

Chapter – 9

Power

9.1 General

In the present developing stage of country's economy, there is a huge requirement of power both in the agricultural as well as industrial sectors, as the productivity in both these sectors is closely linked with the availability of electric power. The electric power is also required for domestic use in towns and villages and energisation of tube wells and pumped canals. Electricity being the most convenient and versatile form of energy, the demand for it has been growing at a faster rate than any other form of energy.

The State of Gujarat which was formed in May, 1960 has a population of 50.60 million (according to 2001 census). The State is relatively urbanized and has a large and fast growing industrial sector. The economy of State is dependent on industries and agriculture, approximately in ratio of 3:2. One of the surveys carried out in the year 1980-81 stated that the per capita electricity consumption of Gujarat was 314.92 Units against all India figure of 134.87. This shows that the position of power availability in Gujarat has been better in comparison to that in other states. Even then, there is need to plan for additional power, keeping in view the rate of industrialization taking place in the state. Like Gujarat, the power position in Maharashtra is also good. This can be gauged from the fact that the power generation of Maharashtra is of order of 9500 MW or more, whereas that of Gujarat is 5000 MW.

9.2 Present status of power development in the states

The installed capacity of power in the state of Gujarat as on 31.3.93 was 5040 MW, which comprises 4468 MW of thermal power, 427 MW of hydropower, and 145 MW of gas power. In addition, Gujarat is also getting its share to the tune of 1100 MW from the central sector schemes. The total power available for Gujarat is 6140 MW. A maximum demand of about 6064.5 MW was met so far during the year 1992-93. Similar details in respect of Maharashtra are not readily available.

9.3 Available generating capacity in the state of Gujarat from different sources with location category wise

Details of available installed capacity of each power project are given below.

a)	Thermal power	
1.	Ahmedabad Electric Co.	550 MW
2.	Wanakbori TPS	1260 MW
3.	Ukai TPS	850 MW
4.	Dhuvaran TPS	588 MW
5.	Gandhinagar TPS	660 MW
6.	Sikka TPS	240 MW
7.	Kutch Lignite TPS	140 MW
8.	Utran TPS (Old)	45 MW
9.	Utran TPS (New)	135 MW
	Sub Total	4468 MW
b)	Hydro power	
1.	Kadana HEP	120 MW
2.	Ukai HEP	300 MW
3.	Ukai L.B.C. HEP	5 MW
4.	Panam	2 MW
	Sub Total	427 MW
c)	Gas power	
1.	GIPCL GPS	145 MW
	Sub Total	145 MW
d)	Central Sector projects	
1.	Tarapur share (Nuclear power)	190 MW
2.	Kakrapar share	62 MW
3.	NTPC-Korba share	360 MW
4.	NTPC-Vindhyachal share	230 MW
5.	NTPC-Kawas share	184 MW
6.	NTPC-Gandhar share	74 MW
	Sub Total	1100 MW
	Grand Total	6140 MW

9.4 Present status of utilization of power produced for various uses

a)	Domestic	8.60 %
b)	Commercial	2.30 %
c)	Industries	35.60 %
d)	Irrigation & Agriculture	26.20 %
e)	Public water works	1.30 %
f)	Others	26.00 %
	Total	100.00%

9.5 Energy requirement (Mkwh) and peaking capacity

The energy requirement and peak load demand in the states of Gujarat and Maharashtra during eighth five year plan were assessed by the Central Electricity Authority (CEA) based on the sanctioned schemes in its 12th Annual Electric Survey and given in the "Report of the working group on power". The details are given below:

Year	Gujarat		Maharashtra	
	Energy requirement (Mkwh)	Peak load demand (MW)	Energy requirement (Mkwh)	Peak load demand (MW)
1990-91	22303	3637	38037	6031
1991-92	24005	3915	40522	6425
1992-93	25783	4205	43293	6864
1993-94	27620	4504	46786	7481
1994-95	29497	4810	50691	8037

9.6 Energy availability (Mkwh) and peak availability

The total energy availability and peak availability for Gujarat and Maharashtra during 8th five year plan based on sanctioned schemes assessed by the Central Electricity Authority are as follows:

Year	Gujarat		Maharashtra	
	Energy availability (Mkwh)	Peak availability (MW)	Energy availability (Mkwh)	Peak availability (MW)
1990-91	20642	2818	37542	5822
1991-92	21861	2994	40109	5177
1992-93	23815	3271	43068	6671
1993-94	25306	3372	46392	6954
1994-95	25887	3420	48390	7042

9.7 Surpluses/deficits of power

The deficits of power and energy in Gujarat and Maharashtra during the eighth plan as assessed by the CEA are as follows:

Period	Gujarat		Maharashtra	
	Power (MW)	Energy (Mkwh)	Power (MW)	Energy (Mkwh)
1990-91	819	1661	209	495
1991-92	921	2144	248	413
1992-93	934	1968	193	225
1993-94	1132	2314	464	394
1994-95	1390	3610	995	2301

However, the Central Electricity Authority has also assessed the power supply position in respect of Gujarat and Maharashtra states, based on i) 27188.7 MW benefits in Western Region from sanctioned and CEA cleared schemes and ii) 38369 MW benefits in western region as envisaged in the report of working group on power. As seen from the above table there was a power deficit of 934 MW and energy deficit of 1968 Mkwh during 1992-93 in Gujarat state. Similarly there was a power deficit of 193 MW and energy deficit of 225 Mkwh during 1992-93 in Maharashtra state. These deficits are likely to increase in subsequent years due to increasing power demand. Hence there is a necessity of producing more power either through thermal schemes or hydro electric power schemes. For this purpose new schemes have to be contemplated to meet the power demands of the state.

9.8 Transmission system

The southern and eastern regions of the Gujarat state have better network of the power lines as compared to the north-western region viz. Kutch area.

9.9 Future plans of power development in the state

9.9.1 Schemes under construction

a) Sardar Sarovar Project

The scheme envisages an underground river bed power house (RBPH) with six reversible turbines on the right bank with an installed capacity of 1200 MW and a surface Canal Head Power House (CHPH) with an installed capacity of 250 MW. The power is to be shared in the ratio of 57:27:16 between Madhya Pradesh, Maharashtra and Gujarat respectively. Thus the share of Gujarat will be 232 MW. This will be used immediately on its availability since the long term power requirement as per forecast made by the CEA in its '12th Annual Electric Survey' is very large.

9.10 Power generation from the present scheme

The NWDA has proposed six hydropower schemes in the proposed Par-Tapi-Narmada Link Project, out of which four power schemes are proposed at the toe of Jheri, Paikhed, Chasmandva and Chikkar dams and the other two are proposed at the drops of feeder canals originating from Dabdar and Kelwan reservoirs. The power houses have been designed on the lines of existing Surya Hydro-electric Project in Maharashtra. The total installed capacity for power generation from all the power schemes is 32.50 MW and the energy generation that could be achieved from the power stations is 92.975 Mkw. The details of power schemes are discussed in the following paragraphs.

9.10.1 Jheri power scheme

The Jheri dam is proposed across river Par near village Jheri in Nasik district of Maharashtra state. The salient features of the Jheri and other dams are furnished in Table - 9.1. The F.R.L. of the Reservoir is + 246.00 m, the M.D.D.L is +203.70 m and the Tail water level on the D/s of dam is +182.00 m. Therefore there is a theoretical maximum head of 64.00 m and average head of 49.90 m available at the dam site. The average head is worked out using the following formula and utilised for generation of hydel power at dam site.

$$\text{Average Head (m)} = \frac{2}{3} (\text{F.R.L.} - \text{M.D.D.L}) + (\text{M.D.D.L.} - \text{T.W.L})$$

The proposed power house is situated in the 18 m block in N.O.F section on the left side of spillway. The power scheme envisages generation of hydel power with an installed capacity of 8.0 MW. It is proposed to operate the power generating unit continuously throughout the year. 4 units of 2 MW each are proposed.

The energy generation that could be achieved from the power station is 26.297 M. Units (Mkw).

9.10.2 Paikhed, Chasmandva and Chikkar power schemes

The power generation has been envisaged at Paikhed, Chasmandva and Chikkar dams also on similar lines as explained for Jheri power scheme. The installed capacity, of Paikhed, Chasmandva and Chikkar power houses are 10 MW, 3 MW and 4.5 MW respectively. Other details are given in Table - 9.1.

9.10.3 Power schemes on the feeder canals

Two power houses, each on Dabdar feeder canal and Kelwan feeder canal, are proposed for power generation. The respective RDs at which these power houses are proposed to be installed are 8.3 Km and 5.925 Km from Dabdar and Kelwan dam sites respectively. The average heads available for power generation at the respective canal drops are 11.22 m and 16.0 m. The installed capacity, of these power houses 3 MW and 4 MW respectively. Other details are given in Table – 9.1.

9.10.4 Total power generation

The details of levels, installed capacity, energy generation, cost and the annual revenue from the power generation from all the six proposed power projects are furnished in Table - 9.1.

Table - 9.1
Details of power schemes

Reservoir	Salient levels			Available average head (m)	Net divertible Yield (MCM)	Installed capacity		Energy generation (MKWH)	Cost of the proposed installed capacity (Rs.in lakhs)	Gross annual revenue
	FRL	MDDL	TWL			Act-ual	Prop-osed			
	(m)	(m)	(m)			(MW)	(MW)			
1.Jheri	246.00	203.70	182.00	49.90	242	5.66	8.0	26.297	6147	1562.04
2.Paikhed	248.00	190.22	165.00	63.74	212	6.34	10.0	29.438	7632	1748.61
3.Chasmandva	214.00	189.92	165.00	40.97	76	1.46	3.0	6.763	2327	401.72
4.Chikkar	210.00	178.15	154.00	45.38	146	3.11	4.5	14.445	3476	858.03
5.Dabdar (on canal fall)	134.67 *	-	123.45 *	11.22	267	1.37	3.0	6.513	2351	386.87
6.Kelwan (on canal fall)	133.95 *	-	117.93 *	16.03	270	2.03	4.0	9.519	3102	565.43
Total					1213	19.97	32.5	92.975	25035	5522.70

* F.S.L. of canal

The total cost of power component is estimated at Rs.25035 lakhs for the installation of 32.50 MW. The cost of installation works out to Rs.770 lakhs/MW of installed capacity. The designed annual energy generation from the project is 92.975 units(Mkwh). The cost of generation per unit works out to Rs.3.40. While calculating the working expenses, interest charges at 8 %, depreciation at 3%, Operation and maintenance charges at 1% and general reserves at 0.5% of capital cost of power component are considered. The energy available for sale is 92.045 M units after deducting auxiliary

consumption. The sale price of energy is assumed as Rs.6.00 per unit on an average. The gross revenue works out to Rs.5522.70 lakhs and the net revenue realized would be Rs.4396.12 lakhs. The financial return of the power component works out to 10.38%. The details are given below.

9.11 Financial return

1.	Cost of the power component	Rs.	25035 lakhs
2.	Installed capacity		32.50 MW
3.	Energy generated		92.975 M Units
4.	Energy available for sale after deducting 1% towards auxillary consumption		92.045 M Units
5.	Gross revenue that would be realised at a tariff rate of Rs.6.00 per unit (based on existing power tariff for commercial use, obtained from South Gujarat Electricity Company)	Rs.	5522.70 lakhs
6.	Working expenses		
a)	Interest charges at 8 %	Rs.	2002.80 lakhs
b)	Depreciation at 3%	Rs.	751.05 lakhs
c)	O & M charges at 1%	Rs.	250.35 lakhs
d)	General revenue at 0.5%	Rs.	125.18 lakhs
	Total working expenditure including interest charges	Rs.	3129.38 lakhs
	Total working expenditure excluding interest charges	Rs.	1126.58 lakhs
7.	Net revenue realised	Rs.	4396.12 lakhs
8.	Cost of generation per unit (Total working expenses/Energy available for sale)	Rs.	3.40
9.	Financial return		
	Net revenue/Total cost of power component		17.55%