CHAPTER 3

STRUCTURE AND ORGANIZATION OF THE POWER PLANT

Electricity being the most versatile form of energy which provides the infrastructure for economic development, the successive Five Year Plans of India have laid special emphasis on the development of power industry in the country. But, until 1975, this remained a rather neglected area of development. The financial outlays on power were of the order of Rs. 5000 crores during the entire plan era from 1951 to 1974. In contrast, the Fith Plan alone provided for an outlay of Rs. 19,265 crores. This outlay far exceeds the total of outlays made during the earlier plan period. Despite vast resources, financial and other material inputs mobilised for power development, this sector has apparently failed to produce the desired results (Sankar, 1982 : 1).

The developed countries are characterised by the use of energy on a large scale, both for deomestic consumption and industrial and agricultural production. The people there are energy conscious. They realised that satisfactory economic growth could not be achieved without adequate supply of energy in suitable forms of acceptable quality and at reasonable cost. Unless this condition is fulfilled, it will not be possible to achieve optimum development of production and productivity in industry, agriculture, transport, services and economic growth may fall short of the set target (Bhanage, 1976).

Till the era of planning was ushered in, the overhead capital in the public sector was meagre and power development there received scant consideration. Public investment was three percent of the national income in 1931-32 and was 1.7 percent on an average during 1932-37. It rose merely to 2.3 percent during 1948-49. During 1927-37, public investment on electricity development accounted for only 1.8 percent of total public investment Healey 1965).

The Government, in fact, had no plan to develop this industry. About this Visvesvaraya (1934 :4) stated "In India the use of electricity has made a headway in a few industrial centres like Bombay and in lighting industrial towns, but its use for industries and manufactures is not being fostered according to a predetermined potential. While other countries are actively prosecuting well thought-out schemes, this country seems to be merely looking on".

Despite such in action , the demand for power had all along an increasing trend. We get a clear picture of this increasing demand from Table 3:1.

Table 3:1

Demand and Supply of Electricity in First and Sixth Five Year Plans

Installed capacity at the beginning of First Plan (1951)	2,270 MW
Installed capacity at the end of 1980-81	32,961 MW
Installed capacity at the end of Sixth Plan (1985)	51,192 MW
Planned installed capacity at the end of this century	1,30,000 MW
Investment to the Power Sector in the 1st Plan	Rs. 320 crores (16.3% of total)
Investment to the Power Sector in the 6th Plan	N.A.
Per capita consumption of electricity in 1951	18
Per capita consumption of electricity at the end of 1980	131
Per capita consumption of electricity in the Sixth plan	N.A.
No. of villages electrified so far	N.A.
No. of pumpsets energised so far	N.A.

[Source - NTPC : Today & Tomorrow, 1981]

Since the records of Seventh and Eighth Plan are not available, the records of Sixth Plan have been considered for our discussion.

It may be pointed out that along with the increasing demand, there has been an increase in the installed capacity.

The following table will provide the picture of the increasing installed capacity.

Table 3:2

Development of Installed capacity

Year	Hydro	Thermal	Total
1900	0.13	1.00	1.13 MW
1915	70.87	35.00	105.87 "
1930	216.00	275.00	491.00 "
1939	155.00	318.00	473.00 "
1947	66.00	226.00	292.00 "
1960-61	N.A.	N.A.	3290.00 "
1965-66	N.A.	N.A.	4374.00 "
1970-71	N.A.	N.A.	5682.00 "
1973.74	N.A.	N.A.	1955.00 "
1974.75	N.A.	N.A.	1658.00 "
1983-84	N.A.	N.A.	5888.00 "
1985-86	N.A.	N.A.	2392.00 "
1986-87	N.A.	N.A.	3456.00 "

Source : i) Rao, 1970 : 153

ii) Statistical Pocket Book : 1975

iii) India : Different years.

Table 3:3

Percentage Share of Different Categories of Consumers in Total Electricity Sold

Sl. No.	Category of Consumers	1950-51	1960-61	1970-71
1.	Domestic Light and small power	12.62	10.70	8.96
2.	Commercial light and small power	7.43	6.08	6.01
3.	Public lighting	1.45	1.38	1.17
4.	Industrial power (Light and medium voltage)	62.64*	11.76	9.14
5.	Industrial power (High voltage)		57.73	59.95
6.	Traction	7.42	3.25	3.19
7.	Public water works and sewage pumping	4.55	3.13	0.24
8.	Agriculture	3.89	5.97	10.44

* Industrial Power-Light, medium and High voltage for all the three.

Source: Shah, 1977 : 21.

The rising power consumption pattern and the compulsion to increase the economy of generation and transmission calls for improvements and new developments in the power sector. The power system is required not only to meet the additional requirements of electricity in the future but also to make up for the past lapses and deficiencies.

For achieving a six percent growth rate during the 8th plan, the electricity generation requirements in 1994-95 will be 480 billion units (Kwh). After taking into account 25 billion units from the captive power units, the generation requirements from utilities would be of the order of 455 billion units. The gross generation after the addition of about 38,000 MW capacity during the 8th plan period is estimated about 410 billion units. However, this can be stepped upto 450 to 452 billion units provided a time bound action programme is taken for improving the performance and productivity of the existing units and operation of the power system as a whole (editorial, Southern Economist; 1990:1).

A detailed figure of target and actual power generation of different years is shown in table 3:4.

Emergence of NTPC

Until the year 1975, the development of power resources in the country had taken place with power stations being planned, constructed and operated almost exclusively by the State Electricity Boards. The Central Electricity Authority acted merely as the co-ordinating agency. Challenging needs of the fast growing power sector made it necessary for the government to review the organisational arrangements and saw the formation of a new Ministry of Energy in late 1974. To facilitate construction, operation, and overall management of the Super Thermal Power Stations, the

Table 3:4

Target and Actual Power Generation of Different Years in India

Year	TARGET (Billion Units)				ACTUAL GENERATION (Billion Units)			
	Hydro	Thermal	Nuclear	Total	Hydro	Thermal	Nuclear	Total
1984-85	52	98.5	3.5	154	53.75	98.77	4.05	156.63
1985-86	56	110.0	4.0	170	50.933	114.119	4.985	170.037
1986-87	Not Available				53.8	128.8	5.0	187.6
1987-88	56.4	143.0	5.6	205	Not Avilable			

Source : India 1985, 1986, 1987, 1988.

Electricity (Supply) Act was amended in 1976 to enable generating companies to be set up in the Central and State sectors. This is a major milestone in the power sector development as this amendment paved the way for the Central Government to be directly involved in power generation and transmission on a countrywide basis.

For the challenging needs of power, NTPC was emerged in the national power scene in November, 1975 under the Ministry of Energy as the sole Central Agency for promoting and organising an integrated development of thermal power in the country. The company started functioning in March, 1976 with the appointment of a Chairman and Managing Director.

The first stage of development of NTPC envisaged installation of more than 9,000 MW of generating capacity in the running decade. Initially there were four pit-head super thermal power projects, being simultaneously constructed at Singrauli, Korba, Ramagundam and Farakka. At present, there are super thermal power projects, thermal power projects, and gas stations under this agency.

While accepting the gigantic power development programme, the company has placed special emphasis on manpower planning and career development in order to provide quicker progression and

job enrichment to employees at all levels. The scope of NTPC's operations are as follows:

(i) Planning, investigation of new sites, preparation of feasibility and project reports and design, and engineering of power stations;

(ii) construction and commissioning of large pit-head thermal power stations and associated transmission networks within tight time schedules;

(iii) operation and maintenance of power stations;

(iv) research and development in power generation.

Organisational Structure of NTPC :

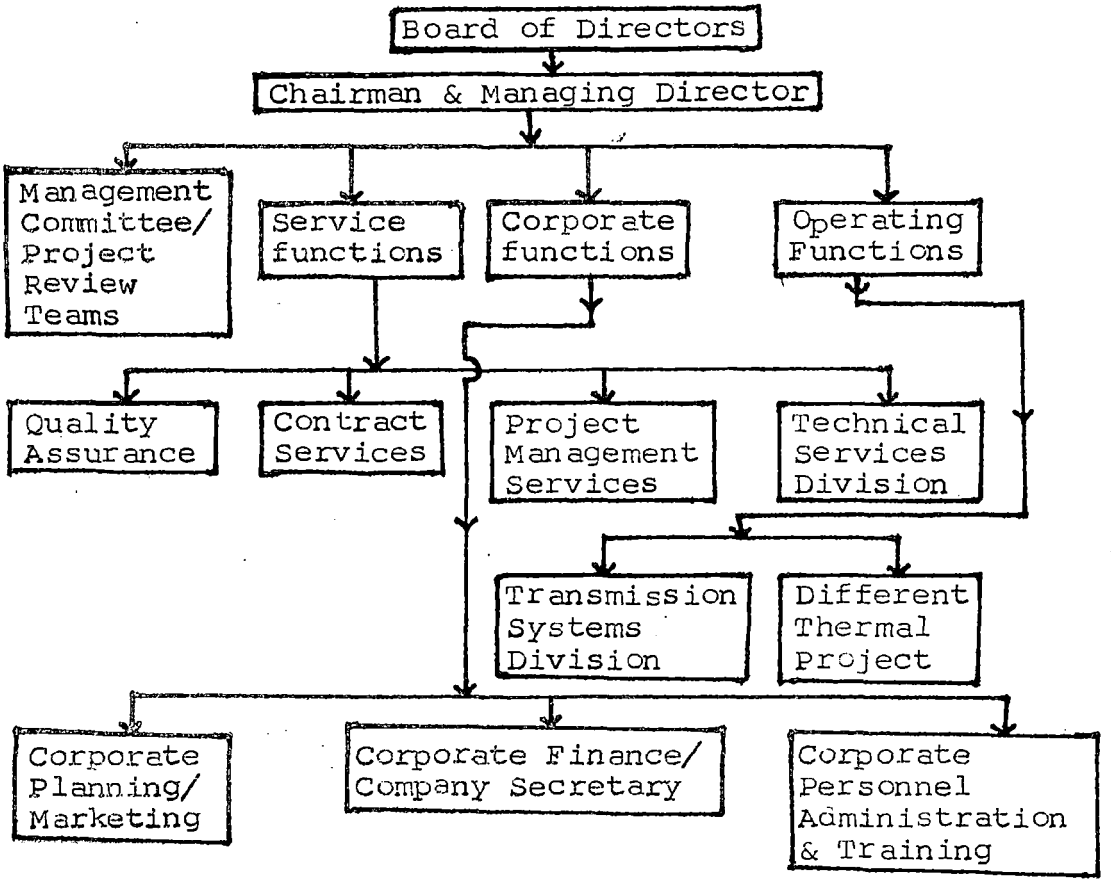
The organisational structure, management systems, and human resources are the important ingredients in the success of an organisation. NTPC has adopted a three tier organisation structure consisting of (i) Corporate Functions, (ii) Centralised Service Functions and (iii) Operating Division (Projects).

The Corporate Functions provide the policy making nuclei and ensure uniform implementation effort of all the projects. The Centralised Service Functions permit a high level of specialisation and building up of a valuable data base with progressive implementation of the projects.

The Operating Divisions (Project) have the total responsibility for implementation of the project within the predetermined targets. The relationship between the Operating Division and the Service Functions has been developed on a client-consultant basis.

Chart 3:1

Organisation Structure of NTPC

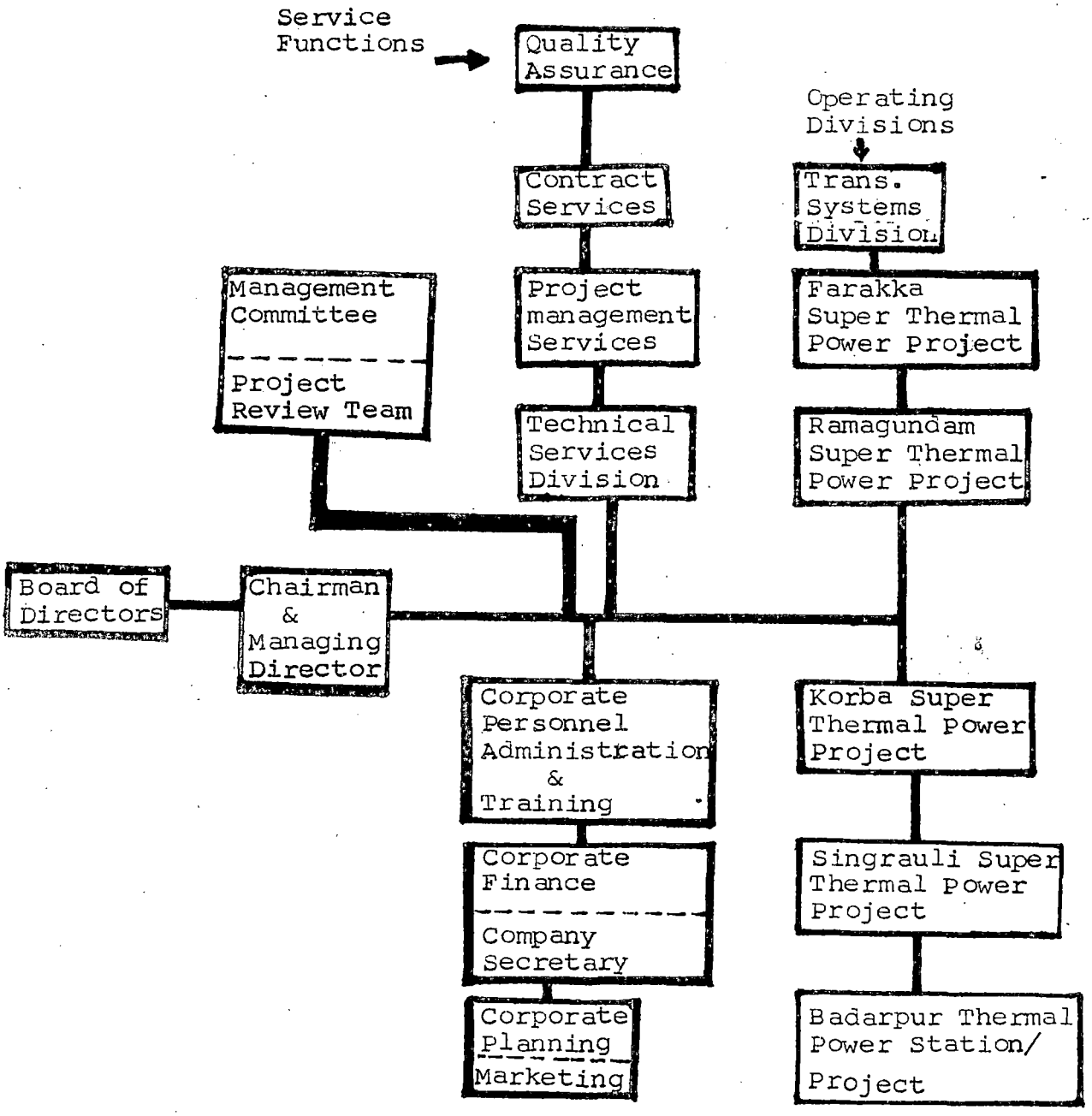


Source : NTPC : Today & Tomorrow, 1981

Service Functions, Operating Functions and Corporate Functions are correlated. The works of Corporate Functions are related and depend upon the works of Service Functions and Operating Divisions. The following Chart gives the interrelation among these three mentioned above.

Chart 3:2

Functional Relations of Corporate Profile



Source : NTPC :Today & Tomorrow, 1981

The Technical Services Division of the Company has been constituted for in-house engineering development. This division has the following main functions:

i) preparation of Feasibility Reports,
ii) preparation of Design Memorandum,
iii) preparation of detailed Project Reports,
iv) preparation of technical specialisation for plant equipment/works and technical evaluation of tenders;
v) detailed engineering,
vi) construction services,
vii) Design development for plant and process improvement.

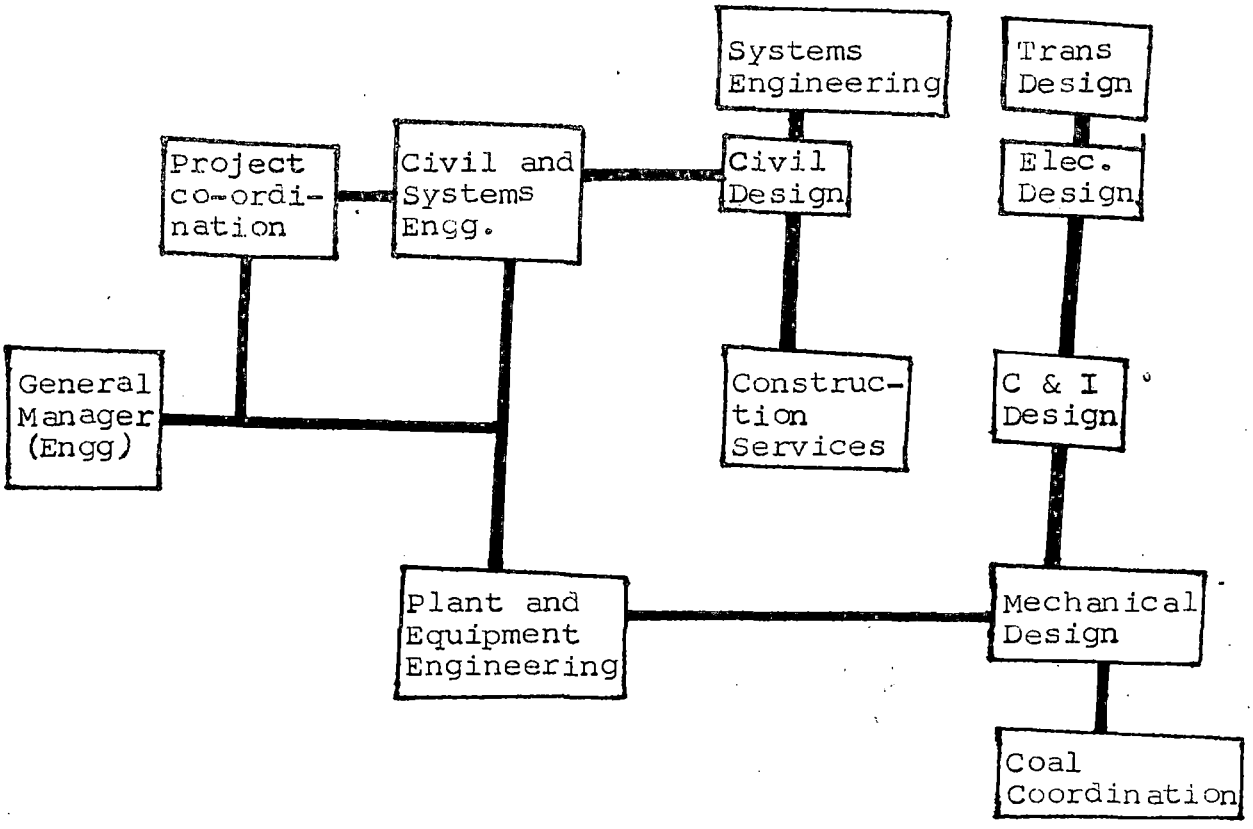
The Technical Services Division has introduced a number of new technological concepts:

i) Merry-go-round coal transportation system
ii) High voltage D.C. transmission
iii) Data acquisition system
iv) Tall multi-flue chimnies
v) Power Plant Training Simulator.

The works of Technical Services Division may be shown in a diagram as follows:

Chart 3:3

Structural Pattern of Technical Service Division



Source: NTPC : Today & Tomorrow : 1981

The Operation Services Function was constituted soon after the inception of the Company to take care of the operational requirements right from the planning and design stages and in order to build a core of specialists to plan and prepare for the operation of the Company's power stations. This group has been actively associated with identifying problem areas ans drawing up time-bound programmes for improving the performance of its projects.

The applied Research and Development function, now being developed as a part of this group, will go a long way in solving many day to day specific operation and maintenance problems, which are bing faced by the thermal power plants in India.

The project management services is involved in drawing up the pre-order activities and master network for each project, identification, co-ordination, and integration of detailed networks, activity status monitoring and reporting for collation and dissemination of control information as well as exception reports.

Electronic Data Processing and management systems group is responsible for identifying and co-ordinating the development, implementation and documentation of management systems in all areas identifying areas for Electronic Data Processing applications, coordinating the computerisation of management systems and procurement of computer services and hardware.

The Contract Services Division has the total responsibility for contract packaging, preparation of commercial documentation and integration of all bid documents for tendering and performing co-ordination of all pre-tendering activities, bid evaluation, award finalisation and contract negotiation. The post-award responsibilities include expediting and co-ordination of inspect work through constant follow up with the contractors in order to ensure timely deliveries of equipment of right quality to the

project sites. In addition, the contract services also undertake centralised procurement co-ordination for steel, cement and diesel for all the projects.

NTPC has set up a separate Quality Assurance Group to ensure the quality requirements of goods and services produced by the Company. All the quality management functions in NTPC involve the following:

i) Contract Quality Assurance
ii) Engineering Quality Assurance
iii) Inspection of Manufacturer's Works
iv) Field Quality Assurance at each of the project sites.

The Finance Function in NTPC has an important role to play in view of the capital intensive nature of its projects. Headed by a whole time Director, the Finance Function has the following main areas of responsibility:

i) Accounts and Budget
ii) Loans and Finance
iii) Financial Information systems
iv) Internal Audit

In addition to normal work, finance function has been able to develop systems in critical management areas such as budgeting, costing, financial and contract accounting, inventory control and

internal audit with appropriate management reporting systems at corporate as well as at project levels.

The Corporate Planning and Marketing Department is responsible for the following functions:

i) Project approvals and progress review

ii) Project appraisals and co-ordination with financing agencies

iii) Long range planning

iv) Organisational planning

v) Marketing.

Corporate Planning Department also functions as the Secretariat for the Chairman and Managing Director. The marketing function involves the formulation of tariff policy, contracts for supply of energy, billing and collection.

The Management Committee chaired by the Chief Executive comprises of all General Managers and whole-time Directors of NTPC. The Committee meets at regular intervals to discuss policy issues for implementation. The Committee reviews and approves all policies and provides a forum for resolution of issues affecting the entire company or a number of projects.

The Project Review Teams consisting of representatives from various functions, both from the corporate office and the

site organisation, meet every month to review the project in its entirely embracing all functions, namely, engineering, contracts, construction, finance and accounts, personnel and administration, and corporate planning. The meeting is chaired by the General Manager of the project.

The Personnel Department looks after the development of the management system of NTPC. The main role performed by this department are as follows:

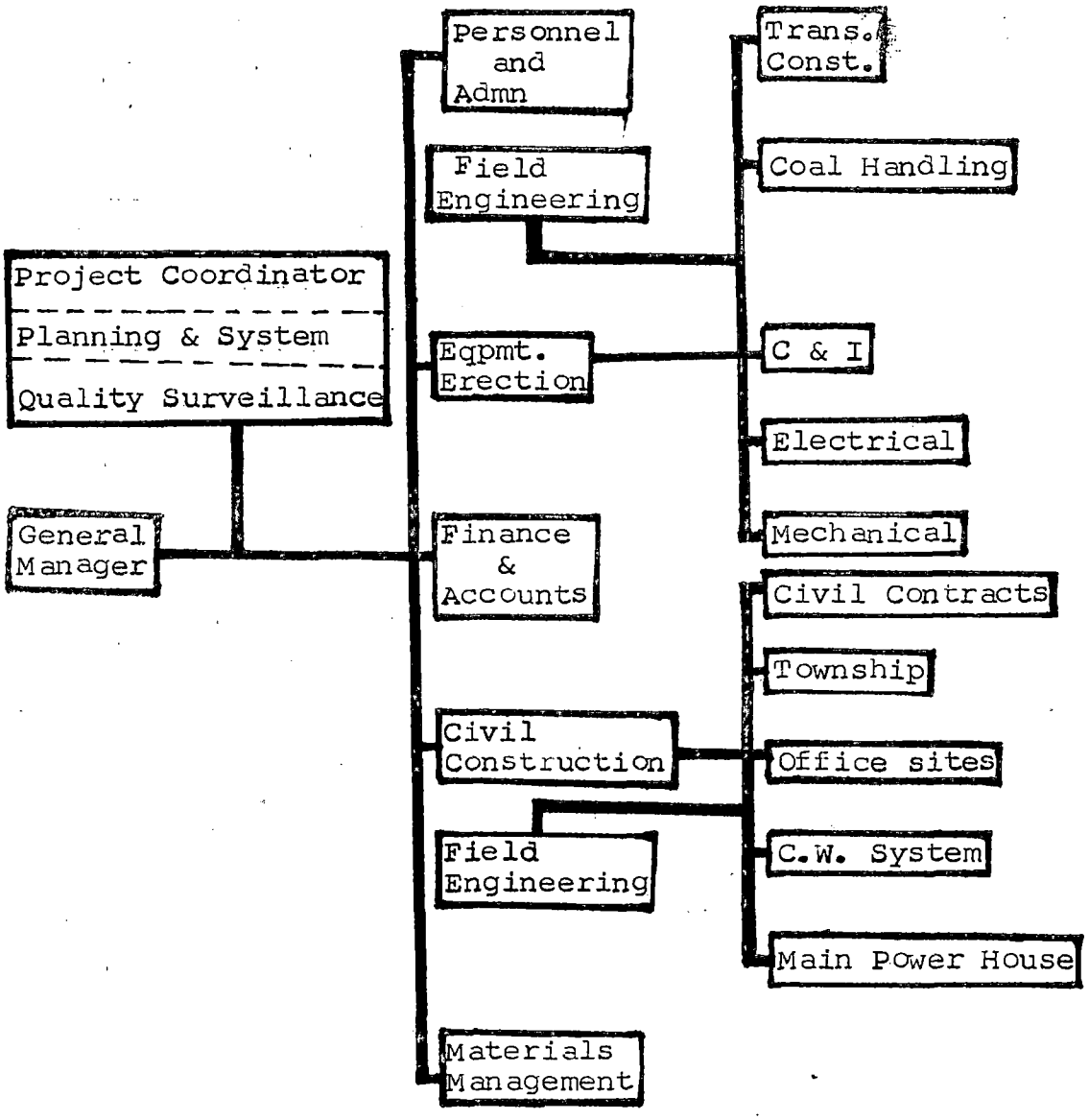
i) Manpower planning
ii) Recruitment & selection
iii) Wage and salary administration
iv) Personnel policies, motivational and welfare schemes
v) Career planning
vi) Organisational development, personnel research & personnel audit
vii) Industrial relations
viii) Training and Management Development

The project organisation (the operating division) headed by a General Manager is entrusted with the total responsibility for implementation of aspects of the project in accordance with the master network schedule. The project organisation is self-sufficient in most respects with delegation of adequate administrative and financial authority to the General Manager to redefine priorities within the framework of time, quality and costs. The

following gives the interrelation among the different Department/ Section of a Power Plant.

Chart 3:4

Functional Arrangement of a Power Plant



Source: NTPC : Today & Tomorrow : 1981

Table 3:5

Some Important Features of a Super Thermal Power Project (Power Station) are as follow:

Generating Capacity	2100 MW
Capital Outlay	Rs. 1,000 crores
400 KV Transmission	2,000 Kms
Annual Revenue	Rs. 200 crores
Coal Consumption	10 million tonnes
Operation Manpower	5,000
Structural Steel	50,000 tonnes
Reinforcement Steel	100,000 "
Cement	200,000 "
Equipment	160,000 "
Cabling	3,000 "
Construction Manpower	20,000 "

Source : NTPC : Today & Tomorrow, 1981.

It may be noted in this connection that despite the transmission system of FSTP being 640 Kms instead of 2000 Kms, still it is said as Super Thermal by NTPC.

Projects of NTPC :

Different Super Thermal Power Projects, Thermal Power Projects, and the Gas Turbine Projects are the operating units or producing units of NTPC. These units are producing power for the country. Production capacity (installed capacity) of some power stations of NTPC are as follows:

(i) Singrauli Super Thermal Power Project - It is one of the biggest power stations in India located at Mirzapur District of Uttar Pradesh with an installed capacity of 2000 MW.

(ii) The Korba Super Thermal Power Project has already achieved a generating capacity of 1600 MW and with the proposed commissioning of the third and final 500 MW unit, the total capacity of Korba located at Bilaspur distroct of Madhyapradesh will raise to 2100 MW.

(iii) At Ramagundam of Karim Nagar District in Andhra Pradesh three 210 MW units and one 500 MW unit have already been installed. Two more 500 MW units are under construction which will raise the ultimate capacity to 2100 MW.

(iv) Farakka in Murshidabad District of West Bengal has already got an installed capacity of 600 MW (3 x 200 MW) in the first stage. The second stage comprising of two units of 500 MW each are under construction.

(v) The Indo-Soviet Venture Vindhyachal in Sidhi District of Madhya Pradesh has a generating capacity of 420 (2 x 210) MW. The approved capacity is, however, 1260 MW, comprising 6 units of 210 MW each.

(vi) Rihand in Mirzapur District of Uttar Pradesh has one unit of 500 MW already in operation and the second unit is under construction.

(vii) Badrapur Thermal Power Station/Project - This power project is located in Delhi and it was not initially a project of the NTPC. The main plant and equipment are among the first few units fabricated indigenously. After setting up, the management of this power station was handed over to NTPC in April, 1978. The first stage of this unit, designed to generate 300 (3 x 100) MW was commissioned in 1973. The second state of 310 MW unit started on commercial operation in 1980 and the third stage of 210 MW unit was commissioned in 1981-82. The installed generating capacity of this power station is 720 MW.

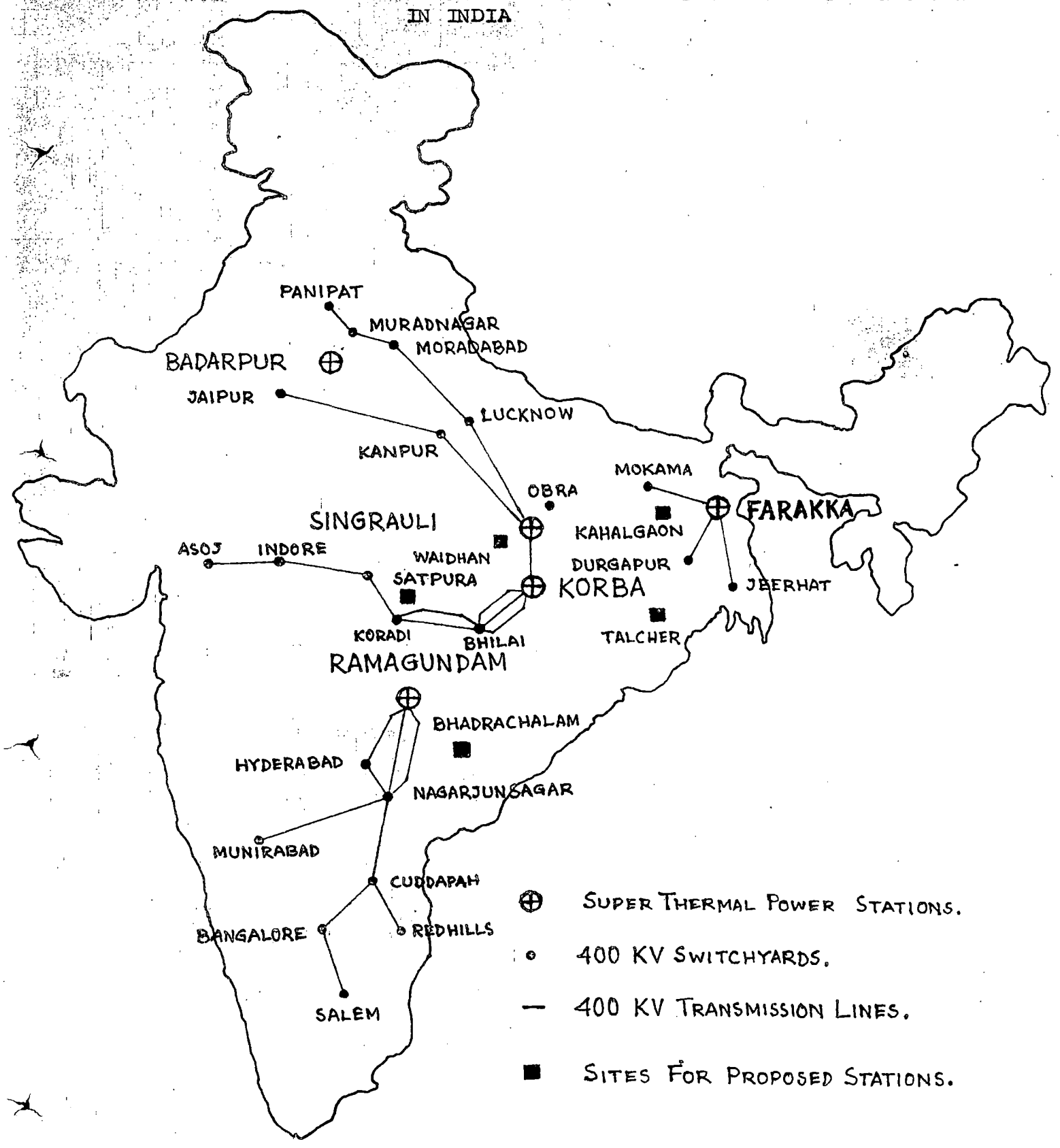
NTPC is also constructing projects at Dadri near Delhi, Kahalgaon in Bihar and three gas stations at Anta, Auraiya and Kawas. Government approval for Talcher Project in Orissa has now been received for the first stage of two units of 500 MW each.

In future, projects at Mangura (Andhra Pradesh), Chandrapur (Maharashtra), Pench (Madhya Pradesh) and Birbhum (West Bengal) will be taken up by NTPC.

Approved capacity and investment of NTPC :

As on 31st March, 1988, the approved capacity of the company was 13,370 MW with an approved investment, including the cost of the associated transmission system, of Rs. 12,227 cores. Including the Talcher Project, the approved capacity of

PROJECTS OF NTPC AND ITS POWER DISTRIBUTION IN INDIA



the company is being raised to 14,370 MW with an approved investment of Rs. 13,758 crore.

Generation and Seventh Plan Profile of NTPC :

The corporation earned a net profit of Rs.302.40 crore during 1987-88, registering a significant 42.77 per cent increase over the previous year's Rs. 211.80 crore. This included a prior income of Rs. 36.17 crores, mainly arising out of conversion of loan into equity for Singrauli and Farakka Projects. Thus the normal profit for the year amounted to Rs. 266.63 crores, which is itself far ahead of the previous year's profit. The return on capital was an impressive 12.1 percent.

NTPC added 2410 MW to its generating capacity during 1987-88 against a target of 1910 MW, raising its total installed capacity to 5510 MW. The corporation achieved an average plant load factor of 75.6 percent against the national average of 56.4 percent from thermal stations during 1987-88. 19,378 million units of power were generated during the year against the previous year's generation of 15,921 million units. This represents almost 10 percent of the total power generation in the country.

Seventh Plan Profile :

An outlay of Rs. 5560 crore initially approved for NTPC was recommended for enhancement ater a mid-term review to

Rs. 9,460 crore by the Planning Commission. The increase is primarily on account of the new starts during the Seventh Plan. This stands for an increase of Rs. 3900 crore, over the initial outlay.

The Corporation has been relying more and more on internal and extra-budgetary resources for meeting the plan fund requirements. In the case of new starts, the requirements of funds to a large extent is envisaged to be either through NTPC's internal resources or by the way of international assistance and market borrowings.

The net budgetary support from the Government would reduce to a mere 9.6 percent in the recommended outaly of Rs. 9460 crore as against 41.6 percent in the initially approved outlay.

Plan Outlay of NTPC :

Year	Amount
1988-89	Rs. 2185 crore
1989-90	Rs. 2565 crore

It is to be metnioned here that modes of production of power industries is quite different from the other manufacturing industries. There is indirect production in this organisation but a number of industries are basically dependent upon its

production. Like the other industries, it is not a factory-based organisation but the correlation among the different departments (like the factory-based organisation) are important. Its productions are totally dependent upon those employees who are highly technical experts. It is a fact that most of the technical experts of the power plants of NTPC have been drawn from five Indian Institute of Technologies. Despite this, the production of this power plants is not entirely satisfactory. As information reveals, Farakka remains the only power plant of NTPC which is running at loss.

II

Emergence of Farakka Super Thermal Power Project

As stated, Farakka Super Thermal Power Projects (FSTPP) is the fourth Super Thermal power project, being constructed by NTPC. The villages surrounding the power plant and townships are generally thickly populated. Percentage of literacy is low (20.57% according to 1981 census) and the area was industrially very backward.

Table 3:6

Population and Literacy of Farakka Block (1981 Census)

	Male	Female	Total
Population	68,371	66,074	1,34,445
Scheduled Caste Population	7,925	7,597	15,522
Scheduled Tribe Population	1,165	1,110	2,275

Literacy	Literate Total Population	Percentage of literacy
Total	27,652	20.57
Male	19,352	28.30
Female	8,300	15.56

Source : Census Report, 1981.

The Farakka Super Thermal Power Project, whe completed, will have an ultimate capacity of 2100 MW. The first 200 MW unit of Stage I was commissioned on January 1, 1986. The generation of Stage I (i.e. total generation) of FSTPP are as follow:

Table 3:7

Generation of Power of FSTPP in different years

Year	Installed capacity	Actual Generation (Million Unit)
1985-86 (From Jan.'86 to April, '86)	200 MW	0.276
1986-87	400 "	552.92
1987-88	600 "	1221.517

Source : Operation & Maintenance Deptt., FSTPP, May'89.

The power from FSTPP is being carried through 400 KV transmission system linking Farakka to Jeerhat and Farakka to Durgapur.

Structure and Organization of FSTPP :

We may divide the works of FSTPP in two categories viz:

(a) Corporate works

(b) Contract Labourers

It is to be mentioned here that it is a strategy of NTPC to complete their construction works in all power stations mainly by the contractors. There is a centralised contract services function of NTPC which has been established to organise and perform all procurement activities pertaining to high-value engineering

based equipments, materials and services for NTPC power stations. Procurement of services/materials/works requiring adherence to procedures of international financing institutions. This involving long delivery periods and intense engineering knowledge have been classified as Category-A contracts which are handled by the Centralised Division of NTPC. All other contracts pertaining to the project are classified as Category-B contracts and are handled directly by the project.

The Corporate's work is to find out the contractor's work and to produce power.

The administerial chief of this power plant is the General Manager. There are nine different departments headed by Deputy General Manager/Managers under the General Manager. These departments are as follows:

(i) Operation & Maintenance
(ii) Project
(iii) Finance
(iv) Materials
(v) Personnel & Administration
(vi) P & S
(vii) EDP (Electronic Data Processing)
(viii) Field Quality Assurance
(ix) Field Engineering Services

Besides these, there are other two Sections which are directly under the General Manager -

(i) Vigilance Department - headed by a Vigilance Officer

(ii) Safety Department - headed by a Safety Officer.

The Managers/Sr. Managers or Deputy General Managers are responsible to report about their Departments/Sections to the General Manager of the plant. The only exception are the cases of Vigilance and Safety Departments. In these two cases, the officers are liable to report to the General Manager directly. The following Chart shows a clear picture about the Bureaucratic structure of FSTPP.

It is important to note down here that the deviations of the said Departments/Sections are not rigid. This system may vary from plant to plant, depending upon the situation of the plants.

The importance of different departments vary from time to time. For example, the importance of the Project Department is too high in comparison with other Departments at the initial state in every plant. After completion of the project, the importance of the 'Operation and Maintenance' becomes very high.

Despite such arrangement for its maintenance generation of power and distribution, only FSTPP is experiencing loss among all project of NTPC, the reasons of which will be discussed in due course.

Chart 3:5

Organisational Structure of Farakka Super Thermal Power Project