



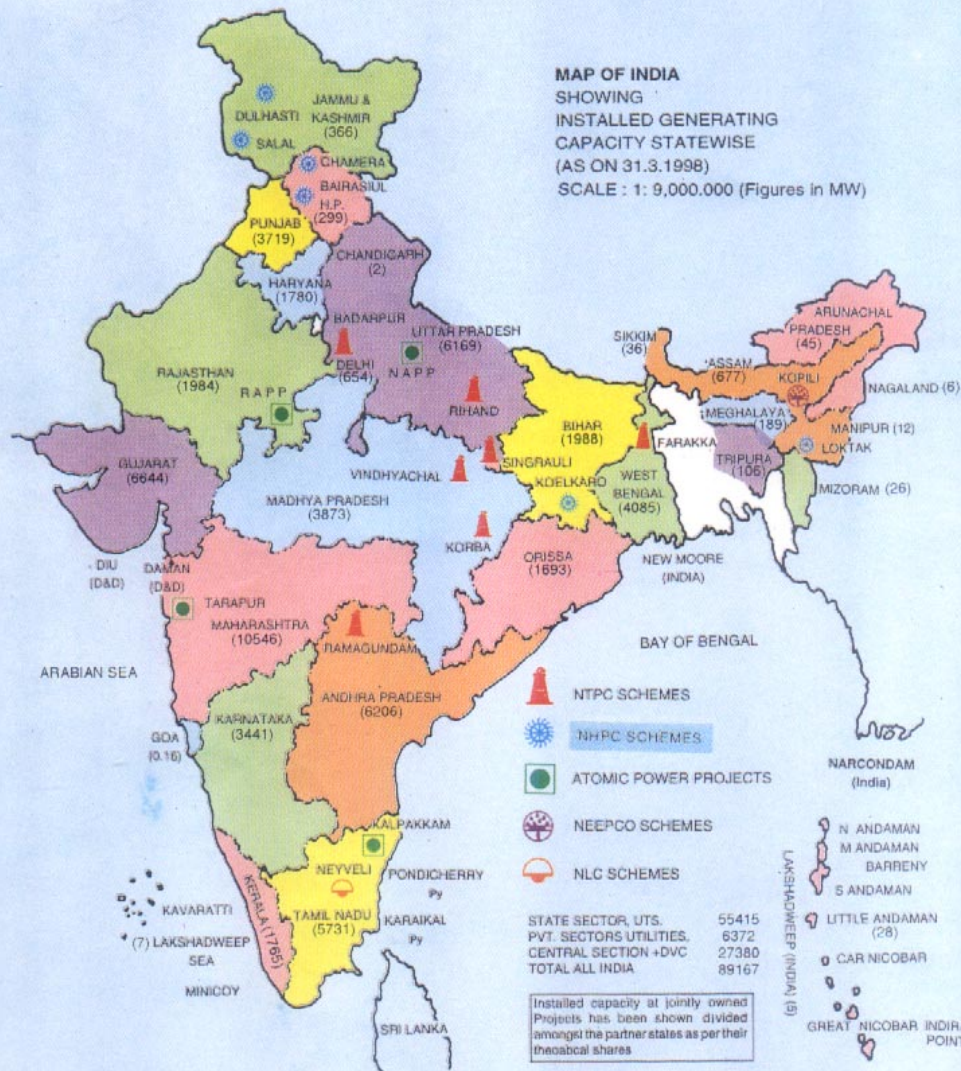
MINISTRY OF POWER  
GOVERNMENT OF INDIA

ANNUAL REPORT  
1997-98





**MAP OF INDIA**  
 SHOWING  
 INSTALLED GENERATING  
 CAPACITY STATEWISE  
 (AS ON 31.3.1998)  
 SCALE : 1: 9,000,000 (Figures in MW)



The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.  
 The boundary of Meghalaya shown in the map is as interpreted from the north-eastern areas (reorganisation) Act, 1971, but has yet to be verified.  
 The responsibility for the correctness of statistical details rests with the publisher.  
 The administrative Head Quarters of Chandigarh Haryana & Punjab are at Chandigarh.  
 Based upon Survey of India map with the permission of the Surveyor General of India.

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CHART 'A'

# **ANNUAL REPORT**

## **1997-98**



# **MINISTRY OF POWER**

GOVERNMENT OF INDIA, NEW DELHI

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## **FRONT COVER**

Singrauli Super Thermal Power Project (SSTPP) - Night View.

## **INSIDE BACK COVER**

Kahalgaon Super Thermal Power Project (KSTPP)

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# 1. MINISTRY OF POWER

## MINISTRY OF POWER

The Ministry of Power started functioning independently with effect from the 2nd July, 1992. Earlier it was known as the Ministry of Energy comprising the Department of Power, Coal and Non-Conventional Energy Sources.

Electricity is a concurrent subject at Entry 38 in the list III of Seventh Schedule of the Constitution of India. The Ministry of Power is primarily responsible for the development of electrical energy in the country. The Ministry is concerned with perspective planning, policy formulation, processing of projects for investment decision, monitoring of the implementation of power projects, training and manpower development and the administration and enactment of legislation in regard to thermal, hydel power generation, transmission and distribution.

The Ministry of Power is responsible for the administration of the Indian Electricity Act, 1910 and the Electricity (Supply) Act, 1948 and to undertake such amendments to these Acts, as may be necessary from time to time, in conformity with the Government's policy objectives.

The Ministry of Power is mainly responsible for evolving general policy in the field of energy. The main items of work dealt with by the Ministry of Power are as below:

1. General Policy in the Electric Power Sector and issues relating to Energy Policy.
2. All matters relating to hydroelectric and thermal power except mini, micro hydel projects and below 3 MW capacity and geo-thermal energy and transmission system network.
3. Research development and technical assistance relating to hydroelectric and thermal power and transmission system network.
4. Administration of the Indian Electricity Act 1910, (9 of 1910), and Electricity (Supply) Act 1948 (54 of 1948).

5. All matters relating to Central Electricity Authority and Central Electricity Board.
6. Rural electrification, power schemes in UTs and issues relating to power supply in States and Union Territories.
7. All matters concerning energy conservation and energy efficiency pertaining to power sector.
8. Matters relating to following Public Sector Undertakings/Organisations etc.
  - (a) Damodar Valley Corporation
  - (b) Bhakra Beas Management Board (except irrigation matters)
  - (c) National Thermal Power Corporation Ltd.
  - (d) National Hydro Electric Power Corporation Ltd.
  - (e) Rural Electrification Corporation Ltd.
  - (f) North Eastern Electric Power Corporation Ltd.
  - (g) Power Grid Corporation of India Ltd.
  - (h) Power Finance Corporation.
  - (i) Tehri Hydro Development Corporation Ltd.
  - (j) Nathpa Jhakri Power Corporation Ltd.
  - (k) Central Power Research Institute.
  - (l) National Power Training Institute
  - (m) Energy Management Centre.

## 1.2 ORGANISATIONS UNDER MINISTRY OF POWER

In all technical and economic matters, Ministry of Power is assisted by the Central Electricity Authority (CEA) constituted under the Electricity (Supply) Act, 1948.

Badarpur Management Contract Cell (BMCC), a subordinate office of this Ministry, is responsible for administering the Badarpur Thermal Power Station (BTPS) Management Contract between the Government of India and the NTPC.

The construction and operation of generation and transmission projects in the Central Sector are entrusted to Central Sector Power Corporations, viz., the National Thermal Power Corporation (NTPC), the National Hydro Electric Power Corporation (NHPC), the North Eastern Electric Power Corporation (NEEPCO) and the Power Grid Corporation of India Limited (PGCIL). The Powergrid is responsible for all the existing and future transmission projects in the Central Sector and also for the formation of the National Power Grid. Two Joint Venture Power Corporations namely, Nathpa Jhakri Power Corporation (NJPC) and Tehri Hydro Development Corporation (THDC) are responsible for the execution of the Nathpa Jhakri Power Project in Himachal Pradesh and Projects of the Tehri Hydro Power Complex in Uttar Pradesh respectively. Two statutory bodies i.e., the Damodar Valley Corporation (DVC) and the Bhakra Beas Management Board (BBMB) are also under the administrative control of the Ministry of Power. Programmes of rural electrification are provided financial assistance by the Rural Electrification Corporation (REC) under the Ministry of Power. The Power Finance Corporation (PFC) provides term-finance to projects in the power sector. Further, the autonomous bodies (Societies) i.e., Central Power Research Institute (CPRI), the National Power

Training Institute (NPTI) and the Energy Management Centre (EMC) are also under the administrative control of the Ministry of Power.

### **1.3 ORGANISATIONAL SET UP**

During 1997-98, Dr. S. Venugopalachari was the Minister of State for Power upto 9.06.1997. Shri Y.K. Alagh was the Minister of State for Power (Independent Charge) from 10.06.1997 to 18.03.1998. Shri P.R. Kumaramangalam is the Minister of Power with effect from 19.03.1998. Shri E.A.S. Sarma is the Secretary (Power). He is assisted by the Additional Secretary and Six Joint Secretaries, including the Financial Adviser. There are six wings in the Ministry of Power, each headed by a Joint Secretary. These are :

- i) Administration; Energy Conservation; Co-ordination and Rural Electrification.
- ii) Hydel and Transmission.
- iii) Thermal and Operation Monitoring.
- iv) Planning, Reform and Restructuring and External Assistance.
- v) Investment Promotion.
- vi) Internal Finance.

Matters relating to reservations are dealt by SC/ST Cell. The total staff strength of the Ministry is 303.

\* \* \* \*

## 2. POWER SECTOR - HIGHLIGHTS AND MAIN ACHIEVEMENTS

### 2.1 POWER GENERATION

The overall generation in the country has increased from 287 BUs during 1991-92 to 420 BUs during 1997-98. (Chart B).

The year-wise generation is as follows:

Year	Generation (BUs)
1991-92	287
1992-93	301
1993-94	324
1994-95	351
1995-96	380
1996-97	394
1997-98	420

### 2.2 INSTALLED CAPACITY

The All India Installed Capacity of electric power

**2.3.1 The achievement in capacity addition during the year 1997-98 (April 1997-March, 1998) against the programme is as under:**

(Figure in MW)

TYPE	PROGRAMME FOR 1997-98 (APRIL '97-MARCH 1998)				ACHIEVEMENT DURING 1997-98 (APRIL '97- MARCH 1998)			
	CS	SS	PS	TOTAL	CS	SS	PS	TOTAL
HYDRO	25	491	-	516	-	233	-	233
THERMAL	384	1463	876	2723	333	1443	626	3050.3
NUCLEAR	-	-	-	-	-	-	1274.3	-
TOTAL	409	1954	876	3239	333	1676	1274.3	3283.3

CS: Central Sectors; SS: State Sector; PS: Private Sector

### 2.3.2. CAPACITY ADDITION (LAST FIVE YEARS)

In the last six years including 1997-98 (April 97 to March, 1998), the following new capacities have been added.

(Figures in MW)

Year	Centre	State	Total
1992-93	2475.00	1062.27	3537.27
1993-94	2340.00	2198.75	4538.75
1994-95	1531.50	3067.00	4598.50
1995-96	987.00	1136.55	2123.55
1996-97	823.50	800.00	1624.40
1997-98	333.00	2950.30	3283.3*

\* This also includes figures in respect of private sector

generating stations under utilities was 85940 MW as on 31.3.97 consisting of 21658 hydro, 61157 MW Thermal and 2225 MW nuclear and 900 MW wind which has increased to 89166.87 MW (Statement-1) as on 31.3.98 consisting of 21891.08 MW Hydro, 64150.78 MW Thermal and 2225.00 (Prov.) MW Nuclear and 900.01 MW Wind (ChartC). At present the rerated installed nuclear capacity is 1840 MW.

### 2.3 GENERATING CAPACITY ADDITION

The aggregate capacity of 3239.00 MW consisting of 516 MW Hydro, 2723 MW Thermal was targetted for comisioning during the year 1997-98. Against the targetted capacity, the total generating capacity commissioned/rolled during the year 1997-98 was 3283.3 MW consisting of 233.0 MW hydro and 3050.3 MW thermal (Chart D).

**2.3.3.** A capacity addition programme of 3299.3 MW consisting of 544.5 MW hydro and 2754.8 MW of thermal has been fixed for the year 1998-99.

#### Capacity Addition Programme (1998-99)(P) (MW)

	Central	State	Private	Total
Hydro	25.00	519.50	—	544.50
Thermal	166.30	758.50	1830.00	2754.80
Nuclear	N.A.	N.A.	N.A.	N.A.
TOTAL	191.30	1278.00	1830.00	3299.30

### 2.4 PLANT LOAD FACTOR (PLF)

The actual all India PLF of Thermal Power utilities during April 97 to March, 1998 was-64.7% which was 1.8% less than the target of 66.5%.



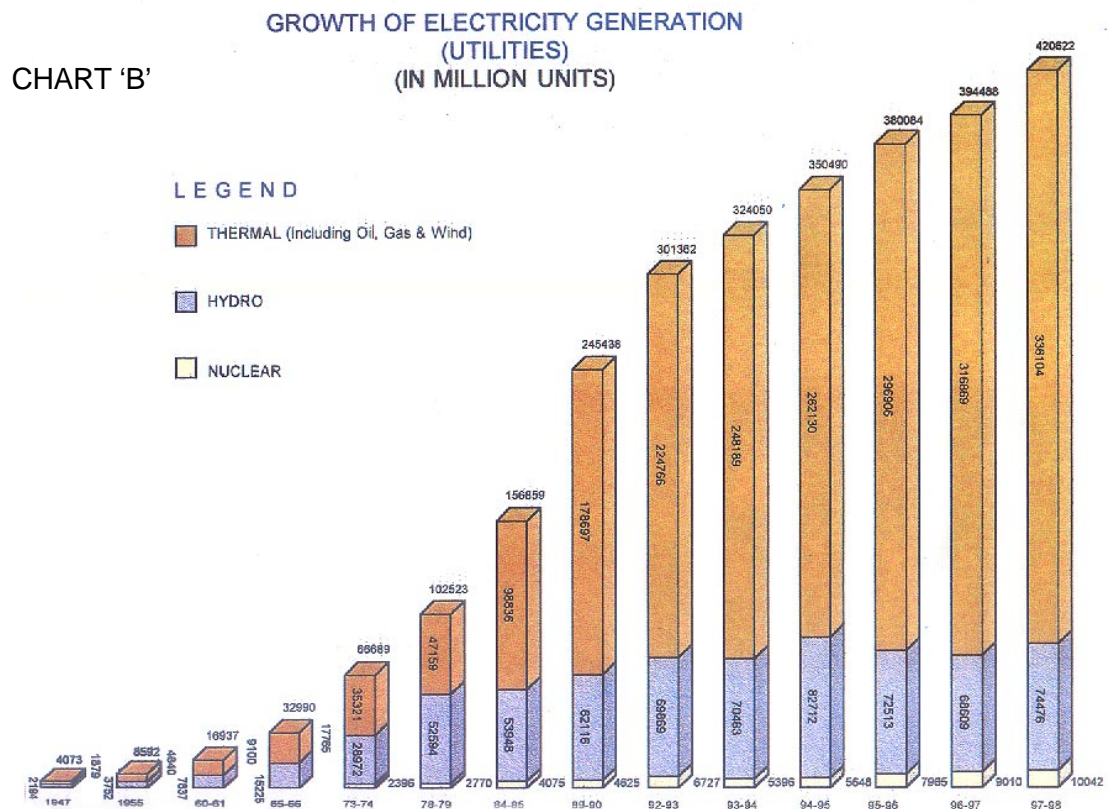
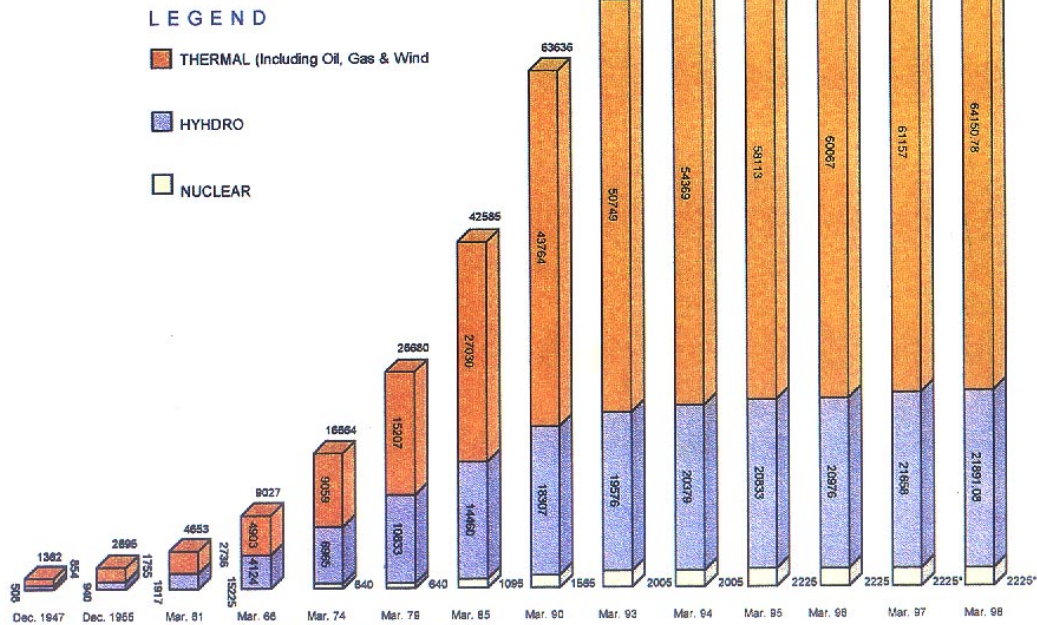


CHART 'C'

GROWTH OF INSTALLED CAPACITY  
(UTILITIES)  
(IN MEGAWATTS)



## INSTALLED GENERATING CAPACITY AS ON 31st MARCH, 1998 (UTILITIES)

								(MW)
Region	State/U.Ts	HYDRO	STEAM	DIESEL	WIND	GAS	NUCLEAR	TOTAL
NORTHERN REGION	Haryana	883.90	892.50	3.92	0.00	0.00	0.00	1780.32
	Himachal Pradesh	299.37	0.00	0.13	0.00	0.00	0.00	299.50
	Jammu & Kashmir	184.06	0.00	6076	0.00	175.00	0.00	365.82
	Punjab	1798.94	1920.00	0.00	0.00	0.00	0.00	3716.94
	Rajasthan	971.08	975.00	0.00	0.00	38.50	0.00	1984.58
	Uttar Pradesh	1504.75	4664.00	0.00	0.00	0.00	0.00	6168.75
	Chandigarh	0.00	0.00	2.00	0.00	0.00	0.00	2.00
	Delhi	0.00	371.60	0.00	0.00	282.00	0.00	653.60
	Central Sector	2010.00	4980.00	0.00	0.00	1882.00	895.00	9767.00
Sub -Total		7652.10	13803.10	12.81	0.00	2377.50	895.00	24740.51
WESTERN REGION	Gujarat	467.00	4464.00	17.48	146.81	1529.00	0.00	6644.29
	Madhya Pradesh	846.11	3017.50	0.00	9.59	0.00	0.00	3873.20
	Maharashtra	1793.22	7655.00	0.00	5.37	1092.00	0.00	10545.59
	Goa	0.05	0.00	0.00	0.11	0.00	0.00	0.16
	D & N Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Central Sector	0.00	3360.00	0.00	0.00	1292.00	860.00	5512.00
	Sub -Total	3126.38	18496.50	17.48	161.88	3913.00	860.00	26575.24
SOUTHERN REGION	Andhra Pradesh	2656.94	2952.50	0.00	54.29	542.40	0.00	6286.13
	Karnataka	2465.55	840.00	129.92	5.85	0.00	0.00	3441.32
	Kerala	1683.50	0.00	80.00	2.02	0.00	0.00	1765.52
	Tamil Nadu	1955.70	2970.00	0.00	674.87	130.00	0.00	5730.57
	Lakshadweep	0.00	0.00	6.92	0.00	0.00	0.00	6.92
	Pondicherry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Central Sector	0.00	4170.00	0.00	0.00	0.00	470.00	4640.00
	Sub -Total	8761.69	10932.50	216.84	737.03	672.40	470.00	21790.46

Contd . ....



Contd. ....

**INSTALLED GENERATING CAPACITY AS ON 31st MARCH, 1998 (UTILITIES)****(MW)**

Region	State/U.Ts	HYDRO	STEAM	DIESEL	WIND	GAS	NUCLEAR	TOTAL
<b>EASTERN REGION</b>	Bihar	174.90	1813.00	0.00	0.00	0.00	0.00	1988.40
	Orissa	1271.92	420.00	0.00	1.10	0.00	0.00	1693.32
	West Bengal	126.51	3836.38	22.50	0.00	100.00	0.00	4085.39
	D V C	144.00	2427.50	0.00	0.00	90.00	0.00	2661.50
	A & N Islands	0.00	0.00	28.33	0.00	0.00	0.00	28.33
	Sikkim	32.89	0.00	2.70	0.00	0.00	0.00	35.59
	Central Sector	0.00	3910.00	0.00	0.00	0.00	0.00	3910.00
	Sub -Total	1750.22	12407.38	53.53	1.10	190.00	0.00	14402.23
<b>NORTH EASTERN REGION</b>	Assam	2.00	330.00	20.69	0.00	324.00	0.00	676.69
	Manipur	2.60	0.00	9.41	0.00	0.00	0.00	12.01
	Meghalaya	186.71	0.00	2.05	0.00	0.00	0.00	188.76
	Nagaland	3.50	0.00	2.00	0.00	0.00	0.00	5.50
	Tripura	16.01	0.00	4085	0.00	85.50	0.00	106.36
	Arunachal Pradesh	29.55	0.00	15.88	0.00	0.00	0.00	45.43
	Mizoram	5.31	0.00	20.36	0.00	0.00	0.00	25.67
	Central Sector	355.01	0.00	0.00	0.00	243.00	0.00	598.01
	Sub -Total	600.69	330.00	75.24	0.00	652.50	0.00	1638.43
	Total (All India)	21891.08	55969.48	375.90	900.01	7805.40	*2225.00	89166.87

\* Provisional Figures. The rerated installed Nuclear capacity at present is 1840 MW.

**Note :** Installed Capacity of jointly owned projects have been shown divided between the partner states as per their theoretical share.

The PLF figures during the last five years including 1997-98 are as under:-

(Figures in %)

Year	Centre	State	Overall
1993-94	69.2	56.5	61.0
1994-95	69.2	55.0	60.0
1995-96	71.0	58.1	63.0
1996-97	71.0	60.3	64.4
1997-98	70.4	60.9	64.7

A target of 65.7% has been fixed for the year 1998-99.

Vijayawada TPS of APSEB achieved the highest PLF of 93.9% during 1997-98.

## 2.5 TRANSMISSION AND DISTRIBUTION LOSSES

The Transmission and Distribution losses in the country are on the higher side. Through concerted efforts, the transmission and distribution losses for the country have declined. They have come down from 22.83% during the year 1991-92 to 22.27% during the year 1995-96, (resulting in a reduction of 0.56%). The year-wise details of transmission and distribution losses in the country are given below:

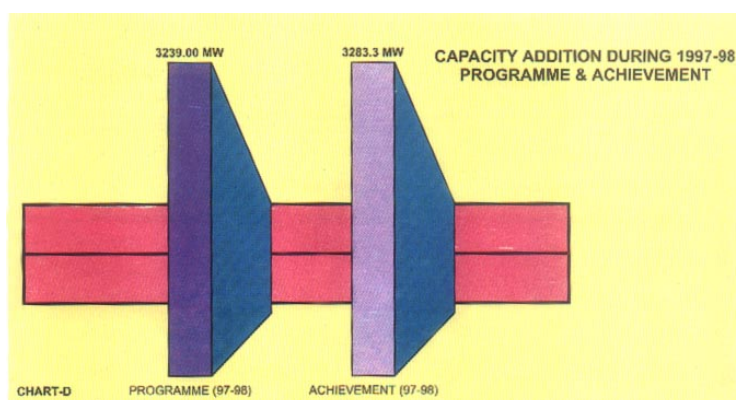
Year	T & D Losses (%)
1991-92	22.83
1992-93	21.80
1993-94	21.41
1994-95	21.13
1995-96	22.27

## 2.6 RURAL ELECTRIFICATION

Rural Electrification Programme has been pursued with determination. Nearly 85.2% of the total villages have been electrified. By March, 1998, 500268 villages had been electrified out of 587258 villages. Similarly, a total of 118,06,607 pumpsets were energised upto March, 1998 out of the total estimated potential of energisation of 145 lakh of pumpsets thus achieving 81.4% of energisation target for pumpsets.

## 2.7. POWER SUPPLY POSITION

In spite of significant growth in power generation the shortage remains. The present shortage is mainly on account of growth in demand for power outstripping the growth in generation and generating capacity addition. The power supply position in the last five years as well as during 1997-98, was as follows :-



Energy (Million Unit net)				
Year	Requirement	Availability	Shortage	(%)
1992-93	305266	279824	25442	(8.3)
1993-94	323252	299494	23758	(7.3)
1994-95	352260	327281	24979	(7.1)
1995-96	389721	354045	35676	(9.2)
1996-97	413490	365900	47950	(11.5)
1997-98	424505	390330	34175	(8.1)

PEAK (MW)				
Year	Peak Demand	Peak Demand Met	Deficit	Shortage (%)
1992-93	52805	41984	10821	20.5
1993-94	54875	44830	10045	18.3
1994-95	57530	48066	9464	16.5
1995-96	60981	49836	11145	18.3
1996-97	63853	52376	11477	18.0
1997-98	65435	58042	7393	11.3

## 2.8 RESTRUCTURING OF STATE ELECTRICITY BOARDS

A process of restructuring of the SEBs has been initiated in several States.

Organisation restructuring aims at:

- Unbundling of power industry by separating generation, transmission and distribution.
- Bringing in competitiveness by allowing private participation in generation and distribution.
- Development of a regulatory framework.

Restructuring of Orissa SEB has been carried out from 1.4.1996 and it has been replaced by two Corporations namely Grid Corporation of Orissa Ltd. and Orissa Hydro Power Corporation Ltd. to look after the functions of distribution and generation respectively. An Electricity Regulatory Commission has also been established for issue of license, fixation of tariffs etc.

The Haryana Bill, after receiving the Presidential Assent has become an Act. Andhra Pradesh, Rajasthan, Goa and Gujarat have also drafted their Reform Bills which are in the process of finalization. Governments of Karnataka and Assam have assigned study on reforms to Administrative Staff College of India, Hyderabad for the purpose of undertaking reforms and restructuring their respective power sectors. Government of Kerala is seeking assistance from CIDA for Kerala' Energy Infrastructure Project and a MOU in this regard was signed on 8.1.97. The Other States which are at different stages of reforms are: Madhya Pradesh, Uttar Pradesh, Maharashtra, Bihar and West Bengal.

As mandated by the Common Minimum National Action Plan for Power, the Ministry of Power introduced the Electricity Regulatory Commission Bill, 1997 in the Lok Sabha on 14th August, 1997. The Bill was referred to the Standing Committee on Energy. As per the directions of the Standing Committee the Bill was circulated among all States for eliciting their comments. The Committee

also advertised in National Newspapers calling for the views of the public on the Bill. But before the Committee could finalize the recommendations the eleventh Lok Sabha was dissolved resulting in the lapsing of the Bill. It is proposed to re-introduce the Bill after the Lok Sabha is reconstituted. The one member committee on Private Sector Participation in Power Distribution headed by Shri S.J. Ceolho submitted its final report in March, 1998. This has been circulated among all States/Union Territories for taking further action.

## 2.9 STATE ELECTRICITY BOARDS - RATE OF RETURN

Restoration of financial health of SEBs and improvement in their operational performance continues to remain the most crucial issue in the power sector. In terms of Section 59 of the Electricity (Supply) Act, 1948, SEBs are required to earn a minimum rate of return (ROR) of 3 per cent of their net fixed assets in service, after providing for depreciation and interest charges. In 1991-92 after taking into account RE subsidy as provided in the accounts, only 12 SEBs had a positive rate of return, with 8 SEBs have a ROR of about 3% or more. During 1995-96 after taking into account RE subsidy as provided in the accounts, out of 17 SEBs all except those of Bihar, Assam, and Meghalaya have achieved the minimum prescribed 3% or more. The position has been improving. Only 3 SEBs now have a negative rate of return i.e. Bihar, Assam and Meghalaya during 1995-96.

## 2.10 PROMULGATION OF ELECTRICITY REGULATORY COMMISSION ORDINANCE, 1998

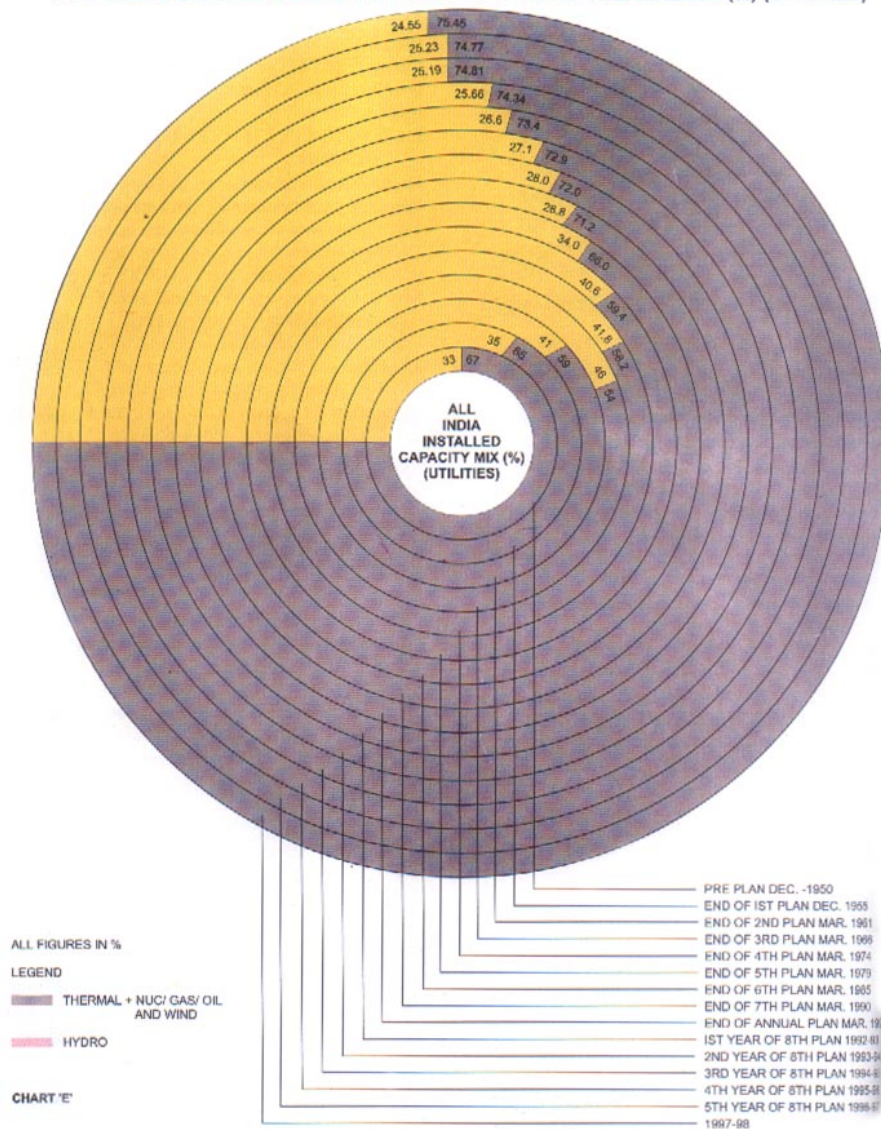
Electricity Regulatory Commission Ordinance 1998 was promulgated on 25.4.1998 for establishment of Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs) for rationalisation of tariffs and matters related thereto. The CERC and SERCs are required to be constituted within a period of three months. Necessary action is being taken by the Ministry of Power and State Governments respectively.

## 2.11 SPECIAL PROGRAMMES FOR DEVELOPMENT OF NORTH EAST AND JAMMU & KASHMIR

The Government has announced new initiatives for North Eastern Region and Jammu & Kashmir State of the country in order to improve the power position and bring about overall development in this area. As a follow up measure the Ministry of Power is constantly reviewing the projects included in the package programme announced by the Prime Minister during the year 1996. A high level team from the Ministry of Power has also visited North Eastern region in Feb., 1997 and J&K in October'97. Since then there has been considerable improvement. It is proposed to intensify the efforts to achieve the set targets.



ALL INDIA INSTALLED GENERATING CAPACITY HYDRO-THERMAL MIX (%) (UTILITIES)





*400 KV D/C Uri - Wagoora Transmission line in  
Kashmir Valley*

### 3. TRANSMISSION

Transmission Line projects continue to be accorded a high priority in the context of the need to evacuate power from the Generating Stations to the beneficiary States. The programme for 1997-98 in the Central and State Sector included construction of 900 CKM of +500 KV HVDC line, 2990 CKM of 400 KV lines, and 2824 CKM of 220 KV lines alongwith the associated substations.

The progress achieved during the year 1997-98 in the construction of transmission lines and substations is summarised below:

± 500 KV HVDC lines	310 CKM
400 KV lines	2087 CKM
220 KV	1794 CKM
400 KV Substations	630 MVA
220 KV Substations	2211.5 MVA

#### 3.1 CENTRAL SECTOR TRANSMISSION

Central Sector transmission lines/substations completed during the year 1997-98 (upto March, 1998) are listed in the following table:

Transmission/ Substation	Length ckt. kms
400KV S/C Gandhar-Padghe	315
400 KV S/C Chamera-K'pur	101
400 KV D/C Bawana-Hissar	198
400 KV S/C Hissar-Jaipur	278
400 KV Vindh. Addl. System	2048
Jabalpur- Itarsi	468
Itarsi-Dhule	802
Vindh.-Jabalpur	778
400 KV S/C R' Gundam-H'bad	194
132 KV D/C Rangit-Thingsung	90
132 KV D/C Thungung-Siliguri	95
<b>Total</b>	<b>3329 ckt kms</b>

HVDC B/B Pole-I 2x500 MW  
 HVDC B/B Pole-II 2x500 MW  
 2 No. 220 KV Bays at Wagoora S/S (PDD)

#### MVA

Bawana	315 MVA
Wagoora	3x105 MVA
<b>Total</b>	<b>630 MVA</b>

At the time of fourth five year plan several InterState and Inter-regional Transmission Lines were planned to facilitate the intergrated operation of the state systems within the region.

Loan assistance equivalent to the full cost of the scheme is extended to state government under the centrally sponsored programme for construction for such Inter-state Lines.

For the year 1997-98, the approved budget provision for releasing loan to utilities for centrally sponsored Inter-state Transmission Lines is Rs.170 lakhs. An outlay of Rs.350 lakhs has been proposed for the programme for 1998-99.

#### 3.2 NATIONAL POWER GRID

The Union Cabinet in 1980 approved in principle the establishment of a Centrally owned and operated national power grid. The national power grid would eventually comprise strong regional networks with suitable asynchronous (HVDC) links between the regions. Already 25433 ckt.kms of 400 KV lines and 5607 ckt.kms of lines at 220 KV level have been constructed in the central sector upto March, 98. An Inter-regional link (Vindhyachal 2x250 MW HVDC back-to-back) connecting Western and Northern Regions is also in operation. HVDC B/B at Chandarpur 2x500 MW is completed. Pole-I is in commercial operation since 10/97. These as well as other AC links between regions form the important components of the National Power Grid today.

In October, 1989 Government of India established the Power Grid Corporation of India Limited (PGCIL) to further accelerate the development of the national power grid. PGCIL have already taken over most of the existing Central Sector transmission Systems. The PGCIL also propose to take up schemes for further strengthening of the regional power grids and establish HVDC back-to-back inter-regional links. This is a continous process and projects are being taken up during each plan period depending upon the requirements of inter-regional power exchanges and the funds availability.

#### 3.3 NATIONAL HIGH VOLTAGE DIRECT CURRENT (HVDC) PROJECT

The first stage of HVDC project between Lower Sileru (AP) and Barsoor (MP) was commissioned in October, 1998 with total



indigenous knowhow. It has been in continuous operation and is presently carrying 20-30 MW Power. The second stage of uprating the link to 200 MW + 200 KV was approved in September, 1993 at a cost of Rs.103.98 crores (since revised to Rs.95.40 crores). The works are in progress and 95 % of the equipment are at site.

The third stage which envisages addition of another pole to convert the monopole DC system to a bipole operation with a voltage level of  $\pm 200$  KV DC and power transfer level of 400 MW will be taken after completion of Stage-II.

### **3.4 FLEXIBLE AC TRANSMISSION SYSTEM (FACTS)**

The Flexible AC Transmission System (FACTS) technology is intended to improve the dynamic performance of the power transmission system and achieve regulated power flow across AC transmission network. In order to consider the various aspects of development of flexible AC transmission technology in India, a Committee of Experts under the Chairmanship of Chairman, CEA has been constituted.

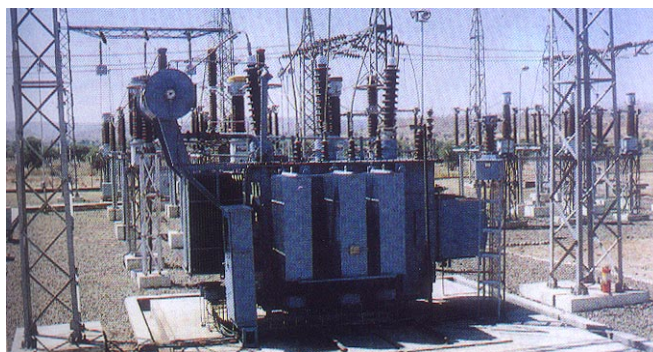
Detailed feasible report for the Flexible AC transmission Project which envisages installation

of Thyristor Controlled Series Compensation (TCSC) on the 400 KV Kanpur-Ballabgarh line of PGCIL, has been prepared.

The project is scheduled for implementation in 2 stages with a total investment of Rs. 20 crores. The project has been discussed in the Experts Committee meeting and the DPR prepared by BHEL has been approved by the Committee.

### **3.5 AWARDS FOR REDUCTION IN TRANSMISSION AND DISTRIBUTION LOSSES**

Under the Incentive Scheme, launched by the Government of India in the year 1987-88, the SEBs/EDs and their Distribution Division/Cities/Towns are awarded with shields on the basis of their performance in reduction of Transmission & Distribution losses. Cash awards are given to Distribution Divisions/Cities/Towns of the Power Utilities which achieve a prescribed minimum reduction in T&D losses. Individuals as well as institutions and organisations also qualify for grant of incentive for developing scientific devices or presenting new ideas which prove to be effective in saving energy by optimal utilisation of T&D system or better quality of power supply or improved efficiency of electrical appliances.



*132/33KV 25MVA Transmission and 132 KV switchyard at Jambapur S/S of MSEB*

## 4. RURAL ELECTRIFICATION PROGRAMME

Rural Electrification involves supply of energy for two types of programmes:

- (a) production oriented activities like minor irrigation, rural industries etc., and
- (b) electrification of villages.

While the emphasis is laid on exploitation of ground water potential and energisation of pumpsets/tubewells, which has a bearing on agricultural production, the accent in respect of areas covered under the Revised Minimum Needs Programme (RMNP), is on village electrification.

The existing definition of village electrification was reviewed and changed in 1997. According to the earlier definition :

“A village is classified as electrified if electricity is being used within its revenue area for any purpose whatsoever”

This definition of village electrification was reviewed in consultation with State Governments and State Electricity Boards and it was decided to adopt the following new definition :

“A village will be deemed to be electrified if electricity is used in the inhabited locality within the revenue boundary of the village for any purpose whatsoever.”

Ministry of Power has circulated the new definition of Village Electrification to all State Governments/ State Electricity Boards on 28th October, 1997 and advised them that the statistics of Village Electrification may be compiled on the basis of new definition and reported to Central Electricity Authority.

During the year 1997-98, 3010 (REC Provisional) inhabited villages were electrified and 241265 irrigation pumpsets/tubewells were energised by the end of March, 1998. Cumulatively 500268 villages have been electrified and 11806607 pumpsets have been energised as on 31.3.1998.

As regards the electrification of tribal villages, out of a total of 114466 tribal villages in the country 80622 tribal villages constituting 70.43 % have been electrified as on 28.2.1998. Similarly, 289858 Harijan Bastis have been electrified as on 28.2.1998.

The Kutir Jyoti Scheme also continued during 1997-98. The scheme is financed from Central Grant which is routed through Rural Electrification Corporation.

Progress report in respect of electrification of villages and energisation of pumpsets has been indicated in the Statements.



*A view of energised pumpset under R.E. Programme*

## STATEMENT

## VILLAGES ELECTRIFIED

Sl. No.	States/ UTs	Annual Target	Achievement
1.	Andhra Pradesh	@	
2.	Arunachal Pradesh	100	100
3.	Assam	230	20
4.	Bihar	330	2&
5.	Delhi	@	
6.	Goa	@	
7.	Gujarat	0	3
8.	Haryana	@	
9.	Himachal Pradesh	0	
10.	Jammu & Kashmir	30	14
11.	Karnataka	@	
12.	Kerala	@	
13.	Madhya Pradesh	500	463
14.	Maharashtra	@	
15.	Manipur	80	59
16.	Meghalaya	50	27
17.	Mizoram	15	10
18.	Nagaland	0	
19.	Orissa	250	800
20.	Punjab	@	
21.	Rajasthan	480	680+
22.	Sikkim	@	
23.	Tamil Nadu	@	
24.	Tripura	35	15
25.	Uttar Pradesh	500	812+
26.	West Bengal	400	5
	Total	3000	3010

(@) 100% electrified State (excluding those villages which are technically not feasible for electrification).

(&) Progress upto Feb., 98 (+) including State Plan

## STATEMENT

## PROGRESS REPORT IN RESPECT OF ENERGISATION OF PUMPSETS UPTO MARCH, 1998

Sl. No.	States/ UTs	Estimated potential in terms of electrification of pumpset	Achievement as on 31.3.97 (Provisional)	%age	Performance during 1997-98	(Provisional)
						Total achievement upto the end 31.3.98 (Provisional)
1.	Andhra Pradesh	1600000	1821291	100	2288	1823579
2.	Arunachal Pradesh					
3.	Assam	200000	3675	1.8		3675
4.	Bihar	1000000	269345	26.9	746	270091
5.	Goa		6063		391	6454
6.	Gujarat	700000	591564	84.5	25931	617495
7.	Haryana	430000	408461	95.0	943	409404
8.	Himachal Pradesh	10000	4780	47.8	318	5098
9.	Jammu & Kashmir	15000	5088	33.9		5088
10.	Karnataka	850000	1049465	100	23853	1073318
11.	Kerala	300000	314632	100	11597	326229
12.	Madhya Pradesh	1300000	1176317	90.5	52699	1229016
13.	Maharashtra	1800000	2091718	100	44396	2136114
14.	Manipur	10000	45	0.5		45
15.	Meghalaya	10000	65	0.7		65
16.	Mizoram					
17.	Nagaland	10000	176	1.8		176
18.	Orissa	500000	70144	14.0	1071	71215
19.	Punjab	700000	726221	100	9850	736071
20.	Rajasthan	600000	539762	90.0	25306	565068
21.	Sikkim	5000				
22.	Tamil Nadu	1500000	1567322	100	50000	1607322
23.	Tripura	10000	1764	17.6		1764
24.	Uttar Pradesh	2400000	778512	32.4		778512
25.	West Bengal	500000	102773	20.6	1610	104383
Total (States)		14450000	11529183	79.8	240999	11770182
Total (UTs)		50000	36159	72.3	266	36425
Total (All India)		14500000	11565342	79.8	241265	11806607

Source : CEA

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## 5. ENERGY CONSERVATION, RENOVATION AND MODERNISATION

### 5.1 ENERGY CONSERVATION

Conservation and efficient use of energy has been accorded high priority by the Government considering the need to bridge the gap between the demand and availability of various forms of commercial energy. Measures to conserve energy are being devised and implemented both on the supply side and the end-use (demand) side. A budgetary provision of Rs.6 .00 Crores (including Rs. 55 lakhs for the Energy Management Centre) has been provided in 1997-98 for promoting energy conservation activities.

#### 5.1.1. SUPPLY SIDE MANAGEMENT

##### GENERATION

The measures adopted consist of studies for reduction of secondary fuel oil consumption in thermal power stations and detailed energy audit studies to identify measures for improving the efficiency of the generating stations. As a result of the measures implemented so far, the specific secondary fuel oil consumption in thermal power stations has come down from 6.77 kl/kwh in 1991-92 to 4.70 kl/kwh in 1995-96. During the year 1997-98, detailed energy audit studies have been carried out by the Central Electricity Authority at Ukai, Durgapur, Panipat, Indraprastha, Neyveli, Raichur and Gandhinagar Thermal Power Stations. CEA was provided with a separate budgetary provision of Rs. 8 lakhs for this purpose in 1997-98. In addition, the Central Power Research Institute (CPRI), during 1997-98, completed the energy audit study at Chandrapur and Korba West TPSs. Studies have been carried out at various thermal power stations during 1994-95, 1995-96 and 1996-97. A project on performance enhancement in Thermal Power Stations through tuning of equipments' during Annual/Capital Overhaul is also under implementation through CPRI.

The concerned State Governments/Utilities have been asked to implement the recommendations of the studies. The renovation and modernisation programme undertaken by the various utilities for their thermal power stations has contributed considerable energy savings on the generation side.

### TRANSMISSION AND DISTRIBUTION

A number of Pilot Projects/Demonstration Projects have been taken up for load management and energy conservation through reduction of T&D losses in the system. The schemes under implementation/taken up for implementation during the year 1997-98 are as follows:

- Pilot projects for energy audit in the Distribution Network of West Bengal State Electricity Board, Kerala State Electricity Board and Haryana State Electricity Board are under implementation. A similar project in the Distribution Network of Punjab State Electricity Board had been sanctioned in 1997-98.
- A pilot project for installation of 3000 LT Switched Capacitors in Andhra Pradesh, Haryana, Punjab and Tamil Nadu has been completed in 1997-98.
- A pilot project on installation of 3000 Amorphous Core Transformers in the Distribution Network of various State Electricity Boards is under implementation through the Rural Electrification Corporation.
- Two projects on Remote Controlled Load Management are under implementation in the Distribution Networks of Rajasthan and Punjab State Electricity Boards. Three projects on Remote Controlled Load Management have also been sanctioned in 1997-98 for implementation in the Distribution Network of Tamil Nadu, Haryana and Uttar Pradesh State Electricity Boards.
- A pilot project on reduction in T&D losses by conversion to high voltage single phase distribution is under implementation in three states through REC.
- An energy conservation-cum-system improvement project, involving installation of Amorphous Core Transformers and LT capacitors is under implementation in the distribution network serviced by the Cooperative Electrical Supply Society, Sirsilla (Andhra Pradesh) through REC.



- A demonstration project on energy conservation through :-
  - (a) restructuring the existing low voltage distribution network to high voltage network through installation of Amorphous Core Transformers,
  - (b) Conversion of three-phase motors by single phase motors, and
  - (c) providing compact fluorescent lamps for street lighting, is under implementation in Chandi Village, Medak District of Andhra Pradesh.
- A pilot project for introduction of 500 Electronic Meters with Time of the Day (TOD) facility is under implementation by the West Bengal State Electricity Board.
- A project on setting up of Energy Meter Testing Facility at Central Power Research Institute (CPRI), Bangalore has been completed in 1997-98.
- A R&D project on reduction of losses in electricity distribution system through suitable capacitors using a solid state switch is under implementation through Electric Research Development Association, Vadodara. The project is expected to be completed in 1998-99.
- A R&D project on development of integrated energy efficient Stirling Engine Battery/Inverter system for Remote Area Power Generation is under implementation through Central Power Research Institute (CPRI).
- A R&D project on Statcon Dynamic Voltage Restorer has been completed in 1997-98 through IIT, Delhi.
- A project for replacement of incandescent bulbs by Compact Fluorescent Lamps (CFLs) in Leh has been sanctioned in 1997-98 for implementation by Ladakh Autonomous Hill Development Council.
- A project for power generation potential through waste heat recovery from existing non-recovery coke ovens in and around Dhanbad area is under implementation through Central Fuel Research Institute, Dhanbad.

## 5.1.2 DEMAND SIDE MANAGEMENT

### AGRICULTURE SECTOR

- Demonstration/Pilot projects on improvement of energy efficiency of agricultural pumpsets are under implementation in Punjab (rectification of 1350 pumpsets), Haryana (rectification of 800 pumpsets), Gujarat (rectification of 5000 pumpsets), and Andhra Pradesh (replacement of foot valves in 20000 pumpsets and setting up 5 demonstration centres of energy efficient electric lift irrigation) are under implementation.
- A project for training of 1000 officers from Banks, SEBs and other organisations in energy efficient pumping system is under implementation through REC.
- A project for preparation of manual on energy efficiency in pumping system is under implementation through EMC.

Ministry of Power is considering launching of a technology mission in collaboration with various Ministries/Departments of the Government as well as other agencies active in the field for developing of an Energy Efficient Pumping System for the Agriculture Sector. The project is estimated to cost Rs. 900 crores and is expected to be taken up in 1998-99.

### INDUSTRY SECTOR

- A project for preparation of DPR for rapid displacement heat pulping process in paper industry is under implementation through Confederation of Indian Industry (CII).
- A feasibility study for co-generation in small and medium agro-paper mills is under preparation through the Indian Agro Paper Mills Association.
- An application oriented training programme for the first-line engineers of process and engineering industries is under implementation through Andhra Pradesh Productivity Council.
- A research-cum-demonstration project on energy conservation in aluminium electrolysis by bringing down the operating temperature of electrolyte through Central Electro-chemical Research Institute, Tamil Nadu has been completed in 1997-98.

- 
- A project on Energy Study on Small and Medium Scale Industries of Kerala for implementation through Energy Conservation Society, Kerala has been sanctioned in 1997-98.

### **5.1.3 AWARENESS PROGRAMME**

The programme to spread awareness and educate consumers through dissemination of information on efficient use and conservation of energy was continued during the year through the Energy Management Centre. Apart from the multimedia campaign in press, TV and Radio, the message of energy conservation is being spread through pamphlets, brochures and hoardings etc. Seminars and workshops are also being sponsored/held on aspects relating to efficiency of energy use in specific areas.

### **5.1.4 ENERGY CONSERVATION AWARDS**

Industrial units which have taken initiatives in implementation of energy conservation measures and shown commendable achievements in energy savings are chosen by the Government for national recognition through grant of awards. Since 1991 National Energy Conservation Awards are being given to entrepreneurs on the National Energy Conservation Day (14 th December) every year. The 1997 awards/certificate for merit have been won by 23 industrial units in Aluminium, Cement, Chemicals, Chlor-Alkali, Fertilizers, integrated Steel Plants, Refineries, Petrochemicals, Pulp and Paper, Sugar and Textile Sub-Sectors.

### **5.1.5 INTERNATIONAL COOPERATION IN ENERGY CONSERVATION**

Two projects involving (a) energy audits in selected small and medium industrial units, and (b) building up of energy audit capabilities in the country through instrumentation support etc., have already been implemented through the Energy Management Centre with technical and financial support from UNDP and EEC. As a result, Lead Agencies/ Advisory Centres in some parts of the country have been identified/developed to assist the consumers in indentifying the scope for energy conservation and implementing the energy saving measures.

An Indo-German Technical Cooperation Programme on Energy Conservation in Indian

Industries is under implementation through the Energy Management Centre.

Phase II of Indo-EC Energy Management Cooperation Programme involving information exchange, energy audit support, sectoral studies, policy studies and data base is under implementation through the Energy Management Centre.

An Energy Efficiency Support project, with support from the Asian Development Bank (ADB), is under implementation through the Energy Management Centre.

An Indo-US Energy Efficiency Cooperation Programme is under implementation through the Energy Management Centre.

### **5.1.6 INSTITUTIONAL FRAMEWORK**

Though a number of agencies at the Government and the non-governmental level all over the country are involved in the task of promoting/facilitating conservation of energy, the task of evolving and implementing a coordinated strategy in this area is being pursued, with assistance from the EMC and various other organisations including the CEA, CPRI and REC.

## **5.2 RENOVATION AND MODERNISATION**

### **5.2.1 R&M (PHASE I) PROGRAMME**

In order to improve the performance of existing Thermal Power Stations, a massive renovation and modernisation (R&M) programme (Phase I) was launched by the Government of India all over the country in September, 1984 for completion during the Seventh Plan period.

The programme covered 163 Thermal Units (13570.50 MW) in 34 selected stations. Total sanctioned cost of various renovation schemes was Rs.1165 crores, out of which Rs. 423.34 Crores was under Central Loan Assistance (CLA) and Rs. 741.66 Crores was proposed to be financed by the States under State Plan/Own resources. The Government of India, had approved an amount of Rs.500.00 Crores in 1984 for providing Central Loan Assistance to various State Electricity Boards/ Organisations to supplement their efforts for R&M of old stations.

The R&M Programme has since been completed

in 3/96 and total amount of Rs.1066 Crores (CLA Rs. 401.62 Crores and State Plan Rs.664.38 Crores) was spent.

Considerable benefits by way of additional generation of more than 1 0,000 MU/Year has been achieved against the targetted benefits of 7000 MU/year.

### 5.2.2. R&M (PHASE II) PROGRAMME

In view of the encouraging results achieved from the implementation of Phase I of R&M programme of selected old thermal units during the 7 th Plan, the Phase II programme for R&M of thermal power stations was taken up in the year 1990-91 by the Government of India for implementation during the 8th Plan. Under this programme 44 thermal power stations consisting of 198 thermal units aggregating to a total capacity of 20869.43 MW are covered. The total sanctioned cost of the scheme is Rs. 2383.03 Crores.

After the completion of the programme the benefits expected are: (i) additional generation of 7864 MU/Year; (ii) increase of 100 MW peaking capacity; (iii) life extension of 24 thermal units by 15-20 years.

#### Progress :

**Physical :** Out of a total 1629 activities (revised) 709 have been completed and balance 346 are under progress. Also 165 MW of peaking capacity has been successfully recaptured after completion of works on some of the Units. Life Extension works on 8 Units have been completed.

**Financial:** An amount of Rs.871.00 Crores has been incurred till January, 1998 with the financial assistance provided by PFC, World Bank/OECF, as per details given below:

	Amount Rs. in Crores)
PFC	163.91
World Bank/OECF	208.26
State Plan own resources	498.83
Total Expenditure upto March 1997	831.40
Expenditure during 1997-98	
(upto January, 1998)	39.60
Funds required for 1998-99	265.00

**Constraints in implementation:** Out of a total of

44 approved schemes, 23 are being partly funded by PFC/World Bank, 5 schemes are funded from project authorities' own resources. The progress of remaining 16 schemes pertaining to UPSEB, BSEB, WBSEB, ASEB, DVC, etc. is very tardy because of paucity of funds with these SEBs/SGCs and their ineligibility for availing loan from Power Finance Corporation.

Also closure of loan by World Bank to MPEB and MSEB w.e.f. 6/94 and 9/94 respectively contributed towards slow progress.

### IDENTIFICATION OF ADDITIONAL R&M WORKS DURING 1997-98 FOR IMPLEMENTATION DURING 9TH PLAN

The additional R&M works, to be implemented during IX Plan, in respect of 156 old thermal units installed at 32 Thermal Power Stations have been identified and schemes finalised. The total estimated cost of all the additional R&M works is about Rs.1204 Crores.

**Programme for 1998-99:** During the year 1998-99, 200 R&M activities of on-going R&M (Phase II) Programme are expected to be completed.

However, the above targets will be achieved provided sufficient funds are made available to the concerned SEBs/Power Stations.

In addition during 1998-99, the works relating to identification of additional R&M activities required to be implemented during 9th Plan for the balance 18 Thermal Power Stations will also be completed.

### 5.2.3 RENOVATION, MODERNISATION AND UPRATING OF HYDRO-ELECTRIC POWER STATIONS

Based on the recommendations of the National Committee and subsequent reviews, a programme for renovation, modernisation and uprating of Hydro Power Stations was formulated by Central Electricity Authority in which 55 schemes were identified with an aggregate capacity of 9653 MW (21 0 generating units). The total estimated cost of these schemes is Rs. 1493 crores and expected benefit is 2531 MW/7180 MU. Out of these 55 schemes, work on 16 schemes have already been completed at a total estimated cost of Rs. 175 crores which have accrued a benefit of 553 MW/1063 MU.

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## 6. CENTRAL ELECTRICITY AUTHORITY

### 6.1 ORGANISATION OF CEA

The Central Electricity Authority (CEA) is a statutory Organisation constituted under Section 3(l) of the Electricity (Supply) Act, 1948. It was established as a part-time body in 1951 and made a full-time body in 1975. It is an attached office of Ministry of Power, Government of India.

In all technical, financial and economic matters, the Ministry of Power is assisted by the CEA. CEA is responsible for technical Coordination and supervision of programmes and is also entrusted with a number of statutory functions. CEA is headed by a Chairman, who is also Ex-officio Secretary to the Government of India and has six full time Members, who are of the rank of Additional Secretaries to the Government of India. These are - Member (Thermal), Member (Hydro), Member (Economic & Commercial), Member (Power Systems), Member (Planning) and Member (Grid & Operation).

### 6.2 FUNCTIONS OF THE CEA

The Authority is generally to exercise such functions and perform such duties and act in such a manner as the Central Government may prescribe under the Rules framed under Section 4B(l) of the Electricity (Supply) Act, 1948 or by issue of written directions in matters of policy involving public interest under Section 4A (1) of the said Act. Under Section 3(l) of the Act, the CEA is particularly charged with the following functions :

1. To develop a sound, adequate and uniform national power policy, formulate short-term and perspective plans for power development and coordinate the activities of planning agencies in relation to the control and utilisation of national power -resources;
2. To act as arbitrators in matters arising between the State Government or the Board and a licensee or other person as provided in the Act;
3. To collect and record the data concerning generation, distribution and utilisation of power and carry out studies relating to cost, efficiency, losses, benefits and such like matters;

4. To make public from time to time information secured under the Act and to provide for the publication of reports and investigation.
5. To advise any State Government, Board, Generating Company or any other agency engaged in generation or supply of electricity on such matters as will enable such Government, Board, generating company or agency to operate and maintain the power system under the ownership or control in an improved manner and where necessary in coordination with any other agency owning or having the control of another power system.
6. To promote and assist in the timely completion of schemes sanctioned under Chapter V of the Act.
7. To make arrangements for advancing the skill of persons in the generation and supply of electricity.
8. To carry out or make arrangement for any investigation for the purpose of generating or transmitting electricity.
9. To promote research in matters affecting the generation, transmission and supply of electricity.
10. To advise the Central Government on any other matter on which its advice is sought or make recommendations to that Government on any matter if, in the opinion of the Authority the recommendation would help improving the generation, distribution and utilisation of electricity, and
11. To discharge such other functions as may be entrusted to it or under any other law.

Under the provisions of Electricity (Supply) Act, 1948, the Central Government has further added a few more functions of the Central Electricity Authority. These are :

- a) Coordination of research and development in the power generation field.
- b) Evaluation of financial performance of the SEBs constituted under Section 5 and

undertaking of studies concerning the economic and commercial aspects of the power industry as well as analysis of the tariff structure in the power industry.

- c) Techno-economic appraisal of power projects.
- d) Promotion of inter-State and joint sector power projects.

Apart from the above functions provided under the Electricity (Supply) Act, the CEA also undertakes design and engineering of power projects with a view to developing in-house technical know-how and also to assist the State Electricity Boards, Generating Companies and State authorities requiring such assistance under 3(I)(V) of the Electricity (Supply) Act, 1948.

### 6.3 SUB-ORDINATE OFFICES

Following are the sub-ordinate offices of the CEA:

1. Northern Regional Electricity Board, New Delhi.
2. Western Regional Electricity Board, Bombay.
3. Eastern Regional Electricity Board, Calcutta.
4. Southern Regional Electricity Board, Bangalore
5. North-Eastern Regional Electricity Board, Shillong.
6. Power System Training Institute, Bangalore.
7. Hot Line Training Centre, Bangalore.
- 8-11 Regional Power Survey Organisations at New Delhi, Bangalore, Bombay and Calcutta
- 12-15 Regional Inspection Organisation at Madras, Goa, New Delhi and Shillong.

### 6.4 TECHNO-ECONOMIC APPRAISAL OF POWER DEVELOPMENT SCHEMES

CEA is a statutory body responsible for technoeconomic appraisal of power schemes of state sector, central sector and private sector. Every scheme of the Electricity Board or generating company estimated to involve a capital expenditure exceeding such sum as may be fixed by the Central Govt. from time to time by notification in the official gazette is required to be submitted to the authority

for its concurrence under the provisions of the Electricity (Supply) Act, 1948. Power development schemes in state/central sector and private sector through MOU route exceeding a capital expenditure of Rs.100 crores and those of the private sector through competitive bidding route exceeding the expenditure of Rs. 1000 crores are required to be submitted to CEA for techno-economic appraisal and concurrence.

In the case of licencees and also captive power plants, projects with the installed capacity exceeding 25 MW are required to be submitted by SEBs to CEA for its consultation as required under Section 44 of the Electricity (Supply) Act, 1948.

### 6.5 TECHNO-ECONOMIC APPRAISAL OF SCHEMES

During the year 1997-98 CEA accorded techno-economic clearance to 29 Nos. of new power schemes comprising 23 generation schemes, 6 T&D schemes involving new capacity addition of 9775 MW and 4696 CKt. Kms, respectively.

#### 6.5.1 Captive Schemes

During the year 1997-98, CEA's clearance was issued to 13 Nos. of Captive Power Plants aggregating to 1102 MW to the various State Electricity Boards.

### 6.6 NEW ITEMS

#### 6.6.1 Power & Telecom Coordination Committee (PTCC)

CEA's Telecommunication Division continued to follow up cases for expeditious PTCC clearance of transmission lines of 220 KV and above through discussions with the Department of Telecom, Railways and Power Utilities. The Telecommunication Division also rendered assistance to the State Electricity Boards for complex PTCC cases of voltage level of 132 KV and below.

#### 6.6.2 National Electric Power System Information Centre

A National Electric Power System Information Centre (NEPSIC) established during 1991-92 to collect vital power system operational data from different Electricity Boards for use in CEA/MOP has become fully operational.



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Hindi version of 15th Electric Power Survey using Computer Software for the first time was prepared.

The work to estimate the power requirements in details upto 2001-02 (9th Plan end) with a perspective demand upto 2006-07 (10th Plan end) of major Urban Centres with a population of 10 lakh and above (as per Census 1991) is in progress.

So far, eight proposals for derating/uprating and retirement of generating units during the year have been received and examined. Five proposals have been rejected and remaining three are under examination.

#### **6.6.3 Design and Engineering of H.E. Project**

Design and Engineering Consultancy is being rendered to 19 nos. of Hydroelectric (HE) Project having installed capacity of over 9050 MW. Some of the major projects where consultancy is being

rendered are Nathpa Jhakri HEP (6x250 MW), Sardar Sarovar HEP (6x200 MW + 3x50 MW), Tehri HEP (4x250 MW), Ranjit Sagar HEP (4x150 MW), Indra Sagar HEP (8x125 MW), Srisaillam HEP (6x150 MW) and Koyna HEP (4x250 MW).

Design and Engineering consultancy is being rendered to TALA HEP (6x170 MW) in Bhutan and Parnai HEP in Jammu & Kashmir.

#### **6.6.3.1 Design and Engineering of Transmission System**

CEA has also rendered Design and Engineering Services for Transmission System.

Design and Engineering of 400 KV Transmission Lines and sub-station associated with Srisaillam Left Bank Power House Project Transmission System of APSEB.

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## 7. PRIVATE SECTOR PARTICIPATION

### 7.1 THE INDIAN ELECTRICITY SCENARIO

Electricity is probably one of the most vital infrastructure inputs for economic development of a country. Indeed it is the fulcrum on which rests the future pace of growth and development. The demand for electricity in India is enormous and is growing steadily. The vast Indian electricity market, today, offers one of the highest growth opportunities for private developers.

In its quest for increasing availability of electricity, the country has adopted a blend of thermal, hydel and nuclear sources. Emphasis is also being laid on non-conventional energy sources-solar, wind and tidal. The abundant energy resources of the country are not being put to the most optimum use mainly due to the financial resource constraints. Mobilization of resources for achieving self-sufficiency in the electricity sector assumes high priority, and therefore the role of the private sector is important.

Since independence, development of the electricity sector has been primarily the responsibility of the Government, with a relatively small contribution from private enterprises, in the form of "licensees" like BSES, TEC, CESC, AEC etc.

To mobilise additional resources for the sector to help bridge the gap in demand and supply, the Government had formulated a policy in 1991 with the objective to encourage greater investment by private enterprises in the electricity sector. The Electricity (Supply) Act, 1948 was amended to provide a legal framework for facilitating these investments.

### 7.2 THE PRIVATE POWER POLICY OF THE GOVERNMENT OF INDIA

The package of incentives in the policy which complements the amended provisions in the electricity legislation comprehensively cover the legal, administrative and financial environment to make private investments in the sector attractive. A two part tariff system for power projects, to be put up by the Independent Power Promoters to cover the fixed costs and variable energy cost in electricity pricing, had been formulated, which, inter-alia, provides for 16% Return on Equity at 68.5% PLF

for thermal plants (coal/lignite/gas) and 90% availability for hydro plants. To encourage efficiency in plant operation, an incentive scheme based on capacity utilisation had also been formulated.

### 7.3 RESPONSE FROM THE PRIVATE SECTOR

The response to GOI's policy has been encouraging. Altogether, 125 private power projects envisaging nearly US\$ 75 billion of investment and 67,221 MW of installed capacity are presently being monitored by the Central Government. These projects, all of which require the Techno-economic Clearance (TEC) of CEA, include 95 proposals on the Memorandum of Understanding (MoU)/Letter of Intent (LoI), etc. route and 30 proposals on the competitive bidding route. In addition, there are several projects which are being set up by the private sector with the approval of the concerned State Government and do not require the TEC of CEA.

#### Projects involving foreign investment

Around 61 power project envisaging a total foreign investment of Rs. 4012.48 crores plus US\$ 4012.5 million and envisaging a total capacity of 21708 MW, have been approved from the foreign investment angle.

#### Projects commissioned/under construction

Presently, 19 private power projects (including projects developed by licensee companies), with a total capacity of 4099.5 MW, are under construction out of which 5 projects have been partially commissioned for a capacity of 748 MW. Also, 12 projects with a capacity of 2276.4 MW have been fully commissioned in the last five years and are under operation.

### 7.4 NEW POLICY INITIATIVES

#### 7.4.1 PPA Guidelines

To strengthen the hands of the SEBs in negotiating PPAs with the private promoters, detailed principles for negotiating PPAs for Indian Private Power Projects have been issued to the State Government/SEBs. In addition some key issues in the PPA which have to be kept in mind while negotiating have also been circulated to SEBs/ State Governments,

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in January 1995. The Government has also been organizing training courses and workshops in order to upgrade the skill of the officials of the State Governments and State Electricity Boards so that they may be better equipped to negotiate the PPAs with the IPPs. Moreover, under a World Bank assistance operated through Power Finance Corporation (PFC), the State Governments can avail of soft loans for hiring consultants to advise them on PPAs and other project related documents.

Model PPA for thermal projects and hydroelectric power projects which had been prepared by the international consultants have already been circulated.

#### **7.4.2 Competitive bidding for Awarding Projects**

The initial batch of projects have been awarded generally on the basis of negotiations between the SEB and a single developer. The SEBs and State Governments had been advised to introduce a more competitive element in the process of selection of developers and award of projects, and consider awarding new projects only on the basis of competitive bidding. In January 1995, it was decided that no new private power project proposal would be considered by CEA, if the project is not awarded through competitive bidding. A cut off date 18.2.1995 was prescribed and only those projects where the MoU's were signed before this date would be considered by the CEA. Projects after this date have to be awarded only after following the competitive bidding route. Detailed guidelines have also been issued to the State Governments for adopting competitive bidding. A notification for competitively bid projects was issued in May 1997 defining the manner in which tariff would be determined for such projects.

#### **7.4.3 Policy regarding expansion of power projects in the private sector**

While competitive bidding for award of power projects has been made mandatory from 18.2.1995, in the case of expansion schemes of private power projects, it has been recognized that in order to have the benefit of the already existing

infrastructure facilities, which results in reduced project costs, it would be preferable for the same project developer to be allowed to undertake the expansion project rather than to undergo the bidding process.

#### **7.4.4 Other exceptions to the ICB route**

Competitive bidding shall not be necessary for selection of the private company partner in such joint venture projects where the SEB/PSU holds major shares of the joint venture company. Also competitive bidding would not be required for setting up generating stations by IPP exclusively for the captive use of an industry or a group of industries without involving any sale to State Grid. In June 1997 power projects based on heavy bottom residue being setup by refineries have also been exempted from the requirement of competitive bidding for selection of the promoters/co-promoters. However these projects would be required to go in for ICB for procurement of equipment.

#### **7.4.5 Captive/Co-generation Plants**

As an alternative to meet the rapidly increasing industrial demand for power, Ministry of Power has suggested encouragement to captive/cogeneration plants by industries. The policy suggests, inter-alia, sale of excess power to the grid as per mutually agreed rates, access to transmission grid of the State on payment of wheeling charges, third party access for direct sale of power etc.

A resolution for promotion of co-generation has been issued on November 06, 1996. The resolution provides details about the definition of co-generation, mode of fixation of tariff and mode of deciding co-generation status for the power plants.

It has also been decided to permit setting up of captive power plants fully dedicated to an Industry or Group of Industries by an Independent Power Company (Third Party) without having to go in for competitive bidding for selection of the IPP. The States have been apprised of this decision in January, 1997. Recently, in January, 1998, the Central Government has again impressed upon the

states to adopt a captive generation policy that will facilitate the maximum use of the available capacity to meet the increasing demand of electricity in the state.

#### **7.4.6 Liquid Fuel Policy**

Even though the response of the private sector to set up coal/lignite, gas and hydel projects has been encouraging, it has been recognized that in view of the long gestation period these projects would take three to five years to come on stream. Hence, a quick capacity addition is essential in order to avert a severe power crisis. After detailed examination of the matter in consultation with Ministry of Petroleum and Natural Gas and Planning Commission, and a detailed study through computer modeling, it is felt that there is economic wisdom in setting up liquid fuel based power plants in certain areas of the country. It was also indicated by the Ministry of Petroleum & Natural Gas that there is a surplus of some heavy fuels in the country and some of them, being on Open General Licence, could also be imported. It was, therefore, decided to permit setting up of power projects based on heavy fuel oils such as, Naphtha, Heavy Petroleum Stock (HPS), Low Sulphur Heavy Stock (LSHS), Heavy Furnace Oil (HFO), Furnace Oil (FO) and Natural Gas, wherever available, as primary fuel.

Allocations have been made to various States and based on their recommendations, linkages have been issued to various projects to the extent of 10672.57 MW.

#### **7.4.7 Setting up of Mega Power Projects**

To facilitate setting up of large sized thermal power plants in the country and in order to derive economies of scale, projects having a capacity of 1000 MW or above and supplying power to more than one State are treated as Mega projects. The Government policy proposes identification of such project sites by the CEA, preparation of FRs by NTPC and Powergrid to facilitate measures for selection of Promoters and finalizing of PPAs between the Promoters and the SEBs.

#### **7.4.8 Enhancing the Capital expenditure limit**

The limit of Capital cost beyond which clearance from CEA is required for competitively bid projects

which was earlier Rs. 400 crores in case of generating stations has been further enhanced to Rs. 1000 Crores in September 1995. It is expected that this measure will enable the States to plan medium projects for quick capacity addition from the private sector in the most economical manner.

#### **7.4.9 Simplification of CEA clearance**

The number of clearances required to be obtained for the purpose of appraisal of the private power projects by CEA has been substantially reduced and necessary communication in this regard has been issued in January, 1996 to all the State Governments/SEBs. 40 projects have been approved by CEA with a total capacity of 19,598 MW.

#### **7.4.10 Bidding for EPC contracts**

The States/SEBs had been advised during June 1996 to impress upon the promoters that for the projects that have not yet finalized their Equipment Procurement and Construction (EPC) contracts, it is necessary for them to follow the International Competitive Bidding route in the selection of their EPC contractors. In case of IPPs who inform that their EPC contracts have been finalised, the SEB should satisfy itself that they have actually done so and in cases where it is not finalised, the SEB should ensure that the bidding route adopted is transparent and proper.

#### **7.4.11 Policy on automatic approval for foreign direct investment upto 74% in power sector**

On a review of the policy on Foreign Direct Investment, it had been decided to accord automatic approvals for foreign equity upto 74% in the following areas of the power sector

##### **A. Electric generation and transmission:**

- ☐ Generation and transmission of electric energy.
- ☐ Generation and transmission of electric energy produced in hydro electric power plants.
- ☐ Generation and transmission of electric energy produced in coal based thermal power plants.

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- ☐ Generation and transmission of electric energy produced in oil based thermal power plants.
  - ☐ Generation and transmission of electric energy produced in gas based thermal power plants.

**B. Non-conventional energy generation and distribution.**

**C. Construction and maintenance of power plants.**

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## 8. COOPERATION WITH NEIGHBOURING COUNTRIES IN HYDRO POWER

The development of the water resources of the common rivers of India and neighbouring countries of Nepal and Bhutan for mutual benefits has been under discussions with these countries. There is regular exchange of electric power between India and these neighbouring countries for the supply of surplus power and meeting the power requirements in the border areas.

India has been assisting Nepal in the utilisation of its hydro power potential and four HE scheme viz. Pokhara Trishuli, Western Gandak and Devighat have been implemented with assistance from Government of India. Three major water resources projects in Nepal viz. Karnali, Pancheshwar and Saptakoshi are presently under discussions. The feasibility report of Karnali Multipurpose Project (10800 MW) was prepared in 1989. The key parameters of the project are to be finalized after mutual discussion. Pancheshwar MPP (Stage 1:2000 MW) has been investigated by the two countries in their respective territories and DPR is presently under preparation/ discussion, jointly. The development of this project is covered under integrated Mahakali River Treaty signed between HMG, Nepal and India in February, 1996. India had offered financial and technical assistance for investigation of Saptakoshi, (3300 MW) Multipurpose project. Joint technical experts groups have been constituted for each of the above projects for joint guidance for investigation and preparation of detailed project reports (DPRs).

In Bhutan, Chukha HE Project (336 MW) implemented with Indian financial and technical assistance and operating in an excellent manner is a shining example of cooperation between the two countries for mutual benefits. The surplus power from the project is being imported by India. Kurichu HE Project (45 MW) in Eastern Bhutan is presently under implementation on turnkey basis with Indian financial and technical assistance. Another project viz. Tala HE Project (1020 MW), has been taken up for implementation and is being executed by Tala Hydroelectric Project Authority (THPA) comprising Indian and Bhutanese Officers and Engineers. Consultancy for the Project in respect of both civil

and electro-mechanical works is being rendered by Central Electricity Authority (CEA). Central Water Commission (CWC) and Water and Power Consultancy Services (WAPCOS). The Project is being funded by India through grant and loan and the major portion of the generation of power will be made available to India.

The investigation of two hydro electric projects namely Wangchu (900 MW) and Bunakha (180 MW) have been completed and DPR prepared and furnished to Bhutanese Government. India is also providing technical assistance for rehabilitation of hydro projects in Bhutan.

Hydro Engineering Division of CEA is rendering Design and Engineering Consultancy to Hydro Electric Projects and-rehabilitation of 8 nos. mini/micro hydroelectric projects in Bhutan.

### ASSESSMENT OF SMALL HYDRO POTENTIAL IN THE COUNTRY

India possesses sizable resource of small hydro potential and the attention of the planners of the country has therefore been focused on its exploitation. Implementation of small hydro stations requires comparatively lesser capital investment, shorter gestation period and obviates the need for providing major transmission lines and, therefore, results in substantial savings. Recognising the benefits of small hydro plants, particularly in the development of remote and isolated areas, Central Electricity Authority carried out the studies for assessment of small hydro potential of the country.

The study identifies small schemes in different river systems and canal systems of the country. The inventory of schemes also includes existing on going and proposed schemes. Such a detailed systematic study has been attempted for the first time in the country.

Statewise draft reports of studies were finalized after incorporating the comments/suggestions of State Authorities. According to the studies, small hydro potential of the country has been assessed as 6782 MW from a total of 1512 nos. of schemes.

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## 9. BADARPUR THERMAL POWER STATION

### PERFORMANCE

Badarpur Thermal Power Station consists of 3x100 MW and 2x210 MW coal-fired units with an installed capacity of 720 MW. However, the 3 units of 100 MW each, have been derated to 95 MW w.e.f. 11.1.1990. The station is owned by Government of India and is being managed by NTPC since 1st April, 1978. Presently, the entire energy generated at this station is supplied to the Delhi Vidyut Board only. During the year 1997-98 upto 31st March, 1998, the station generated a total of 4475.72 MUs at a PLF of 72.47 % against the target of 4200 MUs at PLF of 68.0%. Other parameters like specific oil consumption, auxiliary power consumption, DM water consumption during the year upto March, 1998 are 2.27 ml/kwh, 8.645% and 3.38% respectively. BTPS has lost 340 MUs due to low system demand/high frequency. The loss of generation due to coal shortage was 14.0 MUs. BTPS has been fixed a target of 4225 MUs at a PLF of 68.41% for the year 1998-99.

### RENOVATION AND MODERNISATION

#### PHASE I

BTPS is one of the thermal power stations identified under the centrally sponsored scheme for Renovation and Modernisation of thermal utilities. Under the Renovation and Modernisation Scheme Phase I, various schemes for 3x100 MW of BTPS for Rs.36.97 Crores had been approved.

Most of the schemes have already been implemented and an expenditure of Rs.35.48 Crores has been incurred upto 31st March, 1998. After implementation of R&M-I scheme for BTPS the actual annual average PLF has improved from 45.30% to 65.00% against the estimated improvement in PLF from 45.30% to 55.00%.

The specific oil consumption has also been reduced to less than 5ml/kwh due to reliable operation and less number of outages. The result of successful R&M programme of BTPS has turned out to be exemplary. During the calendar year 1994 the station generated 4586.788 MUs, highest since inception.

#### PHASE II

Under R&M Phase II programme, certain areas were identified for carrying out further modification. BTPS submitted a proposal for R&M Phase II for an estimated cost of Rs. 187.77 Crores for approval covering all units of BTPS. The proposal has been techno-economically cleared by CEA and approved by PIB. At present, the proposal is under approval by CCEA. The scheme mainly emphasises on reduction in heat rate, increase in PLF from 65.00% to 70.00% and increase in generation by about 320 MUs/Year.

#### ASH UTILISATION

BTPS has been making sincere efforts for productive utilisation of ash generated for constructive purposes. M/s Ballarpur Industries has set up a fly ash evacuation system for its use for manufacture of aerated blocks and beams utilising fly ash to the tune of 12000 Cubic metres during the year 1997-98.

BTPS has started manufacture of ash based bricks using FAL-G technology. The BTPS has manufactured 15 lakhs ash bricks during the year 1997-98.

BTPS also used ash in site leveling at Faridabad Gas Power Project and construction of ash dyke. The total utilisation of fly ash was more than 22% during 1997-98.

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## 10. PUBLIC SECTOR UNDERTAKINGS AND OTHER ORGANISATIONS

### 10.1. NATIONAL THERMAL POWER CORPORATION LTD. (NTPC)

National Thermal Power Corporation (NTPC) was set up in 1975, as a central sector generating company for the development of thermal power. The Corporation is at present engaged in operating/setting up of several thermal power projects and Gas based power projects. The total approved investment of the Corporation as on 31.3.1998 stands at Rs.36519.48 Crores (excluding the investment of Transmission Systems which have since been transferred to Power Grid). The NTPC is at present placed in Schedule "A".

The approved capacity of NTPC Projects is 20515 MW. The capacity commissioned upto 31.3.1998 is 16795 MW. This includes acquisition of Unchahar (420 MW) and Talcher (460 MW). Presently, NTPC has to its credit 12 coal based thermal power projects and 7 gas/liquid fuel based combined cycle projects. Besides its own stations, NTPC also manages the Badarpur Thermal Power Station in Delhi (705 MW) and Balco's Captive Power Stations

near Korba, Madhya Pradesh (270 MW), which was also constructed by NTPC.

#### 10.1.1 GENERATION

##### NTPC Stations

As on 31.3.1998 a total capacity of 16795 MW (including Talcher TPS - 460 MW) was under operation at various NTPC stations. This comprises 30 units of 200/210 MW each at Singrauli, Korba, Ramagundam, Farakka, Vindhyachal, Dadri, Unchahar and Kahalgao, 14 units of 500 MW at Singrauli, Korba, Ramagundam, Rihand, Farakka and Talcher and 26 gas/steam turbine units of various capacities operating at gas based combined cycle plants at Anta, Auraiya, Kawas, Dadri and Jhanor Gandhar gas based power Projects.

The generation performance of NTPC Stations has consistently been at a high level. Against the target of 99000 MUs upto 31.3.1998 (MOU excellent target for the year 1997-98), the gross generation from NTPC stations was 106290 MUs. During the year 1997-98 the coal based units



*Kawas Gas Based Project – NTPC*



*Vindhyachal Super Thermal Power Project — NTPC*

under commercial operation generated 86199.5 MUs at a plant load factor of 75.20%.

#### **Stations Managed by NTPC**

##### **Badarpur Thermal Power Station (BTPS), Delhi**

Badarpur Thermal Power Station (BTPS) (705 MW) owned by Government of India is being managed by NTPC since 1st April, 1978. 100% power from this station is supplied to DVB. During the year 1997-98, the station generated a total of 4475.5 MUs at a PLF of 72.5% against the target of 4200 MUs.

##### **Balco Captive Power Plant (BCPP) (4x67.5 MW)**

BCPP generated a total 2112.8 MUs at a PLF of 89.3%.

#### **10.1.2 HIGHLIGHTS FOR THE YEAR 1997-98**

The Government of India has identified National Thermal Power Corporation Ltd. as one of the “Navaratnas” - a potential ‘Global Giant’.

- A record generation of over 106 Billion Units as against the previous year's generation of about 99 Billion Units.
- Marketline, U.K. ranks NTPC as “NINTH LARGEST” thermal generator globally in terms of generation and “THIRD MOST EFFICIENT” in capacity utilisation based on performance data of 1996.
- Turnover at Rs. 12620.59 crores; an increase of 21.4% over last years Rs. 10393.85 crores.
- Profit after tax: Rs. 2122.30 crores against previous year's Rs. 1679.43 crores.
- Clearance accorded to Simhadri (2x500 MW) & Faridabad (400 MW) projects.
- NTPC has been allowed to diversify into areas of Hydro and Non-conventional areas of energy generation.
- Fuel linkages for Stage II of Kawas, Anta, Auraiya and Jhanor-Gandhar Naphtha based projects accorded.
- Meritorious productivity awards given to 6 stations of NTPC namely Singrauli, Ramagundam, Vindhyachal, Rihand, Badarpur and Auraiya for 1994-95

- 33.34 billion Japanese Yen loan raised at much cheaper rates of interest to pay the earlier loans leading to a substantial savings in interest cost.
- Balco Captive Power Project being managed by NTPC, has been awarded ISO-9002 by Bureau of Indian Standards.
- GOLD MEDALS for Singrauli and Rihand Stations.

### 10.1.3 OUTSTANDING DUES OF NTPC

The rising receivables continue to cause concern to NTPC. The billing for the year 1997-98 stood at Rs. 12666.03 crores with realisation of Rs. 11031.47 crores, i.e., 87.1 %. The total outstanding dues rose to Rs. 6881.95 crores as on 31.3.1998. The outstandings in terms of billing month works out to 4. There has been a significant improvement in the L/C coverage with the total L/C opened as on 31.3.1998 being Rs. 997.40 crores as against the previous year's figure of Rs. 834.50 crores. Currently, the L/C covers 92.1% of the average monthly billing.

### 10.1.4 WORLD BANK LOAN FOR NTPC POWER GENERATION PROJECTS

During the year 1997-98 NTPC has utilised US\$ 130.72 million (Rs. 519.59 crores) out of the first tranche of time slice loan of US\$ 400 million extended by World Bank to support NTPC's investment programme for Vindhyachal Stage II, Kayamkulam and EAP for certain operating stations. The cumulative utilisation till 31.3.98 is US\$ 256.42 million (Rs. 958.37 crores).

### 10.1.5. ADB LOAN FOR FEROEZ GANDHI UNCHAHAR TPS STAGE II (2x210 MW)

The ADB have approved NTPC as the implementing agency for stage-II of Feroze Gandhi Unchahar Thermal Power Project under loan for US\$ 160 million consequent to take over of the project by NTPC. The transfer of the loan has been made effective from 14.11.1995 and an amount of US\$ 51.97 million (Rs. 196 crores) has been utilised in the financial year 1997-98. The cumulative utilisation till 31.3.98 is US\$ 91.52 million (Rs. 336.22 crores).

### 10.1.6. OECF ASSISTANCE FOR FARIDABAD GPP (400 MW)

Faridabad Combined Cycle Gas Based Power Project (400 MW) is being implemented with

financial assistance from OECF, Japan. OECF has agreed to extend financial assistance of Japanese Yen 23.536 billion (including assistance for associated transmission system for Faridabad Combined Cycle Based Power Project (400MW)).

As per the revised allocation made by OECF, 23.192 billion shall be available to NTPC for implementation of the project and the balance would be available for implementation of Associated Transmission System by POWERGRID. The OECF assistance of Rs. 99 crores was utilised during 1997-98.

### 10.1.7. OECF ASSISTANCE FOR SIMHADRI TPP (1000 MW)

Simhadri TPP (1000 MW) was posed to OECF, Japan for funding who have pledged a direct OECF loan of JY 19817 million to NTPC as first tranche loan for Simhadri TPP. The loan became effective from 24.6.97.

### 10.1.8. MEMORANDUM OF UNDERSTANDING

NTPC is the first Power sector corporation to have signed a Memorandum of Understanding (MOU) with the Govt. of India and has been rated "Excellent" for the tenth consecutive year (every year since inception of MOU system of rating.)

The MOU targets vis-a-vis achievement for the year 1997-98 in respect of major performance parameters are given below.

Sl.NO.	(Target)		
	V.Good	Excellent	Actual (1997-98)
1. Generation (MUs)	98000	99000	106290
2. Heat Rate (Kcal/Kwh)	2480	2470	2470
3. Gross Margin (Rs.Cr.)	4044.63	4087	4771.87 (Prov.) &
4. Net Profit to Capital employed %	4.63	4.79	Accounts under finalisation

### 10.1.9. GROWTH STRATEGY

NTPC is making significant contribution for the growth of the economy by generating more than 1/4th of the electricity generated in the country. Also NTPC continued its multipronged strategy for capacity addition to maintain/augment its share in the country's installed generating capacity through green field projects, expansion of its existing plants, acquisition of SEB's plants and forming joint ventures.

During VIII plan period (1992-97) NTPC added 5002 MW capacity and acquired 460 MW Talcher TPP



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from Orissa SEB thus taking the total capacity addition to 5462 MW.

#### 10.1.10 NINTH PLAN

NTPC is planning to add 6300 MW in the IX plan. This includes a new generating capacity of 3170 MW under construction. Details of which are as under

##### Capacity under Construction :

The following projects for which investment approval has been accorded by Govt. of India, have been taken up for implementation and are scheduled to be commissioned in the IX plan period:

Project (Location)	Capacity (MW)	Capacity Addition in IX Plan(MW)	Commissioning Schedule
Vindhyachal - II (Madhya Pradesh)	1000	1000	Feb.'2001
Unchahar- II (Uttar Pradesh)	420	420	Jul.'2000
Kayamkulam (Kerala)	350	350	Mar.'2000
Faridabad (Haryana)	430	400	Jan.'2000
Simhadri (Andhra Pradesh)	1000	1000	March.'2002
Total	3200	3170	

#### 10.1.11 BEYOND IX PLAN

NTPC is also planning to add 7500-8000 MW beyond the IX Plan.

#### 10.1.12 JOINT VENTURES

Utility **Powertech Ltd. (UPL) - joint venture of NTPC-BSES:** UPL has been incorporated for Construction, Erection and Project management work in Power sector and other sectors in India and abroad. UPL has raised the authorised share capital from Rs.50 Lakhs to Rs.2 Crores and additional equity of Rs.93.10 Lakhs has been subscribed by

NTPC. NTPC and BSES have decided for award of contracts to UPL on cost plus basis upto the value of Rs.5 Crores.

##### JV for Ash Utilisation

A proposal has been approved by NTPC management for setting up of a fly-ash bricks plant at Badarpur with a capacity of producing 5 lakh bricks per day in Joint Venture with a prospective partner. A committee has been constituted to evaluate the proposal and signing of MOU with the joint venture partner.

# DETAILS OF NTPC PROJECTS SHOWING AGGREGATE APPROVED CAPACITY OF 20515 (MW)

## A. UNIT COMMISSIONED

S. No.	Name of the Region/Project/State	Approved Capacity in MW	Actual date of Commissioning
<b>NORTHERN REGION</b>			
1.	Singrauli STPP Uttar Pradesh	2000 Stage-I (3x200)  Stage-II (2x200+2x500)	Unit-1 (200) Feb. 82 Unit-2 (200) Nov. 82 Unit-3 (200) Mar. 83  Unit-4 (200) Nov. 83 Unit-5 (200) Feb. 84 Unit-6 (500) Dec. 86 Unit-7 (500) Nov. 87
2.	Rihand STPP Uttar Pradesh	1000 Stage-I (2x500)	Unit -1 (500) Mar. 88 Unit-2 (500) July 89
3.	National Capital Thermal Power Project (Dadri) Uttar Pradesh	840 Stage-I (4x210)	Unit-1 (210) Oct. 91 Unit-2 (210) Dec. 92 Unit-3 (210) Mar. 93 Unit-4 (210) Mar. 94
4.	Dadri GBPP Uttar Pradesh	817 Stage-I (4x131+2x146.5)	Gas Turbine Unit-1 (131) Feb. 92 Unit-2 (131) Mar. 92 Unit-3 (131) June 92 Unit-4 (131) Oct. 92  Steam Turbine Unit-5 (146.5) Feb. 94 Unit-6 (146.5) Mar. 94
5.	Unchahar TPP Uttar Pradesh	420 Stage-I (2x210)	Unit-I (210) Nov. 88 Unit-2 (210) Mar. 89
6.	Auraiya GBPP Uttar Pradesh	652 Stage-I (4x112+2x102)	Gas Turbine Unit-1 (112) Mar. 89 Unit-2 (112) July 89 Unit-3 (112) Aug. 89 Unit-4 (112) Sept. 89  Steam Turbine Unit-5 (102) Dec. 89 Unit-6 (102) June 90
7.	Anta GBPP Rajasthan	413 Stage-I (3x88+1x149)	Gas Turbine Unit-1 (88) Jan. 89 Unit-2 (88) Mar. 89 Unit-3 (88) May 89  Steam Turbine Unit-4 (149) Mar. 90

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**SOUTHERN REGION**

8.	Ramagundam STPP Andhra Pradesh	2100 Stage-I (3x200+1x500)	Unit-1 (200) Nov. 83 Unit-2 (200) May 84 Unit-3 (200) Dec. 84 Unit-4 (500) June 88
		Stage-II (2x500)	Unit-5 (500) Mar. 89 Unit-6 (500) Oct. 89

**EASTERN REGION**

9.	Farakka STPP West Bengal	1600 Stage-I (3x200)	Unit-1 (200) Jan. 86 Unit-2 (200) Dec. 86 Unit-3 (200) Aug. 87
		Stage-II (2x500)	Unit-4 (500) Sept. 92 Unit-5 (500) Feb.94
10.	Kahalgaon STPP Bihar	840 Stage-I (4x210)	Unit-1 (210) Mar. 92 Unit-2 (210) Mar. 94 Unit-3 (210) Mar. 95 Unit-4 (210) Mar. 96
11.	Talcher STPP Orissa	1000 Stage-I (2x500)	Unit-1 (500) Feb.95 Unit-2 (500) Mar. 96
12.	Talcher TPP (taken over from OSEB on 3.6.95)	460 (4x60+2x110)	Stage-I (4x60 MW) 1967-1969 Stage-II (2x110 MW) 1982-1983

**WESTERN REGION**

13.	Korba STPP Madhya Pradesh	2100 Stage-I (3x200+1x500)	Unit-1 (200) Mar. 83 Unit-2 (200) Oct. 83 Unit-3 (200) Mar. 84 Unit-4 (500) May 87
		Stage-II (2x500)	Unit-5 (500) Mar. 88 Unit-6 (500) Mar. 89
14.	Vindhyachal STPP Madhya Pradesh	1260 Stage-I (6x210)	Unit-1 (210) Oct. 87 Unit-2 (210) July 88 Unit-3 (210) Feb.89 Unit-4 (210) Dec.89 Unit-5 (210) Mar. 90 Unit-6 (210) Feb.91
15.	Kawas GBPP Gujarat	645 Stage-I (4x106+2x110.5)	Gas Turbine Unit-1 (106) Mar. 92 Unit-2 (106) May 92 Unit-3 (106) June 92 Unit-4 (106) Aug. 92
			Steam Turbine Unit-5 (110.5) Feb. 93 Unit-6 (110.5) Mar. 93
16.	Gandhar GPP Gujarat	648 (3x131+1 x255)	Gas Turbine Unit-1 (131) Mar. 94 Unit-2 (131) Mar. 94 Unit-3 (131) May 94
			Steam Turbine Unit-4 (255) Mar. 95

**Sub-Total****16795 MW**

**B. SCHEDULE TO BE COMMISSIONED BEYOND 1997-98**

S. No.	Name of the Region/Project/State	Approved Capacity in MW	Schedule date of Commissioning
<b>NORTHERN REGION</b>			
1.	Unchahar TPP Uttar Pradesh	420 Stage-II (2x210)	Unit-3 (210) Jan. 2000 (Ant.) Unit-4 (210) Jul. 2000 (Ant.)
2.	Faridabad GPP Haryana	400	GT-1 Jan. '2000 (Ant.) GT-2 Mar.'2000 (Ant.) ST-1 Jan.'2000 (Ant.)
<b>SOUTHERN REGION</b>			
3.	Kayamkulam CCPP Kerala	400	Gas/Steam Turbine G.T. Unit-1 Mar.'99 (Ant.) G.T. Unit-2 May. '99 (Ant.) S.T. Unit-3 Mar. '2000 (Ant.)
4.	Simhadri TPP Andhra Pradesh	1000 (2x500)	Unit-1 Mar. '2002 (Ant.) Unit-2 Dec. '2002 (Ant.)
<b>WESTERN REGION</b>			
5.	Vindhyachal STPP Madhya Pradesh	1000 Stage-II (2x500)	Unit-7 (500) Feb. '2000 (Ant.) Unit-8 (500) Feb. '2001 (Ant.)
<b>Sub-Total</b>		<b>3220 MW</b>	

**C. UNITS YET TO BE DECIDED**

S. No.	Name of the Region/Project/State	Capacity in MW Approved	Expected date of Commissioning
<b>EASTERN REGION</b>			
1.	Farakka STPP West Bengal	500 Stage-III (1x500)	Unit-6 (500) Yet to be decided. The project not taken up due to low demand of electricity in Eastern Region.
<b>TOTAL</b>		<b>500 MW</b>	

**GRAND TOTAL (A+B+C) = 20515 MW (APPROVED CAPACITY)****NB :** Capacity commissioned upto March, 1998 is 16795 MW.

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## **10.2 NATIONAL HYDROELECTRIC POWER CORPORATION LTD. (NHPC)**

National Hydroelectric Power Corporation Ltd. (NHPC) was incorporated in 1975 under Companies Act, 1956. The main objectives of the Corporation are to plan, promote and organise an integrated development of hydroelectric power in the country. The authorised Share Capital of the corporation is Rs.3500 Crores. NHPC is a Schedule 'A' Enterprise of the Govt. of India.

### **10.2.1 ACHIEVEMENTS IN 1997-98**

NHPC Power Stations generated 8820.23 MUs energy against the target of 7710 MUs upto 31.3.98 i.e. 1110.83 MUs more than the target.

### **10.2.2 STATUS OF ONGOING PROJECTS**

#### **10.2.2.1 URI PROJECT (480MW) J&K**

Uri Project (480 MW) in J&K was completed well within the scheduled time. The project started commercial generation w.e.f. 1.6.1997.

#### **10.2.2.2 RANGIT H.E. PROJECT (3X20 MW), SIKKIM**

Excavation of main Dam has been completed (68,000 cum). Further 23500 cum (26%) of concrete has been placed in the dam against the total concreting of 92000 Cum. The river has been diverted and further action has been initiated to start concreting 1398 m tunnel excavation of HRT from upstream side has been completed against the total length of 1558 m. Concreting in intake tunnel -I & II and silt flushing tunnels and excavation of gate operation chamber for silt flushing tunnel and gate operation chamber of desilting chambers completed. Benching of desilting chambers is in progress. Tunnel excavation from downstream side completed. Excavation and concrete lining of surge shaft, 110 m deep pressure shaft 3 nos. penstocks completed. Erection of steel liner for pressure shaft in progress. In Power House, service bay has been completed. The erection of Unit-1,2 & 3 upto pit liner has been completed. The Stator core for Unit-1,2 & 3 has been built up. About 99% of equipment has been received at Project site. The project is scheduled for completion by March 1999.

#### **10.2.2.3 DULHASTI H.E. PROJECT (3X130 MW), J & K**

The contract for balance civil works has been awarded to M/s JSA(JV) and agreement was signed

on 09.04.97. The new contractor has started work at site. In dam structure 36% concreting has been completed. In HRT 41% excavation has been completed. Excavation of Power House Cavern, Transformer Cavern expansion gallery, and Switchyard has been completed. Concreting of transformer cavern is also in progress. The project is scheduled for completion by March 2001.

#### **10.2.2.4. DHAULIGANGA H.E. PROJECT, STAGE - I (4X70 MW), U.P.**

The forest and defence land have been acquired. Private land at Tapovan and Dobat measuring 3.27 ha. have been taken over and development work for colony construction and job facilities is in progress. 7.35 ha. of private land at Nigalpani meant for main colony and project headquarter taken over in by the project after payment of compensation to the owners. For private land measuring 13.95 ha. coming under submergence, the award has been approved by Commissioner, Kumaon in May '97. The work on infrastructure and pre-construction activities started. Activities like temporary housing, development of benches and protection works besides access and haul roads have been taken up. The work of improvement of Tanakpur-Tawaghat Road, being executed by Border Roads Organisation, has been stopped for want of forestland.

The second tranche of OECF loan amounting to 16316 million Yen has become effective from 9.2.98. The project is scheduled for completion by Sept. 2004.

#### **10.2.2.5 KOEL KARO H.E. PROJECT (710 MW), BIHAR**

Work of the Project could not be started due to paucity of funds and local resistance. The project was posed to OECF for their financial assistance during 1996-97 and details of the project execution were presented to OECF Fact Finding Mission. The response from OECF in the matter has not been favourable. CEA has justified the execution of Koel Karo Project even after considering coming up of Purulia H.E. Project in West Bengal. Central Empowered Committee (CEC) recommended freezing of further expenditure on Koel Karo Project. It has been decided to pose this project to

OECF or other financing agencies for financing the project.

**10.2.2.6. KALPONG H.E. PROJECT (2.25 MW)  
A&N**

The execution of the project has been entrusted to NHPC as a deposit work with the funds to be provided by A & N Island Authorities. The MOE&F has accorded the clearance for diverting right fork of the river for additional power generation. The installed capacity has increased to 5.25 MW (3x1.75MW) from the original 2.25 MW. Revised

tender documents of civil works have been finalised after incorporating the increased scope of work due to clearance of right fork.

**10.2.2.7. KURICHU H.E. PROJECT (3X15 MW),  
BHUTAN**

NHPC has been entrusted with the execution of Kurichu Hydroelectric Project in Bhutan and an agreement was signed between Kurichu Project authority of Bhutan (KPA) and NHPC on 27.9.1995. The infrastructure and pre-construction activities are progressing satisfactorily. The diversion tunnel



*Rangit Project - Dam Concreting in Progress*



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was daylighted on 14th Nov. 1997 and the benching and concreting lining is in progress. The excavation of left abutment of dam and realignment of road beyond dam axis has been done. The work of open excavation of power house is in progress. The order for supply of main generating equipment i.e. Turbine and Generators have been placed on M/s BHEL and manufacturing of the same has been started. For Power Transformers and E.O.T Crane tenders received are under technical evaluation. The preliminary survey of 67 km long 132 kv s/c transmission line has been completed. The technical specification for transmission line works has been accepted by WAPCOS.

### **10.2.3. NEW SCHEMES**

#### **10.2.3.1. CHAMERA H.E. PROJECT, STAGE-II (3X100 MW), H.P.**

The tenders were received for turnkey execution with external financial assistance. Negotiations did not result in an acceptable and the offer considered by NHPC as unacceptable. PIB desired fresh TEC from CEA and exploring the possibility of financing package by indigenous financiers and suppliers.

#### **10.2.3.2. TEESTA H.E. PROJECT, STAGE-V (510 MW), SIKKIM**

Teesta H.E. Project located in East Sikkim is a run of the river peaking scheme identified on Teesta river. The installed capacity of the Project is 510 MW to generate 2172 MUs of electricity in a 90%

dependable years. Techno economic clearance for estimated project cost of Rs.1925.44 crores including IDC of 477.31 crores at March 1993 price level was accorded by CEA in May 1993 and anticipated construction period of the project as 8 years. Sikkim Govt. has decided the execution of this project through NHPC. Accordingly NHPC completed necessary pre-construction investigations activities. DPR updation, observation of Hydrological/meteorological data and statutory clearances are under progress. NHPC is firming up the final project cost estimate, construction equipment planning etc. for submission of report for PIB clearance.

#### **10.2.3.3. LOKTAK DOWNSTREAM HE PROJECT (90MW) MANIPUR**

Loktak Downstream HE Project is located in the Tomenglong District of Manipur. The Project envisages harnessing of hydro potential of utilising the tail water discharge of Loktak HE Project. The project is expected to generate 464 MUs of energy in a 90% dependable year. The project was accorded techno-economic clearance by Central Electricity Authority in Jan. 93 for an estimated cost of Rs. 418.05 crs. (June 92 Price Level). The project has also been accorded Environmental & Forest clearance by MOEF. The State Govt. has agreed 'in principle' for the execution of this project in the central sector through NHPC. The project has been posed for OECF assistance during 1998-99.

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### 10.3 RURAL ELECTRIFICATION CORPORATION LIMITED

Rural Electrification Corporation (REC) was set up in 1969 with the primary objective of providing financial assistance for rural electrification in the country. REC was declared a public financial institution under Section 4-A of the Companies Act in 1992. Rural Electrification Programmes financed by the Corporation cover electrification of villages including tribal villages and Dalit Bastis, energisation of pumpsets, provision of power for small, agro based and rural industries, lighting of rural households and street lighting. The Corporation has been providing assistance to the State Electricity Boards for taking up System Improvement Projects for strengthening and improving of system transmission and distribution system and small generation power projects like wind energy and hydel projects. REC is a schedule 'B' Organisation.

During the year 1997-98, REC approved 1261 new projects involving a loan assistance of about Rs. 1214 crores for electrification of 4459 new villages, energisation of 1.96 lakhs pumpsets besides provision of electricity to other categories of services, electrification of Dalit Bastis and Hamlets etc. The Corporation has (cummulatively upto March 1998 sanctioned 33187 RE Projects involving financial assistance of over Rs.14724 crores for electrification of about 3.24 lakh new villages and energisation of over 68 lakh pumpsets besides provisions of electricity to other categories of services and electrification of Dalit Bastis.

#### 10.3.1 PHYSICAL ACHIEVEMENT

During the year 1997-98, against the target of 3000 villages and energisation of 2.4 lakh irrigation pumpsets, provisionally 3010 villages were reported electrified and 2.41 lakh pumpsets energised. The annual plan targets of village electrification and pumpset energisation were thus exceeded.

Cumulatively, upto March, 1998 over 2.99 lakh villages have been electrified and 70.6 lakh pumpsets energised under REC schemes. The level of rural electrification in the country as a whole stood at 12.8% at the time of establishment of the Corporation has risen to 85% (revised as per 1991 census) at the end of the March, 1998. Similarly,

the number of pumpsets energised which stood at 10.9 lakhs at the time of setting up of the Corporation in 1969 has sharply risen to over 118 lakhs.

#### 10.3.2 KUTIR JYOTI PROGRAMME

The Government of India in 1988-89 launched a programme called Kutir Jyoti for extending single point light connection to the households of rural poor families below poverty line including Harijan and Adivasis. Under this programme, one time initial cost of internal wiring and service connection charges upto a certain maximum limit is provided by way of grant to the State Governments/SEBs through REC. The Government has fixed the grant amount of Rs. 800 per connection without installation of meter and Rs. 1000 with meter.

For the year 1997-98 the Government allocated a grant of Rs. 36.93 crores for release of 4.3 lakh Kutir Jyoti connections. During the year, a grant of Rs. 28.69 Crores was disbursed and 3.52 lakh single point light connections were released. For the current financial year 1998-99, the Corporation has proposed for a provision of Rs. 40 crores under



11KV/415 Volt VDTC -Gujarat

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the programme for release 4.45 lakh connections. Cumulatively upto the end of March, 1998 the Corporation has released a grant of about Rs.116 Crores which has enabled the States to release about 28 lakh connections since its inception.

### **10.3.3 SYSTEM IMPROVEMENT PROJECTS**

To improve the quality and reliability of power supply in the rural areas and reduce lines losses, the Corporation continued its emphasis on promotion and financing of System Improvement and Energy Conservation Projects. During 1997-98, the Corporation sanctioned 246 new System Improvement Projects, involving a financial assistance of Rs. 432 Crores. These sanctioned projects inter-alia envisage installation of 315 new sub-stations.

Cumulatively upto the end of March 1998, as many as 1956 System Improvement Projects for financial assistance of Rs.2198 crores have been sanctioned. 1356 new Substations have been commissioned. So far 1145 projects have been completed.

### **10.3.4 RURAL ELECTRIC COOPERATIVES**

Out of 41 approved Rural Electric Cooperatives sanctioned by REC, 35 Rural Electric Cooperatives were in operation by the end of year 1997-98, the balance six societies having been taken over by SEBs.

During 1997-98, one RE Cooperative Society at Lucknow has been taken over by UPSEB. At the end of October, 1997, 34 RE Cooperatives which were in operation electrified cumulatively 4167 villages and 1855 hamlets and released 1 1.07 lakhs services.

### **10.3.5 OECF ASSISTANCE**

Under the assistance of 24.4 Billion Yen (Rs.760 Crore @ Exchange Rate of 1 Re=3.21 Yen) sanctioned by Overseas Economic Cooperation Fund (OECF) of Japan for utilisation with the extended validity period of February, 2002, 21 System Improvement Sub-projects under the current batch involving an outlay of Rs. 104 Crores in the State of Andhra Pradesh, Haryana, Karnataka, West Bengal are under implementation. All the sub-projects are slated for completion by December, 2000. OECF has also approved 20

System Improvement sub-projects for Rs. 361.54 crore in the State of Andhra Pradesh and Orissa and one small hydro electric sub-project (2x2 MW) for Rs.13 crore in Tamil Nadu. OECF has also empowered REC to sanction new projects (with the concurrence of OECF) of credit worthy SEBs. The additional sub-projects are due to be completed by December 2000.

### **10.3.6. CENTRAL INSTITUTE FOR RURAL ELECTRIFICATION**

During the year 1997-98, the Central Institute for Rural Electrification (CIRE) embarked on expansion and diversification of its activities covering inter-alia R&D, demonstration project services and Consultancy services including Standardisation and Technical Development. During the year under review, the Institute organised 44 Training Programmes, imparted training to 680 Officers/employees and recorded achievement of 4016 participant days. The training courses covered diverse areas such as Technology, Upgradation, Power Systems Improvement, New and renewable Sources of Energy, Conservation of Energy, System Management and Information Technology. Besides, a year long Induction Training Programme for new recruited REC Officers was taken up. The Institute in collaboration with NonConventional Energy Development Corporation of Andhra Pradesh (NEDCAP) and with assistance from Ministry of Non-Conventional Energy Sources (MNES) also set up an Energy Park for demonstrating and highlighting new and renewable energy systems and devices as a part of its education and training activities for selected officers participating in its various training programmes.

### **10.3.7 STANDARDISATION OF EQUIPMENT CONSTRUCTION PRACTICES AND RESEARCH AND DEVELOPMENT**

The Corporation continued its drive towards standardisation of equipment, material and construction practices for RE Programmes including introduction of innovative technologies with special emphasis on energy conservation. So far 308 standards comprising 74 specifications for equipment/material and 234 construction practices have been evolved and issued by the Corporation.

The National Level Committee constituted under the

Chairmanship of CMD, REC and comprising of top ranking technical experts and representatives for SEBs, Bureau of Indian Standards (BIS), Research Institutions and Transformer Manufacturers, after series of meetings and intense deliberations, finalised the report containing the Action Points/Recommendations for reducing the failure rate of the transformers and improving their performance in a time bound manner.

### **10.3.8 ANNUAL PLAN 98-99 OF REC**

In the Annual Plan for REC for the fiscal year 1998-99, REC has proposed funds allocation of Rs.1250 Crores for electrification of 2800 villages and energisation of 2.51 lakh pumpsets. An amount of Rs.50 crores and Rs.76 crores has specifically been earmarked for Tribal Sub-Plan and Special Component Plan respectively for electrification of 500 tribal villages and 1720 Dalit Bastis during 1998-99.

### **10.3.9 NEW THRUST AREAS : SMALL GENERATION SCHEMES**

REC has diversified its activities in the area of small generation and distribution projects including decentralised generation for electrification of remote and inaccessible villages where grid extension is neither feasible nor economical. Under this programme, co-generation and small/mini/micro hydel projects are being taken up as thrust areas. A separate Appraisal Division has been created to set up modern appraisal systems suiting to financial institutions and adopt suitable commercial practices to finance projects including the private sector. Necessary guidelines have been put in place and appraisal formats developed to follow standard practices. REC has already sanctioned 4 mini hydel projects (4 MW) to APSEB and have in principle sanctioned a cogeneration project to Mysore Sugar Mills, Karnataka for exportable surplus generation of 15 MW. IREDA has sanctioned intermediary status for REC for utilising their World Bank funds

for solar photovoltaic applications. REC has also finalised a proposal to launch SPV pumping programme based on leasing of equipments to be taken up in 1998-99.

### **10.3.10 SYSTEM IMPROVEMENT FOR SPECIAL PROJECT AGRICULTURE (SI-SPA)**

During March, 1997, the Corporation introduced a new scheme for financing of System Improvement Programme in areas with high pumpset load demand (SI-SPA) to be financed by the Corporation and Banks in the ratio of 1:2, with a loan outlay of Rs. 5 crores to 15 crores per scheme.

During the year 1997-98, 22 SI-SPA Projects from Gujarat (4), Kerala (8), Maharashtra (7) and Tamil Nadu (3) were sanctioned involving a total loan of Rs.234.15 crores (REC portion-Rs.78.049 crores) and Rs. 45.23 crores (REC-Rs. 15.31 Crore) was disbursed towards new and ongoing projects. This has helped in installation of 20 MVA capacity sub-stations (3) and 187 Kms. of EHT and HT lines.

### **10.3.11 PRIORITY SECTOR LENDING**

The Corporation had requested RBI to classify pumpsets energisation under 'Priority Sector' lending by Banks for minor irrigation pumpsets, in line with the priority accorded by the Government to the agriculture, so that the Corporation could mobilise additional resources for implementation of SPA-BP Programmes. RBI accorded approval for the same during the year 1996-97, and the Corporation has sanctioned 452 SPA-BP projects involving loan assistance of Rs. 259.87 crores (REC portion Rs. 86.62 Crore) for energisation of 111733 pumpsets.

### **10.3.12 CONSULTANCY SERVICES**

The Corporation has recently started extending Consultancy Services to other PSUs/SEBs depending upon their specific needs for mobilisation of resources from the market.

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## **10.4 NORTH EASTERN ELECTRIC POWER CORPORATION (NEEPCO)**

The North Eastern Electric Power Corporation Ltd. (NEEPCO) was constituted in 1976 under the Company's Act 1956 with the objective of developing the large power potential of the North Eastern Region of the country through planned development of power generation projects which in turn would effectively promote the development of the North Eastern region. Since then NEEPCO has grown into one of the pioneer public sectors with an authorised share capital of Rs.1500.00 Crores. It is a schedule 'B' organisation.

The North Eastern Region of the country is blessed with highest hydro power potential of the country which is estimated at 48,000 MW constituting about 33% of the total reserves of the country. The region has abundant natural gas reserves. There is ample scope of development in this under developed region, where the main infrastructure has been Identified as power.

The main objectives of the the North Eastern Electric Power Corporation are to add to the power generating capacity in the North Eastern Region by installing hydro and thermal power plants; to ensure optimum utilisation of commissioned generation projects; to generate adequate internal resources by ensuring justifiable return on investment and to continue sustained efforts to obtain the receivable from State Electricity Boards/ Departments; to undertake long term feasibility studies for optimum development of hydro power resources of river basins in North Eastern Region.

Out of a total effective installed capacity of 1 638.43 MW (Grid) in the North Eastern Region, NEEPCO is contributing 595 MW through its Kopili Hydro Electric Projects and Assam Gas Based Power Projects, Kathalguri under O&M. During 1997-98 NEEPCO has been able to synchronise 2ST units each 30 MW of Assam Gas Based combined cycle project and 4 units each of 21 MW of Agartala Gas Based Power Project in Tripura. In spite of having only 36.3% of the total installed capacity in the region the Corporation has been able to meet more than 40% of the peak demand/energy needs of the region. The Corporation achieved a capacity addition of 251 MW within the 8th Five Year Plan and another 144 MW in the year 1997-98. In 1998- 99 a capacity addition of 80 MW has been targetted to be

achieved. In addition, the Corporation proposes a capacity addition of 405 MW of Ranganadi HE Project (ongoing) and 25 MW of Doyang HE Project (ongoing) during remaining period of 9th Plan.

The Corporation also proposes to take up the following new schemes during 9th Plan:

- (a) Turial HE Project (Mizoram) - 60 MW
- (b) Tuivai HE Project (Mizoram) - 210 MW
- (c) Kameng HE Project (Arunachal Pradesh) - 600 MW
- (d) Lower Kopili HE Project (Assam) - 150 MW
- (e) Kopili HE Project - 2nd Stage (Assam) - 25 MW
- (f) Dikrong HE Project (Arunachal Pradesh) - 100 MW
- (g) Ranganadi HE Project - 2nd Stage (Arunachal Pradesh) - 180 MW
- (h) Sissiri HE Project (Arunachal Pradesh) - 225 MW
- (i) Kolodyne HE Project (Mizoram) - 90 MW

### **POWER PROJECTS UNDER OPERATION AND MAINTENANCE (COMPLETED)**

#### **KOPILI HYDRO ELECTRIC PROJECT (150 MW) - ASSAM**

Kopili HE Project (150 MW) is located in N.C. Hills District of Assam and was completed in March, 1988 at a cost of Rs.243.82 Crores. It is a twin project consisting of two Dams and two water conductor systems leading from the Kopili Reservoir to the Khandong Power House (2x25 MW) and from Umrong Reservoir to the Kopili Power House (2x50 MW). This project started commercial generation from June/July, 1988.

#### **KOPILI HYDRO ELECTRIC PROJECT (1st STAGE EXTENSION -100 MW), ASSAM**

This project is located in N.C. Hill District of Assam. It involves laying of additional penstock and extension of the existing Power House building of the Kopili H.E. Project for installation of 2 more TG. Units of 50 MW each. Investment approval to the project was accorded in May, 1993 at an estimated cost of Rs.110.99 Crores (including IDC). The revised cost estimate of the project have been

worked out at Rs.134.48 crores including IDC. The project, on completion will generate 502 MU of energy annually at 90% dependable year. All major civil works of the Project have been completed.

This is an extension of existing project only. The Unit III of 50 MW was rolled on 1.11.1996 and synchronised on 5.3.1997. The Unit IV of 50 MW was rolled on 29.3.97 and synchronised on 17.6.1997.

During 1997-98, actual generation was 817 MU against a target of 1112 MU by Hydro Power Stations and 721 MU was generated against a target of 740 MU by Thermal Power Stations.

The cumulative generation upto March 1998 in respect of Kopili H.E. Project since inception is Rs. 7768.03 MU and 367.40 MU by Kopili HE Project Ist Stage Extension and 1568.44 MU by Assam GTPP Kathalguri. Total earnings in terms of sale of power from Kopili H.E. Project is Rs. 32.22 crs. and that of Assam Gas Based Power Project, Kathalguri is Rs. 64.21 crs. during 1997-98.

## **ONGOING PROJECT (GENERATION)**

### **DOYANG HE PROJECT (75 MW) - NAGALAND**

This project is located in the Wokha District of Nagaland. The project was administratively approved in July, 1989 for installing 3 units of 25 MW. The latest cost of the project at February, 1993 price level stands at Rs. 384.75 Crores (including IDC), and the CCEA clearance was obtained in August, 1995. The annual generation target is 227 MU at the rated capacity. Two units of the project are scheduled to be commissioned during 1998-99 and Unit III in 1999-2000, and the project is expected to be fully completed in 2000-2001.

### **RANGANADI HE PROJECT (405 MW) ARUNACHAL PRADESH**

This project is located in the Lower Subansiri District of Arunachal Pradesh and has a provision of installing 3 units of 135 MW each with zero date as 05/87. The cost of the project has been updated to February, 1993 price level and stands at Rs.774.12 Crores (including IDC) and the same has been



*Work in progress at Doyang HE Project, Nagaland*



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approved in August, 1995. The project envisages to generate 1874 MU annually at rated capacity. The project is expected to be fully commissioned by 2000-2001. The anticipated cost of The project is now Rs.1024.10 Crores.

#### **ASSAM GAS BASED COMBINED CYCLE POWER PROJECT (291 MW) - ASSAM**

This project is located in Dibrugarh District of Upper Assam. The project was administratively approved in November, 1987 at a cost of Rs. 203.17 Crores for installing 6 units of Gas Turbine and 3 units of Steam Turbine to utilise the waste heat with a total installing capacity of 291 MW. The project cost subsequently was revised at Rs.895.77 Crores. The revised cost estimate was approved by the Government in May, 1992. The latest revised cost estimate (April, 1996 price level) works out to Rs.1347.57 Crores and approval obtained in September, 1997.

#### **NEW SCHEMES FOR EXECUTION WITHIN IXTH PLAN**

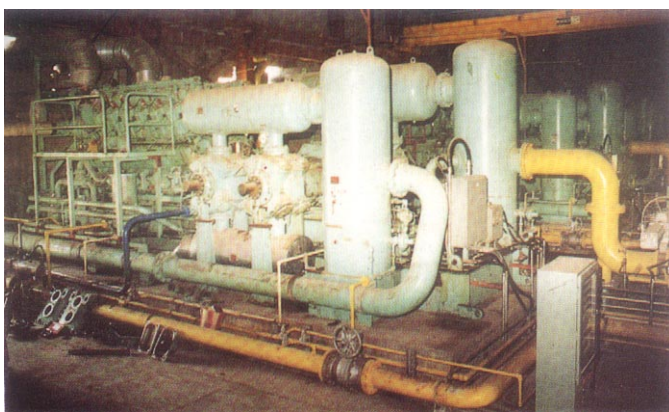
The following new schemes are being considered by the Corporation for executing during 9th Plan:

##### **TURIAL HE PROJECT (60 MW) - MIZORAM**

The Proposed Turial HE Project in Mizoram is located in the border of Cachar District of Assam and Aizawl District of Mizoram. The proposal comprises of construction of a 77 M high homogenous earthfill Dam across the Turial river with an installed capacity of 2x30 MW surface Power House on the left bank of the river. The completed cost of the project at December, 1996 price level is Rs. 448.19 Crores. The PIB clearance is obtained and CCEA clearance is awaited. The project is proposed to be financed by OECF.

##### **TUIVAI HE PROJECT (210 MW) - MIZORAM**

The proposed Tuivai HE Project is located in



*Assam Gas Based Power Project - Assam*

Aizawl District of Mizoram and comprises of construction of a 155 M rock fill dam across the Tuivai River with installation of 3 units of 70 MW each (210 MW). The total completed cost of the project has been estimated to Rs.1198.15 Crores.

#### **KAMENG HE PROJECT (600 MW) ARUNACHAL PRADESH**

The proposed Kameng HE Project is located in the West Kameng District of Arunachal Pradesh. The proposal comprises of construction of a 96.5 M high concrete gravity Dam across the river Bichom. The techno-economic clearance (TEC) of the project is obtained. The estimated cost of the project is updated to Rs.1758.89 Crores. The State Government contemplated the execution of the project through private sector. However, Government of Arunachal Pradesh has been approached for transfer of the project to NEEPCO.

#### **KOPI LI HE PROJECT STAGE II(25 MW)- ASSAM**

The proposed location of the Power House is near the existing Khandong Power House. The scheme consists of a bye-pass tunnel of length 325 M from Khandong Surge-Shaft, one 2.75 M dia Penstock, a semi-underground Power House and a Tail race to release the water into Umrong Reservoir. The project cost has been revised considering availability of infrastructure and other major works. The revised cost has come to Rs. 63.30 crores.

#### **LOWER KOPI LI HE PROJECT(150 MW) - ASSAM**

The proposed Lower Kopili HE Project is located in N.C. Hills District of Assam. The proposal

comprises of construction of a 71.35 M high concrete gravity Dam across the Kopili river in the down stream of the Kopili Power Station with an installation of 3 units of 50 MW each. The total estimated cost of the project has been updated to 1996 price level at Rs.618.18 Crores. The State Government decided in September, 1996 to entrust the construction of the project to NEEPCO on "built own and operate" basis.

#### **RANGANADI HE PROJECT STAGE II (180 MW) - ARUNACHAL PRADESH**

The project located at 10 Km upstream of present Ranganadi Diversion Dam envisages construction of 100 M high concrete Dam with an installed capacity of 3x60 MW. The estimated cost of the project is Rs.1012.70 Crores at 3/98 price level.

#### **DIK RONG HE PROJECT (100MW) ARUNACHAL PRADESH**

The project is situated in downstream of Dikrong Power House with an installed capacity of 100 MW. The discharge of Dikrong alongwith tail water of Ranganadi HE Project will be utilised to generate power. The project envisages construction of 48.50 M high composite Dam and 1 No. 7.6 M dia, 4 Km long Head Race Tunnel.

The following HE Projects are also proposed to be taken up during the IX Plan:

Sissiri HE Project (225 MW) - Arunachal Pradesh  
Kolodyne HE Project (90 MW) - Mizoram

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## **10.5 POWER FINANCE CORPORATION LIMITED**

The Power Finance Corporation Limited (PFC) was incorporated on 10th July, 1986 under the companies Act, 1956 to function as the prime Development Financial Institution for growth and overall development of the Power Sector. The borrower-portfolio of PFC comprises the State Electricity Boards (SEBs), State Generation Corporations (SGCs), Municipality-run power utilities. The funds provided by the Corporation are in the nature of additionality to Plan Allocation (in respect of SEBs etc.) and based on the merits of the individual projects. As on 31st March, 1998, the Authorised Capital and the paid-up (equity) capital of the Corporation stood at Rs.2000 Crores and Rs.1030 Crores respectively. The PFC is a schedule 'A' organisation.

### **10.5.1 PERFORMANCE HIGHLIGHTS**

The operations of the Corporation, as on 31st March, 1998, included new Loan Sanctions during the year 1997-98, are of the order of Rs.2922 Crores, for a wide variety of power projects in various parts of the country and disbursements are to the tune of Rs.2026 Crores.

The Corporation had declared a dividend of Rs.48 Crores for the year 1996-97 to the Government of India which owns all its equity. Besides this, PFC had paid an interim dividend of Rs.15 Crores to Government of India for the year 1997-98. Being a Consistently profit making Corporation, PFC was placed in the highest category of 'Excellent' for the fourth time in succession, by the Government of India on the basis of its all round performance.

During the year, PFC had launched a tax-free bonds issue (through book-building process) of Rs.100 Crores with green shoe option of Rs.75 crores. The significant feature of this issue is that the cut-off rate came to 8.85% which is a benchmark set by PFC for tax-free bonds.

### **10.5.2 RESOURCE MOBILISATION**

In order to meet its increasing fund requirements, PFC stepped-up its efforts to tap External Commercial Borrowing (ECB) market during 1997-98.

### **Syndicated loan of US \$ 75 million**

PFC entered the syndicated loan market for raising of US \$ 50 million. PFC has been successful in raising the loan at Libor +50 basis points. As the issue received an overwhelming response from the market, the issue size was increased to US \$75 million. The loan agreement was signed on 9.1.97.

### **Fixed Rate Euro Notes**

The Corporation raised Euro note of US \$ 100 million in July, 1997 at 7.5% fixed with maturity period of 12 years. This is the finest pricing ever received by any Indian Company for a 12 year paper.

### **Line of Credit under ECAs**

During the financial year 1997-98, PFC has signed an agreement with IKB Bank of Germany for a line of credit of DM 100 million which is to be used for financing imports from designated countries by various borrowers of PFC.

### **10.5.3 LENDING RATES**

PFC has recently reduced its lending rates by two percent for transmission and power generation projects. As per the revised structure, term-loan for thermal generation schemes of state-owned utilities would bear an interest rate of 16% against 18% earlier; 15% (compared to 17%) for transmission schemes above 132 kv and generation schemes (other than thermal projects). Term loans under Pre-Investment Fund would carry an interest rate of 11% as against 15%. The Corporation has also reduced the lending rates for private power utilities by 2%.

### **10.5.4 EXTERNAL CREDIT UTILISATION**

#### **WORLD BANK**

The Loan of US \$ 265 million (revised to US \$ 240 million) from World Bank for Power Utilities Efficiency Improvement Project routed through Government of India became effective from 18.3.1997. The Corporation has sanctioned US\$ 258.21 million against US\$ 220 million and for PreInvestment Fund the Corporation has sanctioned US\$ 36.66 million against US\$ 20 million. The Corporation has sent claims to Government of India

equivalent to Rs.675.90 crores as on 31.3.1998. The target of utilisation during 1997-98 was Rs.200 Crores.

### **ADB**

The loan of US\$ 250 million from ADB under Power Efficiency (Sector) Project routed through the Government of India became effective from 22.7.1997. The loan is to finance sub-projects of selected SEBs. The Corporation has sanctioned US\$ 289 million against US\$ 250 million and submitted claims to Government of India equivalent to Rs.541 crores as on 31.3.1998.

### **ODA**

The ODA of UK signed an agreement with Government of India in 1993 under Energy Efficiency Programme, under which a Project of Renovation and Upgrading of Hirakud Hydro Power Station of Stage-I Unit 1 & 2 (of OHPC) has been approved. The funds are to be canalised through PFC. The PFC has sanctioned a sum of US\$ 23.52 million and claim submitted to Government of India equivalent to Rs.63.51 Crores on 31.3.1998.

### **KFW**

PFC signed loan agreement with Kreditanstalt Für Wiederaufbau (KFW) in June, 1995 for a mixed credit of DM 46.5 million under Energy Investment Programme, for being utilised for financing rehabilitation of existing Power Plants and distribution systems. Rehabilitation of Koyna HEP Stage I & II in Maharashtra and Hirakud HEP Stage I (unit 3 & 4) are to be covered from the loan. PFC has disbursed Rs.45.14 Crores as on 31.3.1998 for Koyna HEP of MSEB.

## **10.5.5 INSTITUTIONAL DEVELOPMENT**

### **Operational & Financial Action Plan**

PFC has been endeavouring to improve the operational and financial health of the state power utilities through formulation and implementation of Operational and Financial Action Plan (OFAP). During the year 1997-98, 3 new OFAPs have been finalised. These are reform OFAPs of HSEB, ASEB and GRIDCO. In addition OFAP of TNEB has been revised. As of now OFAPs are in place for 14 SEBs and 7 SGCs, 1 Municipality-run utility, 2 State

Electricity Departments, one Joint Sector Power Utility and one transmission utility incorporated under the Companies Act. Efforts are underway for formulation of OFAPs for the remaining utilities.

### **Power Sector Studies and Training**

PFC has been developing model documents and conducting various studies. The major achievements during the year are; 253 power utility/ SEB officials have been trained in eight training programmes and three workshops/seminars have been organised during the year; studies on (a) costing of power projects (b) tariff formulation and (c) case study on structural reforms in Orissa have been initiated; model documents for distribution management agreement, request for qualification, request for proposal, power purchase agreement for fossil fuel power projects and hydroelectric power projects were finalised and circulated to the power utilities during the workshops.

### **Support for Consultancy Services**

PFC is providing concessional financing to the SEBs/SGCs for engaging the services of consultants to help them in the preparation, solicitation and evaluation of proposals and negotiation of Power Purchase Agreement with the Independent Power Producers. PFC is also maintaining a Data Bank of consultants to help the SEBs in hiring their services.

## **10.5.6 ACCELERATED GENERATION AND SUPPLY PROGRAMME (AGSP)**

Government of India approved the Accelerated Generation and Supply Programme of PFC to provide interest subsidy to State Sector through PFC. Under the programme interest subsidy would be provided to ongoing generation project, implementation of which got delayed for want of funds, R&M projects, Life Extension Programmes, System Improvement and Missing Transmission Links etc., which are expected to enhance power availability and supply and would partially bridge the demand-supply gap in the short-term. Government of India has decided to provide interest subsidy of 4% throughout the life of the loan for disbursements made during 1997-98 which is likely to be extended to the 9th Plan period. The Salient features of the schemes are as follows:-

- Interest subsidy of Rs.200 Crores was provided during 1997-98.
- Budget grants would be utilised to provide interest subsidy during repayments.
- Interest subsidy would be 4% below normal lending rates of PFC.
- If projects/schemes are delayed in comparison to the projected commissioning date as agreed with SEBs/SGCs at the time of sanction/disbursement, the interest subsidy shall be reduced in proportion to the delay in a predetermined manner.
- Interest subsidy would be provided to eligible project/schemes under the programme for all State sector utilities who are eligible, under relaxed conditionalities.

#### **10.5.7 STREAMLINING ACTIVITIES PERTAINING TO R&M AND LIFE EXTENSION STUDIES AND WORKS**

Government of India has set up a Task Force on R&M in July, 1997 with members from CEA, Planning Commission, BHEL and PFC to identify and prioritise R&M projects by close coordination with SEBs etc. for speedy implementation. PFC is entrusted with the work of formulating prequalification bid invitation documents for shortlisting and registration of vendors to undertake Life Extension Studies/work of thermal power stations.

#### **10.5.8 DESIGN OF MODEL DISTRIBUTION MANAGEMENT SYSTEM (DMS)**

PFC has agreed to provide loans on soft terms for Research and Analysis study to design and set up pilot Distribution and Management System (DMS), a model of excellence, one in each SEB/Utility. A model DMS is aimed at study of all the aspects of distribution system and full accounting of electricity, fed into distribution system leading to reduction of T&D losses. The priority areas under this scheme are:

- Urban Distribution network strengthening and improvement.
- Installation of Capacitors.
- Installation of meters (Electronic and Electromechanical meters)

- The salient features of this scheme are:
- One pilot project in each SEB/Utility may be provided soft loan to institute a DMS to establish a model of excellence.
- The loan may be provided either through grants from GOI or from PFC resources.
- Interest free loan or grant would be provided for Phase I.
- Loan on interest @ 12% or lower would be provided for Phase II.

#### **10.5.9 CONTRIBUTION TO PHYSICAL ACHIEVEMENT THROUGH PFC FINANCING**

PFC's financial assistance have cumulatively helped in installation of 6972 MVAR Shunt Capacitors; addition of 300 MW by way of restoration of capacity and additional generation of 172 millions units per annum through Renovation and Upgrading of Hydro Power plants; addition of 9454.50 MW of Thermal Generation and 955 MW of Hydel Generation capacity by way of completion of on going generation projects; addition of 15,995 Ckt. Kms. of transmission lines and 22140 MVA transformation capacity through Transmission schemes; 3877 Ckt. Kms. of transmission lines, 4163 MVA transformation capacity and 933 MVAR capacitors through Urban Distribution schemes till March 1997.

#### **10.5.10 PARTICIPATION IN PRIVATE PROJECTS**

PFC has in principle decided to expand its borrowers portfolio to include private sector borrowers. Towards this effort PFC has so far sanctioned 4 loans worth about Rs.321 Crores.

#### **10.5.11 FINANCING WORKING CAPITAL REQUIREMENTS**

PFC has decided to provide finance against Working Capital requirements of the state utilities. The scheme covers all existing borrowers in the State Sector who are not declared as defaulters by PFC at any point of time in the 12 months preceding the month in which the application for Working Capital Loan (WCL) is received by PFC. Loans for the working Capital bear interest rates of 14 to 15% for different time span.

#### **10.5.12 CUSTOMER ORIENTATION**

PFC has been organising meetings with the Heads of State power utilities, and senior officials of State Governments. The main objectives of these meetings is to understand better the expectations which the State utilities and State Governments may have from PFC and to evolve a common strategy to reorient the operations of PFC vis-a-vis State utilities for a mutually beneficial relationship and faster growth.

#### **10.5.13 FUTURE PERSPECTIVE**

PFC's efforts will be directly towards consolidating its position as the premier Development Financial

Institution for the Power Sector. PFC with the active support of Government of India is striving to emerge as the nodal agency through which all credits to Power Sector from bilateral/multilateral sources would be channelled. PFC would also endeavor to facilitate structural reforms in the State Power Sector to make it commercially viable and efficient.

Besides providing term finance to its borrowers, PFC had recently added lease finance, bill discounting; bill rediscounting, guarantee services, and consortium/syndicate financing to its portfolio. The range of financial services may be progressively broadened in future.

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## **10.6 POWER GRID CORPORATION OF INDIA LIMITED**

The Power Grid Corporation of India Limited (PGCIL) was incorporated as a Government of India enterprise on October 23, 1989 under the Companies Act, 1956 as a limited Company with an authorised capital of Rs.5000 Crores. The mandate of the Corporation, in terms of corporate mission, is establishment and operation of Regional and National Power Grids to facilitate transfer of power with and across the Regions with reliability, security and economy, on sound commercial principles. In line with the mission, POWERGRID set the following objectives:

- Efficient operation and maintenance of transmission systems
- Strengthen Regional Power Grids and establish Inter Regional links leading to formation of National Grid.
- Establishment/augment Regional load despatch centres and communication facilities.
- Introduce rational tariff structure for exchange of power
- Establish Power Pools to facilitate exchange of power between States/Regions leading to formation of National Power Grid.
- Achieve constructive cooperation and build professional relations with stake-holders, peers and other related organisations.

### **10.6.1 SIGNIFICANT ACHIEVEMENTS**

#### **OPERATIONAL**

As on March 31, 1998, POWERGRID operates a Total of 31250 CKMs transmission lines consisting of 23415 CKMs of 400 KV, 5080 CKMs of 220 KV, 1125 CKMs of 132 KV and 1630 CKMs of HVDC system distributed over 54 sub-stations with over 24000 MVA of transformation capacity. Overall average availability of transmission lines during the year was 98.9% which is comparable with International standards.

During the year, POWERGRID has commissioned 3150 CKMs of 400, transmission lines along with 1360 MVA of transformation capacity. Major

projects commissioned include Chandrapur HVDC Back to Back, Vindhyachal Additional Gandhar Phadge, Malda-Siliguri.

#### **CONSTRUCTION**

POWERGRID has constructed 1987 CKMs of transmission lines surpassing the target of 1938 CKMs. Presently, about 10,000 CKMs of transmission lines with voltage levels varying from 132 KV to 800 KV and 17 substations including bays, are under construction.

#### **FINANCIAL**

During the year, 1997-98, the Corporation has earned a net profit of Rs.402 Crores against a total turnover of Rs.1380 Crores including miscellaneous income. The asset base of the Corporation is over 6000 Crores. The paid up capital of the company as on 31.3.1998 was at Rs.3036.54 Crores (including Rs.157.89 Crores of Share Capital Deposit).

During the financial year 1997-98, POWERGRID has utilised the entire budgeted amount of Rs.1600 Crores. It utilised an external assistance of Rs.307 Crores against a target of Rs.303 Crores.

#### **COMMERCIAL**

POWERGRID continued to realise 100% and more on the monthly notified billing all through the year. 23 constituents were persuaded to open LC and total LC amount as on 31.3.1998 stands at Rs.73.34 Crores, which is more than 70% of average monthly billing by POWERGRID. Bulk Power Transmission Agreements (BPTA) were signed with all the constituents in the country. Other long pending issues such as issuance of notification for transmission lines associated with ex-NHPC system, foreign exchange variation, O&M charge related to ex-NTPC system, tariff for additional line and associated bays of Salal-II transmission system etc. were also resolved. The World Bank has also expressed satisfaction for the effectiveness of the commercial efforts taken by POWERGRID.

### **10.6.2 VIII PLAN PERFORMANCE**

During 8th Five Year Plan actual expenditure against the capital outlay budgeted for POWERGRID of Rs.4539 Crores was exceeded and an amount of

Rs.5158 Crores was utilised. Around 10000 CKMs of EHV line was added to the transmission network. The asset base of the company grew 56% from 3521 Crores in 1992-93 to Rs.5582 Crores. The turn over grew at an average annual growth rate of 13.4% during the last five years. Net profit also rose by 29%. Rs.1422 Crores of external assistance through budget and Rs.1368 Crores of External Commercial Borrowings were utilised. The remaining investment was funded mainly through Bonds and Internal Resources.

### **10.6.3 BUSINESS DEVELOPMENT**

The first consultancy work awarded to POWERGRID by Electricity Department, Government of Pondicherry for turnkey design, Engineering and Contract Management as well as setting up of sub-stations was successfully completed. During the last financial year, POWERGRID has participated in the international competitive bidding for review consultancy services related to strengthening of transmission system of West Bengal State Electricity Board (WBSEB). Haryana State Electricity Board (HSEB) has awarded POWERGRID the work of preparation of bid document of transmission projects consisting of 15 nos. transmission lines. POWERGRID is providing consultancy services to GRIDCO for the Project Management Consultancy (PMC) alongwith M/s. Merz and McLellan, which was awarded by the ODA, U.K.

Other business development efforts of POWERGRID include conducting system studies for Bihar State Electricity Board (BSEB), O&M contract spanning over five years duration for 400 KV transmission lines from Karnataka Electricity Board (KEB), third party inspection contract of Andhra Pradesh State Electricity Board (APSEB) for 400 KV/220 KV transformers, conductors, earthwire and accessories.

### **10.6.4 POWERGRID PROJECTS**

The projects undertaken by POWERGRID are broadly classified as Generation Linked Projects; Grid Strengthening Projects; Inter-regional links; and Unified Load Despatch and Communication Schemes. Further, in view of the entry of the various large Independent Power Producers in the Power Sector, POWERGRID is also contemplating

possible investments towards implementation of transmission projects related to IPP projects.

### **10.6.5 GENERATION LINKED PROJECTS**

During the 8th Five Year Plan, POWERGRID met all its commitments for providing transmission services for evacuation of power from various power stations executed under Central Sector. Major projects commissioned by the Organisation during this period are Uri transmission system, Gandhar transmission system, Salal-II transmission system, Kathalguri transmission system (part) etc. To meet, the requirements of evacuation and dispersal of power, POWERGRID is executing important schemes like Nathpa-Jhakri (400 KV), Unchahar (220 KV), Ganga Valley (800 KV), RAPP-B (220 KV), Vindhyachal Stage-II (400 KV) and Vindhyachal Additional (400 KV), Kayamkulam (200 KV), and Kathalguri (400 KV). During the last financial year none of the generating stations associated with POWERGRID's evacuation system was affected by non availability of lines.

### **10.6.6 GRID STRENGTHENING PROJECTS**

Grid strengthening occupies a priority in the operations of POWERGRID. The Corporation is implementing a scheme for augmentation of transmission system in North-Eastern Region. This scheme shall provide alternative paths for supply of power to these beneficiaries with security and thus shall meet the much needed transmission requirements of this part of the Region. In Southern Region, another 400 KV circuit between Ramagundam and Hyderabad is being augmented which would help in evacuation of power imported from Western to Southern Region via Ramagundam-Chandrapur HVDC Back-to-back link. In Northern Region, POWERGRID is implementing the prestigious 800 KV transmission line from Kishenpur to Moga. This transmission line would be one of the first 800 KV line to be commissioned in this country. In Northern Region, POWERGRID is implementing a 400 KV new substation at Jalandhar alongwith loop in loop out of Chamera - Moga 400 KV D/C line. Further, a 220 KV D/C line from this substation to Dasuya has also been planned. Also some of the major projects like Moga-Hissar-Bhiwani-Bawana-Jaipur, 220 KV link lines at Hissar are already

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commissioned whereas 400 KV Chamera-I Kishenpur is nearing completion.

It has been decided to interconnect various regional grids through HVDC back to back links which technically enable integrated operation at different parameters and also ensure controlled power exchange between the two inter-connected Regions.

#### **10.6.7 SHORT TERM PLAN**

Today POWERGRID is operating a 500 MW HVDC back to back link at Vindhyachal interconnecting Western and Northern Region, 220 KV Birpara-Bongaigaon transmission line linking Eastern and North Eastern Regions. In addition, it has a 400 KV D/C Ramagundam-Chandrapur line between Western and Southern Region operating in radial mode.

##### **HVDC back to back at Chandrapur**

POWERGRID executed a 1000 MW HVDC back to back at Chandrapur in March 1998 when its 2nd Pole was also put commercial operation. This line would enable power transfer of the order of 1000 MW between Western and Southern Regions on regular basis. This link can also be utilised to transfer power from Eastern Region to Southern Region via Western Region.

##### **HVDC back to back at Gazuwaka**

POWERGRID is also implementing 500 MW HVDC link between Jeypore (Orissa) - Gazuwaka (Andhra Pradesh). This link would interconnect Eastern Region with Southern Region for bulk transfer of 500 MW power and is scheduled for completion by February, 1999.

##### **Bongaigaon - Malda 400 KV D/C Line**

POWERGRID is executing a 400 KV D/C line between Bongaigaon (Assam-North Eastern Region) and Malda (West Bengal - Eastern Region) as a part of Kathalguri transmission system. This would provide means to export power out of NER in the range of 800 MW.

##### **HVDC back to back Sasaram**

POWERGRID has planned a 500 MW HVDC link between Biharsharif (Bihar - Eastern Region) -

Sasaram (Bihar-Eastern Region) and Rihand (U.P.Northern Region) which would facilitate transfer of power to Northern Region.

#### **10.6.8 MEDIUM TERM PLAN**

While the above mentioned Inter-Regional links would establish a well connected national grid, the capacities of such links will have to be augmented from time to time. Steps have been initiated by POWERGRID to identify such links. Based on its preliminary findings, POWERGRID has plans to take up the following transmission projects in future which would further augment the inter-regional exchange capacity:

**400 KV Raipur-Rourkela System:** This project envisages construction of a 400 KV double circuit transmission line from Raipur (MP Western Region) to Rourkela (Orissa - Eastern Region) to establish an inter-regional link between Western and Eastern regions of the country.

**2000 MW HVDC Bi-pole from Talcher to Bangalore:** NTPC has plans to extend its Talcher STPP by additional 2000 MW by adding 4 units of 500 MW each under Stage II. Its transmission system has been evolved by POWERGRID and this project envisages construction of a 2000 MW HVDC bi pole link between Talcher (Orissa) in Eastern Region to Bangalore (Karnataka) in Southern Region.

#### **10.6.9 LONG TERM PLAN**

POWERGRID has evolved a long term perspective for the nation in association with an international consultant PTI Inc., USA. The scheme evolved broadly would comprise of:

- a) High capacity 400 KV links in chicken neck area
- b) A ring of 2 nos. of 800 KV lines interconnecting Eastern Region, Western Region and Northern Region.
- c) 2nd HVDC bipole of 2500 MW between Eastern Region and Southern Region.
- d) 2nd 500 MW HVDC back to back at Vizag between Eastern Region and Southern Region.

The above projects have been prioritised by POWERGRID taking into account the potential for generation, development of loads and requirement of various regional grids. Two nos. of 400 KV lines

with quadruple conductors would be executed between Siliguri/Birpara and Purnea through chicken neck area, during 9th Plan period at an estimated cost of Rs.500 Crores. It would facilitate evacuation of power from various hydro and gas projects identified in North Eastern Region and Bhutan under central/private sector. An 800 KV single circuit transmission ring from IB valley Biharshariff (in Eastern Region) - Allahabad - Agra (in Northern Region) - Nagda - Jabalpur (in Western Region) - IB apart from Biharshariff -Purnea-Birpara (in Eastern Region). This would facilitate evacuation of bulk thermal power from Eastern region and large quantum of gas and hydro power from North Eastern Region to any where in the country. The estimated cost of the project is Rs.5000 Crores and it is likely to be completed during early 10th Plan. POWERGRID also intends to supplement this 800 KV ring by another circuit and also execute 2 HVDC bipole of 2500 MW between Eastern and Southern regions and another 500 MW HVDC back to back at Vizag between Eastern and Southern regions.

#### **10.6.10 STRENGTHENING OF REGIONAL GRIDS**

A number of projects have been identified in various regions to overcome shortcomings which are coming in the way of better operation of the grids. In total 33 projects have been identified at an investment of Rs.814 Crores.

#### **10.6.11 UNIFIED LOAD DESPATCH AND COMMUNICATION FACILITIES**

Unified Load Despatch and Communication Projects are essential for enhanced performance of Regional/National Grids and are extremely attractive techno-economically. At present the implementation of this facility is in progress in Southern and Northern Regions. POWERGRID is seeking the services of pioneer international consultants to help timely execution of such projects. These projects are expected to be commissioned by the turn of the century. Other such project in the pipeline are for North Eastern Region. The schemes for Western Region and Eastern Region are in different stages of integrated system operation and control.

#### **10.6.12 DOVETAILING MEGA IPPS**

POWERGRID is shouldering the responsibility to

promote private sector participation in development of mega power projects having capacity of 1000 MW or more and envisaging more than one State as beneficiary. POWERGRID signed an MOU with M/s Consolidated Electric Power Asia Ltd., Hong Kong for gigantic task of developing transmission system to evacuate power of more than 10000 MW in different phases to various beneficiary States. In addition, POWERGRID will also strive to dovetail other IPPs into the overall transmission system by selection of Independent Power Producers (IPPs) on international competitive bidding basis and will also provide escort services and act as a facilitator to IPPs.

Hot-line maintenance technique is employed to ensure maximum line availability without interruptions even during maintenance activities and as such the transmission system availability of POWERGRID is over 98.5%. For faster restoration of transmission lines in the event of failure due to storm, tornado, landslide, etc. Emergency Restoration System (ERS) have been utilized which can save time. To analyse the grid disturbances, indigenously developed cost effective and enhanced remote Terminal Units (RTUs) for timestamping of power system events by re-engineering the RTUs. POWERGRID in association with Central Power Research Institute (CPRI), has undertaken study for measurements of AC/DC fields in EHV transmission lines and sub-stations. POWERGRID has also introduced special earthing device in case of double circuit transmission line, which facilitates maintenance of one circuit when the other is charged. The task of indigenously developing Time Digital Simulator (TDS) for Northern Region is underway in association with IIT, Kharagpur. POWERGRID is also equipping itself with the latest computing facilities besides making forays into communications. In addition, new technologies in telecommunications like VSAT links, Multi-access Radio and point to point UHF radio are also being implemented for various operational and corporate requirements.

#### **10.6.13 CONTRACT MANAGEMENT**

POWERGRID with active support from the World Bank and Asian Development Bank, has evolved its procurement strategy based on the latest market trend in the industry. POWERGRID has introduced

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financial parameters as a part of the qualifying requirements.

#### **10.6.14 INTEGRATED PROJECT MANAGEMENT**

POWERGRID has developed an Integrated Project and Construction Management System to ensure availability and optimal utilisation of input resources resulting in elimination of time and cost over-run in implementation of its projects. Streamlined computed data based systems to accommodate all necessary input from related resources including vendors etc. have also been developed. Adoption of such techniques have immensely benefitted POWERGRID's project implementation programme.

#### **10.6.15 SOURCING OF FUNDS**

The World Bank loan commitment today amounts to about US \$1.5 billion for financing various projects of POWERGRID. This includes the World Bank direct loan to POWERGRID for an amount of US\$ 350 million for POWERGRID System Development Project. Further, the World Bank has agreed "in principle" to extend the 2nd loan to POWERGRID, on a time slice concept, amounting to around US \$ 1.20 billion against a basket of projects spread in a time slice of 5-7 years. The Asian Development Bank has extended POWERGRID a first sectoral loan in the Indian Power Sector of US\$ 275 million against a basket of the projects which include Augmentation of Transmission System in North Eastern Region and the Overseas Economic Cooperation Fund, Japan has already provided a loan amounting to Yen 32.754 billion towards the implementation of transmission system associated with the Gas Power Projects of Gandhar, Kathalguri and Faridabad. In addition European Investment Bank, Overseas Development Administration, West Merchant Bank, the Banque Indosuez and Credit Nationale Paris, Industrial Bank of Japan and Export-Import Bank of Japan etc. have also financed POWERGRID projects and have shown keen interest in financing new projects.

#### **10.6.16 FUTURE PERSPECTIVE**

POWERGRID envisages to invest around Rs.13000 crores during the 9th Plan excluding transmission systems associated with

mega IPPs. The national transmission plan earmarks a central sector outlay of Rs.18000 crores for the ninth Plan period. It is expected that an additional investment of Rs.5000 Crores is required to be allocated towards construction of transmission systems associated with mega IPPs.

Major inter-regional projects to be undertaken by POWERGRID during the 9th Plan inter-alia cover; 500 MW Eastern-Northern, 2000 MW HVDC bipole from Talcher-II Bangalore area, 2000 MW HVDC bi-pole from IB valley to Jaipur and 400 KV transmission system from Raipur-Rourkela and 400 KV system from IB Valley to Western Region via Raipur.

#### **10.6.17 REGIONAL POWER POOLS**

POWERGRID plans to form Regional Power Pools to facilitate a continuous economic exchange of power between SEBs on sound commercial principles. For this power pooling options have to be agreed upon, the power tariff structure needs to be rationalized and regulatory mechanism is to be introduced. POWERGRID is propagating these concepts in line with its overall goal.

Apart from the above, POWERGRID had been purchasing power from Chukha HEP in Bhutan for the past few years to sell the same in various Regions in India through massive transmission network constructed by POWERGRID. During the year 1996-97, sale of power to the tune of over Rs. 100 Crores has been made.

The Mahakali Treaty (Article 2 b ) between Government of India and Government of Nepal provides that Nepal shall have the right to receive 70 million units of energy on a continuous basis annually, free of cost, from the date of entry into force of the treaty. For this purpose, India is required to construct a 132 KV transmission line upto Mahendra Nagar, Nepal on the Indo-Nepal Border from the Tanakpur Power Station. A 132 KV transmission line from Tanakpur upto this point will be constructed by POWERGRID. The project is likely to be executed in one and half years time.

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## 10.7 TEHRI HYDRO DEVELOPMENT CORPORATION (THDC)

The Tehri Hydro Development Corporation (THDC) was incorporated on 12th July, 1988, as a joint venture of the Government of India and Government of Uttar Pradesh, to execute the Tehri Hydro Power Complex (2400 MW) in Garhwal District of U.P. and also to plan, promote and organise the development and harnessing of such other hydro electric sites/projects in Bhagirathi, Bhilangana valley as may be entrusted to the Corporation by the Government. The Corporation has an authorised share capital of Rs.2000 Crores.

The Corporation is presently engaged in the implementation of Tehri Project (Stage I) (1000 MW). The cost of the project is being shared in the ratio of 75:25 (equity portion) for Power Component, while the Irrigation Component (20% of Stage-I) is to be entirely funded by the Government of Uttar Pradesh.

The Tehri Power Complex comprises of four components viz., (i) the 260.5 M high rock fill Tehri Dam and 1000 MW Hydro Power Plant (HPP) (Stage I of the Complex); (ii) 103.5 high concrete Dam with 400 MW Hydro Power Plant at Koteshwar 22 KM downstream of Tehri; and (iii) 1000 MW Pump Storage Plant (PSP) situated just downstream of the confluence of Bhagirathi and Bhilangana rivers at Tehri, alongwith 800 KV Associated Transmission System for evacuation of power from the Tehri Hydro Power Complex to be executed by Powergrid Corporation of India.

### 10.7.1 PROJECT CLEARANCE

Environment clearance was accorded to the entire Tehri Hydro Power Complex during July'90. Forest clearance was accorded to Tehri Dam & HPP during June, 1987. Tehri PSP does not involve any forest land. The Public Investment Board (PIB), Government of India accorded clearance to the Tehri Hydro Power Complex (2400 MW) during January 1992. Government of India clearance for the execution of Tehri Dam and HPP Stage I (4x250 MW) was accorded in March, 1994 for the various components at an estimated cost of Rs.3334.66 Crores (Excluding IDC of Rs. 427.74 Crores) at March, 1993 price. Koteshwar Dam and HPP and the Pump Storage Plant were to be taken up after funding for the same was tied up.

### 10.7.2 BENEFITS

Tehri Dam & HPP Stage I is a Multipurpose Project catering to the needs of power generation, irrigation and drinking water. The main benefits from the Project when completed would be:

- Addition to the installed capacity in Northern Region: 1000 MW (2400 MW on completion of entire Complex);
- Annual energy availability (peaking: 3568 Million Units (6500 MU on completion of entire Complex);
- Additional irrigation in 2.7 lakh hectares area besides stabilisation in existing 6.04 lakh hectares area;
- 162 Million Gallons of water per day (300 Cusecs) for drinking water supply to Delhi to cater to a population of 40 lakhs;
- 108 Million Gallons of water per day (200 Cusecs) for drinking water supply to the towns and villages of Uttar Pradesh;
- Integrated development of Garhwal Region, including construction of a new hill station viz. New Tehri Town (NTT) with provision of all possible facilities, improved communication, education, health, tourist traffic, setting up of non-polluting industries, development of horticulture, fisheries, afforestation of the region etc. much to the advantage of the people of the region,

### 10.7.3 STATUS OF THE PROJECT WORKS

The present status of the project is:

Tehri Hydro Power Plant Stage I:—

- Various infrastructural works have been completed at the project site.
- All the four diversion tunnels have been completed and the river diverted through the two right bank tunnels. Left Bank tunnels have also been made operational.
- Excavation of four numbers head race tunnels (two each for Tehri HPP Stage I and Tehri PSP) of 8.5 M diameter each with a total length of 5190 M have been completed and lining work is completed in Stage I tunnels while it is partly



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done in tunnels for PSP. The balance works are in progress.

- The foundation of the Main Dam over the entire length of 1:1 Km. has been laid and the Main Dam raised upto 15 M above the river bed level.
- The Coffor Dam, which would form part of the Main Dam, has been raised upto EL 661.0 m.

**Power House Civil Works:** The work of Power House, awarded in three packages during November, 1995, is in progress. Excavation work in Power cavity, Transformer Hall, Butterfly Valve Chamber, Penstock Assembly Chamber, Ventilation Tunnels, Underground excavation for TRT's and drainage galleries etc. is in progress.

**Dam:** Work on the 260 m high rockfill dam, which would be the highest dam in the Asian Region, has been taken up after it was awarded in January, 1997.

**Spillways:** Excavation works were taken up in the Spillway area, which are under progress.

**E&M Equipment:** Contracts for Turbine, Generator, Valves and Control Systems with financing have been awarded to the consortium of manufacturers from Russia/Ukraine, and ABB-Germany. Loan agreements have been signed with KfW, Germany for financing of the ABB portion of supply. Contract for imported penstock liner plate awarded and for penstock fabrication, Dam instrumentation and Power House EOT Cranes are under various stages of processing. Tenders under ICB with compulsory minimum 85% financing for other Power house equipment, viz. Transformers, Busducts, Switchgear have been issued and prequalification bids received. Tenders for balance Power House auxilliary equipment packages and Hydromechanical Works are also under various stages of processing.

**Rehabilitation:** After the formation of THDC the rehabilitation policy as evolved by the State Government has been fully adopted and followed. THDC upgraded the compensations so as to account for escalations, apart from introducing other improvements wherever essential. Rehabilitation is being implemented in two phases. Phase I covers those families affected by construction of Coffor

Dam, including the Old Tehri Town. In Phase II, all remaining families affected by construction of Main Dam would be rehabilitated. Phase I Rural rehabilitation is nearly completed with 98.5% of the families having been paid compensation and rehabilitated. In Phase II, 435 out of 2845 rural families have been rehabilitated and land for the balance families in Hardwar/Dehradun areas is being acquired. The entire Phase II affected population would be rehabilitated well before the impoundment of the reservoir. The urban affected population are being rehabilitated in New Tehri Town or at Rishikesh/Dehradun at their option. The NTT has been developed at a height of 1350 - 1850 mts., and has all modern facilities including a University Campus, hospital, institutions, markets, places of worship and public utility buildings. Over 98% of the residential plots have been allotted, 70% of residential flats and 75% of the shops developed have also been allotted.

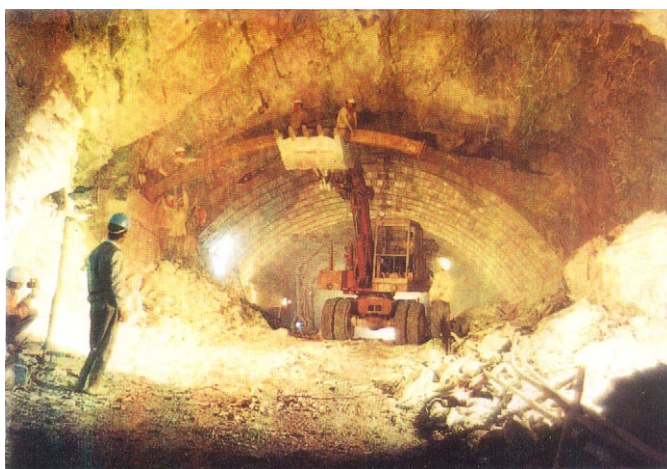
**Environment:** Ministry of Environment and Forests laid down certain conditions as per studies which were to be carried out and based on their findings, actional plans had to be drawn up for execution pari-passu with construction of the project. All the required studies have been completed and reports submitted to the MOEF. It has been established that there would be no adverse effect on the environment and bio-diversity of the area due to Tehri Project. THDC is carrying out Catchment Area Treatment in the high and very high erodibility classification. Around 31,000 Ha. area has been treated so far. MOEF granted forest clearance in June, 1997 with stipulation that the project authorities will carry out compensatory afforestation in an area of 3815 ha. of non forest land. An area of 4516 ha. has already been planted in districts of Jhansi and Lalitpur in U.P. The plantation done on non-forest land is now being converted into reserve forest.

**Koteshwar Project:** Koteshwar Project consists of a 97.5 M high concrete dam with a surface power house at the toe of the dam, housing four units of 100 MW each with Francis type turbines. Necessary access and major infrastructure required to start the Koteshwar Project is already established. For construction of the dam, 8 m dia diversion tunnel of 582 m length would be

constructed to divert the flow of river. Work on this diversion tunnel has been taken up. The construction period of the project is 5 years. Funding arrangements for the project and Government approval is being pursued.

**Pump Storage Plant (PSP):** Tehri PSP has been envisaged to generate 1 000 MW of peaking power for enhancing system reliability and also to provide balancing load to the thermal base generation during off peak hours. Reservoir created by the Tehri Dam would function as the upstream reservoir for this project. Koteshwar Dam will create a balancing reservoir to regulate the releases from Tehri Reservoir. Koteshwar dam will also serve as the downstream reservoir for the PSP. Certain essential works of PSP were taken up alongwith the execution of Stage I works. Excavation of HRT

for both Stage I and PSP has been completed while lining work is completed in Stage-I tunnels and partly done in PSP tunnels. The intakes for HRT for PSP are being constructed alongwith Stage-I works. The PSP envisages 4 reversible units of 250 MW each. The main feature of the Project is the variation of about 90 m between the maximum and minimum head, under which the reversible units shall operate. This would require specialised studies to firm up the design and specification of the pump turbine units. Further, studies would be required for optimising the integrated operation of the three stages of the Complex, viz. Tehri Stage-I, PSP and Koteshwar. Action is being taken to get the necessary studies conducted and firming up the design and parameters.



*Construction work of Underground Tehri Power House in Progress*

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## **10.8 NATHPA JHAKRI POWER CORPORATION LTD.**

### **10.8.1. INTRODUCTION**

The Nathpa Jhakri Power Corporation Limited (NJPC) was incorporated on May 24, 1988 as a joint venture of the Government of India and the Government of Himachal Pradesh, to plan promote organise and execute Hydro-electric Power Projects in the Satluj river basin in the Himachal Pradesh. The authorised share capital of NJPC is Rs.2200 crores with debt equity ratio as 1:1.

NJPC is presently executing its first project namely Nathpa Jhakri Hydroelectric Power Project (NJHPP) with an installed capacity of 1500 MW in the Kinnaur and Shimla districts of Himachal Pradesh.

The World Bank has sanctioned a loan of US \$ 437 million for part financing of the project and the Govt. of India and the Govt. of Himachal Pradesh are sharing the equity capital in the ratio of 3:1 respectively. NJPC also plan to take up investigations of new hydroelectric projects in the Satluj river basin in the Himachal Pradesh.

In the implementation of its first project NJPC is supported by CWC and CEA as the Principal Consultants, along with the consortium of Nippon Koei, Japan; Electrowatt, Switzerland; and WAPCOS, India as the Retainer Consultants. Besides these, NJPC is also backed by the services of a Panel of Experts, comprising both nationally/ internationally renowned professional and an Advisor (ENV/R&R).

### **10.8.2. NATHPA JHAKRI HYDROELECTRIC POWER PROJECT (6X250 MW)**

The Nathpa Jhakri Hydroelectric Power Project envisages the construction of :

A 60.50 m. high concrete Dam on Satluj river at Nathpa to divert 405 cumecs of water through four Intakes.

An underground Desilting Complex, comprising four chambers, each 525 m. long, 16.31m. wide and 27.5 m. deep, is one of the largest underground complex in the the World.

A 10.15 m. dia. and 27.3 km. long Head Race Tunnel (one of the longest hydro power tunnel in the World), terminating in 21 m. dia and 301 m. deep Surge Shaft.

Three circular steel-liner Pressure Shaft, each

of 4.9 m. dia. and 633 m. long bifurcating near the Power House to feed six generating units.

An underground Power House with a cavern size of 222 m. x 20 m.x49 m. having six Francis Units of 250 MW each to utilise a discharge of 405 cumecs; and design head of 425 m.

A 10.15 m dia and 982 m log Tail Race Tunnel to discharge the water back into the river Satluj.

### **10.8.3. PROJECT BENEFIT**

Besides the social and economic upliftment of the persons in its vicinity, on commissioning of the 1500 MW NJHPP will generate 6700 million units of electrical energy in an average year, besides providing 1500 MW of valuable peaking power to the Northern Grid.

### **10.8.4. PROJECT COMMISSIONING SCHEDULE & BENEFITS:**

All the six generating units are estimated to be commissioned by March, 2002.

### **PROJECT COST**

The approved cost of the NJHPP was Rs.4337.95 crores at March, 1993 price level. This includes Rs.648.69 crores as interest during construction. The project is now estimated to cost Rs.7217.05 crores.

### **PROJECT PROGRESS**

#### **INFRASTRUCTURE WORK**

The Excavation of all the HRT Adits have been completed. Construction of the Residential Buildings as well as Non-Residential Buildings such as Administrative Office, Transit Camps, Auditorium etc; have been completed.

#### **MAIN CIVIL WORKS**

The implementation of the civil works for the four major civil contracts are in progress with the three joint ventures of Indian and foreign construction companies.

#### **DAM COMPLEX**

Presently, the excavation in the river channel is underway. Out of 2,60,000 cum, 2,46,230 cum excavation has been completed. Dental concreting of 60 cum has been placed in the Dam foundation. On the left bank of the river Satluj, 165 nos. of 200 Ton cable anchors have been installed. With this the cable anchoring at the Damsite for stabilisation of the left bank has been completed.

The excavation of the crown of all the Desilting Chambers have been completed and job of Steel fibre reinforced shotcrete is likely to commence shortly.

### **HEAD RACE TUNNEL**

Excavation of a length of 23.0 kms has been completed out of a total of 27.30 km. of the Head Race Tunnel (HRT). The progress of excavation has suffered due to shortage of construction power and emergence of Shear zones at various places on the excavation fronts of HRT. Major milestones achieved were on joining up Head Race Tunnel reaches between Rattanpur and Manglad on April 29, 1997, and between Manglad and Wadhal on November 27, 1997. The works for erection of the steel liner at Manglad D/S reach of HRT is progressing well. On the 301 m Surge Shaft, excavation up to the depth of 260m has been completed. The excavation and concreting of 10.15 m dia expansion gallery of length 180m has also been completed.

### **POWER HOUSE COMPLEX**

After completion of the excavation of the entire machine hall and turbine pits, concreting work was started. Concreting work of all 'A' and 'B' line columns and beams have been completed. Concreting work of control bay structure inside the machine hall has also been completed. Excavation of all the three number Pressure Shafts has been completed in all respects. Besides the erection of steel liners, all the top horizontal portions of pressure shafts has been completed. Consequent upon the completion of the excavation of 982 m long Tail

Race Tunnel, the concreting has started and the cumulative progress is 330m. The excavation and concreting work of entire Valve House structure has been completed. Construction work of cable tunnel, ventilation tunnel and pot head yard are in progress.

### **ELECTRO - MECHANICAL PACKAGES**

Erection of 2 nos. 250/50/10 Tons EOT Cranes in Power House has been completed. The EOT cranes are now available for handling and carrying out erection activities of Generating Plant and equipment in Power House upto unit-VI. The contract for design and commissioning of 6x250 MW Generating Units and associated equipments was awarded to M/s EUCONA-BHEL, a consortium of international firms. Out of 10,839 MT of material to be supplied under this package, 5658.74 MT material consignment has been received at site and erection works are in progress. Erection and concreting of Draft Tubes of unit I-IV have been completed and erection of spiral casing works of these units are in progress.

Major packages i.e. Butterfly Valves, Gates and Hoists, Generator transformer, 400 kv GIS and Bus Ducts have been awarded to Indian/Foreign suppliers. The contracts have become effective by September/October, 1997 and the design engineering activities for all the packages are in progress.

### **FUTURE PROJECT**

The new projects envisaged to be taken up by the Corporation in the near future are (i) Rampur HEP, (550 MW) and (ii) Parbati HEP Stage-II.



*Diversion Tunnel Inlet at Nathpa Dam Site*



## 10.9 DAMODAR VALLEY CORPORATION

### 10.9.1 ORGANISATION AND OBJECTIVES

The Damodar Valley Corporation (DVC) was established on July 7, 1948 under the Damodar Valley Corporation Act. The Corporation has a full time Chairman and two part time Members. The part time Members represent the States of Bihar and West Bengal.

The objectives of the Corporation include:

- \* Flood Control
- \* Irrigation and Water Supply for Industrial and Domestic use
- \* Generation, Transmission and distribution of Electrical Energy
- \* Promotion of Afforestation and control of Soil Erosion in the Damodar Valley; and
- \* Promotion of Industrial, Economic and General well-being of the people in the Damodar Valley and its areas of operation.

DVC's command area extends over an area of 24,235 sq.kms. comprising seven districts of Bihar and five districts of West Bengal.

The Corporation has so far constructed four multipurpose dams at Tilaiya, Konar, Maithon and

Panchet and an irrigation system comprising a barrage on river Damodar at Durgapur and a canal system of 2459 kms. The management of Barrage and irrigation system have, however, been transferred to the Government of West Bengal in 1964.

### 10.9.2 DVC POWER SYSTEM

DVC has also constructed five thermal power stations, three hydel power stations and one gas turbine station. The existing power plants of DVC are:

#### THERMAL

Bokaro A	175 MW (3x45 MW) & (1x40 MW)
Bokaro B	630 MW (3x210 MW)
Chandrapura	750 MW (3x130 MW) & (3x120 MW)
Durgapur	350 MW (1x140 MW) & (1 x210 MW)
Mejia TPS (Unit I)	210 MW (1x210 MW)
(Unit II)	210 MW (1x210 MW)-oil synchronised
(Unit-III)	210 MW (1x210 MW) Commissioned on 25.3.98

#### GAS TURBINE

GTP, Maithon	82.5 MW (3x27.5 MW)
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#### HYDEL

Tilaiya	4 MW (2x2 MW)
Maithon	60 MW (3x20 MW)
Panchet	80 MW (2x40 MW)



MAITHON DAM

DVC's Transmission System runs to a total length of 5271 ckt. kms. comprising 1121 ckt. kms. 220 kv lines, 3146 ckt. kms. 132 kv lines and 1007 ckt. kms. 33 kv lines. The system is supported by 52 sub-stations. The system is also interconnected with NTPC & Chukha and operates as a constituent of interconnected grid system of EREB.

DVC's soil conservation activities have already covered an area of 4.62 lakh ha. of which 1.85 lakh ha. have been covered by afforestation, 2.12 lakh ha. by agricultural upland and 0.65 lakh ha. covering improving of waste land and gullied area. More than 8400 check dams have also been constructed for controlling run-off soil and providing minor irrigation facilities.

### 10.9.3 OVERALL PERFORMANCE AND ACHIEVEMENT

During the year under review (April, 97- March, 1998) DVC's system generation was 7307 MU of which 6908 MU was contributed by thermal stations, 385 MU by hydel power stations and 14 MU by gas turbine. During the period DVC's turnover was around Rs. 1500 Crores (provisional) leading to profit of around Rs. 60 Crores. (provisional).

#### Performance Highlights

(April 97 - March 98)

System Generation (MU)	7307
PLF (Thermal) on installed capacity	40%
Turnover (Rs. crores)	1500
Profit (Rs. crores)	60

**Bermo Mines:** DVC's Bermo Mines produced

360106 MT of coal during April 97-March, 1998 period.

### MEJIA THERMAL POWER STATION (3x210 MW)

Government of India sanctioned the project in 1986, estimated cost of which stands at Rs. 1989.14 Crores (third quarter, 1995 price level) including IDC of Rs. 427.58 crores and WCM of Rs. 9.56 Crores. This has been approved by PIB and Government of India. Expenditure from 4/97 to 3/98 for the project was Rs. 75.17 Crores (provisional).

Unit-I of the project was synchronised with coal firing on 25.3.96 while the Unit-II has been synchronised in March, 1998 and is scheduled for commercial operation in September, 1998. Synchronisation of Unit - III was achieved within a record time of 75 days from the hydro test and has been commissioned on 25.3.1998. In Units - I, II and III work in Cooling Towers are in various stages of progress. Work relating to reservoir compartments are in progress. Four streams for DM plant has been commissioned and 4 storage tanks have been filled with DM water. WT plants has also been commissioned and taken over by DVC in September, 1997. Work related to AHP of Unit-I and jobs related to Bottom Ash Hopper, Fly Ash Trench under ESP, Bottom Ash Slurry Pipeline for Unit - II are over and progress of civil work for Ash Slurry Pump House has reached more than 80% while more than 66% of the civil work for Ash Slurry Pump House for Unit - III has also been completed. Formation work for MGR System and Rail Linkage,



750 MW Chandrapur TPS of DVC

super structure of rail portion alongwith track laying on Rail cum road bridge across Damodar river are nearing completion. All works related to transformer Yard and of equipment erection of 220 KV switchyard for Unit-II and the Control Room have been completed and more than 95% of the work for Unit-III is over. The DTPS-Mejia TPS Loop erection has already been completed and the revised route for 220 KV Maithon-Mejia Line have been partly completed. Apart from this, out of 429 families of homestead land evictees, 402 have been shifted to rehabilitation site and compensation payment has been made to 386 evictees. Employment has been offered to 90 land losers who have already joined.

#### **PANCHET HILL HYDEL UNIT-II (1X40 MW)**

The Panchet Hydel Unit II was commissioned in turbine mode which is already in operation. But the construction work of Tail Pool Dam for utilising the reversible mode of the turbine has remained totally stopped since 8.1.1996. In view of economic unviability of the project due to abnormal time and cost overrun attributable to frequent stopages of work for reasons beyond DVC's control, it has been decided not to implement the project and demobilisation has been made.

#### **10.9.4 RENOVATION AND MODERNISATION**

DVC has undertaken R&M programmes in three phases with the objective of extension of plant life of its old and ageing thermal units at Bokaro 'A', Chandrapura and Durgapur and for improvement in PLF.

Comprehensive programmes for BTPS 'A'. CTPS and DTPS are being formulated for submission to PFC for funding. It has also been planned to convert the Single Cycle Gas Turbine Station at Maithon to Combined Cycle by adding 45 MW extra. Outlay of Rs.625.45 Crores plan allocation and Rs.100 Crores as non-plan allocation have been provided for the 9th Plan period for the R&M activities.

Renovation & Augmentation of T&D System is continuing in the 9th Plan period alongwith additional items of T&D work. A total amount of Rs.77.69 Crores has been provided for the purpose of which Rs. 52.49 Crores is spilled over from 8th Plan and Rs. 25.20 Crores is proposed to be included in the 9th Plan period.

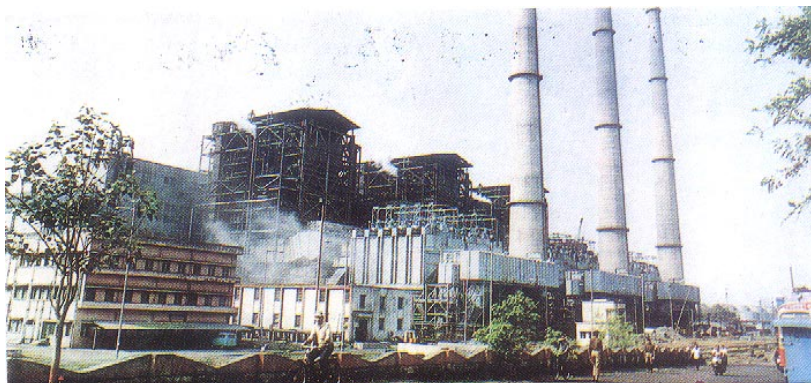
#### **10.9.5 FUTURE PROJECTS**

##### **Maithon Right Bank TPS:**

Revised Project Report for this 4x250 MW TPS at an estimated cost of Rs.3297.75 Crores (based on 1 st quarter of 1997-98 price level) without IDC and WCM is being prepared for submission to CEA for techno-economic clearance.

##### **Combined Cycle Gas Turbine Station:**

The existing 82.5 MW (3x27.5 MW) Single Cycle Gas Turbine Station at Maithon has been planned to be converted to combined cycle which would add 45 MW (3x15 MW) extra to the station. Estimated cost is likely to be around Rs. 150 Crores and funding arrangement is yet to be identified.



*630 MW Bokaro Thermal Power Station DVC*



**DETAILS OF DVC NETWORK****POWER**

Total Installed Capacity	:	2761.5 MW
Thermal Power Station	:	Six
	:	Capacity 2535 MW (Including MejiaTPS Unit - I & II & III)
Hydel Power Stations	:	Three
	:	Capacity : 144 MW
Gas Turbine Station	:	One
	:	Capacity : 82.5 MW
Power Expansion Programme	:	Mejia Thermal 630 MW (3x210 MW)
	:	Unit - I : Synchronised with coal on 25.3.96
	:	Unit - II : Synchronised with oil on 24.3.97
	:	Unit - III : Commissioned on 25.3.98
	:	Mejia Stage - II 500 MW
	:	Maithon Thermal (Proposed) 1000 MW
	:	Combined Cycle Gas Turbine Stn. (3x15 MW extra)
Sub.Stns. & Receiving Stns.	:	At 220 KV : 7
	:	At 132 KV : 31
	:	At 33 KV : 14
Transmission Line	:	At 220 KV : 11 21 Circuit KM
	:	At 132 KV : 3146 Circuit KM
	:	At 33 KV : 1004 Circuit KM

**WATER MANAGEMENT**

Major Dams and Barrages	:	Tilaiya, Konar, Maithon, Panchet and Durgapur Barrage
Irrigation Command Area (Gross)	:	5.69 Lakh hectares
Irrigation Potential Created	:	3.64 Lakh hectares
Floor Reserve Capacity	:	1295 million cu.m.
Canals	:	2495 KMs

**SOIL CONSERVATION**

Forest, Farms, Upland & Wasteland Treatment	:	4 lakh ha. (approx.)
Check Dams	:	8,400

## 10.10 BHAKRA BEAS MANAGEMENT BOARD

Bhakra Management Board (BMB) was constituted under section 79 of the Punjab Re-organisation Act, 1966 for the administration, maintenance and operation of Bhakra Nangal project w.e.f. 1st october 1967. The Beas Project Works, on completion, were transferred by Government of India from Beas Construction Board (BCB) to BMB as per Section 80 of the Act, 1966 and the Bhakra Management Board was renamed as Bhabkra Beas Management Board (BBMB) w.e.f. 15.5.1976.

### 10.10.1 FUNCTION

The Bhakra Beas Management Board manages the facilities created for harnessing the waters impounded at Bhakra and Pong in addition to those diverted at Pandoh through the BSL Water conductor system. It has also been assigned the responsibility of delivering water and power to the beneficiary States in accordance with their due/entitled shares. The Board is responsible for the administration, maintenance and operation works at Bhakra Nangal Project, Beas Project Unit I and Unit II including Power Houses and a network of transmission lines and grid substations. The functions of Bhakra Beas Managemet Board are:

To regulate the supply of Satluj and Ravi-Beas waters to the States of the Punjab, Haryana, Rajasthan and Delhi, through a wide network of canals.

To distribute power from Bhakra Nangal and Beas Projects to the States of Punjab, Haryana, Rajasthan, Himachal Pradesh and U.T. of Chandigarh.

The works being managed by the BBMB are broadly grouped as three large multipurpose projects viz. Bhakra Nangal Project, Beas Project Unit-I (BSL Project), & Beas Project Unit-II (Pong Dam).

The Bhakra Nangal Project comprises the Bhakra Dam, Bhakra Left Bank and Bhakra Right Bank Power Houses, Nangal Dam, Nangal Hydel Channel and Ganguwal and Kotla Power Houses. Bhakra Dam is a majestic monument across the river Satluj. It is a high straight gravity concrete dam rising 225.55 m (740 ft.) above the deepest

foundation and spanning the gorge with 518.16 m (1700 ft.) length at the top. The Gobind Sagar Lake created by the Dam has 168.35 Sq.Km. area and a gross storage capacity of 9621 million cubic metre (7.80 MAF). The two power houses, one on the Left Bank ( $5 \times 108 = 540$ ) and the other on the Right Bank ( $3 \times 132 + 2 \times 157 = 710$  MW), have a combined installed capacity of 1250 MW. The Ganguwal and Kotla Power Houses fed from Nangal Hydel Channel have an installed capacity of 155.3 MW.

The Beas Project Unit-I (BSL Project) diverts Beas Water into the Satluj Basin, falling from a height of 320 metre (1050 ft.) and generating power at Dehar Power House having an installed capacity of  $6 \times 165$  MW = 990 MW. This project comprises a diversion dam at Pandoh, 13.1 Km long Pandoh Baggi Tunnel having a capacity of 9000 cusecs, 11.8 Km. long Sundar Nagar Hydel Channel, Balancing Reservoir at Sunder Nagar, 12.35 Km long Sunder Nagar Satluj Tunnel, 125 Metre high Surge Shaft and Dehar Power Plant.

The Beas Dam at Pong is the highest earth-fill (earth core, gravel shell) dam in India, being 132.6 metre (435 ft.) high with a live storage capacity of 7290 million cubic metre (5.91 MAF). The Pong Power Plant ( $6 \times 60 = 360$  MW) is located in the stilling basin d/s of penstock tunnels.

The total installed generating capacity of the BBMB Power Houses is 2755.30 MW which is more than 1/8th (about 13%) of the total installed Hydroelectric generating capacity in the country as under:

POWER HOUSE	INSTALLED CAPACITY (MW)	
Bhakra (Right Bank)	$3 \times 132 + 2 \times 157$	= 710
Bhakra (Left Bank)	$5 \times 108$	= 540
Ganguwal	$2 \times 24.2 + 1 \times 29.25$	= 77.65
Kotla	$2 \times 24.2 + 1 \times 29.25$	= 77.65
Dehar	$6 \times 165$	= 990
Pong	$6 \times 60$	= 360
<b>Total</b>		<b>= 2755.30 MW</b>

### 10.10.2 GENERATION AND TRANSMISSION SYSTEM:

The BBMB Power Plants have the highest plant availability factor (90 to 94%). The generation during

1996-97 was 12083 MU against the target of 11600 MU contributing about 17.5% of the all India Hydro Generation against installed capacity of about 13%. The generation during the year 1997-98 is expected to be comparatively less despite availability of machines because of the poor inflows, low reservoir level at Bhakra and less releases during the depletion period due to poor demand for irrigation and power.

The Power generation at BBMB power stations is being evacuated through BBMB power evacuation system running into 3735 Circuit Km length of 400 KV, 220 KV, 132 KV and 66 KV transmission lines and 24 EHV sub stations. The BBMB power evacuation system runs in an integrated manner in the Northern grid with its transmission network spreading over the States of Himachal Pradesh, Punjab, Haryana and Delhi. The system is interconnected with transmission system of Power Grid and the States of Uttar Pradesh, Rajasthan and Delhi.

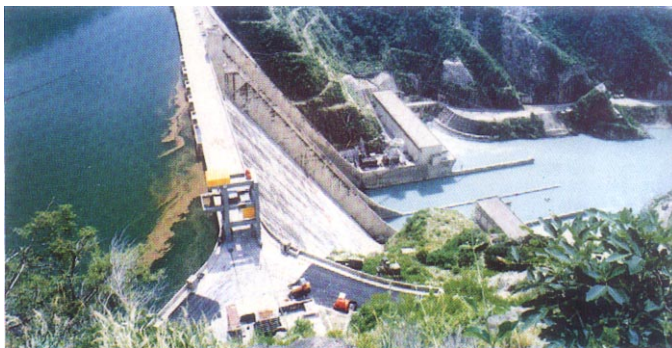
#### **10.10.3 RENOVATION AND MODERNISATION**

All the 5 units of Bhakra Right Bank Power House are being uprated from original capacity of 120 MW to 157 MW each. This will result in gain of the installed capacity by 185 MW with additional annual

energy generation of 310 MUs. Up-rating of Unit No.9 and Unit No.6 has been completed in February 1996 and June 1997 respectively. Unit No.8 has been taken up for uprating during July, 1997 which will be completed by April, 1998.

The R&M and uprating of Ganguwal and Kotla Power Houses has been planned in two phases. In Phase I, the R&M and Up-rating of one Unit each at Ganguwal and Kotla Power Houses has been approved. The work of these units is likely to be completed by mid 1998. The enhancement in the installed capacity of these two units will be 7.75 MW and additional annual generation of 63 MU. In phase II, the R&M and uprating of one more unit each at Ganguwal and Kotla Power Houses is under process. This will result in capacity enhancement of 5.94 MW and increased annual generation of 49 MU.

Up-rating and modernisation of one unit of Pong Power Plant from 60 MW to 66 MW has already been undertaken on 1.10.1997. Up-rating and modernisation of remaining 5 units will also be taken up. The benefits include additional peaking capacity of 36 MW, additional annual generation of 173 LUs in good monsoons when spillage becomes inevitable, apart from the additional 90 MVAR reactive power and life extension of the units.



*Panoramic View of Bhakra Dam*

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## **10.11 CENTRAL POWER RESEARCH INSTITUTE:**

The Central Power Research Institute (CPRI) was established in Bangalore by the Government of India in 1960. It was organized into an autonomous society in the year 1978 under the aegis of the Ministry of Power, Government of India. The main objective of setting up the Institute was to serve as a National Laboratory for undertaking applied research in electric power engineering besides functioning as an independent National Testing and Certification Authority for electrical equipment and components to ensure reliability and improve, innovate and develop new products.

### **10.11.1 OBJECTIVES**

- To serve as a national centre for applied research in electrical power engineering .
- To function as an independent and impartial authority for certification and testing of electrical equipments manufactured in the country for quality assurance.
- Performing tests for product development.
- To offer consultant on problems referred by utilities and industries.
- Undertake sponsored research programmes on subjects of interest in the power systems field.

The Institute is headed by a Director General and has several research laboratories and testing facilities and employ over 300 qualified scientists and engineers besides other supporting staff guiding and maintaining various operations. The Head Office of the Institute is at Bangalore and its other units are located at Bhopal, Hyderabad, Nagpur, Ghaziabad, Thiruvananthapuram and Raichur.

### **10.11.2 PERFORMANCE AND ACHIEVEMENTS - AT A GLANCE**

#### **Financial Promotion**

The financial performance surpassed previous years by touching Rs.22 crores during 1997-98. The Non-Plan expenditure stood Rs. 18.30 crores, thus generating a surplus of Rs. 3.70 crores. The institute has been meeting its non plan expenditure through revenue generated by testing and consultancy for the last ten years and the revenue has been increasing over the years.

#### **Business Promotion and Image Building**

The CPRI continued to play a vital role in quality assurance to ensure reliability of power equipment through testing and certification in accordance with national and international standards. The year, witnessed accelerated activity for improving efficiency and revenue. These covered improving improvements in service to customers by way of modernization of handling facilities, lowering waiting period and test duration, expeditious issue of test reports and their presentation. Marketing & Publicity has been given a boost by participating in International exhibitions. This has resulted in an increase in the testing orders by foreign clients. Apart from getting accredited as per EN 45000/ ISO 25 quality norms the Institute has gained recognition by Underwriters laboratories USA and Canadian Standard Association for certain test which has further widened the spectrum of testing activities of CPRI.

#### **Automation**

The focus was to achieve full automation in all the activities through computerisation and also mechanisation of handling of equipment, sequencing of testing etc. In the area of computerisation there has been manifold increase not only in the hardware and software capabilities but also in the networking area. Network has been established linking all the divisions locally, as well as internationally through INTERNET and EMAIL facilities. This has reduced the information gap and enhanced communication. Training of engineers/scientists in the use of computers and latest softwares was continued to achieve full automation.

#### **Research Projects and Progress on implementation of Capital Projects**

The Institute continued its strides in the area of research by successfully completing 33 projects upto March, 1998 out of a total of 99 ongoing and new projects. A new thrust is given to orient the research towards the benefit of the power utilities and the manufacturing industry. This resulted in stepping up of liaison with the utilities, industries and academic institutions for promoting joint research projects. As an off shoot of R & D efforts, CPRI continued its course of collaboration with other organisations but signing Memoranda of Understanding with term for commercialisation of the technologies already developed viz... MOU is

signed with (a) M/s. Telecraft Engineers for design & development of 0.5 class accuracy Trivector meter, (b) M/s Power Products & Projects, Bangalore for DC Earth Fault Indicator, (c) M/s Apel Radio Communication Systems Pvt. Ltd. Secunderabad, for Automatic Power Factor Controller and (d) M/s DUCOM, Bangalore for TESPERS Evaluation of Solid Particles Erosion Resistance. During the year 13 technical reports were brought out covering the outcome of research in various areas and a large number of technical papers were presented in both National and international seminars/ workshops. Augmentation and modernization of its laboratories taken under the VIII plan has been completed. This has enabled CPRI to be par with the other international laboratories and meet the requirements of the standards. Under the Ninth Plan, the Institute has framed a total of 18 proposals keeping in view of the utilities requirements during their expansion envisaged in the power sector. Two proposals have been sanctioned at total outlay of Rs. 720 lakhs for modernizing the power supply distribution in CPRI and to improve the test and handling facilities in various laboratories of CPRI. Commendable progress is achieved in implementation of these projects.

### 10.11.3 NEW TEST FACILITIES

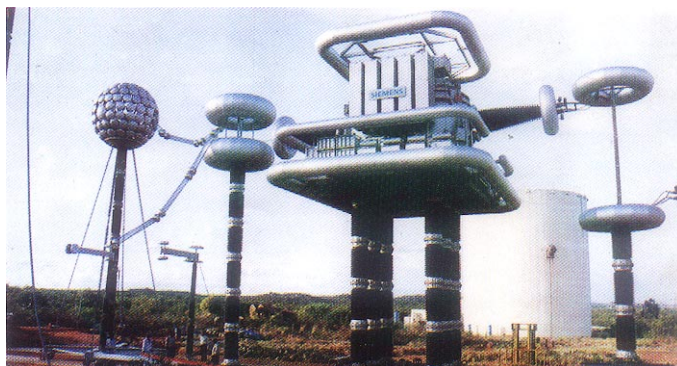
Some of the new test facilities added during the year are :

- Pollution test on all type of booth tension & suspension insulators upto 400 KV class.
- Puncture with stand facility for DC Insulators
- RIV test (outdoor) and corona inception & extinction voltage test (dry) for 800 KV line components like insulators, conductors, hardware etc.
- High voltage dielectric tests on 800 KV transmission line insulators
- Fuel evaluation test facility at TRC, Nagpur
- Electric field exposure facility
- Solar lantern test facility at Energy Research Centre, Thriuvananthapuram.

### 10.11.4 UNIQUE TESTS CARRIED OUT IN CPRI

Accuracy test on CTs & PTs at Sharavathy Generating Station, Jog Falls.

The Short Circuit laboratory of CPRI , Bangalore undertook the testing of 220 KV CT s (outdoor) and 11 KV Generator CTs & PTs at the Sharavathy Generating Stations site, Jog Falls on the request of Karnataka Power Corporation Ltd. The test



*Set up for RIV Test on 800 KV Single Suspension Insulator - CPRI*

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arrangements were carefully planned in view of impending monsoon and an requirement of shutdown of the line. For this purpose, several sensitive and expensive equipment were transported to the site to complete the tests without interruption. All the 132 CT s and 24 PT s were tested for their accuracy. The complete testing work took about ten days. For the first time CPRI had undertaken site testing of CT s and PT s in such a larger scale. Considering the huge quantum of

energy generated and transmitted in electric power system, such intermittent verification of performance of Instrument transformers already installed in power stations is necessary for operating the plant more efficiently.

#### **10.11.5 TESTING OF CAPACITORS**

The Institute carried out endurance tests on full size capacitors of rating 200K Var, 7.3 KV as per IEC 871 part 2-1987, for the first time in the country.



*View of 66 KV Cable with termination under impulse voltage test - CPRI*

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## 10.12 NATIONAL POWER TRAINING INSTITUTE

### 10.12.1 INTRODUCTION

National Power Training Institute (NPTI) has been set up by Govt. of India to function as the National Apex Body for the Human Resource Development of Indian Power Sector.

The Headquarter of NPTI is located at NPTI Complex, Sector 33, Faridabad (Haryana). It operates on all India basis through its four Regional Power Training Institutes located at Neyveli (Tamil Nadu), Durgapur (West Bengal), Badarpur (New Delhi) and Nagpur (Maharashtra). The NPTI including its four Regional Power Training Institutes, is fully equipped with the latest state-of-the-art training infrastructure and having expert faculties with long years of professional and teaching background. The Institutes are conducting a number of training programmes for Power Engineers, Operators and Technicians in the areas of Thermal and Hydro Power Generation, Power System and other related areas. The Training Institute at Badarpur is equipped with a computer based full scope replica simulator of 210 MW Fossil Fuel Thermal Power Plant to provide off-job/hands on training. Two more simulators of 500 MW and 210 MW have been commissioned at NPTI HQ, Faridabad and at Nagpur Institute respectively. In addition, an Institute for Advanced Learning & Management Studies for higher echelons of Power Sector is being established at NPTI Complex, Faridabad. It will have departments in specialised areas of Hydro, Thermal, Power System and Management Studies. It will function as a Nodal Institute for Power Sector training not only for designing, implementing and supervising the whole power sector training activities but also to create the right type of organisational culture.

### 10.12.2. ACTIVITIES/ACHIEVEMENTS

#### Training Output

With its mission to improve Productivity, Safety and Environment quality of the Power and allied industries through effective development of People and Organisations, NPTI conducts a large number of long-term and short-term training courses.

Upto March, 1998, 45066 personnel of various level from different Organisations have been trained at the four Training Institute of NPTI since their

inception. About 4500 personnel have been trained on the 210 MW Simulator at Badarpur Institute since its installation in 1983. The Training Output in terms of Trainee Weeks is 24,592 vis-a-vis the target of 20,555 Trainee Weeks for the year 1997-98

#### Post Graduate Diploma in thermal Power Plant Engineering :

The first-ever Post Graduate Diploma Course in Thermal Power Plant Engg., duly recognised by AICTE, launched on 5.8.96 and concluded on 4.8.97 met with a great success in that more than 40% of Candidates have been selected through Campus Interviews by renowned Organisations, namely, M/s. ABB, M/s. Jindal Strips, M/s. Jindal Tractabel Co. Ltd., M/s. ACC, M/s. Usha India, M/s. Chambal Fertilizers etc. The Second Batch which commenced on 4.8.97 attracted overwhelming response from the Candidates from all over the country.

#### Specialised Training Programmes:

- \* A four days Training Programme for four Technical Officers of Zimbabwe Electricity Supply Authority (ZESA) was organised at RPTI, Badarpur from 27.1.98 to 30.1.98.
- \* A two day training programme on "Introduction to Indian Power Sector" for the Civil Service Probationers was organised on 28.2.98 and 1.3.98 at NPTI Complex, Faridabad. The programme was attended by 78 IAS Officer Trainees undergoing IAS Professional Course Phase-I. The programme was highly appreciated by the Participants as well as Course Coordinators from Lal Bahadur Shastri National Academy, Mussorie.

#### Computer Based Training

Computer Based Training (CBT) identified as one of the means for delivering and replicating high quality training has been fully established by NPTI with the assistance of ODA, UK. NPTI has set up Open Learning Centre at its Regional Institutes and a dedicated unit at its Hqrs. A large number of multimedia CBT Packages on different topics have since been developed and are available for use for Power Sector Companies at their training centres.

#### Consultancy Services :

NPTI as a National Apex Organisation in the field of training have diversified into different areas of consultancy such as Setting up of training institutes,



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Assessment of Training Needs etc. BSEB have given the assignment of Recruitment of Asstt. Executive Engineers in the Telecommunication Cadre which has since been completed.

### **10.12.3. IMPLEMENTATION OF ON-GOING SCHEMES**

The following Schemes are under implementation:

- Setting up of NPTI together with institute for Advanced Learning & Management Studies.
- Installation of 210 MW Simulator at Nagpur.
- Installation of 500 MW Simulator at Faridabad.
- Computer Based Training.
- Renovation & Modernisation of existing 210 MW Simulator at Badarpur.

### **10.12.4. NEW SCHEMES UNDER NINTH PLAN:**

The following New Schemes have been proposed during the Ninth Plan :

- Augmentation of Regional Power Training Institutes.
- Setting up of Trg. Institute in North Eastern Region.
- setting up of Environmental Cell
- Setting up of Training Institute for Hydro Power
- Augmentation of CBT Scheme
- Expenditure on Training in NPTI/RPTIs to be treated as Plan.

These Schemes have been accepted in principle for a total outlay of Rs.117.05 Crores.

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### **10.13 ENERGY MANAGEMENT CENTRE (EMC)**

The Energy Management Centre (EMC) was established by the Government in April, 1989 (registered as an autonomous body under the Societies Registration Act) to act as a focal point for exchange of experience and function as a centre for information, research, training and international cooperation in the field of energy management. EMC advises/assists the Ministry of Power in formulation of policy and designing of programmes on energy conservation and functions as a nodal point at the Central level for monitoring and coordination of energy conservation activities in the country. It also takes up implementation of specific programmes on its own as well as on behalf of the Ministry of Power and other organisations. At present, EMC is sustained by budgetary support from the Government in the form of grants-in-aid. Its current annual budget is of the order of Rs.55 lakhs.

#### **10.13.1 ACTIVITIES OF THE ENERGY MANAGEMENT CENTRE**

EMC carried out the following activities during 1997-98:

Macro-level policy study on Energy Efficiency in Indian Economy vis-a-vis other developing economies in Asia-Pacific region.

Preparation of Industrial Energy Efficiency booklets on:

- (i) Pulp and Paper
- (ii) Secondary Steel Sector

Preparation of Status Report and Action Plan on Time of Use Tariff in India.

Status reports for selected domestic appliances

Development of informative booklet on strategic management of energy efficiency at the Corporate level.

Showcase demonstration project on energy savings through fan efficiency improvement in Cement Industry.

DSM plan for Gujarat Electricity Board.

Energy consumption norms in foundry and mini steel industry.

Development of computer aided monitoring and targeting system for a process industry.

Energy saving in Aluminium Electrolysis by bringing down the operating temperature of Electrolyte.

Preparation of material for inclusion in the text books prescribed in the school curriculum.

Development of practical energy saving guide for small business and industries.

Development of Industrial Energy Efficient Booklets.

Preparation of industrial energy efficiency agenda for Secondary Steel, Pulp and

Paper and Chlor-alkali industrial sub-sectors

Preparation of status report and action plan on time of use tariffs in India.

Study on prospects and strategies for energy efficient buildings.

Training programmes for training of personnel on energy conservation in the various sectors of industry.

Indo-EC Energy Management Cooperation Programme (Phase II).

Indo-German Technical Cooperation Programme on Energy Conservation in Indian Industries.

Studies sponsored by a Swedish Agency for Research Cooperation for developing countries programme (SAAREC).

Energy Efficiency Support Project of the Asian Development Bank (ADB).

Indo-US Energy Efficiency Cooperation Programme.

World Bank project on India regarding Environmental Issues in the Power Sector.

Energy Efficiency Support Project of the Asian Development Bank (ADB).

Indo-US Energy Efficiency Cooperation Programme.

World Bank project on India regarding Environmental Issues in the Power Sector.

## 11. OTHER IMPORTANT ACTIVITIES

### 11.1 CONSULTATIVE COMMITTEE OF MEMBERS OF PARLIAMENT

During the year 1997-98 the Ministry of Power coordinated and organised three meetings of the Consultative Committee of Members of Parliament for the Ministry of Power. The subjects for discussion at these meetings were (i) Power Grid Corporation of India Ltd; (ii) Issues in Energy Conservation; and (iii) Power Policy.

### 11.2 IMPLEMENTATION OF OFFICIAL LANGUAGE POLICY

The Ministry of Power, its attached and subordinate offices and Public Sector undertakings/Autonomous Bodies/Boards/Societies/Institutions under the administrative control of Ministry of Power have continued their efforts in ensuring effective implementation of the official language policy of the Government and encouraging progressively the use of Hindi in official work.

In compliance with the constitutional and statutory requirements of Section 3(3) of Official Language Act as amended from time to time, all documents required to be issued bilingually are being issued bilingually by the Ministry. Similarly all communications received in Hindi are replied to in Hindi compulsorily. The SubCommittee of Parliament on Official Language visited National Hydroelectric Power Corporation Limited Faridabad, an Undertaking under the administrative control of this Ministry.

Hindi Salahakar Samiti of the Ministry of Power has been reconstituted. Meetings of Official Language Implementation Committee of the Ministry of Power were also regularly convened during the year 1997-98.

Cash award schemes such as Incentive Scheme for original Noting /Drafting in Hindi as well as Hindi Dictation Scheme formulated and circulated by the Department of Official Language, Ministry of Home Affairs for promoting the use of Hindi in official work continued to be followed in the Ministry and its attached offices.

### 11.3 VIGILANCE ACTIVITIES/DISCIPLINARY CASES

At the beginning of the year 1997-98, there were

eleven disciplinary cases, of which one has been closed during the year. Another disciplinary case was initiated during the year, bringing the total number of cases to eleven again. These are at various stages of processing.

### 11.4 WELFARE OF MINORITIES

The Prime Minister's 15 point programme on Welfare of Minorities is being implemented in the Ministry of Power. It has been ensured that in case of direct recruitment to Group 'C' and 'D' posts, a member of a minority community is included in the selection committee. Quarterly returns in respect of Scheduled Caste Scheduled Tribe and minorities from Public Sector Undertaking are being regularly monitored in accordance with the guidelines on the subject.

Name of Office	Group 'A'			Group 'B'			Group 'C'			Group 'D'		
	Total	SC	ST	Total	SC	ST	Total	SC	ST	Total	SC	ST
Ministry of Power	36	5	-	97	26	-	103	42	10	69	30	2

### 11.5 RECREATION ACTIVITIES

The Ministry is promoting sports and cultural activities. Power Sports Control Board (PSCB), constituted as a nodal agency with the participation of Central Power Organisation i.e. Central Electricity Authority and all the public sector undertakings/ autonomous bodies under the administrative control of the Ministry of Power, is arranging various tournaments in various disciplines every year, all over the country with the help of member organisations. The Board got formally registered as a society under the Societies Regulation Act, 1860 on May 13, 1994. The Ministry is encouraging the participation of its officers and staff in several other sports and cultural meets organised by the Central Civil Services Cultural and Sports Board.

### 11.6 GRIEVANCES CELL

The Grievance Cell of Ministry of Power dealt with 49 cases. Most of these cases relate to Pension, Pensionary Benefits, Transfer, Pay fixation, Seniority, Employment on Compassionate Grounds etc. Out of these, 24 cases have been finally disposed off.

## 11.7 CONTROLLER OF ACCOUNTS

The Office of the Controller of Accounts has four Pay & Accounts Offices, working under his payment control viz. PAO, CEA, New Delhi. PAO(CEA), Bangalore, PAO(Sect), New Delhi and PAO(BMCC), New Delhi. The monthly accounts of these offices are submitted regularly to Principal Accounts Office, thereafter these are consolidated and sent to the office of the Controller General of Accounts, Ministry of Finance. The monthly accounts are prepared after incorporating the financial transactions of the Ministry of Power in a detailed classified form. The payment on account of DCRG, Pension, Committed value of pension, GPF to the officials of the Ministry of Power/Central Electricity Authority on retirement during the year by all the PAOs were made in time. The Principal Accounts Office is also responsible for the preparation of Appropriation Accounts, Statement of Central Transaction (SCT) and Finance Account on annual basis for submission to the Controller General of Accounts (CGA). The Principal Accounts Office also brought out the document 'Accounts at a Glance' for 1996-97.

### Computerisation of Accounts

The office of the Controller of Accounts utilises the

software packages INTEGRATED MODULE FOR PROCESSING VOUCHER (IMPROVE) and CONTROLLER'S ACCOUNTING (CONTRACT) provided by CGA. The voucher level computerisation has been carried out in all the four PAOs. The consolidation of monthly accounts of all the PAOs in Ministry of Power is done by using the CONTACT software packages. Various other packages like SCT, MIS are also used for report generations. Reports are also generated from the options provided in Report Generation menu in CONTACT. The accounts consolidated through the CONTACT programme are then sent by the Controller of Accounts to the Controller General of Accounts (CGA).

## 11.8 INTERNAL AUDIT WING

The Internal Audit Wing ensures adoption of sound procedure, regularities and financial propriety of transactions and accounts. This wing advises the DDOs and their staff for correct implementation of rules and maintenance of proper records. Internal Audit wing also pursues the settlement of objections raised by the Statutory Audit.

### Performance of the Internal Audit wing during the year 1996-97

Year (Accounts due for audit during 1996-97)	No. of units due/inspected	No. of paras raised	No. of paras settled	No. of paras outstanding upto 31.3.97
1995-96	22/22	291	98	193

## 11.9 AUDIT OBSERVATIONS

The organisation-wise breakup of Audit observations and Inspection Reports as on 31.3.1997 are as under:

### Audit objections as on 31.3.1997

S.No.	Organisation	No. of Inspection Reports	No. of Paras
1	Ministry of Power	5	29
2.	Central Electricity Authority	2	47
<b>PAY &amp; ACCOUNTS OFFICE/CONTROLLER OF ACCOUNTS</b>			
3.	PAO (CEA), New Delhi	7	26
4.	PAO (BMCC), New Delhi	3	4
5.	PAO (Sectt.), New Delhi.	4	12
6.	PAO (CEA), Bangalore.	Nil	Nil
<b>TOTAL:</b>		21	118

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#### **11.10 COMMEMORATION OF 50TH ANNIVERSARY OF INDIA'S INDEPENDENCE**

Golden Jubilee of India's independence is a matter of great pride and happiness for all of us. The Ministry of Power through its PSUs namely NTPC, NHPC & DVC etc. had participated in the National Exhibition on Rails which was organised by the Ministry of Railways in collaboration with Department of Culture w.e.f. 15.8.1997. The

Ministry of Power had also organised a special programme for celebrating the 50th anniversary of Independence through Power Sports Control Board in Delhi on 29.3.98.

It is also proposed to bring out a calender of events/ programmes which have been organised or are to be organised by the Ministry of Power and its organisations from Aug.'97 to Aug.'98.

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## POWER SUPPLY INDUSTRY IN INDIA - HIGHLIGHTS

	Dec.1950	31.3.71	31.3.81	31.3.91	31.3.94	31.3.95	31.3.96*
<b>I. GENERATING CAPACITY (MW)</b>							
<b>(Total All India)</b>	<b>2301</b>	<b>16271</b>	<b>33316</b>	<b>74699</b>	<b>87475</b>	<b>92332</b>	<b>95183</b>
<b>Utilities</b>							
Hydro	559	6383	11791	18753	20379	20833	20986
Steam	1005	7508	17122	43004	49147	52139	53480
Gas	-	168	274	2552	4883	5631	6268
Diesel & Wind	149	230	167	212	339	343	335
Nuclear	-	420	860	1565	2005	2225	2225
<b>Total (Utilities)</b>	<b>1713</b>	<b>14709</b>	<b>30214</b>	<b>66086</b>	<b>76753</b>	<b>81171</b>	<b>83294</b>
Public Sector							
(Utilities)	628	13221	28832	63344	73729	77625	79418
Private Sector							
(Utilities)	1085	1488	1382	2742	3024	3546	3876
Average Annual Growth Rate (%)							
during the decade	4.34	12.20	7.46	8.14	6.91	6.66	5.94
<b>Non Utilities :</b>							
(including Railways)							
Hydro	-	-	3	4	4	4	4
Steam	-	-	2137	5010	5812	6029	6310
Gas	-	-	54	475	774	808	825
Diesel & Wind	-	-	908	3124	4132	4320	4750
<b>Total (Non-Utilities)</b>	<b>588</b>	<b>1562</b>	<b>3102</b>	<b>8613</b>	<b>10722</b>	<b>11161</b>	<b>11889</b>
	<b>(267)</b>	<b>(469)</b>	<b>(1218)</b>	<b>(1363)</b>	<b>(1627)</b>	<b>(1711)</b>	<b>(1750)</b>
	Dec.1950	1970-71	1980-81	1990-91	1993-94	1994-95	1995-96*
<b>II. GENERATION (GWH)</b>							
<b>(Total All India)</b>	<b>6575</b>	<b>61212</b>	<b>119260</b>	<b>289439</b>	<b>356335</b>	<b>385557</b>	<b>417237</b>
<b>Utilities</b>							
Hydro	2520	25248	46542	71641	70463	82712	72598
Steam	2387	27797	60714	178322	233151	243110	273745
Gas	-	251	522	8113	14727	18475	24858
Diesel & Wind	200	114	65	112	311	545	704
Nuclear	-	2418	3001	6141	5398	5648	7982
<b>Total (Utilities)</b>	<b>5107</b>	<b>55828</b>	<b>110844</b>	<b>264329</b>	<b>324050</b>	<b>350490</b>	<b>379887</b>
Public Sector							
(Utilities)	2104	49562	104114	251382	310197	335293	361734
Private Sector							
(Utilities)	3003	6266	6730	12947	13853	15197	18153
Average Annual Growth Rate (%)							
during the decade	6.57	12.67	7.10	9.08	8.74	8.37	8.35
<b>Non Utilities :</b>							
(including Railways)							
Hydro	-	-	15	15	15	15	15
Steam	-	-	7232	20017	25416	27390	28835
Gas	-	-	102	1845	3149	3407	3640
Diesel & Wind	-	-	1067	3233	3705	4255	4860
<b>Total (Non-Utilities)</b>	<b>1468</b>	<b>5384</b>	<b>8416</b>	<b>25110</b>	<b>32285</b>	<b>35067</b>	<b>37350</b>
	<b>(267)</b>	<b>(469)</b>	<b>(1218)</b>	<b>(1363)</b>	<b>(1627)</b>	<b>(1711)</b>	<b>(1750)</b>

## Abbreviations used

\* Provisional

- Data not available.

Figure in brackets indicates number of selected industries covered. From 1986-87 onwards coverage is only for captive plants of capacity 1 MW and above.

	Dec.1950	1970-71	1980-81	1990-91	1993-94	1994-95	1995-96*
<b>III. SYSTEM PEAK DEMAND (AGGREGATE)</b>							
Utilities (MW)	–	9743	19121	40672	48351	–	–
<b>IV. FUEL CONSUMPTION Utilities-Steam Stations</b>							
Coal (MTx10)	2.22	14.59	35.82	112.92	156.86	161.27	–
Lignite (MTx10)	–	2.54	3.98	9.62	12.05	14.08	–
Furnace Oil (Kilo Ltsx10)	–	1.28	1.87	0.78	0.61	0.64	–
Diesel Oil (Kilo Ltsx10)	–	0.04	0.22	0.27	0.24	0.34	0.38
<b>V. AVERAGE GENERATION PER KW OF INSTALLED CAPACITY (KWH/KW)@ @</b>							
<b>(Utilities)</b>							
Hydro	4505	3956	4075	3820	2458	3970	3459
Steam	2377	3702	3672	4147	4744	4663	5119
Diesel & Gas	1342	917	1219	2976	2887	3184	3871
Nuclear	0	5757	3512	3924	2693	2538	3587
Overall	2982	3795	3772	4000	4224	4318	4561
<b>VI. ELECTRICITY SALE (GWH) Utilities</b>							
Domestic	525	3840	9247	31682	43344	47915	52539
Commercial	309	2573	4682	11181	14144	15973	16999
Industrial	2604	29579	48069	84209	94503	100126	105291
Agriculture	162	4470	14489	50321	70699	79301	85736
Public Lighting	60	500	748	1648	1939	2071	2188
Railway Traction	308	1364	2266	4112	5621	5886	6227
Public Water Works & Sewage Pumping	189	1016	1534	3634	4838	5037	5388
Miscellaneous	–	382	1332	3261	3481	3321	3955
<b>Total</b>	<b>4157</b>	<b>43724</b>	<b>82367</b>	<b>190357</b>	<b>238569</b>	<b>259630</b>	<b>278323</b>
Average Annual Growth Rate (%) during the decade	6.34	12.19	6.55	8.74	8.83	8.57	8.51
<b>VII. PATTERN OF ELECTRICITY SALE (%)</b>							
Utilities							
Domestic	12.6	8.8	11.2	16.8	18.2	18.5	18.9
Commercial	7.5	5.9	5.7	5.9	5.9	6.1	6.1
Industrial	62.6	67.6	58.4	44.2	39.6	38.6	37.8
Agriculture	3.9	10.2	17.6	26.4	29.6	30.5	30.8
Others	13.4	7.5	7.1	6.7	6.7	6.3	6.4
<b>VIII. ELECTRICITY CONSUMPTION</b>							
<b>Utilities+Non-Utilities</b>							
Per 1 000 of Population (KWH)	15550	89760	132340	252770	298960	320100	335420
Per 1000 Sq. Kms. of area in (GWH)	1.69	15.35	25.05	64.35	80.75	88.02	93.87
Per MW of connected Load (GWH)	1.86	1.85	1.34	1.57	1.67	1.75	–
Per 1000 consumers (GWH)	3.52	3.31	2.53	2.73	3.22	3.35	–

@ @ The Figures given under this table indicate the generation in Kwh during the year per KW of installed capacity at the end of year.

\* Provisional

– Data not available



	Dec.1950	1970-71	1980-81	1990-91	1993-94	1994-95	1995-96*
<b>IX. PER CAPITA (KWH) (Utilities+Non Utilities)</b>							
Generation	18.17	113.29	175.95	345.87	401.31	426.52	453.53
Consumption	15.55	89.76	132.34	252.77	298.96	320.10	335.42
<b>X. NO. OF CONSUMERS (Thousand)</b>							
Domestic	1157	10165	22338	50389	60193	63406	—
Commercial	259	2306	4582	8002	9209	9558	—
Industrial	**63	553	1150	2077	2337	2423	—
Agriculture	19	1571	4233	8631	9971	10372	—
Others	3	70	268	534	602	637	—
<b>Total</b>	<b>1501</b>	<b>14665</b>	<b>32571</b>	<b>69633</b>	<b>82312</b>	<b>86399</b>	—
<b>XI. CONNECTED LOAD (MW)</b>							
Domestic	734	5986	13079	32051	49254	51590	—
Commercial	401	1911	4494	8341	11800	12123	—
Industrial	**1562	11631	24844	42947	52438	54235	—
Agriculture	118	6225	16489	32511	38556	40108	—
Others	20	477	2492	5051	6895	7445	—
<b>Total</b>	<b>2835</b>	<b>26230</b>	<b>61398</b>	<b>120901</b>	<b>158943</b>	<b>165501</b>	—
<b>XII. LENGTH OF T&amp;D LINES (Circuit Kms)</b>							
HVDC	-	-	-	-	1667	1667	—
400 KV	-	-	2340	21634	27129	28025	—
230/220KV	-	11211	31834	62345	72916	75572	—
132/110KV	2708	46160	59738	87965	93929	96551	—
78/66/44KV	7431	25769	26752	34947	36613	37675	—
15/11/6.6/3.3/2.2KV	14110	362628	784513	1329774	1470217	1509070	—
Distribution lines	-	576323	1453402	2784482	2949195	3038500	—
<b>Total</b>	<b>-</b>	<b>1117164</b>	<b>2522461</b>	<b>4533414</b>	<b>4878028</b>	<b>5018408</b>	—
<b>XIII. TRANSFORMATION CAPACITY (MVA)</b>							
Step up	972.81	16256.24	37094	75823	92861	97153	—
Step down	1366.76	34726.70	97882	207595	264088	256664	—
Distribution	834.37	17048.84	43829	87501	110568	139976	—
<b>XIV. SYSTEM LOSSES(%)</b>							
<b>All India</b>	<b>15.83</b>	<b>17.50</b>	<b>20.56</b>	<b>22.89</b>	<b>21.41</b>	<b>21.13</b>	<b>21.74</b>
<b>XV. PROGRESS OF RURAL ELECTRIFICATION</b>							
No. of Villages							
Electrified	306(\$)	104942	272287	481124	494191	497745	501831
Percentage							
Electrified	0.54	18.50	47.3	83.1	85.3	86.0	86.7
Percentage of rural							
Population benefitted	(@)2.06	—	68.0	84.1	85.5	85.3	83.4
<b>XVI. ENERGISATION OF PUMPSETS</b>							
<b>Total energised</b>	<b>21008</b>	<b>1629423</b>	<b>4330453</b>	<b>8909110</b>	<b>10276044</b>	<b>10721255</b>	<b>11104090</b>

@ Estimated

(\$) Figures ending March 1951

\*\* Including water works &amp; traction

— Data not Available

\* Provisional

**XVII. GENERATING CAPACITY AS ON 31.3.96\* & 31.3.95 (MW) (UTILITIES)**

Region	HYDRO		THERMAL		NUCLEAR		TOTAL	
	3.96	3.95	3.96	3.95	3.96	3.95	3.96	3.95
Northern	7162	7142	15883	15786	895	895	23940	23823
Western	3113	3014	20758	20428	860	860	24731	24302
Southern	8506	8505	10820	10486	470	470	19796	19461
Eastern	1710	1680	11751	10622		–	13461	12302
North-Eastern	495	492	871	791		–	1368	1283
<b>Total</b>	<b>20986</b>	<b>20833</b>	<b>60083</b>	<b>58113</b>	<b>2225</b>	<b>2225**</b>	<b>83294</b>	<b>81171</b>

**XVIII. ELECTRICITY GENERATED DURING 1995-96 1994-95 (GWH) (UTILITIES)**

Region	HYDRO		THERMAL		NUCLEAR		TOTAL	
	95-96	94-95	95-96	94-95	95-96	94-95	96-95	94-95
Northern	29429	30244	81763	72431	2752	1333	113764	104008
Western	7553	10298	115731	102931	3820	1883	127104	115112
Southern	28453	35056	65195	54802	1410	2432	95058	92290
Eastern	55163	5259	34671	30542		–	40184	35801
North-Eastern	1830	1855	1947	1424		–	3777	3279
<b>Total</b>	<b>72598</b>	<b>82712</b>	<b>299307</b>	<b>262130</b>	<b>7982</b>	<b>5648</b>	<b>379887</b>	<b>350490</b>

**XIX. ELECTRICITY SOLD DURING 1995-96- & 1994-95 (GWH) (UTILITIES)**

Region	DOMESTIC		COMMERCIAL		INDUSTRIAL		AGRICULTURAL		OTHERS		TOTAL	
	95-96	94-95	95-96	94-95	95-96	94-95	95-96	94-95	95-96	94-95	95-96	94-95
Northern	17413	16166	6040	5528	23663	22110	24279	23883	5279	4655	76674	72342
Western	14484	12934	4590	4188	38222	36077	32019	27153	5917	5489	95232	
Southern	13157	12182	3624	3672	26784	26823	26319	25330	3277	3050	73161	71057
Eastern	6622	5914	2477	2317	15675	14163	3022	2846	2659	2569	30455	27809
North-Eastern	863	719	268	268	947	953	97	89	626	552	2801	2581
<b>Total</b>	<b>52539</b>	<b>47915</b>	<b>16999</b>	<b>15973</b>	<b>105291</b>	<b>100126</b>	<b>85736</b>	<b>79301</b>	<b>17758</b>	<b>16315</b>	<b>278323</b>	<b>259360</b>

\* Provisional

\*\* The rerated installed Nuclear capacity at present is 1840 MW

**XX. ELECTRICITY GENERATION (MW) (UTILITIES)**

REGION	1995-96*				1996-97*			
	HYDRO	THERMAL	NUCLEAR	TOTAL	HYDRO	THERMAL	NUCLEAR	TOTAL
Northern	29249	81763	2752	113764	29221	85283	2823	117327
Western	7553	115731	3820	127104	7484	122657	4223	134364
Southern	28453	65195	1410	95058	25355	69842	1978	97175
Eastern	5513	34671	—	40184	4664	37281	—	41945
North-Eastern	1830	1947	—	3777	1894	2065	—	3989
<b>Total</b>	<b>72598</b>	<b>299307</b>	<b>7982</b>	<b>379887</b>	<b>68618</b>	<b>3171558</b>	<b>9024</b>	<b>394800</b>

**XXI. PER CAPITA CONSUMPTION DURING 1995-96\* & 1994-95 (KWH) (UTILITIES & NON-UTILITIES)**

Region	DOMESTIC		COMMERCIAL		INDUSTRIAL		AGRICULTURAL		OTHERS		TOTAL	
	95-96	94-95	95-96	94-95	95-96	94-95	95-96	94-95	95-96	94-95	95-96	94-95
Northern	66	63	23	21	113	109	92	92	20	18	314	302
Western	71	64	22	21	228	221	156	135	29	27	506	468
Southern	62	59	17	18	155	156	125	122	16	14	375	369
Eastern	32	30	12	12	120	114	15	14	14	12	193	182
North-Eastern	24	21	8	8	47	48	3	3	18	16	100	96
<b>Total</b>	<b>57</b>	<b>53</b>	<b>18</b>	<b>18</b>	<b>147</b>	<b>144</b>	<b>93</b>	<b>88</b>	<b>20</b>	<b>17</b>	<b>335</b>	<b>320</b>

\* Provisional

(\$) Retirements &amp; addition of small sets excluded

