.1    | 49.1    | 49.3    | 50.9    | 51.7    |
| Less Proposed Dividend                                                    | 7.0     | 7.0     | 20.7    | 20.5    | 20.5             | 20.5     | 20.5    | 20.5    | 26.3    | 42.7    | 42.7    | 42.7    | 42.7    |
| Retained Profit to General Reserve                                        | 14.0    | 13.0    | 6.3     | 10.0    | 3.6              | 3.4      | 3.8     | 4.3     | 9.8     | 6.4     | 6.6     | 8.2     | 9.0     |
| Operating Ratio (operating expenses as percentage of operating revenue) % | 87      | 87      | 87      | 87      | 89               | 94       | 93      | 91      | 87      | 84      | 85      | 82      | 83      |

March 22, 1978.

## INDIA

## THIRD TROMBAY THERMAL POWER PROJECT

## TATA ELECTRIC COMPANIES

Combined Forecast Source and Application of Funds FY1977 through FY1985  
(in millions of Rupees, except where otherwise stated)

| March 31                                                      | Estimated<br>Actual<br>1977 | Forecast |       |       |         |       |       |       |       |
|---------------------------------------------------------------|-----------------------------|----------|-------|-------|---------|-------|-------|-------|-------|
|                                                               |                             | 1978     | 1979  | 1980  | 1981    | 1982  | 1983  | 1984  | 1985  |
| <u>SOURCES OF FUNDS</u>                                       |                             |          |       |       |         |       |       |       |       |
| Internal Cash Generation                                      |                             |          |       |       |         |       |       |       |       |
| Total Income                                                  | 171.5                       | 97.9     | 105.9 | 146.4 | 229.5   | 303.7 | 269.1 | 314.3 | 303.4 |
| Depreciation                                                  | 23.6                        | 24.3     | 25.2  | 25.7  | 26.0    | 26.3  | 25.6  | 86.3  | 86.6  |
| Miscellaneous Expense (Written-off)                           | 0.3                         | 0.3      | 0.3   | 0.2   | -       | -     | -     | -     | -     |
| Total - Cash Generation                                       | 195.4                       | 122.5    | 131.4 | 172.3 | 255.5   | 330.0 | 294.7 | 400.6 | 390.0 |
| Capital Raised                                                |                             |          |       |       |         |       |       |       |       |
| Equity Subscriptions                                          | -                           | -        | -     | -     | 87.5    | 87.5  | -     | -     | -     |
| Security Deposits from Consumers                              | -                           | -        | 30.0  | 50.0  | 50.0    | 20.0  | -     | -     | -     |
| Approved Loans:                                               |                             |          |       |       |         |       |       |       |       |
| - World Bank (for Trombay)                                    | -                           | -        | 93.7  | 151.5 | 392.8   | 225.7 | 39.3  | -     | -     |
| - Local Loans (for Trombay)                                   | -                           | 3.3      | 16.5  | 205.2 | 252.2   | 30.8  | 64.0  | -     | -     |
| - Local Loans (Other)                                         | -                           | -        | -     | 4.6   | 16.9    | -     | 16.2  | -     | -     |
| Debentures                                                    | -                           | 50.0     | -     | -     | -       | -     | -     | -     | -     |
| Cash Credits                                                  | -                           | -        | 13.6  | 22.9  | -       | -     | 3.2   | -     | -     |
| Total Capital Raised                                          | -                           | 53.3     | 153.8 | 434.2 | 799.4   | 364.0 | 122.7 | -     | -     |
| Fixed Deposits                                                | 7.9                         | -        | -     | -     | -       | -     | -     | -     | -     |
| Other Items (Realisations from assets retired)                | 0.5                         | 1.1      | 1.1   | 1.1   | 1.1     | 1.3   | 1.3   | 1.3   | 1.3   |
|                                                               | 203.8                       | 176.9    | 286.3 | 607.6 | 1,056.0 | 695.3 | 418.7 | 401.9 | 391.3 |
| <u>APPLICATION OF FUND</u>                                    |                             |          |       |       |         |       |       |       |       |
| Capital Expenditure                                           |                             |          |       |       |         |       |       |       |       |
| General Construction                                          | 42.3                        | 34.0     | 30.0  | 30.0  | 30.0    | 30.0  | 30.0  | 30.0  | 30.0  |
| Third Trombay Power Project                                   | -                           | 3.3      | 140.2 | 406.7 | 782.5   | 364.0 | 103.3 | -     | -     |
| Total                                                         | 42.3                        | 37.3     | 170.2 | 436.7 | 812.5   | 394.0 | 133.3 | 30.0  | 30.0  |
| Debt Service                                                  |                             |          |       |       |         |       |       |       |       |
| Repayment - Cash Credit                                       | 9.9                         | 13.8     | -     | -     | -       | 3.2   | -     | -     | -     |
| Interest                                                      | 32.8                        | 30.9     | 49.2  | 78.8  | 140.9   | 189.0 | 212.6 | 208.7 | 196.5 |
| Amortization                                                  | 9.9                         | 27.1     | 17.6  | 17.6  | 17.6    | 8.0   | 8.0   | 108.4 | 108.4 |
| Total - Debt Service                                          | 52.6                        | 71.8     | 66.8  | 96.4  | 158.5   | 200.2 | 220.6 | 317.1 | 304.9 |
| Investment of Contingencies Reserve                           | 8.0                         | 2.9      | 2.4   | 1.3   | 2.8     | 2.8   | 1.2   | 7.2   | 7.2   |
| Tax Provisions                                                | 67.8                        | 27.1     | 22.6  | 33.7  | 49.2    | 64.4  | -     | -     | -     |
| Dividends                                                     | 20.5                        | 20.5     | 20.5  | 20.5  | 26.3    | 42.7  | 42.7  | 42.7  | 42.7  |
| Working Capital (Increase/(Decreases))                        | 12.6                        | 17.3     | 3.8   | 19.0  | 6.7     | (8.8) | 20.9  | 4.9   | 6.5   |
|                                                               | 203.8                       | 176.9    | 286.3 | 607.6 | 1,056.0 | 695.3 | 418.7 | 401.9 | 391.3 |
| No. of Times Debt Service covered by<br>Total Cash Generation | 3.7                         | 1.7      | 2.0   | 1.8   | 1.6     | 1.6   | 1.3   | 1.3   | 1.3   |

March 22, 1978.

INDIA  
THIRD TROMBAY THERMAL POWER PROJECT  
TATA ELECTRIC COMPANIES

Condensed Balance Sheets as at end of FY1976 through FY1985  
(in millions of Rupees, except where otherwise stated)

| March 31                                                                        | Actual<br>1976 | Estimated<br>Actual<br>1977 | Forecast |         |         |         |         |         |         |         |
|---------------------------------------------------------------------------------|----------------|-----------------------------|----------|---------|---------|---------|---------|---------|---------|---------|
|                                                                                 | 1976           | 1977                        | 1978     | 1979    | 1980    | 1981    | 1982    | 1983    | 1984    | 1985    |
| <b>Assets</b>                                                                   |                |                             |          |         |         |         |         |         |         |         |
| Gross Fixed Assets                                                              | 852.6          | 906.7                       | 950.1    | 980.7   | 1,005.7 | 1,030.7 | 1,054.7 | 2,878.7 | 2,902.7 | 2,926.7 |
| Less Depreciation                                                               | (330.1)        | (352.1)                     | (372.4)  | (393.6) | (415.3) | (437.3) | (458.8) | (479.6) | (561.1) | (642.9) |
| Net Fixed Assets in Service                                                     | 522.5          | 554.6                       | 577.7    | 587.1   | 590.4   | 593.4   | 595.9   | 2,399.1 | 2,341.6 | 2,283.8 |
| Work in Progress                                                                | 57.6           | 43.2                        | 32.1     | 166.7   | 573.4   | 1,355.9 | 1,719.9 | 23.2    | 23.2    | 23.2    |
| Foreign Exchange - Increased Cost<br>of Loans for purchase of Capital<br>Assets | 21.0           | 15.4                        | 10.8     | 6.4     | 2.0     | -       | -       | -       | -       | -       |
| Total - Fixed Assets                                                            | 601.1          | 613.2                       | 620.6    | 760.2   | 1,165.8 | 1,949.3 | 2,315.8 | 2,422.3 | 2,364.8 | 2,307.0 |
| <b>Investment</b>                                                               |                |                             |          |         |         |         |         |         |         |         |
| Contingencies Reserve                                                           | 34.1           | 42.1                        | 45.0     | 47.4    | 48.7    | 49.9    | 51.2    | 52.4    | 59.6    | 66.8    |
| Others                                                                          | 9.7            | 9.7                         | 9.7      | 9.7     | 9.7     | 11.3    | 12.8    | 12.8    | 12.8    | 12.8    |
|                                                                                 | 43.8           | 51.8                        | 54.7     | 57.1    | 58.4    | 61.2    | 64.0    | 65.2    | 72.4    | 79.6    |
| <b>Current Assets</b>                                                           |                |                             |          |         |         |         |         |         |         |         |
| Cash and Bank                                                                   | 2.2            | 19.1                        | 4.0      | 4.0     | 4.0     | 4.0     | 4.0     | 6.0     | 6.0     | 6.0     |
| Inventories                                                                     | 106.8          | 111.7                       | 113.7    | 115.7   | 117.7   | 120.0   | 122.0   | 144.0   | 147.0   | 150.0   |
| Debtors (Consumers)                                                             | 152.3          | 159.7                       | 148.1    | 148.1   | 163.3   | 176.0   | 184.0   | 178.0   | 178.0   | 182.0   |
| Other Debtors                                                                   | 38.0           | 54.7                        | 54.7     | 54.7    | 54.7    | 54.5    | 54.5    | 54.5    | 54.5    | 54.0    |
| Total - Current Assets                                                          | 299.3          | 345.2                       | 320.5    | 322.5   | 339.7   | 354.5   | 364.5   | 382.5   | 385.5   | 392.0   |
| Deferred Expenses                                                               | 1.1            | 0.8                         | 0.5      | 0.2     | -       | -       | -       | -       | -       | -       |
| Total - Assets                                                                  | 945.3          | 1,011.0                     | 996.3    | 1,140.0 | 1,563.9 | 2,365.0 | 2,744.3 | 2,870.0 | 2,822.7 | 2,778.6 |
| <b>Liabilities</b>                                                              |                |                             |          |         |         |         |         |         |         |         |
| Share Capital                                                                   |                |                             |          |         |         |         |         |         |         |         |
| Ordinary Share Capital                                                          | 133.6          | 133.6                       | 133.6    | 133.6   | 133.6   | 221.1   | 308.6   | 308.6   | 308.6   | 308.6   |
| Preference Share                                                                | 38.6           | 38.6                        | 38.6     | 38.6    | 38.6    | 38.6    | 38.6    | 38.6    | 38.6    | 38.6    |
| Total - Capital                                                                 | 172.2          | 172.2                       | 172.2    | 172.2   | 172.2   | 259.7   | 347.2   | 347.2   | 347.2   | 347.2   |
| <b>Reserves</b>                                                                 |                |                             |          |         |         |         |         |         |         |         |
| Shareholders Reserves                                                           | 156.7          | 160.3                       | 163.7    | 167.5   | 171.8   | 181.6   | 188.0   | 194.6   | 202.8   | 211.8   |
| Contingencies Reserves                                                          | 42.1           | 45.0                        | 47.4     | 48.7    | 49.9    | 51.2    | 52.4    | 59.6    | 66.8    | 74.1    |
| Other Statutory Reserves                                                        | 15.8           | 54.2                        | 63.2     | 67.3    | 70.8    | 70.8    | 70.8    | 70.8    | 118.3   | 166.2   |
| Total - Reserves                                                                | 214.6          | 259.5                       | 274.3    | 283.5   | 292.5   | 303.6   | 311.2   | 325.0   | 387.9   | 452.1   |
| <b>Debt</b>                                                                     |                |                             |          |         |         |         |         |         |         |         |
| Cash Credits                                                                    | 34.7           | 24.8                        | 11.0     | 24.6    | 47.5    | 47.5    | 44.3    | 47.5    | 47.5    | 47.5    |
| Debentures                                                                      | 158.5          | 158.5                       | 208.5    | 200.5   | 192.5   | 184.5   | 176.5   | 168.5   | 158.5   | 148.5   |
| AID Loan                                                                        | 48.9           | 38.4                        | 28.8     | 19.2    | 9.6     | -       | -       | -       | -       | -       |
| IBRD Loan (Trombay)                                                             | -              | -                           | -        | 93.7    | 245.2   | 638.0   | 863.7   | 903.0   | 842.8   | 782.6   |
| Other Financial Institution                                                     | -              | -                           | 3.3      | 19.8    | 229.6   | 498.7   | 529.5   | 609.7   | 571.5   | 533.3   |
| Unsecured Loans                                                                 | 95.3           | 103.2                       | 85.7     | 85.7    | 85.7    | 85.7    | 85.7    | 85.7    | 85.7    | 85.7    |
| Total                                                                           | 337.4          | 324.9                       | 337.3    | 443.5   | 810.1   | 1,454.4 | 1,699.7 | 1,814.4 | 1,706.0 | 1,597.6 |
| Consumers Deposits                                                              | -              | -                           | -        | 30.0    | 80.0    | 130.0   | 150.0   | 150.0   | 150.0   | 150.0   |
| <b>Current Liabilities</b>                                                      |                |                             |          |         |         |         |         |         |         |         |
| Sundry Creditors                                                                | 136.8          | 163.5                       | 122.3    | 122.3   | 122.3   | 127.3   | 129.0   | 126.0   | 124.0   | 124.0   |
| Other Liabilities                                                               | 80.4           | 87.0                        | 86.2     | 84.4    | 82.6    | 85.7    | 102.8   | 102.9   | 103.0   | 103.0   |
| Total - Current Liabilities                                                     | 217.2          | 250.5                       | 208.5    | 206.7   | 204.9   | 213.0   | 231.8   | 228.9   | 227.0   | 227.0   |
| Consumers Contributions                                                         | 3.9            | 3.9                         | 4.0      | 4.1     | 4.2     | 4.3     | 4.4     | 4.5     | 4.6     | 4.7     |
| Total - Liabilities                                                             | 945.3          | 1,011.0                     | 996.3    | 1,140.0 | 1,563.9 | 2,365.0 | 2,744.3 | 2,870.0 | 2,822.7 | 2,778.6 |
| <b>Debt/Equity Ratio - Unpaid Debt as<br/>% of Capital and Reserves</b>         |                |                             |          |         |         |         |         |         |         |         |
|                                                                                 | 47.0           | 43.0                        | 43.0     | 49.0    | 64.0    | 72.0    | 72.0    | 73.0    | 70.0    | 67.0    |
| <b>Current Ratio</b>                                                            |                |                             |          |         |         |         |         |         |         |         |
| Current Assets to Liabilities                                                   | 1.4            | 1.4                         | 1.5      | 1.6     | 1.6     | 1.7     | 1.6     | 1.7     | 1.7     | 1.7     |

March 22, 1978.

## INDIA

## THIRD TROMBAY THERMAL POWER PROJECT

## TATA ELECTRIC COMPANIES

## Estimated Clear Profit

(in million of Rupees, except where otherwise stated)

| March 31                                       | 1977    | 1978    | 1979    | 1980    | 1981    | 1982    | 1983    | 1984    | 1985    |
|------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <u>Expenses</u>                                |         |         |         |         |         |         |         |         |         |
| Power Purchases                                | 609.0   | 740.5   | 740.5   | 793.0   | 855.5   | 892.5   | 681.0   | 411.0   | 460.5   |
| Cost of Fuel                                   | 389.2   | 368.3   | 368.3   | 368.3   | 358.9   | 358.9   | 501.3   | 654.9   | 654.9   |
| Tax on Sale of Electricity                     | 26.3    | 26.4    | 26.4    | 27.1    | 27.9    | 28.7    | 29.6    | 30.5    | 31.4    |
| Operating Expenses                             | 148.2   | 158.8   | 167.8   | 173.3   | 178.8   | 184.0   | 224.0   | 230.5   | 237.0   |
| Interest on Security Deposits                  | -       | -       | 0.8     | 3.0     | 5.8     | 7.7     | 8.3     | 8.3     | 8.3     |
| Interest on Approved Loans (World Bank)        | -       | -       | 11.2    | 22.9    | 48.8    | 78.1    | 92.0    | 89.5    | 83.3    |
| Interest on Approved Loans (Local Unit-5)      | -       | -       | 6.9     | 20.2    | 47.6    | 64.6    | 73.3    | 71.9    | 66.9    |
| Interest on Approved Loans (Local - Others)    | 1.5     | 1.1     | -       | 0.3     | 1.7     | 2.8     | 3.9     | 4.9     | 4.9     |
| Interest on Debentures                         | 12.6    | 14.0    | 17.6    | 16.8    | 19.7    | 18.9    | 18.0    | 17.0    | 16.0    |
| Interest on Cash Credits                       | 7.0     | 4.5     | 2.6     | 5.4     | 7.1     | 6.9     | 7.1     | 7.1     | 7.1     |
| Depreciation                                   | 23.3    | 24.0    | 24.9    | 25.4    | 25.7    | 26.0    | 25.3    | 86.0    | 86.3    |
| Taxation                                       | 69.4    | 28.7    | 24.2    | 35.3    | 50.8    | 66.0    | -       | -       | -       |
| Miscellaneous Expenditure Written of           | 0.3     | 0.3     | 0.3     | 0.2     | -       | -       | -       | -       | -       |
| Appropriation to Contingencies Reserve         | 3.5     | 2.4     | 1.3     | 1.2     | 1.3     | 1.2     | 7.2     | 7.2     | 7.3     |
| Appropriation to Investment Allowance Reserve  | 9.6     | 6.4     | 4.1     | 3.5     | -       | -       | -       | -       | -       |
| Special Appropriation Re. Devaluation Increase | 5.8     | 5.2     | 4.8     | 4.7     | 2.1     | -       | -       | -       | -       |
| Special Appropriation Re. Deferred Tax Reserve | 27.0    | -       | -       | -       | -       | -       | -       | -       | -       |
| Special Appropriation Re. Loan Redemption Fund | -       | -       | -       | -       | -       | -       | -       | 47.5    | 47.9    |
|                                                | 1,332.7 | 1,380.6 | 1,401.7 | 1,500.6 | 1,631.7 | 1,736.3 | 1,671.0 | 1,666.3 | 1,711.8 |
| <u>Addition</u>                                |         |         |         |         |         |         |         |         |         |
| Margin for Clear Profit 1/                     | 41.2    | 41.5    | 35.7    | 36.4    | 47.9    | 60.8    | 62.6    | 64.2    | 65.0    |
| Total to be Covered by Revenue                 | 1,373.9 | 1,422.1 | 1,437.4 | 1,537.0 | 1,679.6 | 1,797.1 | 1,733.6 | 1,730.5 | 1,776.8 |
| Deduct Other Income                            | 17.4    | 6.7     | 6.8     | 6.9     | 7.0     | 7.1     | 7.2     | 7.4     | 7.8     |
| Total Revenue to be covered by Tariff          | 1,356.5 | 1,415.4 | 1,430.6 | 1,530.1 | 1,672.6 | 1,790.0 | 1,726.4 | 1,723.1 | 1,769.0 |
| Energy Sales (kWh million)                     | 6,382.0 | 6,350.0 | 6,350.0 | 6,540.0 | 6,735.0 | 6,940.0 | 7,145.0 | 7,360.0 | 7,580.0 |
| Average Price (paise/kWh)                      | 21.23   | 22.25   | 22.53   | 23.40   | 24.83   | 25.79   | 24.16   | 23.41   | 23.34   |

1/ "Clear profit" exceeded the amount of reasonable return by Rs 5.3 million (15%) in FY1977, and by a forecast Rs 7.0 million (20%) in FY1978. From FY1979 the "clear profit" is assumed to equal the "amount of reasonable return (Annex 10). It differs from "distributable profits" shown in Annex 6 because certain items of income and expenditure are outside the definition of clear profit.

March 22, 1978.



INDIA

THIRD TROMBAY THERMAL POWER PROJECT

TATA ELECTRIC COMPANIES

Estimated Capital Base and Reasonable Return  
(in million Rupees)

| March 31                                             | 1977    | 1978    | 1979    | 1980    | 1981    | 1982    | 1983    | 1984    | 1985    |
|------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <u>Capital Base Computation</u>                      |         |         |         |         |         |         |         |         |         |
| Original Cost of Fixed Assets                        | 899.8   | 943.2   | 973.8   | 998.8   | 1,023.8 | 1,047.8 | 2,871.8 | 2,899.8 | 2,919.8 |
| Less: Capital Contributions from Consumers           | 3.9     | 4.0     | 4.1     | 4.2     | 4.3     | 4.4     | 4.5     | 4.6     | 4.7     |
|                                                      | 895.9   | 939.2   | 969.7   | 994.6   | 1,019.5 | 1,043.4 | 2,867.3 | 2,895.2 | 2,915.1 |
| Cost of Licences and Capital Issue Expenses          | 6.4     | 6.4     | 6.4     | 6.4     | 6.4     | 6.4     | 6.4     | 6.4     | 6.4     |
| Cost of Works-In Progress                            | 50.0    | 35.6    | 30.0    | 30.0    | 30.0    | 30.0    | 30.0    | 30.0    | 30.0    |
| Cost of Works-In-Progress Unit-5                     | -       | 3.3     | 143.5   | 550.2   | 1,332.7 | 1,696.7 | -       | -       | -       |
| Contingencies Reserve Investments                    | 42.1    | 45.0    | 47.4    | 48.7    | 49.9    | 51.2    | 52.4    | 59.6    | 66.8    |
| Average Stores and Tools Balances                    | 97.1    | 108.0   | 110.0   | 112.0   | 114.0   | 116.0   | 132.0   | 139.5   | 142.9   |
| Average Cash and Bank Balances                       | 16.5    | 4.0     | 4.0     | 4.0     | 4.0     | 4.0     | 6.0     | 6.0     | 6.0     |
| Average Cash Credit Balances                         | -42.6   | -14.9   | -17.0   | -36.0   | -47.5   | -45.9   | -47.5   | -47.5   | -47.5   |
|                                                      | 1,065.4 | 1,126.6 | 1,294.0 | 1,709.9 | 2,509.0 | 2,901.8 | 3,046.6 | 3,085.2 | 3,119.3 |
| <u>Deductions</u>                                    |         |         |         |         |         |         |         |         |         |
| Depreciation Fund                                    | 349.6   | 369.6   | 390.5   | 411.9   | 433.6   | 454.8   | 475.3   | 556.5   | 638.0   |
| Licence and Capital Issue Expenses W/off             | 5.6     | 5.9     | 6.2     | 6.4     | 6.4     | 6.4     | 6.4     | 6.4     | 6.4     |
| Security Deposits from Consumers                     | -       | -       | 30.0    | 80.0    | 130.0   | 150.0   | 150.0   | 150.0   | 150.0   |
| Approved Loan from World Bank                        | -       | -       | 93.7    | 245.2   | 638.0   | 863.7   | 903.0   | 842.8   | 782.6   |
| Approved Loans from Local Institutions-Unit-5        | -       | 3.3     | 19.8    | 225.0   | 477.2   | 508.0   | 572.0   | 533.8   | 495.6   |
| Approved Loans from Local Institutions-Others        | 10.0    | -       | -       | 4.6     | 21.5    | 21.5    | 37.7    | 37.7    | 37.7    |
| Debentures                                           | 158.5   | 208.5   | 200.5   | 192.5   | 184.5   | 176.5   | 168.5   | 158.5   | 148.5   |
| Tariffs and Dividends Control Reserve                | 12.4    | 14.2    | 16.8    | 16.8    | 16.8    | 16.8    | 16.8    | 16.8    | 16.8    |
| Consumers' Benefit Account                           | 1.8     | 3.6     | 6.2     | 4.4     | 2.6     | -       | -       | -       | -       |
| Investment Allowance Reserve                         | 9.6     | 16.0    | 20.1    | 23.6    | 23.6    | 23.6    | 23.6    | 23.6    | 23.6    |
| Deferred Tax Reserve                                 | 30.4    | 30.4    | 30.4    | 30.4    | 30.4    | 30.4    | 30.4    | 30.4    | 30.4    |
| Loan Redemption Reserve                              | -       | -       | -       | -       | -       | -       | -       | 47.5    | 95.4    |
|                                                      | 577.9   | 651.5   | 814.2   | 1,140.8 | 1,964.6 | 2,251.7 | 2,383.7 | 2,404.0 | 2,425.0 |
| Capital Base (A - B)                                 | 487.5   | 475.1   | 479.8   | 469.1   | 544.4   | 650.1   | 662.9   | 681.2   | 694.3   |
| <u>Reasonable Return</u>                             |         |         |         |         |         |         |         |         |         |
| 7% on Capital Base of Rs 475 million as of 31-3-1965 | 33.2    | 33.2    | 33.2    | 32.8    | 33.2    | 33.2    | 33.2    | 33.2    | 33.2    |
| 11% on balance of Capital Base                       | 1.4     | -       | 0.6     | -       | 7.7     | 19.3    | 20.7    | 22.7    | 24.1    |
| Other Income                                         | 0.4     | 0.3     | 0.3     | 0.3     | 0.4     | 0.6     | 0.6     | 0.6     | 0.6     |
| 2% on approved loan from World Bank                  | -       | -       | 0.5     | 1.2     | 3.2     | 4.2     | 4.4     | 4.1     | 3.8     |
| 2% on approved loans from local Institution Unit-5   | -       | -       | 0.1     | 1.1     | 2.4     | 2.5     | 2.7     | 2.6     | 2.4     |
| 2% on approved loans from local Institution - Others | 0.1     | -       | -       | -       | 0.1     | 0.1     | 0.2     | 0.2     | 0.2     |
| 2% on Debentures                                     | 0.8     | 1.0     | 1.0     | 1.0     | 0.9     | 0.9     | 0.8     | 0.8     | 0.7     |
| Amount of Reasonable Return                          | 35.9    | 34.5    | 35.7    | 36.4    | 47.9    | 60.8    | 62.6    | 64.2    | 65.0    |

March 22, 1978.

INDIA

THIRD TROMBAY THERMAL POWER PROJECT

TATA ELECTRIC COMPANIES

Assumptions Used for Financial Statements

1. The statements in this report present forecasts of TEC's financial operations for the period FY1977 through FY1985. They include income statements, incorporating forecasts of the generation and sales of energy (Annex 6), sources and application of funds (Annex 7), balance sheets (Annex 8) estimated clear profit statement with calculation of the forecast average energy prices each year (Annex 9), and details of the capital base, and the calculation of the annual amounts of reasonable return (Annex 10).

2. The following assumptions have been used.

Income Statements (Annex 6)

- (a) Energy output from 500 MW generating unit would reach full commercial operation when operating at 6,000 hours a year (load factor = 68%).
- (b) TEC would adjust its selling prices annually to achieve a "clear profit" equal to the annual " amount of reasonable return." The calculation of the forecast average prices are detailed in Annex 9.

Fuel Cost

- (c) The cost of fuel is based on 1977 fuel prices as follows:

For Units 1, 2, 3 and 4 -

|                    |                  |
|--------------------|------------------|
| Fuel Oil averaging | Rs 880 per tonne |
| Coal do            | Rs 170 per tonne |

For Unit 5 -

|                    |                  |
|--------------------|------------------|
| Fuel Oil averaging | Rs 850 per tonne |
| Coal do            | Rs 170 per tonne |

TEC's operates a fuel adjustment clause which permits price adjustment by means of a surcharge to meet variations in fuel costs. No attempt is made to estimate fuel cost increases after 1977 so that revenue does not need adjustment.

### Other Operating Costs

- (d) For FY1977 to FY1979 costs are based on expected increases of about 5% and thereafter, are assumed to increase at 3% per annum. Insurance charges are computed separately at 0.75% of original costs and included in the total.

### Depreciation

- (e) Depreciation on existing plant is provided in accordance with 6th and 7th Schedule to the Electric (Supply) Act 1948, using the straight line method of depreciation. This assumes a salvage value equal to 10% of the original cost of the asset by the "prescribed period" which is the assumed life of an asset, set out in 7th Schedule. Depreciation is brought into account as an operating expense only from the beginning of the year of account next following that in which the asset became available for use in the business.

The annual accruals of depreciation on plant expressed as a percentage of original cost are as follows:

| Depreciable Plant                    | Composite Depreciation<br>on Original Cost (100%)<br>% |
|--------------------------------------|--------------------------------------------------------|
| Hydroelectric Plant (3 Stations) )   |                                                        |
| Trombay Thermal Unit 1, 2, 3 and 4 ) |                                                        |
| Do Housing Colony )                  | 2.7                                                    |
| Transmission etc. )                  |                                                        |
| Trombay Unit 5 (Assumed)             | 3.4                                                    |

### Interest on Debt

- (f) Assumes
- (i) Interest at the standard rate for Bank loans, plus a GOI guarantee fee to make the effective rate 10-1/4% which is equal to that charged by GOI on the relending of IDA Credits to the National Thermal Power Corporation, plus a commitment charge;
  - (ii) Interest on local loans at 13% per annum, plus commitment charges at 1% per annum on undrawn balances;
  - (iii) Interest on loans raised to finance construction would be met from revenues (section XVII (2) (b) (IVa) of the Sixth Schedule).

Dividends

- (g) Assumes existing rates of dividend would continue to be paid, i.e. 7-1/2% and 9-1/4% on Preference Shares, and 13% on Ordinary Shares.

Balance Sheets

3. Gross fixed assets are recorded at original cost. During construction, forecast projects costs are escalated annually from the 1977 prices at 7% per annum on civil works, and at 7% per annum on Plant and Machinery up to the placing of the contract which would then be firm.

Debtors (Consumers)

4. Forecast debtors (consumers) at the end of each year are assumed at approximately one month's billing.

Inventories

5. Forecasts are made on the basis of the quantities of fuel oil, coal, and materials which should be held in stock at the end of each year.

INDIA

THIRD TROMBAY THERMAL POWER PROJECT

Project Justification

The Return on the Investment

1. The return on investment for the Project demonstrates the relationship of the expected revenues to the expected economic costs. In a year of full operation, it is assumed that the 500 MW of additional generating capacity will operate on average 6,000 hours each year. The tariff that will be charged on the basis of financial performance criteria is expected to average about 24 paise per kWh after 1981; the equivalent tariff in 1977/78 prices would be about 20.2 paise per kWh. Thus, assuming 8% station consumption and transmission losses, revenue in the first year will be about Rs 440 million (at two-thirds of the final output rate) and about Rs 662 million annually thereafter.

2. The cost streams for the project at market prices are shown in Part A of Table 1. All the costs are net of identifiable taxes. The foreign exchange costs have been phased for the middle years of the investment period, 10% in year 2, 40% in year 3, 40% in year 4, and the remaining 10% in year 5. Labor costs have been estimated at 15% of equipment costs and 35% of civil works. Total capital costs in 1977/78 (year 1) prices are expected to be Rs 1,536 million, net of price and physical contingencies. Operation and maintenance costs from year 7 onwards have been estimated at 1.5% of total capital costs. Other operating costs are based on a fuel cost of Rs 77.5 per tonne (net of taxes), and transport costs of Rs 82.8 per tonne. On these assumptions, the internal rate of return is 14.2%.

Shadow Pricing

3. Shadow pricing makes very little difference to the rate of return on the project. The most important cost components to shadow price are foreign exchange and labor. In the case of foreign exchange a shadow exchange rate of 1.16 times the official exchange rate, based on Planning Commission estimates, has been used. In the case of labor it was assumed that about 70% of the market wage would fairly represent the shadow wage rate. On these assumptions, the shadow priced rate of return is 14.0%. Sensitivity analysis on this rate of return is shown in Table 2.

Selection of the Most Economic Alternative

4. The obvious alternatives to the Third Trombay Development are hydro or nuclear. In the case of hydro the most readily available and economic hydro sites that could supply the Western Region are to be developed in parallel any way -- they are supplements and not alternatives to the project. In the case

of the nuclear alternative, the long gestation period of nuclear power development (8-10 years for a first unit), the technical problems in developing a nuclear power station and the attendant political problems eliminate this as a practicable alternative.

5. Confining attention to thermal options the only realistic alternative is the establishment of the additional 500 MW of capacity at a pithead location. This is however, likely to be an unacceptable alternative since a delay of at least two years would most likely result from locating the extra capacity on an undeveloped site. Also, it would raise technical problems and involve substantial load transfers with a consequential need to reassess the Western Region and the Central generation and transmission development programs. However, this alternative was costed out using cost estimates for the project suitably adjusted to reflect: (a) the reduced operating costs involved in pithead coal consumption; (b) the higher capital costs resulting from associated transmission and additional infrastructure and site development investments; and (c) the delay implied by extra site development. The cost streams, at market prices (net of identifiable taxes) are summarized in Table 1B.

6. The delay implies that benefits would come on stream two years later, if the alternative were adopted. Thus the benefit streams are not strictly comparable, which slightly complicates the comparison of the Project and the alternative; the difference in the estimated benefit streams must be added to the difference in the cost streams.

7. At market prices, the equalizing discount rate is about 6.0% (Table 3) and at any discount rate above 6.0%, the present value of the pithead alternative cost stream exceeds that of the project, because the project is less capital intensive. At a discount rate of 8.5%, the difference in the present worth of the cost streams is Rs 217.5 million (see Table 4). This difference in the present worths increases to Rs 286 million at a 10% discount rate. Shadow priced, the difference is somewhat less at Rs 243 million (using a 10% discount rate).

8. If the capital costs of the Project were to increase by 10% and the recurrent costs of the alternative were 10% less than indicated, the Project would be only marginally preferred at both market prices and shadow prices. The economic justification of the Project is therefore sensitive to a capital cost increase.

9. The whole comparison shows the Project to be the preferred alternative. If, additionally the less quantifiable factors listed in paragraph 6.03 of the report, such as availability of multiple fuels and system reliability are taken into account, the Project is well justified.

Table 1A: Project Costs  
(Market Prices: Rs Million)

Costs of Trombay III

| <u>Year</u> | <u>Capital Costs</u>        |              |              | <u>Operation<br/>and<br/>Maintenance</u> | <u>Fuel</u> | <u>Transportation</u> | <u>Total<br/>Costs</u> |
|-------------|-----------------------------|--------------|--------------|------------------------------------------|-------------|-----------------------|------------------------|
|             | <u>Foreign<br/>Exchange</u> | <u>Labor</u> | <u>Other</u> |                                          |             |                       |                        |
| 1           | 0.00                        | 12.19        | 10.23        | 0.00                                     | 0.00        | 0.00                  | 22.42                  |
| 2           | 65.78                       | 44.87        | 100.62       | 0.00                                     | 0.00        | 0.00                  | 211.27                 |
| 3           | 197.34                      | 112.40       | 322.56       | 0.00                                     | 0.00        | 0.00                  | 632.31                 |
| 4           | 263.12                      | 61.30        | 175.95       | 0.00                                     | 0.00        | 0.00                  | 500.37                 |
| 5           | 131.56                      | 9.84         | 28.26        | 0.00                                     | 0.00        | 0.00                  | 169.66                 |
| 6           | 0.00                        | 0.00         | 0.00         | 0.00                                     | 77.50       | 82.50                 | 160.00                 |
| 7-30        | 0.00                        | 0.00         | 0.00         | 23.03                                    | 116.25      | 123.74                | 263.02                 |

Table 1B: Costs of Alternatives (Pithead Generation)  
(Market Prices: Rs Million)

Costs of Alternative

| <u>Year</u> | <u>Capital Costs</u>        |              |              | <u>Operation<br/>and<br/>Maintenance</u> | <u>Fuel</u> | <u>Trans-<br/>portation</u> | <u>Total<br/>Costs</u> |
|-------------|-----------------------------|--------------|--------------|------------------------------------------|-------------|-----------------------------|------------------------|
|             | <u>Foreign<br/>Exchange</u> | <u>Labor</u> | <u>Other</u> |                                          |             |                             |                        |
| 1           | 0.00                        | 19.47        | 92.17        | 0.00                                     | 0.00        | 0.00                        | 101.54                 |
| 2           | 0.00                        | 24.34        | 109.21       | 0.00                                     | 0.00        | 0.00                        | 133.55                 |
| 3           | 0.00                        | 12.61        | 60.64        | 0.00                                     | 0.00        | 0.00                        | 73.25                  |
| 4           | 51.63                       | 41.25        | 186.30       | 0.00                                     | 0.00        | 0.00                        | 279.18                 |
| 5           | 206.52                      | 122.40       | 654.60       | 0.00                                     | 0.00        | 0.00                        | 983.52                 |
| 6           | 206.52                      | 89.94        | 488.42       | 0.00                                     | 0.00        | 0.00                        | 784.88                 |
| 7           | 51.63                       | 19.00        | 104.00       | 0.00                                     | 0.00        | 0.00                        | 174.63                 |
| 8           | 0.00                        | 0.00         | 0.00         | 20.88                                    | 77.50       | 10.00                       | 108.38                 |
| 9-32        | 0.00                        | 0.00         | 0.00         | 20.88                                    | 116.25      | 15.00                       | 152.13                 |

**Table 2: Internal Rate of Return and Net Present Values**

### 1.01 The Project: Rate of Return

|     | <u>Price Assumptions</u>                                        | <u>Rate of Return</u> |
|-----|-----------------------------------------------------------------|-----------------------|
| 1.1 | Market Prices                                                   |                       |
| -   | No variation                                                    | 14.2%                 |
| -   | 10% increase in capital costs                                   | 13.0%                 |
| -   | 10% decrease in revenues                                        | 11.8%                 |
| -   | 10% increase in capital costs and<br>a 10% decrease in revenues | 10.6%                 |
| 1.2 | Shadow Prices                                                   | 14.0%                 |
| 1.3 | Sensitivity on Shadow Prices                                    |                       |
| -   | Shadow Exchange Rate           -15%                             | 14.8%                 |
|     | +15%                                                            | 13.2%                 |
| -   | Shadow Wage Rate             -15%                               | 14.2%                 |
|     | +15%                                                            | 13.8%                 |

Table 3: Comparison of Alternatives

|    | <u>Price Assumptions</u>                                                             | <u>Equalizing<br/>Discount Rate</u> |
|----|--------------------------------------------------------------------------------------|-------------------------------------|
| 1. | Market Prices                                                                        |                                     |
| -  | No variation                                                                         | 6.0%                                |
| -  | 10% increase in Trombay Capital Costs and 10% decrease in alternative recurrent cost | 7.4%                                |
| 2. | Shadow Prices                                                                        |                                     |
| -  | No variation                                                                         | 6.3%                                |
| -  | 10% increase in Trombay Capital Costs and 10% decrease in alternative recurrent cost | 7.9%                                |
| 3. | Sensitivity on Shadow Prices                                                         |                                     |
| -  | Shadow Exchange Rate -15%                                                            | 6.1%                                |
|    | +15%                                                                                 | 6.6%                                |
| -  | Shadow Wage Rate -15%                                                                | 6.1%                                |
|    | +15%                                                                                 | 6.5%                                |



Table 4: Comparison of Alternatives

|    | <u>Price Assumptions</u>                                                                 | <u>Discount Rate</u> | <u>Difference in Present Values of Cost Streams (Alternative minus project)</u> |
|----|------------------------------------------------------------------------------------------|----------------------|---------------------------------------------------------------------------------|
| 1. | Market Prices                                                                            |                      |                                                                                 |
| -  | No variation                                                                             | 8.5%                 | 217.5                                                                           |
|    |                                                                                          | 10.0%                | 285.7                                                                           |
|    |                                                                                          | 11.5%                | 324.4                                                                           |
| -  | Trombay capital costs increased by 10% and alternative recurrent costs decreased by 10%. | 8.5%                 | 77.9                                                                            |
|    |                                                                                          | 10.0%                | 152.3                                                                           |
|    |                                                                                          | 11.5%                | 196.6                                                                           |
| 2. | Shadow Prices                                                                            |                      |                                                                                 |
| -  | No variation                                                                             | 8.5%                 | 178.0                                                                           |
|    |                                                                                          | 10.0%                | 242.6                                                                           |
|    |                                                                                          | 11.5%                | 287.7                                                                           |
| -  | Trombay capital costs increased by 10% and alternative recurrent costs decreased by 10%. | 8.5%                 | 36.0                                                                            |
|    |                                                                                          | 10.0%                | 112.0                                                                           |
|    |                                                                                          | 11.5%                | 157.8                                                                           |
| 3. | Sensitivity on Shadow Prices                                                             |                      |                                                                                 |
| -  | Shadow Wage Rate -15%                                                                    | 8.5%                 | 201.8                                                                           |
|    |                                                                                          | 10.0%                | 270.9                                                                           |
|    |                                                                                          | 11.5%                | 310.5                                                                           |
|    | +15%                                                                                     | 8.5%                 | 160.7                                                                           |
|    |                                                                                          | 10.0%                | 231.0                                                                           |
|    |                                                                                          | 11.5%                | 271.6                                                                           |
|    | Shadow Exchange Rate -15%                                                                | 8.5%                 | 205.2                                                                           |
|    |                                                                                          | 10.0%                | 275.2                                                                           |
|    |                                                                                          | 11.5%                | 315.6                                                                           |
|    | +15%                                                                                     | 8.5%                 | 150.6                                                                           |
|    |                                                                                          | 10.0%                | 219.8                                                                           |
|    |                                                                                          | 11.5%                | 259.5                                                                           |

INDIA

THIRD TROMBAY THERMAL POWER PROJECT

Related Documents and Data Available in Project File

A. General Reports and Studies Related to the Sector and the Project

- (a) First Trombay Feasibility Study and Supplement dated May 1973.
- (b) Pre-appraisal report and documents supplied by TEC.
- (c) TEC's licenses.
- (d) TEC's Memorandum of Association and Articles of Agreement.
- (e) Review of Maharashtra State Power Sector.

B. Selected Working Papers

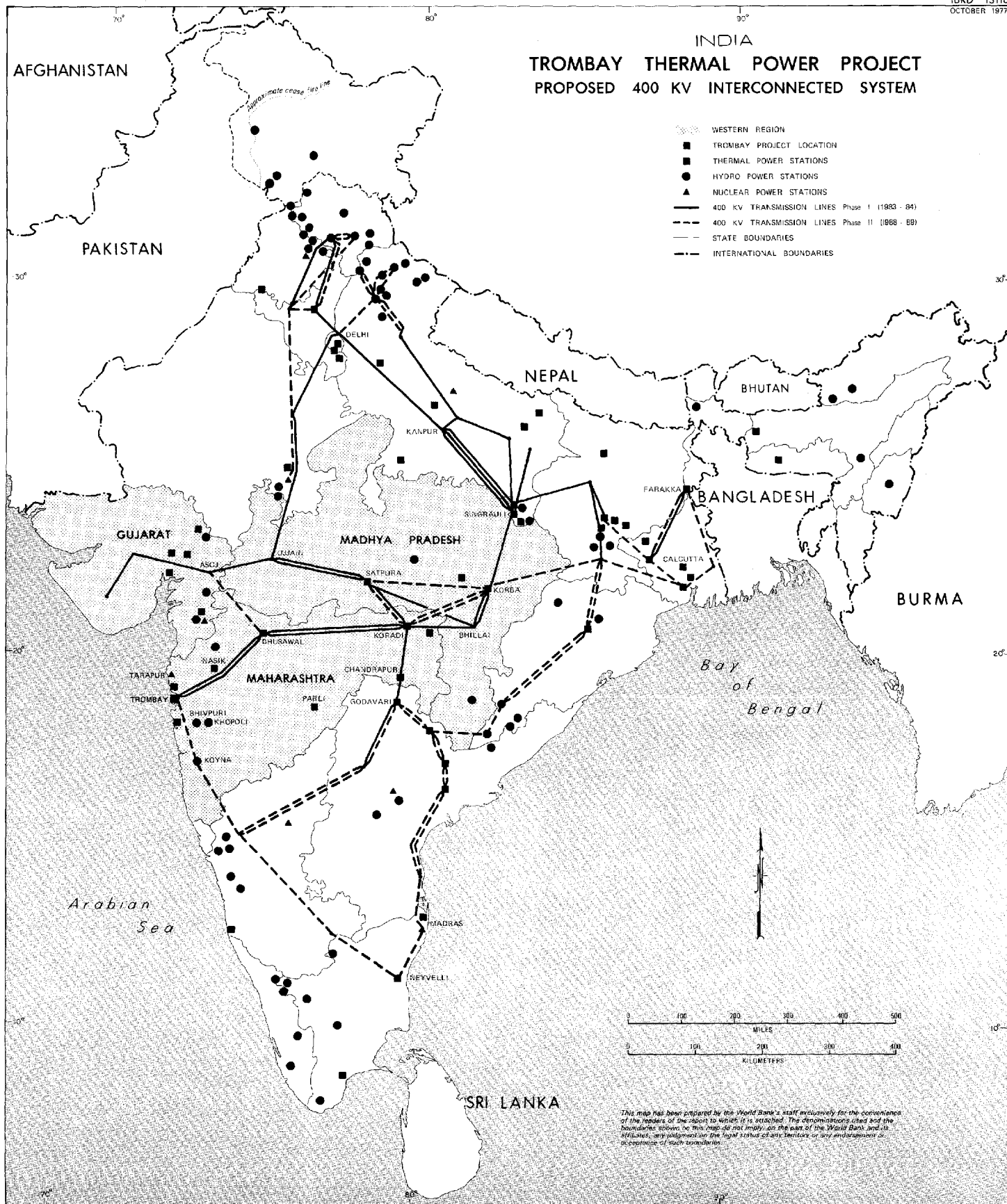
- (a) Working Papers for cost estimates.
- (b) 500 MW extension site layout plan.
- (c) Power map of the Western Region.
- (d) Operational Statistics - Maharashtra State System.
- (e) Operational Statistics - TEC System.
- (f) List of contracts for Project and estimated value.
- (g) Tariff structures of BSES, BEST, TESCO, MSEB and TEC.
- (h) MSEB tariff to TEC.
- (i) Energy sales of major distributing licensees.
- (j) Notes on Power Pool.
- (k) Details of TEC's consumers.
- (l) Detailed working papers to support financial statements.
- (m) Miscellaneous supporting technical data.

September, 1977

# INDIA

## TROMBAY THERMAL POWER PROJECT PROPOSED 400 KV INTERCONNECTED SYSTEM

- WESTERN REGION
- TROMBAY PROJECT LOCATION
- THERMAL POWER STATIONS
- HYDRO POWER STATIONS
- NUCLEAR POWER STATIONS
- 400 KV TRANSMISSION LINES Phase I (1983 - 84)
- 400 KV TRANSMISSION LINES Phase II (1988 - 89)
- STATE BOUNDARIES
- INTERNATIONAL BOUNDARIES



This map has been prepared by the World Bank's staff exclusively for the convenience of the readers of the report to which it is attached. The denominations used and the boundaries shown on this map do not imply on the part of the World Bank and its affiliates, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.



# INDIA TROMBAY THERMAL POWER PROJECT LICENSEES' AREAS OF SUPPLY

